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Reflections on the Challenges of the Ethiopian Construction Industry

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Abstract

These days the concept of competitiveness in the construction sector has gained and has been gaining unprecedented importance. International construction markets are considered more accessible to foreign firms as a consequence of globalization. Numerous international contractors have started to strategically develop overseas propositions to gain new revenue and minimize domestic market risk. Construction industry all over the world is dynamic and the reason for this include clients' growing demand, complexity of construction projects, advancement in technology and introduction of new innovation amongst others (Ali Parsa, Simon Huston, Anil Kashyap (2015)).

Construction by its nature is a complex task that needs tight planning and control system and tools throughout the project life. The progress of a construction can be affected by lots of factors. Koskela (1992) indicated that these problems are poor production planning, weak project management, defective design, poor quality, inferior working conditions, and low safety arrangement. Unfortunately, such problems result a significant waste level for construction projects like lagging behind the schedule, poor quality work and cost overrun characterized by low productivity and limited competitiveness (Fiallo c., M. & Revello P., 2002).

To enhance competitiveness and be successful in the dynamic environment requires more sophisticated management tools and appropriate Production Planning and Control (PPC) tools. Currently, Lean Construction (LC), as defined by the Lean Construction Institute "…the application of lean thinking to the design & construction process creating improved project delivery to meet client needs and improved efficiency for constructors."; is considered as a good approach to design production systems and diminish waste of resources and time as well as obtain the maximum possible efficiency. The term 'lean construction' is an adaptation of lean production techniques applied to the construction industry. Very broadly it can be characterized as techniques aimed at maximizing value and minimizing waste.

It is very hard to achieve high level of reliability in construction plan. Last Planner System (LPS), which is a planning, monitoring and control tool that follows lean construction principles has been developed as a useful technique for production planning and control in construction. It has been successfully and widely implemented in many construction projects in developed countries such as United States, Brazil, Chile and Korea. It helps to increase the reliability of planning, improve production performance and create a predictable and smooth workflow by coping with the uncertainties in design.

In Ethiopia, there are a number of different level contractors who are involve in road, dam, and house building projects. However, these contractors are not involved on projects that require high competition and are prone to the problems that are listed above. Therefore, it is useful to identify the basic strategies that Ethiopian contractors can proactively adopt to respond to changing internal and external circumstances in order to achieve more sustainable growth in the international construction market. In this context, it will be necessary for Ethiopian construction firms to adopt different methods of operation in order to be competitive in the global construction markets.

Key Notes: Construction firms, contractors, productivity, competitiveness, infrastructure

1.1. Problem Statement

The world today is full of competition and businesses have to devise methods of improving their productivity so that they can compete and survive in this dynamic global market.

Ethiopia has embarked on a long-term development strategy which aims at achieving sustainable human development with all prerequisites for a middle income country by the year 2025. This envisages the creation of a strong, diversified, resilient and competitive economy that can effectively cope with the challenges of development and that can easily adapt to the changing market and technological conditions in the regional and global economy. The priorities identified as essential catalysts for the attainment of being a middle income country by the year 2025 include development of infrastructure as an important ingredient towards attainment of faster economic growth.

The construction industry is a fundamental economic sector which permeates most of the other sectors as it transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the physical infrastructure is planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished. The construction industry has important contributions to the Ethiopian economy, as demonstrated by its share in the Growth and Development Plans (GTP-I & II).

The sector has registered a remarkable growth over the last 11 years. There has been increased investment on the development and expansion of various infrastructure projects. Among the major developments, the construction of road infrastructure, real estate developments, and condominium housing projects are some of the examples. More specifically public infrastructure development projects by Ministry of Education and Health and road infrastructure projects accounts to the significant portion of the investment outlay on construction activities.

The construction industry trend in the past 10 years has increased at constant price from Birr 2, 853,336,000 to Birr 8,185,747,000, at an average annual growth rate of 12.43% and this also shows an increase in the share from 3% to 5.3% of the country's GDP (ECIDP, 2014). However; the contribution of the Ethiopian construction industry against the average annual growth GDP that is 10.9%, is lower than the sub-Saharan African average which is 6% (UNDP, 2014).

Thus, the realization of Vision 2025, that is to be middle income country partly depends on the existence of a reliable and competitive local construction industry that is capable of delivering quality services and value for money in the development and maintenance of the physical infrastructure.

In developed countries, local construction industries have the lions share in market opportunities. However, in developing countries, the construction industries are dominated by foreign service providers to the tune of at least 65% in terms of money value of market share. For example, in the Southern Africa Development Community (SADC) region, and with the exception of South Africa, local contractors and consultants have approximately 30% market share in the region; Malawi (23%), Swaziland (35%), Tanzania (20%), South Africa (85%). In Ethiopia foreign contractors and consultants account for major proportions of the market share, i.e., about 58% in terms of value. While the involvement of foreign contractors in Ethiopia has developed rapidly over the last decade; the relative share of Ethiopian contractors still remains insufficient. Having this fact in construction activity in Ethiopia, it is paramount for Ethiopian firms to be competitive at least on their local market if not on the global.

Since 2005 there have been a number of initiatives geared towards fostering the local construction industry. Despite such interventions, the state of the local construction industry has remained poor. Performance constraints include inadequate capacity of local contractors and consultants, inadequate public sector delivery capacity, corruption, inconsistent work opportunities, use of outdated technologies and practices, lack of effective planning and control methods…etc.

Despite of significant improvements in Ethiopia, no researches are found to address the impacts & long term effect of having appropriate production planning & control tool on competitiveness of the construction sector. Therefore, this study aims to fill this gap by trying to address the case.

1.2. Objectives of the Study

General Objective

The main objective of this research is to review literature & the competitiveness of Ethiopian construction industry, study the status of production planning & control (PPC) within the Ethiopian construction industry and propose appropriate PPC model to enhance its global competitiveness.

Specific Objectives

- To review literature on PPC in construction industry.
- To identify the level of competitiveness of Ethiopian construction industry.
- To identify PPC methods used in the construction sector in Ethiopia.

- To propose appropriate PPC model in order to improve the global competitiveness of Ethiopian construction industry.

1.3. Research Methodology

To achieve the objectives of this research the following methodologies were used:

Literature study: different articles, and online resources that discuss about Competitiveness, Production Planning and Control, Last Planner System, Construction Industry were reviewed and gaps were identified.

Data collection: Observation, and secondary data were used in order to collect the data for the purpose of this research.

1.4. Scope of the Study

This research work is conducted to review the competitiveness of Ethiopian construction industry, study the PPC system applied in the construction sector in Ethiopia and identify gaps and propose appropriate tools that will enhance the global competitiveness of the industry.

1.5. Significance of the Study

This study is useful for the construction sector at large. Implementation of the findings of this research will help the construction sector diminish waste of resource and time in order to obtain the maximum possible efficiency that enhances the productivity and global competitiveness. This findings of the research could also be good inputs for researchers.

1.6. Organization of the Study

This paper consists of six sections; after the introduction section, in the second section different literature on Global competiveness, PPC, Construction project management, lean thinking and last planner system are reviewed and will be presented in chronological order. In the third section, construction industry in the global arena is presented. In the fourth section, PPC and construction in Ethiopia will be discussed. In the fifth section proposed PPC for Ethiopian construction is discussed. In the sixth section conclusion and recommendation is presented. In the final and the seventh section future work is highlighted.

