

BOTTOM-UP STRATEGY FOR LEAN CONSTRUCTION ON SITE IMPLEMENTATION

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1 INTRODUCTION

The main barrier to Lean Construction implementation is resistance by the middle management, supervisors and employees. Team resistance comprises more than 86% of the barriers to implementation becoming the major problem that must be overcome for a successful lean transformation to occur. This paper aims to evaluate an on-site implementation of lean construction using a bottom-up strategy, where the workers themselves improved their own processes. All data were collected by studying a large water pipeline construction site in Brazil.

The project that was studied for this paper is a large water production system. The scope is the construction of the pipeline, which has a diameter of 2.1m and the trenches have 4 meters of depth. The construction cycle is composed by soil excavation, pipeline installation, welding, soil backfill.

2 THE STRATEGY

As Womack and Jones (2013) describe, kaizen means continuous incremental improvement. They also say that a combination of both radical improvement (*kaikaku*) and continuous improvement (*kaizen*) can produce endless improvements.

This research focused on only continuous incremental improvements, or kaizen events. It began with a training phase in which all workers were trained. Then the improvements were captured using a kaizen form (Figure 1) based on simplified A3 thinking method, so that the foreman and his crew could identify different kinds of waste, and make improvements to overcome them. Finally, all data collected were analyzed comparing the improvements and the labor productivity rate during the same period.

KAIZEN	
WORK CELL UNIT IDENTIFICATION	IDENTIFY THE WASTE TYPE <input type="checkbox"/> Overproduction <input type="checkbox"/> Transportation <input type="checkbox"/> Defects <input type="checkbox"/> Excessive motion <input type="checkbox"/> Extra processing <input type="checkbox"/> Underutilized personnel <input type="checkbox"/> Inventory <input type="checkbox"/> Waiting
WASTE OR PROBLEM IDENTIFICATION	SOLUTION OR IMPROVEMENT ADOPTED
WASTE OF PROBLEM CAUSES	RESULTS OBTAINED

Figure 1: kaizen form.

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3 IMPROVEMENTS REFLECTING ON PRODUCTIVITY

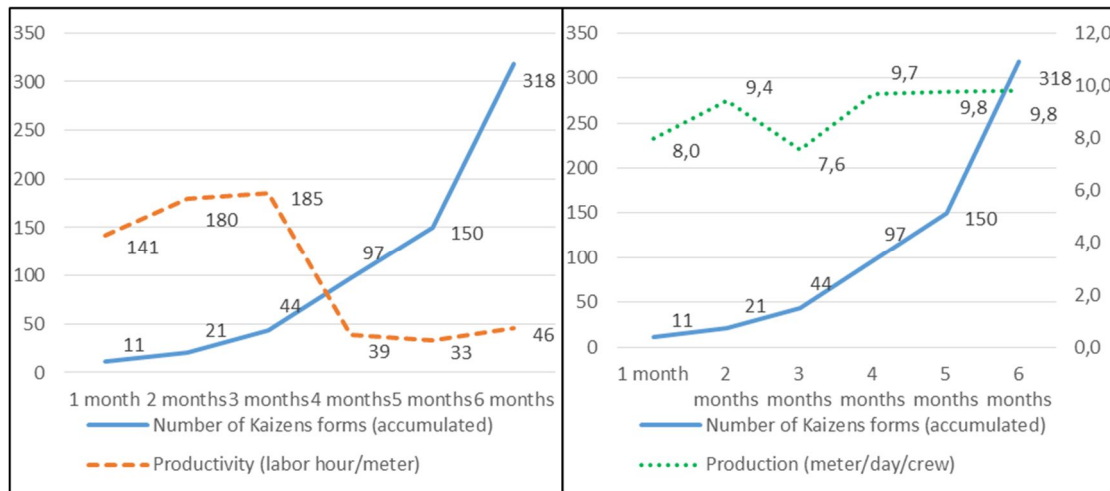


Figure 2: kaizens versus productivity and production

4 CONCLUSIONS

The bottom-up strategy for Lean Construction implementation on construction sites described on this paper is effective because it stimulates the engagement of the workers to make improvements on their own processes. This is made possible through training to enable them to find and eliminate wastes in their daily work.

Even though the labor productivity rate and the average production rate were chosen as the performance indicators for measuring the success of Lean Construction implementation on this case, it is expected that other performance indicators could also show a positive outcome, reflecting the improvements made by the kaizen forms, as shown on this paper. Systematically speaking, a reduction of waste on the construction process can also lead to an increase of quality and worker safety.

It was also observed that, as the number of kaizen grew, the effect it had on increasing the productivity and production rate would grow less, reaching a superior limit. This happened because the first improvements made had big impacts on performance, but as time went on, there was a tendency that the improvements would have a significantly smaller impact on performance, which meant that the work processes were close to their limit of improvement. Therefore, this study advocates radical change (*kaikaku*) followed by collective kaizen to promote a systematically continuous improvement.

To avoid that all the spontaneous improvement made could be somehow lost within time, it is suggested that a standardized manner of cataloguing what was made is created, to add the improvements made by the application of the kaizen forms into the working culture of the company. And to really achieve continuous improvement, further actions, taken from a top-down perspective, must be added to the bottom-up spontaneous improvement methods, so that the company can reach its peak efficiency on working routines on a faster way.

