ASSESSING THE IMPACT OF LEAN METHODS IN MINING DEVELOPMENT PROJECTS

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1 Background and Identification of Problem

One of the main challenges that face developing countries is the need to increase productivity. It is generally accepted that productivity is a contributing factor to help explain the difference in Gross Domestic Product per capita between countries. In Chile, mining is the industry that has the highest relative productivity rate, reaching 68% of the productivity of Australia. Meanwhile, the construction industry in Chile has 38% relative productivity compared with the same industry in the United States (McKinsey and Company, 2013). When identifying these gaps, low operational efficiency is considered to have the main potential of improvement in both the mining and construction industries, which has the potential to increase relative productivity in mining and construction by 27% and 32%, respectively. The main causes of low operational efficiency are low adoption of advance management methods (McKinsey and Company, 2013).

2 Research aim and Methodology

In particular, this research evaluates the impacts of the implementation of Lean production methodologies, such as the Last Planner System (LPS), on an underground mining development project. To develop this research, a case study methodology was used. One underground mining development project was selected in order to evaluate the impacts of the lean implementation. The amount of data gathered in this research permitted us to perform inferential statistical analysis and correlational analysis, which provided sturdiness to the analysis carried out. This implementation took place during the execution phase of the project, i.e. under construction, due to the owner's need to improve contractor productivity.

2.1 Implementation plan

This implementation took place in an underground mining development project, developed by an international construction company, which carried out tunnelling work, specifically at the production, caving, intermediate transport, ventilation and crushing levels. The scope of the development work was the development of horizontal underground tunnelling for a new mine.

This implementation lasted twelve months and it was divided in three stages: diagnosis, implementation and control, as illustrated in Figure 1. In the diagnosis stage, the current state of the project was established. Then, in the second stage, the lean methods chosen were implemented for a period of six months. Finally, in the control stage, the impact of the implementation was established.

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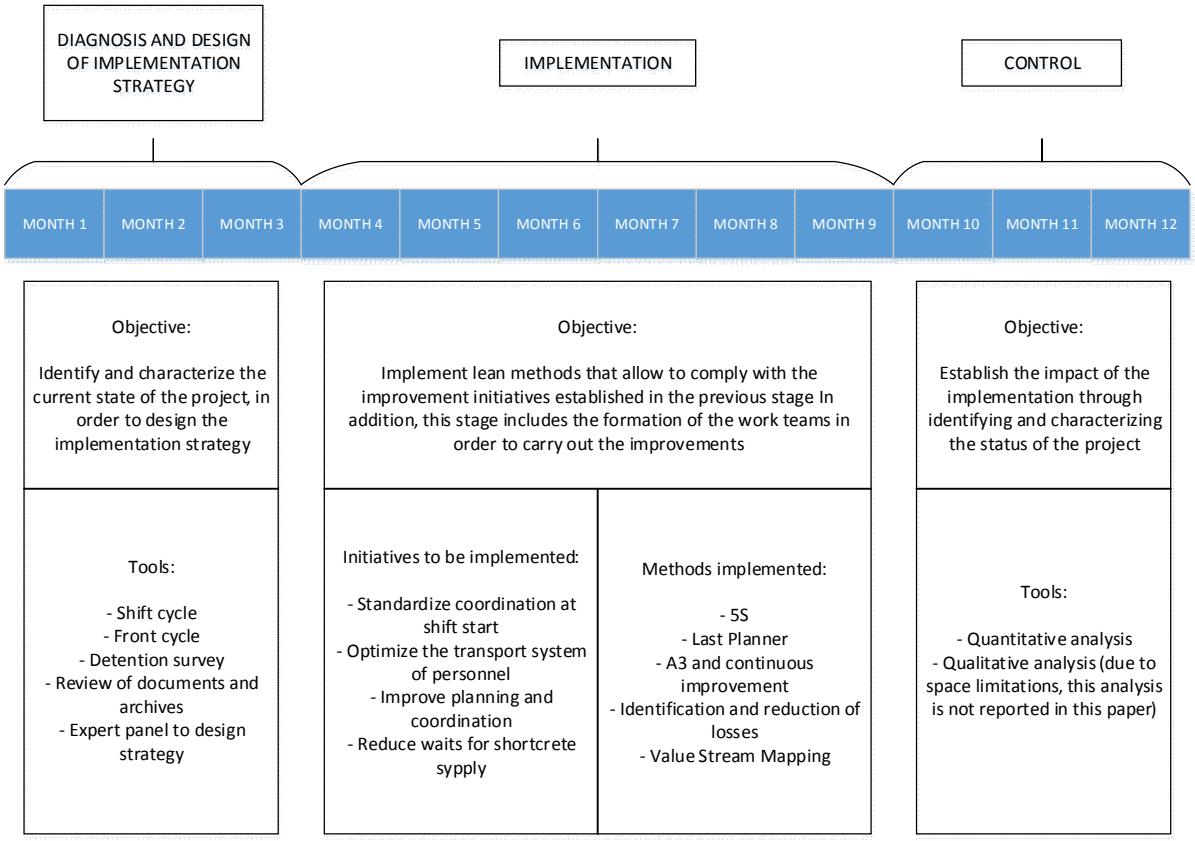

Figure 1: Research and implementation scope and timeline

2.2 Selection of indicators

The indicators analysed were selected considering literature review, expert opinion and the capability of monitoring them. Also, these indicators were chosen because it was possible to keep track of them during the diagnosis and control stages, and they were directly related to productivity. The indicators are workable time, daily physical progress, program completion and percent of plan completed (PPC). The quantitative data was obtained from field samples and reports from the contractor.

3 RESEARCH FINDINGS

From the results of this research, we can indicate that the implementation of lean methods in underground mining development projects in execution positively impacts its performance. In particular, the results of this research indicate that the implementation of lean methodologies in this type of projects produces (considering a 5% of significance level):

- Positive and statistically significant impacts with respect to the improvement of the mean. This stands for all the variables measured in this research and that were subjected to statistical analysis.
- Statistically significant reduction of the variability in project performance for certain indicators. As well, it is important to notice the reduction on the coefficient of variation of some indicators.
- Statistically significant relationship between PPC and its coefficient of variation, as found in commercial and residential projects.

Regarding the contributions to IGLC community, this research is a quantitative study that could be useful to persuade researchers outside the lean community, who have different production conceptions.