2. Literature Review

2.1. Global Competitiveness

With the increased globalization of the world economy, the term competitiveness has become ubiquitous. (Atkinson, 2013). The World Economic Forum's (WEF) Global Competitiveness report defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country. The World Competitiveness Yearbook (WCY) also defines competitiveness as how an economy manages the totality of its resources and competencies to increase the prosperity of its population. Atkinson (2013) noted competitiveness as the ability of a region to export more in value added terms than it imports. Hence, in order to manage their global competitiveness, business companies need to improve customer response time, increase product/service offerings, manage demand variability and be price competitive. If these things have to be fulfilled, interruption in organizations must be managed effectively with careful production planning and control activities (Cai et al, 2011), that is, to operate the production system efficiently, a company must organize itself to design the processes and equipment, plan and control the production orders, and satisfy product quality requirements (O'Sullivan, 2009). Organizational resources flowing within a defined system are combined and transformed in a controlled manner to add value. An efficient production system is characterized by smooth flow of activities and materials through the system, most lead times are value-added processing, and jobs hardly ever wait (Nicolas, 1998). To maintain effective production system, PPC helps to decide the type and quantity of products to produce, scheduling the processing and delivery times, planning the manpower and equipment needed to execute the production plan, and control the shop floor activities (Nicolas,1998; Groover, 2001; Kumar and Suresh, 2008).

2.2. Overview of the PPC

2.2.1. Theory of Production

Production has been an explicit topic of study primarily in industrial engineering, which has dealt almost entirely with one type of production; namely, manufacturing (in the sense of 'making'), with only occasional consideration into construction, plant maintenance, building maintenance, agriculture, forestry, mining, fishing, etc. Design and engineering have infrequently been conceived as production processes; the focus almost entirely being placed on making things rather than designing them. Although the meaning of the term at its most universal is synonymous with "making", "manufacturing" is most commonly used to denote the making of many copies from a single design, and consequently is primarily focused on products for a mass market, most of those products being moveable from the place manufactured to the place of use. There are exceptions to the products being moveable, although still copies from a single design; e.g., ships and

airplanes. Within the world of construction, manufacturing in this sense is approached mostly closely by 'manufactured housing'.

Various types of making have been proposed, among them ‘assembly’, the joining of parts into a whole, as distinct from ‘fabricating’, the shaping of materials. For example, construction is often categorized as a type of ‘fixed position manufacturing’ (Schmenner, 1993), along with shipbuilding and airplane assembly. In all these instances of assembly, the assembled product eventually becomes too large to be moved through assembly stations, so the stations (work crews) must be moved through them, adding additional components and subassemblies until the artifact (building, bridge, tunnel, plant, house, highway, etc) is completed.

Many publications exist on the topic of production management in manufacturing, the larger part of which adopt the perspective of the industrial or production engineer (Bertrand et al, 1990; Hopp and Spearman, 1996; Murrill, 1991; Vollman et al, 1992).

A subset of this category concern themselves with the psychological/sociological aspects of manufacturing management (Scherer, 1998). The development of alternatives to mass production over the last 40 years has been revolutionary. Early and influential production management theorists include Jack Burbidge (1983; 1988) and W. Edwards Deming (1986), to mention but a few from the West. TaiichiOhno (1988) and Shigeo Shingo (1988) were the primary architects of the Toyota Production System, the archetype for lean production, so named in part to counter pose it to "mass" production. Burbidge's groundbreaking thought began to emerge in the 1960s. Deming was instrumental in the implementation of quality management and statistical quality control concepts and techniques in Japan after the 2nd World War. The work of Ohno and Shingo was concentrated in the period of the late 50's into the 70's. The Machine That Changed the World (Womack et al., 1990) reported the findings of an international study of the automotive industry and was followed by Lean Thinking (Womack and Jones, 1996) which presented the principles and basic concepts behind the new forms of manufacturing and proposed to extend them to the entire enterprise. Womack and Jones have popularized and made more easily accessible the concepts and techniques of lean production. Defining production as the designing and making of artifacts allows us to understand how construction is a type of production and also that design is an essential component in production generally and in construction specifically. Lauri Koskela (Koskela 1992, 1999; Koskela and Huovila 1997; Koskela et al. 1996, 1997) is the foremost production theorist in construction. His study of the applicability of newly emergent manufacturing concepts and techniques to the construction industry has driven him back to the development of a theory of production as such (Koskela, 1999).

Production control theorists working in manufacturing distinguish two primary ways of regulating workflow in manufacturing systems: push and pull. As indicated in figure-1 Push systems release materials or information into a system based on pre-assigned due dates (from a master production schedule, for example)

for the products of which they are parts. As indicated in figure-2, Pull systems release materials or information into a system based on the state of the system (the amount of work in process, the quality of available assignments, etc) in addition to due dates (Hopp and Spearman, 1996). In factory systems, pull may be derivative ultimately from customer orders. In construction, pull is ultimately derivative from target completion dates, but specifically applies to the internal customer of each process. Applicability of these concepts to production planning and control has been explored by this author (Ballard, 1999).

