

A SUBCONTRACTOR'S LEAN JOURNEY: A CASE STUDY ON ILYANG

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ABSTRACT

In most cases, owners of companies or general contractors initiate Lean implementation on construction projects. The value in this case study is that it presents a subcontractor successfully implementing Lean construction on its projects. The case study investigated its motivation for making a Lean transformation, the course of its Lean transformation, and the lessons learned through its Lean journey. The study used interviews with twenty-five key personnel, twelve site visits, and an analysis of twelve documents on twelve projects. Further, it shows that while subcontractors have difficulty initiating Lean implementation beyond their own firms due to their lack of influence, it is possible for them to affect this kind of change.

KEY WORDS

Case study, Lean journey, subcontractor

INTRODUCTION

Lean production, which originated from the Toyota Production System, has taken manufacturing industry by storm since the late eighties. It has expanded beyond manufacturing to services, software, health care, and construction.

Many papers have been published on how Lean tools are applied to construction projects. However, few have been published on how an organization transformed itself into a Lean organization. Most of the papers focusing on organizations' change to Lean have assumed that Lean implementation is led by the general contractors (GCs) or owners (Mastroianni and Abdelhamid, 2004; Diekman et al., 2004). Indeed, in most cases, owners or GCs have initiated Lean implementation on construction projects. It has been argued that subcontractors have had limited power to implement Lean on projects because they tend to play a subordinate role to GCs and owners. Some subcontractors are willing and able, but do not have enough influence over the entire project. This paper describes an exception to the rule. The study used interviews with twenty-five key personnel, twelve site visits, and an analysis of twelve documents on twelve projects done by Ilyang construction.

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ORGANIZATION OF PUBLIC PROJECTS IN KOREA

In Korea, it is common for 80~90% of construction work to be subcontracted (Kim, 2003). The GC plays the role of coordinator. When the GC awards public projects, it usually gives the vast majority to the primary subcontractor to execute. Thus, sometimes, the GCs rely on a lead subcontractor to lead, and act, as a GC themselves. While Ilyang Construction, one of the leading subcontractors in heavy construction projects, has its own workforce for earthwork, it usually hires its subcontractors for structural work as a second-tier subcontractor. Ilyang's major role at the project site is production. However, Ilyang needs to manage the second-tier subcontractors as well as executing its own work.

It is hard to make suggestions from the bottom to up in Korean construction projects especially in public projects, because there is a strict hierarchy. Usually there is no suggesting anything to stakeholders higher in the hierarchy. When Ilyang implemented Lean, at first the GC was not interested because the subcontractor was lower in the hierarchy. However, after having seen the results, the CG was impressed, and implemented Lean.

LEAN INITIATIVES: WHY THE COMPANY ADOPTED LEAN

In 2005, Ilyang hired an outside consultant for the implementation of Lean construction. There are two ways Lean construction was implemented at Ilyang. Ilyang's home office disseminated the implementation about visual controls first as they were easiest to put into practice, and no special training sessions were needed. Since at Ilyang the priority was planning reliability, the pilot project for the Last Planner System (LPS) gradually followed (Kim and Jang, 2005).

The motivations for implementing Lean construction came from both financial and organizational needs.

- The construction market became very competitive. Ilyang was seeking a competitive as well as technical advantage. Since 1995 the number of Korean construction companies has continuously increased because of the lifting of governmental restrictions on the number of construction licensees granted. In 2002 the number of GC was 12,598 and increased between 1995 and 2002 by 3.2 times. In 1995 the number of Subcontractors was 36,509, increasing during the same period by 1.5 times. The average contracted amount per company in 1995 was \$20 million; however, in 2002 it was \$5.6 million. The decrease was due to competition. The lowest bidders were usually awarded the projects, however this has changed. Now, being the lowest bidder is a prerequisite, but the implementation of specialty techniques is also necessary to be awarded projects. The implementation of such activities as Lean has become a competitive advantage. Lean construction, especially cost and production management, is an alternative plan for overcoming competition.
- Production planning had not been reliable. According to the outside consultant's analysis, increasing planning reliability was a priority for Ilyang. Ilyang encountered frequent changes, from internal & external needs. Before implementing the LPS the GC made the project plan, which was then given to the subcontractor. Since the implementation of LPS, all project participants started contributing to plan, thus there were fewer internal and external changes, and thus

the planning became more reliable. Ilyang's skill at work execution was very high, but the lack of planning, and problems with resource management, and storage, hurt Ilyang. For example, materials were often stacked unnecessarily high in the field because of poor planning.