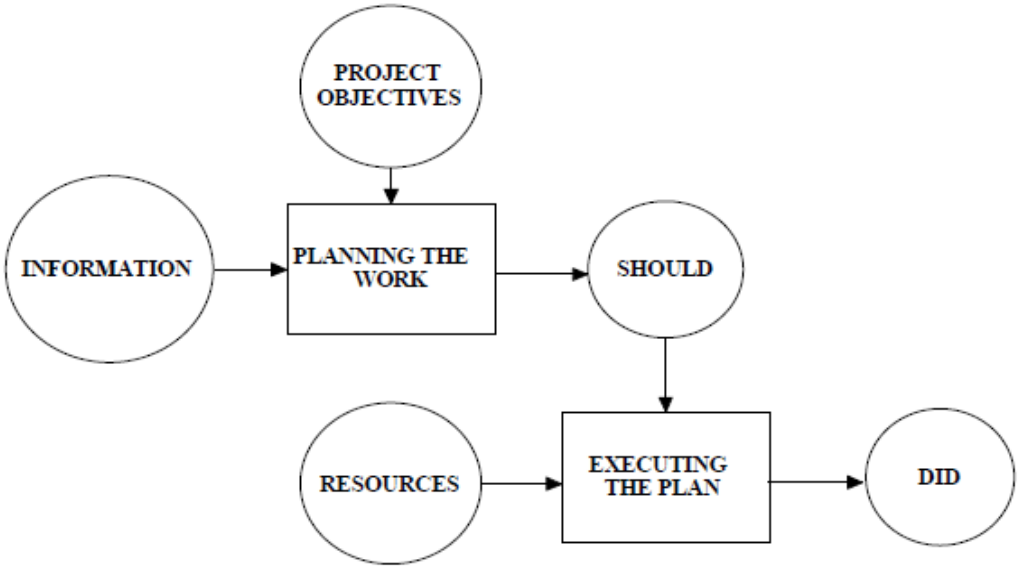

Figure 1. Traditional (push) Planning System

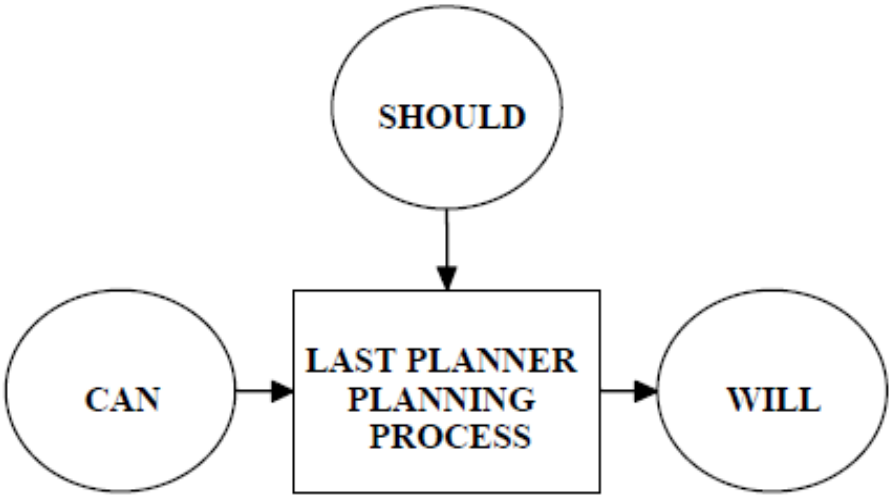

Figure 2. Last Planner: A Pull System

2.2.2. Planning and Control

Planning is a formalization of what is intended to happen at some time in the future. But a plan does not guarantee that an event will actually happen. Customers change their minds about what they want and when they want it. Suppliers may not always deliver on time, machines may fail, or staff may be absent through illness.

Control is the process of coping with changes. It may mean that plans need to be redrawn. It may also mean that an 'intervention' will need to be made in the operation to bring it back 'on track'– for example, finding a new supplier that can deliver quickly, repairing the machine which failed, or moving staff from another part of the operation to cover for the absentees. Control makes the adjustments which allow the operation to achieve the objectives that the plan has set, even when the assumptions on which the plan was based do not hold true.

Within the constraints imposed by its design, an operation has to be run on an ongoing basis. 'Planning and control' is concerned with managing the ongoing activities of the operation so as to satisfy customer demand. All operations require plans and controlling, although the degree of formality and detail may vary. The different aspects of planning and control can be viewed as representing the reconciliation of supply with demand.

Planning and control are concerned with the reconciliation between what the market requires and what the operation's resources can deliver. Planning and control activities provide the systems, procedures and decisions which bring different aspects of supply and demand together. The purpose is always the same – to make a connection between supply and demand that will ensure that the operation's processes run effectively and efficiently and produce products and services as required by customers.

2.2.3. Scope of Planning and Control

The nature of planning and control activities changes over time. The scope of planning can generally be classified as long, medium and short term plans.

In the very **long term**, attention is drawn to make plans concerning what they intend to do, what resources they need, and what objectives they hope to achieve. The emphasis is on planning rather than control, because there is little to control as such. They will use forecasts of likely demand which are described in aggregated terms. Managers will be concerned mainly to achieve financial targets. Budgets will be put in place which identify its costs and revenue targets.

Medium-term planning and control is more detailed. It looks ahead to assess the overall demand which the operation must meet in a partially disaggregated manner. Just as important, contingencies will have been put in place which allow for slight deviations from the plans.

In **short-term planning and control**, many of the resources will have been set and it will be difficult to make large changes. However, short-term interventions are possible if things are not going according to the plan. By this time, demand will be assessed on a totally disaggregated basis. In making short-term interventions and changes to the plan, managers will be attempting to balance the quality, speed, dependability, flexibility and costs of their operation on an ad hoc basis. It is unlikely that they will have the time to carry out detailed calculations of the effects of their short-term planning and control decisions on all these objectives, but a general understanding of priorities will form the background to their decision making. Figure-3 shows how the control aspects of planning and control increase in significance closer to the date of the event.

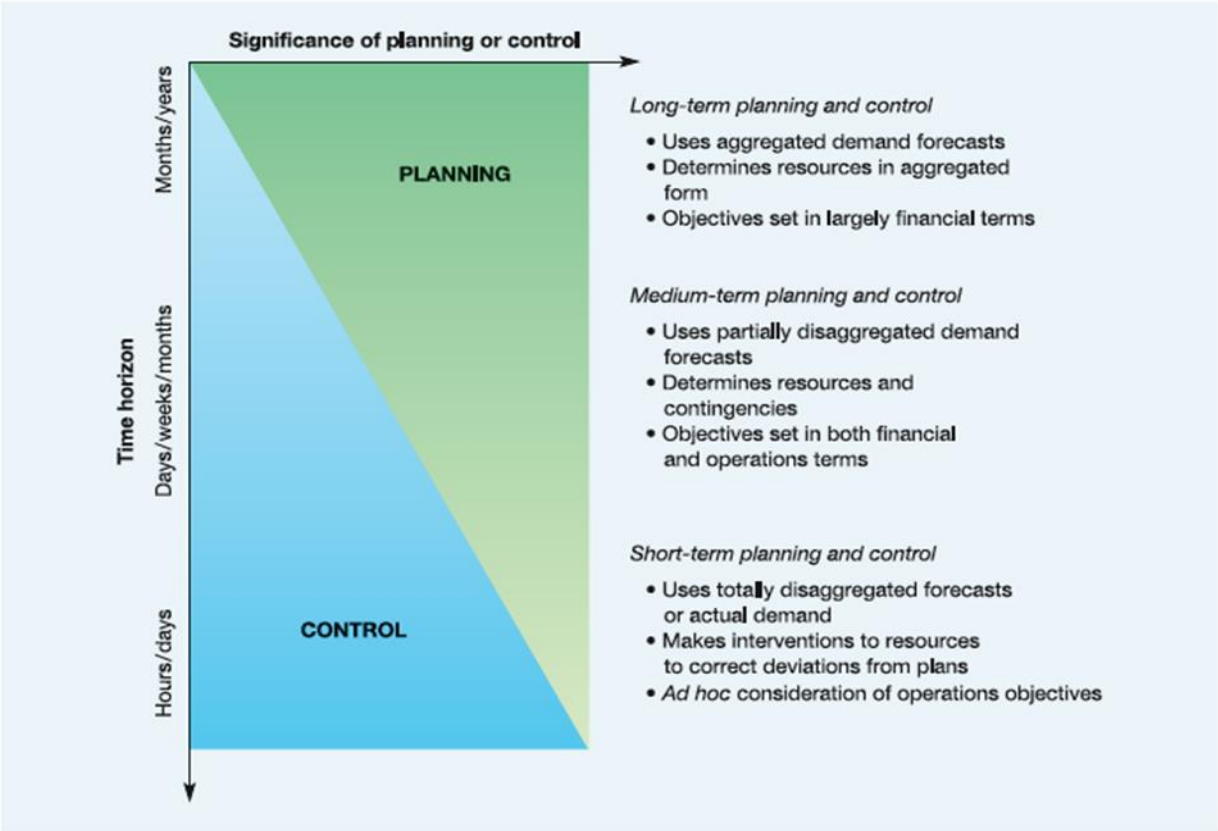

Figure 3. The balance between planning and control activities changes in the long, medium and short term
Source: (http://catalogue.pearsoned.co.uk).

2.3. Construction Project Management

It has been argued that production management in construction is based on a deficient theory, which leads to added costs and the reduction of overall performance (Koskela, 1992; Ballard and Howell, 1998; Ballard, 2000; Koskela, 2000; Koskela and Howell, 2002). Koskela and Howell (2002) contend that current construction project delivery practices fail to provide a solid basis for improvement and are inadequate when

projects are complex, uncertain and quick. They cite the simplicity and insufficiency of two underlying theories, 'management as planning' and the 'thermostat model' of control, whose shortcomings are summarized under three headings: 1) the unrealistic role of planning and poor short-term planning; 2) unsystematic management of execution and 3) a narrow view of control as measuring and taking corrective action, rather than as a process of learning. The same authors criticize the traditional construction planning and control system, as described in the Project Management Body of Knowledge (PMBOK) guide (2004), for the insufficiency of its underlying theories and the ineffectiveness of its techniques (Abdullah o.alsehaimi, 2013).

These claims are in agreement with Laufer and Tucker (1987), who pointed out more than two decades ago that the primary internal motivation for planning is often control, rather than execution. Thus, the significance of control is somehow corrupted by the separation of execution from planning, and in practice planning becomes a way of explaining what has happened and trying to find a way to recover it. In this paper, it is argued that addressing these shortcomings of project management provides a possible starting point for improvement in practice. A reasonable approach to tackle the aforementioned shortcomings could be the applicability of tools to help in improving planning and control. Such tools should facilitate short-term planning and allow managers to ensure the availability of all task prerequisites before the start, investigate reasons for failure and act on them (Abdullah o.alsehaimi, 2013). This argument is supported by several scholars (Koskela, 1992; Morris et al., 2000; Maylor, 2001; Morris, 2004), who identify the need to introduce alternative theoretical approaches to the study of projects. Koskela (2000) suggests that project management theory could be based on three points of view: transformation (realizing value-adding activities efficiently), flow (reducing the share of non-value-adding activities) and value (improving customer value).

2.4. Lean Thinking (LT)

Lean theory, principles and techniques, taken together, provide the foundation for a new form of project management. Waste in construction and manufacturing arises from the same activity centered thinking. However, Howell (1999) argues that there is a need to maintain pressure on every activity to ensure continuous improvement through the reduction of cost and duration of each activity.

2.4.1. Lean Production (LP)

The revolutionary story of Toyota's production system has impressed many European and US manufacturing experts with the value of lean production (LP) techniques. The five-year study of the Japanese automobile industry conducted by the MIT highlighted the efficiencies of LP (Womack et al., 1991).

The main principles of LP are to distinguish between conversions and flows as value and non-value adding activities to be made more efficient or eliminated respectively. Means of achieving LP include teamwork, communication, and efficient use of resources, elimination of waste and continuous improvement. Compared to the traditional mass production system LP applied to the auto industry led to reductions of half the human effort, manufacturing space, investment tools, engineering hours and time to develop and manufacture new products. The principles of LP are applicable to the construction industry in many ways as have been described by Koskela (1992).

2.4.2. Lean Construction (LC)

Lean construction is concerned with the holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment: design, construction, activation, and maintenance, salvaging and recycling (Howell, 1999). The term 'lean construction' was coined by the International Group for Lean Construction in its first meeting in 1993 (Howell, 1999). This approach presents an opportunity for theory to mix with practical solutions to achieve efficiency in construction and to rethink the way that projects are managed to improve practice.

Lean construction, much like current practice, has the goal of better meeting customer needs while using fewer resources. Furthermore, it is based on production management principles, the 'physics' of construction. The result is a new project delivery system that can be applied to any kind of construction but is particularly suited to complex, uncertain and quick projects (Howell, 1999). This system advocates identifying the root causes of waste, removing those causes by means of related tools and techniques, and encouraging the prevention of loss rather than reactively attempting to overcome the negative effects of loss (Womack and Jones, 1996; Lapinski et al., 2006).

Three features distinguish lean construction from conventional construction management practice (Abdullah o.alsehaimi, 2013). First, it focuses on reducing waste that may exist in any form in the construction process, such as inspection, transportation, waiting and unnecessary motion. Second, it aims to reduce variability and irregularity so that materials and information can flow without interruption. Third, construction material is expected to be on site only when it is needed. Howell (1999) contends that lean construction supplements traditional construction management approaches in two ways: first with two critical and necessary dimensions for successful capital project delivery, by requiring the deliberate consideration of material and information flow and value generation in a production system; and secondly, with different project and production management (planning-execution-control) paradigms.

Lean construction considers planning and control to be complementary and dynamic processes maintained during the course of the project. Planning defines the criteria and creates the strategies required by the

project objectives. At the same time, control makes sure that each event will occur in the planned sequence. Re-planning must be done when the previously established sequences are no longer applicable or convenient, while feedback facilitates learning when events do not occur as planned (Howell, 1999; Ballard, 2000). Howell (1999) argues that control should be redefined from 'monitoring results' to 'making things happen'. Planning system performance is measured and improved to assure reliable workflow and predictable project outcomes.

Lean entered construction a couple of years after it had gained momentum in Western manufacturing industries. Its application to the building environment was first discussed by Koskela (1992), who investigated what he (then) referred to as "the new production philosophy" and its application to construction. Basically, Lean Construction (LC) is a big scale of adaptation from the Japanese manufacturing principles and the concept is implemented to the construction process.

Literatures stated that if a company successfully implements the concept of LC, it would be able to gain significant cost advantage by eliminating cost-consuming flow activities and become a cost leader.

Lean Construction Institutes (2012) further emphasized that the objectives of lean are to maximize value and minimize the wastage using a specified techniques and applies them in the new project delivery. Hence, LC can be regarded as a continuous improvement in the construction process, aimed at reducing waste of resources while increasing the value of the project to the client.

An important implication of applying the lean philosophy to construction is the understanding of waste and value. In the lean terminology (as originally suggested by Ohno, 1988) value is understood very narrowly as consisting only of what the end customer perceives as representing value to him/her. Anything that does not directly add to this value is regarded waste. Consequently, any process is wasteful, so it is appropriate to distinguish between waste that cannot be avoided but should be reduced as much as possible (type 1), and waste that in principle is not required for delivering the value requested (type 2) which should be eliminated.

LC recommends the simultaneous consideration of product and process development. According to Howell (1999), managing construction under lean is different from typical contemporary practice because it has a clear set of objectives in the delivery process, which is aimed at maximizing the performance for the end user at the project level. By implementing the lean concept, production control should be done throughout the life of the project.

According to Womack and Jones (1996), there are five principles of lean construction, which are specify value from the customers' view, identify the value stream, make the value-creating flow, achieving customer pull at the right time and pursue perfection for continuous improvement. On the other hand, Salem and Zimmer (2005) suggested the five lean principles that applicable in the construction industry are customer

focus, culture/people, workplaces standardization, waste elimination and continuous improvement/ built-in quality.

2.5. Last Planner System (LPS)

The best known lean construction technique is the Last Planner System (LPS), which has been demonstrated as a very useful tool for the management of the construction process and the continuous monitoring of planning efficiency. Generally, LPS is closely associated with lean construction, and in some circumstances the term seems to be used as if it were synonymous with lean construction. Perhaps LPS has achieved a greater degree of industrial penetration.

As its name indicates, in LPS the decision making is given to the "last planner" or foreman, so that he can add in details and commit to what can actually be achieved in the coming week (Ballard, 2000) site among different trades and/or subcontractors during the planning exercise.

LPS is perceived as one line of research, interpreting the application of lean production methods to construction. Its goal is to create a reliable workflow by having the project team, including all affected firms, collaboratively create a phase plan for each segment of the work (such as the foundations). This is a social process involving discussion with site staff and also planning to ensure that work is not waiting on workers, and that workers are not waiting on work.

The "Last Planner" is the person or group accountable for production unit control, that is, the completion of individual assignments at the operational level. In essence, LPS enables the collaborative management of the network of relationships and communications needed to guarantee effective program coordination, production planning and project delivery.