- Ilyang wanted the capability to implement different procurement strategies. Procurement requires the prediction of demand that is one result of production planning. The more reliable the production plan, the more accurate the procurement plan. Otherwise, there is typically a build-up of inventory to avoid a lack of resources on site. A longer and more reliable lookahead window is the result of greater workflow reliability and enables strategic resource procurement such as MTO materials (e.g., rebar, beams or cement).
- The home office did not have insight into production on each project site. Many problems of each site were hidden from management.

LEAN PREPARATION

Plan reliability is the foundation of Lean implementation. The focus of Lean implementation is to maximize value and minimize waste. In order to achieve these results, a reliable plan is necessary. Some companies implement Lean tool sets without reliable planning, thus do not achieve optimal results. Therefore, Ilyang's first goal was to make workflow reliable.

Ilyang applied the LPS on two pilot projects. For the pilot project, Ilyang brought a "sensei" (an external specialist who guides the journey). The purpose of the pilot project was two fold: instilling a sense of urgency and testing the new approach. Instilling a sense of urgency helped employees see Lean as essential to the future of the company. Testing the new approach was needed to adapt methods and tools to fit Ilyang and to demonstrate benefits. On the pilot projects, weekly percent plan completion⁴ rose by 30% to 85% (Kim and Jang, 2005). After successful implementation on two pilot projects, top management made a strong commitment to the LPS. The successful elements of those pilot projects included:

- External consulting (sensei)
- Organizational structure: Ilyang made a Lean task force, which consisted of three fulltime engineers, supported by a senior managing director.
- Training: Numerous project managers and project engineers were trained for pilot projects on Lean, Lean construction, and production control system (i.e. LPS).
- In addition to that training, every manager was given the opportunity to receive training at Toyota Motor Company, in Japan. While the expense was significant, the chief executive officer (CEO) and managing director felt it was worth the investment.
- Lean implementation manual: The Lean task force developed an implementation manual taking into account its culture and lessons learned from pilot projects.

⁴ Percent Plan Completion = (The Number of Assignment Completed / The Number of Assignment Assigned) x 100 % (Ballard, 1994)

LEAN PRINCIPLES APPLIED

THE LAST PLANNER SYSTEM (LPS)

Ilyang pursued the LPS as a strategy for production control. The following steps are main processes for their LPS.

- Six-week look-ahead schedule: Ilyang identified constraints, used “post-it” notes and invited the GC and Engineers (or owner’s representatives) to the meetings.
- Constraint removal strategy and shielding process
- Weekly plan and learning process

The implementation of LPS came in three phases. The first phase was production management. Setting up the manual, standardizing the report format, and training all of the members of the company were implemented based on the results of the 2005 pilot project. The second phase is on-going and focuses on using LPS as a tool for production management in addition to cost management. Cost information is combined in the project schedule. The third phase will be the extension of LPS to resource management, by implementing Lean with other stakeholders, such as the core suppliers. This phase will focus on strategic resource procurement.

KANBAN

Ilyang has adopted a kanban system to facilitate the LPS and to support its safety plan. Each card indicates the scope and quantity of each task and any major accidents that may have happened on the same task are described. Each foreman is required to pick up the cards (production kanban) under his/her responsibility and announce records of accidents related to the job before the job begins. After the job is complete, he/she is required to return the cards (withdrawal kanban) to the office. The use of the Kanban system eliminates the efforts to measure and check progress because tasks are clearly defined in the production control system.

VISUAL CONTROL

Coloured Hardhats

Ilyang used hardhat visual control where each colour indicated distinct work division and levels of management. It helped managers to identify tasks and the numbers of workers on the task in each location.