LPS was developed to increase the effectiveness of planning and control by making programs more predictable, thereby improving the chances of delivering them on time. The system works to enhance reliability in three ways: through look ahead planning and the "make-ready" process, in which construction managers make work ready by ensuring that materials, information and equipment are available; by filtering planned activities through the weekly work planning procedure to ensure that the preceding activities have been completed; and by seeking conscious and reliable commitment of labor resources by the leaders of the work teams involved. According to Ballard and Howell (1994), the LPS focuses on quality characteristics of weekly work plans by helping in the selection of the right work sequence and the right amount of work and by ensuring that the selected work can be done.

LPS has five main integrated elements (Alsehami, Abdullah O., Tzortzopouls, Patrcia and Koskela, Lauri, 2013): master planning, phase planning, look ahead planning, weekly work planning, percent plan complete (PPC) and analysis of reasons for incomplete assignments.

The **master plan** serves to obtain the collaborative creation of, and agreement to, the production sequence. The aim is to bring all the major actors together early in the process, so that critical interdependencies can be discussed, assumptions tested and best practice agreed on. The purpose of the master plan is to develop and display execution strategies, demonstrate the feasibility of completing the work within the available time and identify milestones important to clients or stakeholders.

Phase planning is about dividing the master plan into various phases, aiming to develop more detailed work plans and provide the project team with goals that can be considered targets. Since a construction project moves through various phases, phase planning aims to provide certain goals for each phase and then work backwards to achieve them. Its purposes are to develop a plan for completing work within a phase of the master plan, to produce the best possible plan by involving representatives of all organizations working on that phase and to develop detailed works plan for each of the parties (contractors, subs, clients, consultants, suppliers etc) involved in the phase.

Look ahead planning means making tasks ready so that they can be done when the right time comes. This can be achieved by means of a medium-term look ahead plan. Look ahead planning helps to focus management's attention on what is supposed to happen at some time in the future, and to encourage actions in the present that will produce the desired outcome. According to Henrich and Koskela (2005), the objectives of look ahead are to reduce uncertainty, to identify and eliminate constraints and to achieve the project objectives in the look ahead period, which typically varies from 4 to 8 weeks. Making ready (Ballard, 1997) ensures that tasks are ready for production when required, thereby reducing waste of time, materials and equipment.

The Weekly Work Plan (WWP) is a collaborative agreement on the production tasks for the next day or week via weekly meetings. The WWP is based on look ahead planning and should include only quality assignments, i.e. those that are well defined, sound, in the proper sequence and sized to capacity. The purpose of the weekly meeting is to communicate progress, plan the following week and make ready for the future, which helps to explore any interdependencies between resources, access and equipment; the WWP meeting covers the weekly plans, safety, quality issues, resources, construction methods and any problems that occur in the field. It promotes two-way communication and team planning to share information on the project efficiently and accurately.

Percent plan completed and analysis of reasons for non-completed tasks are intended to improve project planning by continual assessment and learning from failure. PPC is a measure of the proportion of promises made that are delivered on time. It can be calculated as the number of activities that are completed as planned divided by the total number of planned activities, presented as a percentage. According to Ballard and Howell (2001), the starting point for improvement in planning is measuring PPC, identifying reasons for

non-completion and tracing these back to root causes that can be eliminated to prevent repetition (Ballard, 2000). Additionally, over time, PPC statistics show where attention should be paid to yield better results. This in turn can assist in improving the learning process over the project period and in the longer term.

The aforementioned integrated components of LPS, when systematically implemented offer major benefits to construction management practice in general and planning practice in particular. Outcomes of LPS implementation in a large number of projects across several countries since 1992 (Ballard and Howell, 2003) provide evidence of these benefits. Many reports and research papers have confirmed that the technique has achieved remarkable improvements, including better planning and control, improved work flow reliability, promotion of team building, improved communication and collaboration, increased productivity and improved work quality, thereby reducing the duration and cost of projects (Alsehami, Abdullah O., Tzortzopouls, Patrcia and Koskela, Lauri (2013)). When compared with the critical path method, LPS produces far superior project results (Ballard and Howell, 2003).

3. The Global Construction Industry

3.1. Historical Background of the Construction Industry and in Ethiopia

Before looking into the historical background of the construction industry, it is necessary to look at what exactly constitutes the construction industry. In trying to define the construction industry, it may not be easy to come up with a universal definition. This is because of the fact that the definitions bestowed to the phrase in different societies tend to contain different aspects pertinent to that society. Of the definitions given, the definition given to the phrase by Australian Bureau of Statistics to its construction industry survey seems appropriate and widely applicable. Accordingly, the construction industry is described as including:

"all units mainly engaged in constructing buildings (including the on-site assembly and erection of prefabricated buildings), roads, railroads, aerodromes, irrigation projects, harbor or river works, gas, sewerage or storm water drains or mains, electricity or other transmission lines or towers, pipelines, oil refineries or other specified civil engineering projects. In general, units mainly engaged in the repair of buildings or other structures are also included as are those engaged in the alteration or renovation of buildings, preparation of mine sites, demolition or excavation (ABS, 1993).

Construction has been an aspect of life since the beginning of human existence. The first buildings were huts and shelters constructed by hand or with simple tools. As cities grew during the Bronze Age, a class of professional craftsmen like bricklayers and carpenters appeared. In the 19th century, steam-powered machinery appeared, and later on diesel and electric powered vehicles such as cranes, excavators and bulldozers. Traditional construction, might be considered as having properly commenced between 4000 and

2000 BC in Ancient Egypt and Mesopotamia when humans started to abandon a nomadic existence that caused the construction of shelter. The construction of Pyramids in Egypt (2700-2500 BC) might be considered the first instance of large structure construction. Other ancient historic constructions include the Parthenon by Iktinos in Ancient Greece (447-438 BC), the Apian Way by Roman engineers (312 BC), and the Great Wall of China by General Ming T'ien under orders from Ch'in Emperor Shih Huang Ti (c. 220 BC). Similarly, the Romans developed civil structures throughout their empire including aqueducts, harbors, bridges, dams and roads.

Population growth and urbanization led to an increasing need for shelter developments, and focused attention on the importance of local building materials and techniques. Accordingly, the construction industry in many parts of the world started to grow with an increasing demand. In line with this, construction companies are growing at a fast pace all over the world. With this growth of the construction industry and subsequent growth of construction companies, contractual relationships related to construction are increasing.

Coming to Ethiopia, the growth and increasing demand for the construction industry has followed a similar pattern as observed in the world.

In the New Economic Policy statement issued in 1992, the TGE made its intention clear which is to transform the stagnant command economy inherited from its predecessors into a functioning market-based economy. This transformation is sought to be achieved through an Agricultural Development Led-Industrialization (here after ADLI) strategy for the country which is supported by similar strategies in education, health and transport sectors. However, even if the country is well endowed with natural resources with 60% of its total land area estimated to be potentially arable, its road density standard is amongst the lowest in Africa or other developing countries. Furthermore, the existing road network has deteriorated to the extent that only eleven percent of paved roads and nineteen percent of gravel roads are in good condition, making it the worst in comparison with other developing countries. It is evident from the above that the success of the ADLI strategy and the consequent economic recovery and development of the country is highly dependent on the restoration of the country's road infrastructure.

With the above considerations in mind, the construction industry is being given special focus in the policies of the country. The construction industry is one of the three (i.e. agriculture & manufacturing being the two) sectors of the economy identified by the Ethiopian government a special consideration to foster the country's economic development. However, the general state of the domestic construction industry in Ethiopia is still characterized by inadequate capital base, old and limited numbers of equipment, low levels of equipment availability and utilization, deficiencies in technical, managerial, financial and entrepreneurial skills, limited experience and participation of the private sectors in construction and consultation works, and insufficient and ineffective use of labor-based road construction and maintenance technology.

The construction industry in Ethiopia is a sector that opens the door for the growth of many additional industries. Building works require high input. For instance, they require different metal products, clay works, and cement and cement products, etc. As such, the growth of these industries will surely follow the growth of the construction industry. Similarly, when the construction and renovation of housing increases, the demand for household furniture increases; thereby, indirectly, opening the door for the growth of the furniture industry. All in all, the construction industry is a sector that can entertain big micro companies, that are widely labor based. Amid these, the industry policy of the Federal Democratic Republic of Ethiopia has sought to pay special attention to the construction industry of the country.

3.2. Review of the International Construction Sector and Competitiveness

Construction as an economic activity is becoming exposed to an increasingly competitive set of environmental circumstances in many parts of the world. This is largely facilitated by global communication networks which have opened a worldwide marketplace for construction goods and services. While some are specific to local circumstances others are rapidly growing more universal in reflection of the increasing globalization of construction activity. The largest construction companies compete for work on an international basis and collaborative ventures have become the norm to manage projects on an unprecedented scale. (Young HoonKwak, Andy Clark, AntonyoGrilo, Martin Betts, C.WilliamIbbs)

Engineering News Records (ENR) defined the international construction market as the specified volume open to foreign construction firms in the global market (ENR, 2014). The Global construction 2020 report (2009) forecasted that construction in emerging markets would double in size over the next decade, growing by an estimated 110% to become a market worth $7 trillion, representing a massive 17.2% of global GDP in2020.

The increasing international construction sector could be supported by the ENR's annual statistics, which has shown that ENR 'Top 250 International contractors' have increased their revenue from international construction contracts in the global markets over the last decade (ENR, 2014). In comparing the top 250 international contractors over the past decade, the revenue generated by these firms has increased from US$167.5 billion in 2004 to US$544.0 billion in 2013(ENR, 2014); therefore, it can be stated that large international contractors are finding an abundance of work in the global market. See Figure 4 below.

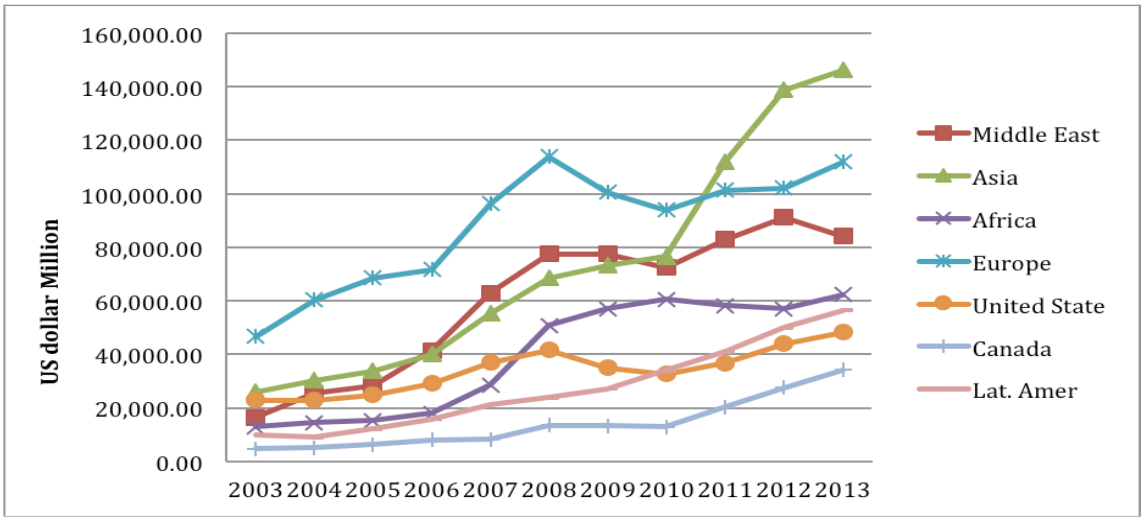

Figure 4. The international revenue of region by top 250 international contractors in last decades.

Source: Top 225/250 international contractors (ENR, 2004-2014)

Figure 4 shows that the trend of international construction revenue by top 250 international contractors in every region has increased over the last 10 years. The important markets are Asia, Europe and the Middle East, those which have had significant positive growth from 2006. In the above figure, the Asian market exhibited a significant growth rate in the year 2010-2013, being valued at 1.91 times its pre-defined value in 2010; which allowed the Asian construction market to have a higher value than its European equivalent.

However, in spite of the observable growth of the international construction market, the uncertainty and dynamic changes surrounding the global construction pose serious threats to global contractors (Han, et al., 2007). Kim, et al. (2010) indicated that competition has been shifting from conventional price competition to a more complex competitive framework where non- price factors such as key products and quality-focused competition rules are more critical in their effect on the selection of contractors. Some experts agreed that not only financing capability but also a high level of technology, foreign firms' advanced experience, the knowledge and management skill of overseas project managers all play a key role in the international construction market (Mahalingam and Levitt, 2005; Low and Lim, 2000; Kim, et al., 2010; ENR, 2014). This suggests that Ethiopian contractors should be capable of managing the multiple dimensions of construction projects including design, engineering, procurement and construction.

The analysis above, describes the rapid development of the global construction market especially in Europe, Asia and the Middle East. In this globalized market numerous key factors have been identified to appeal to overseas investors when selecting foreign contractors. These include: financial capabilities, technology, project experience, management skills and risk protection.

4. Ethiopia's Competitiveness and the Construction Industry

4.1. Ethiopia's Global Competitiveness

Ethiopia is the fastest-growing, non-oil driven economy among African countries (https://www.diretube.com, 2016). The country has showed a remarkable growth over the past ten years and has got attention by world economic and financial institutions including the IMF and the World Bank and individual leading economists such as Jeffery Sachs and Joseph Stieglitz, (www.ezega.com). Such economic growth is not only remarkable but it is also the best performance in sub-Saharan Africa for the years under review, according to some reports (3- WEF GCR 2014/15). The average annual growth GDP is 10.9%, (https://openknowledge.worldbank.org, 2015. This figure is double of the Sub Sahara Africa and triple of the world average growths indicating that Ethiopia is one of the fastest economic growths in the world. (Zinabu Tebeje Zewdu, Getachew Teka Aregaw, (2015))

Despite the trend in growth and the increase in exports over the last several years, Ethiopia's competitiveness in the global economy has remained low. According to the 2014/15 report released by the World Economic Forum's global competitiveness, Ethiopia was ranked 118 of the 144 national economies treated in the report.

4.2. Ethiopia's Competitiveness in the Construction Industry

The fast growth of the construction industry resulted in increasing number of contractors joining the industry. Consequently, there are a total number of 7259 Building Contractors (BC), Road Contractors (RC) and General Contractors (GC) registered for 2014/15 budget year, according to the Ministry of Urban Development, Housing and Construction of Industry Development and Regulatory Office. Where the numbers of larger contractors up to level three are: 263 BC1/RC1/GC1; 73 BC2/RC2/GC2; 163 BC3/RC3/GC3. However, regardless of the increasing number of contractors joining the industry, their competitiveness in the local and international market remains poor. (Report on contract construction survey central statistical agency, 2008/9. International construction markets are considered more accessible to foreign firms as a consequence of globalization (Kim, et al., 2010). Therefore, recent economic liberalization of the construction market has placed private contractors in a stronger position to compete for work.