Safety and Standard Procedure

Ilyang made a handbook of safety and standard procedures for more than 50 construction processes. Experienced construction managers and engineers participated in the process. It helped reduce the time for planning preparation and variability of processes. They posted a signboard describing standard procedures and safety issues on the site so that workers could easily understand and follow them.

LESSONS LEARNED

Since 2005, due to the implementation of Lean, there have been many changes at Ilyang. Ilyang learned the importance of having a production control system and reliable

workflow in starting their Lean journey. The production control system was about more than just improving PPC. Internally and externally, communication among project members and informational transparency were improved. All participants were required to cooperate with, and contribute to, the overall planning and controls. After the implementation of Lean all members of Ilyang have become very active participants in their work, making suggestions for continuous improvement.

Lee, a project manager at a pilot project site (highway construction project) remarked, "Three months after we started LPS, we recognized that our ability to improve work flow reliability was limited. By not extending to outside the organization, such as a GC, there was always an ad-hoc work practice or priority changes, which resulted in changes to our work plan. We came up with the idea of bringing a member of the GC and the relevant subcontractor into our work plan meetings. This action extended the LPS across the entire organization."

Lee continued, "(The GC's) first reaction, when we asked them to participate in our work plan meeting, was not positive. They said, 'Why should we help you with your work? It is your job.' However, later they realized the benefit of having a reliable work plan from Ilyang, and provided them with a reliable work plan also. The GC's willingness to adopt Lean was an important factor in the success of the project."

Throughout Lean implementation, Ilyang had a good channel of communication that reduced the number of correspondences needed to coordinate and remove constraints. By having the GC and Engineer at the table during production planning, there was a reduction in both fire-fighting and the time necessary to get approval and to launch projects. Woosuk Jang, a managing director, explained the other benefits. He said, "One of our clients [i.e., GCs] appreciates what we are doing, and asked for training on these successful procedures. He also encouraged other subcontractors to adopt Lean. Several GCs expressed interest in having long-term alliances with us."

Externally the view of Ilyang improved. The reliability of Ilyang's project execution has increased, as has the number of preferred contracts offered to Ilyang, and amount of respect awarded Ilyang by all project participants. The number of Ilyang's preferred relationships with GCs and owners has increased. Ilyang also made long-term alliances with preferred vendors, thus Ilyang reduced material procurement costs due to the increase in reliable planning.

CONCLUSIONS

It is very important to be a leading company in new concepts. There are more than 30,000 subcontractors and there are 200 companies the same size as Ilyang. Ilyang can attribute its place in the market to the use of Lean construction. Ilyang's decision to pursue Lean principles was driven by the CEO's commitment and his unique vision. This organization is a good example of a subcontractor implementing Lean without a GC or an owner's initiative. They started a production control system within their organization. Later, they extended its implementation to the GC and other subcontractors. They started with improving workflow reliability as their Lean implementation strategy, which was in line with Toyota's recommendations (Liker, 2004). Once they became comfortable with the production control system resulting in improved work flow reliability, their Lean journey extended to other Lean tools.

REFERENCES

- Diekman, J., Krewedl, M, Balonick, J., Stewart, T., and Won, S. (2004). Application of Lean Manufacturing Principles to Construction, *Research Team 191, Construction Industry Institute*, Austin, TX.
- Kim, D. (2003). "Guidelines for Implementing Lean Construction", *J. of the Architectural Institute of Korea.*, AIK, Seoul, Korea, v.19 n.9(2003-09)
- Kim, Y., and Jang, J. (2005). "Application of Last Planner to Heavy Construction in Korea" *Proceedings of the 13th Annual Conference of the International Group for Lean Construction*, Sydney, Australia
- Liker, Jeffrey K. (2004). *The Toyota Way*. McGraw-Hill, New York, NY. 330 p.
- Mastroianni, R. and Abdelhamid, T. (2004). "The Challenge: The Impetus for Change to Lean Project Delivery", *Proceedings of the 12th Annual Conference of the International Group for Lean Construction*, Denmark