In developed countries, local construction industries have the lions share in market opportunities. However, in developing countries, the construction industries are dominated by Foreign Service providers to the tune of at least 65% in terms of money value of market share. For example, in the Southern Africa Development Community (SADC) region, and with the exception of South Africa, local contractors and consultants have approximately 30% market share in the region; Malawi (23%), Swaziland (35%), Tanzania (20%), South

Africa (85%). In Ethiopia foreign contractors and consultants account for major proportions of the market share, i.e., about 58% in terms of value.

Moreover, when we consider the contribution of Ethiopian construction industry against the average annual growth GDP 10.9-% (UNDP, 2014), it is only 3% and this is lower than the sub-Saharan African average which is 6%. The construction industry trend in the past 10 years shows a yearly growth rate of 12.43% and this shows a share of 5.3% of the country's GDP (ECIDP, 2014).

Though the construction sector is given high attention, several defects are being noted in the sector that needs immediate action. Some of the significant problems in the construction sector are delay, cost overrun and poor quality (ECIDP, 2014). All of these problems exert a huge financial pressure on government, and they can hold back or impair planned economic development resulting in low competitiveness of the country in general and the sector in particular.

This is occurring in spite of the fact that the Ethiopian Government played significant role in assisting contractors by providing training, supplying machinery, and by developing supportive guidance *(Alem Tesfahunegn, 1999*).

4.3. PPC in the Ethiopian Construction Industry

Concerning the current PPC practice in the Ethiopian Construction sector the researcher has conducted observations as well reviewed secondary data. The researcher has identified that

1. Planning is applied at the beginning of the construction phase of the project based on masterplan presented on bar chart. As for planning techniques, most of the interviewees stated that their firms used the critical path method. The software packages most commonly employed were MS Project and Primavera.
2. Systematic review of project planning (and project review in general) was found to be rare or non-existent.
3. No overall project evaluation is conducted, which is necessary to identify the reasons for shortcomings in project execution.
4. No past job records to be referred, as these were either non-existent or inadequate.
5. Absence of detailed short-term planning and improvement meetings to discuss project progress.
6. No idea about Last Planner System, which has been applied and proven to be effective and efficient tool in most of the construction industries of the developed countries.

Therefore, the investigation into current practice established an overview of the status of the PPC followed and this suggested a direction for improvement.

4.4. Gaps identified

Gap in the LPS literature as well in the PPC system of the Ethiopian Construction Industry:

- This research will contribute to fill the gap in the literature regarding the adoption of LPS in an environment different from those of the developed countries where it has usually been implemented, taking into account all the influencing factors.
- Literatures reviewed on Last Planner System showed that no evidence of research conducted on its suitability to or its practical application within the construction industry in Ethiopia.
- Traditional Production Planning and Control(Push) tools like the Gant-Chart (CPM, PERT) are still practiced though plans are not achieved and quality, cost and time are compromised on most projects
- Therefore, to the best knowledge of the researcher, this study will be the first proposed tool to the construction in Ethiopia.
- It aims to improve management practice and create new knowledge.
- That is to say, this study is concerned with the proposing of existing principles of (LPS) to a new context and different working environment where commitment and attitude to time make it likely to operate differently.
- As this study was undertaken to improve the quality of work, solve delay and cost problems and to contribute to knowledge.
- This paper is devoted to creating awareness and proposes LPS to improve construction planning practice and to enhance site management in the Ethiopian construction industry.
- From own experience, a number of different factors can influence the success of LPS deployment in the Ethiopian construction industry. Some of these factors include:
    - ✓ Lack of leadership
    - ✓ Organizational inertia
    - ✓ Resistance to change
    - ✓ Lack of training on LPS
    - ✓ Contractual issues
    - ✓ Lack of experience and knowledge of LPS, particularly at senior management level

5. Proposed PPC System for Ethiopia Construction Industry

5.1. The Proposed Model

As discussed in the previous sections the Ethiopian construction industry is less competitive in the market. This is due to poor management and planning practices which resulted in delay, cost overrun and poor quality performances of projects.

Nowadays, Lean Construction (LC) is considered as a good approach to design production systems and diminish waste of resource and time in order to obtain the maximum possible efficiency (Ballard et al., 2002). Fiallo and Revelo (2002) showed that poor production planning is a main reason for activities that are not completed on time. In addition, Koskela (2000) pointed out that it is very hard to achieve a high level of reliability in construction plans. In this circumstance, Last Planner System (LPS) has been developed as the useful technique for production planning and control in construction. It has been successfully and widely implemented in many construction projects in developed countries such as United States, Brazil, Chile and Korea. It helps to increase the- reliability of planning, improve production performance and create a predictable and smooth workflow through coping with uncertainties in design.

Last Planner helps move from push to pull. The historic Critical Path planning system used in the Ethiopian Construction is a push system — it pushes work into production based on pre-determined start and completion dates in the CPM schedule. It does this without regard to whether the work is ready to be done, the progress made by prior trades — or the readiness of the producers. If this system worked, there would be a high coincidence between what should be done and what is done.

LPS changes the way the program is arrived at and adds a critical step, designed to ensure that only work that can be done is scheduled for production.

Last Planner System is good for the Ethiopian Construction Industry as a production planning and control tool to improve performance and enhance the level of competitiveness in the industry due to the fact that:

- LPS was one of the few effective and efficient tools to be mentioned explicitly in the countries where it has been practiced
- LPS helps deliver projects more safely, faster or at reduced cost
- LPS creates a more predictable production program
- LPS helps to reduce stress on project management staff
- LPS help improve the overall production process

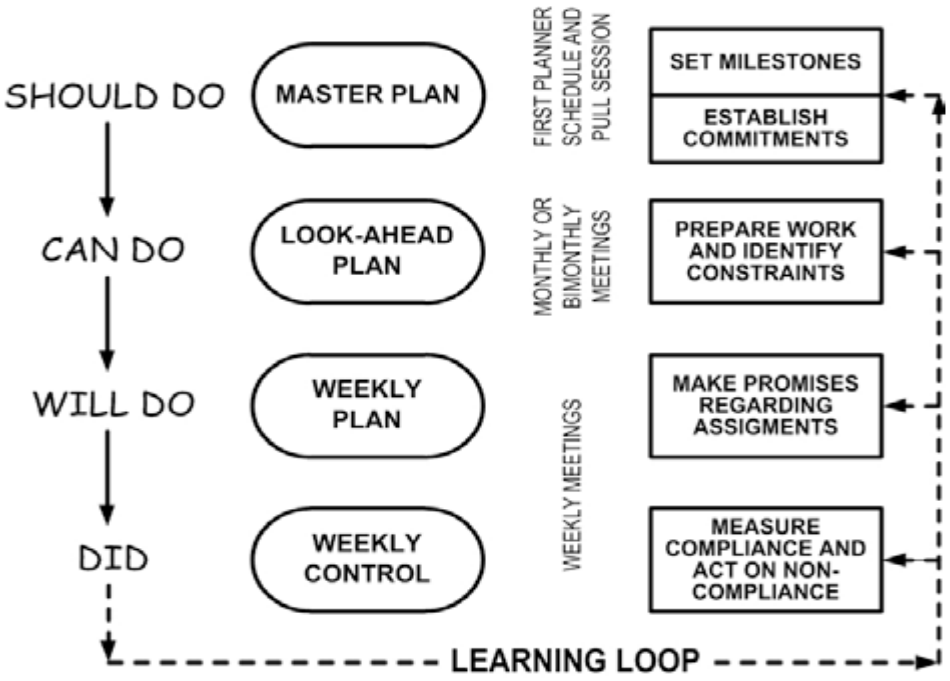

Figure 5. Last Planner System model for Ethiopian Construction Industry

5.2. Implementation Procedure

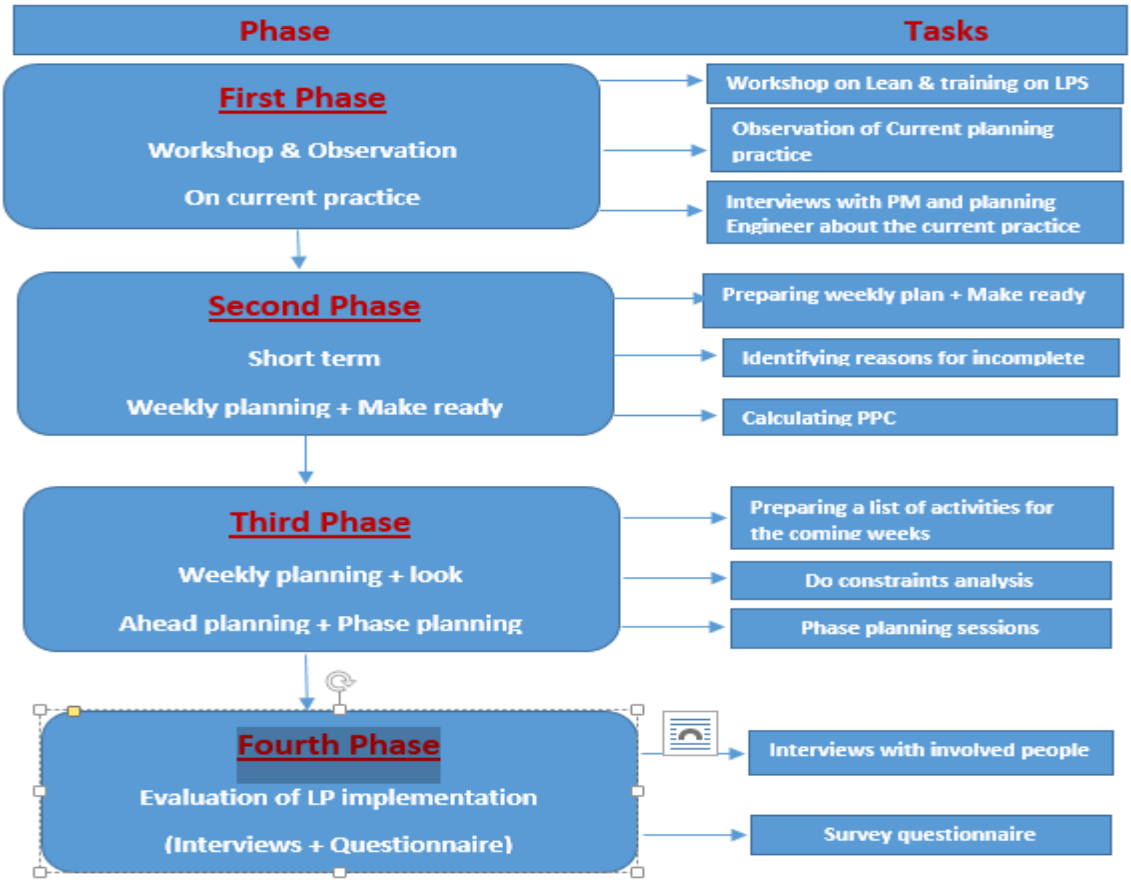

Figure 6. LPS implementation strategy in the studied projects

First Phase:

In the first phase, a workshop should be provided to highlight the benefits and discuss the advantages of Lean and LPS. After that, observation period is required to monitor the current planning practice, to interview the participants and to make notes. In addition, this phase would be useful to train the team in how to calculate the PPC, identifying reasons for failures, etc.

Second Phase:

In this phase PPC and reasons for incomplete assignments would be traced and recorded weekly for four to six weeks, in an attempt to help the team in driving improvement and to see how LPS would improve planning practice. In this phase, the focus will be on short-term planning and make-ready, while little attention is to be directed to look-ahead planning. Weekly meetings should be held with the involvement of all project parties (contractor's team, client representatives, consultant engineers). Data (PPC and reasons for incomplete assignments) will be collected.

Third Phase:

This third phase will be the longest, lasting for about six to 10 weeks, during which, in addition to weekly planning and make-ready, two main components of LPS will be introduced: look-ahead planning and phase planning. Phase planning allowed activities to be pulled through by reverse team planning and for resources to be optimized in the long term. Look-ahead planning is to be extracted from the master plan zone by zone, then coordinated in the Last Planner sheets. Phase planning sessions will be held throughout the project phases (structural, finishing and mechanical). All planning levels should be linked, i.e. look-ahead plans will be connected to the phase plans and phase plan to the master plan. Moreover; during the all-day phase planning sessions, sticky notes should be used to show the names, durations, prerequisites and locations of individual tasks on the project map. Each session will be dedicated to a certain type of activity, aiming to provide certain goals in each phase and then work backwards from the target completion date to achieve the proposed milestones. In practice, phase planning allowed better visualization of the flow of work, assisting all parties to negotiate deadlines for the planned work.

Fourth Phase:

During the fourth phase a survey questionnaire should be administered to evaluate the process of LPS implementation. Its aim is to allow all participants including the project team, client representatives, consultant engineers and subcontractors' managers to report the benefits, Critical Success Factors (CSFs) and barriers to LPS implementation in the project. Respondents should be given sufficient time to read the questionnaire, think about it and ask any questions they wished. Formal and informal discussions, explanation to questions, any necessary clarification should be made and motivate the participants to choose the answers they believed to be the most appropriate.

5.3. LPS Implementation Strategy

Strategic plan is required to properly implement the LPS process as following the procedure in the four phases. Discussion with participants and review of the advantages and disadvantages of previous strategies of LPS implementation should be properly managed. Incremental implementation of this kind is believed to gradually stabilize the elements of LPS, to minimize resistance to change and to have the additional advantage of providing an opportunity to evaluate each phase, allowing lessons learned to be carried to the next one.

6. Conclusion and Recommendation

Conclusion:

As discussed in the previous sections the Ethiopian construction industry is less competitive in the market. This is partly due to poor management and planning practices which resulted in delay, cost overrun and poor quality performances of projects.

Recommendation:

As the first opportunity to use lean techniques for operational purposes in both projects, major benefits will be achieved in terms of improving management practice. The LPS technique has been previously proven that it could enhance various aspects of construction management practice and bring major advantages. The benefit adding most value will be that by means of implementing LPS in the planning practice, factors underlying the various causes of delay could be discovered and dealt with. LPS has also been proven to be a very proactive approach to reorganizing the planning process, promoting better coordination of field operations among project participants, assisting in collaborative planning and providing forward information for control. LPS enables site teams to be more organized, effective and productive, which resulted in significant improvement to overall project management practice. Moreover, the learning process improved by means of continuous assessment and evaluation. Besides its contribution to improving project management practice in the construction management, this study will have a valuable contribution to construction management practice in Ethiopia in particular and its applicability for the developing countries in general.

Therefore, it is recommended that the proposed Last Planner System (LPS) model be practiced in the Ethiopian construction sector.

7. Future Work

Practical implementation of the Last Planner System in the Ethiopian Construction firms.

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