

LEAN CONSTRUCTION PROFESSIONAL'S PROFILE (LCPP): UNDERSTANDING THE COMPETENCES OF A LEAN CONSTRUCTION PROFESSIONAL

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ABSTRACT

The consolidation of lean construction demands the application of its concepts and principles in practical situations, but until now most of the implementations have been very fragmented. They have mainly focused on the improvement of project performance through the application of new tools and methodologies, leaving aside organizational and human issues. Therefore, it is necessary to state the role of people and to identify what competences they need for working in a lean organization. In order to advance in these issues, an assessment of what skills Project Manager's (PM) need and a research of how construction PMs use their time were recently completed, complementing these results with an analysis of the best practices identified in previous studies. This paper proposes a way to support lean construction in contractor organizations by creating a Lean Construction Professional Profile (LCPP), which identifies the competence areas needed and organizes them in a consistent model which was validated by lean construction experts and professionals. The results allowed to infer that a lean construction professional needs to develop simultaneously three competence areas: enterprise vision, technical competence and social competence; which are associated to the three elements of *lean management*: business purpose, processes and people. These results are expected to contribute to improve the effectiveness of professionals who work in a lean organization.

KEY WORDS

Lean construction, lean management, human resource development, competences.

INTRODUCTION

The consolidation of the lean construction theory demands the application of its concepts and principles in practical situations (Koskela, 2000), but until now most of the implementations have been very fragmented (Picchi & Granja, 2004). They have mainly focused on the improvement of project performance through the application of new tools and methodologies, leaving aside human, organizational and cultural issues.

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This situation has been widely recognized in any problem related to the implementation of new management systems or every kind of innovation that involve some changes in the classical ways of acting (Juran, 1990). Therefore, it is necessary to educate people and/or train them for dealing better with these situations, supporting this course of action by the adequate vision, processes and organizational structure (Price & Chahal, 2006; French & Bell, 1996).

In the case of Chilean implementations, this problem has arisen strongly in the last three years and companies decided to guide their collaborative efforts of lean construction implementation to an *organization development* program (French & Bell, 1996). The creation of an adequate profile of competences for the professional staff of the companies (key actors for reaching successful implementations - agents of change) was one of the main work lines and its purpose was the improvement of lean implementation effectiveness.

The main objective of this paper is to propose a way to support lean construction in contractor organizations by creating a *Lean Construction Professional Profile (LCPP)*, which could expand the focus centred in projects to address people issues that are necessary to carry out a sustainable and successful lean construction implementation. For doing so, an assessment of what skills Project Manager's (PM) need and a research of how construction PMs use their time were recently completed, complementing these results with an analysis of the best practices coming from the outcomes of previous studies in management science, construction industry and lean construction (Pavez, 2007; Alarcón & Pavez, 2006).

The research outcomes allowed to infer that a lean construction professional needs to develop simultaneously three competence areas: *enterprise vision*, *technical competence* and *social competence*; which are associated to the three elements of *lean management*: *business purpose*, *processes* and *people*. These results represent an important step to improve the effectiveness of professionals who work in a lean organization, because they go deep in the coherence of the competences that a lean professional need according to the main elements of *lean management*, which drives the transformation of a lean organization (Womack, 2006).

BACKGROUND: WHY DO WE NEED RESEARCH ON PEOPLE ISSUES?

Lean construction springs from the failure of current project management and opens the door to significant reform. Koskela (2000) has identified the inadequate conceptual foundations of current practices in terms of both management and the project, and the resulting calls for reform offer new hope for a stagnant discipline (Macomber & Howell, 2003). However, although a good management system combines technical and social issues, lean construction has focused until now on the organization of production in terms of project settings by the technical perspective (flow, value, buffers, etc.), leaving aside the role of people and the organizational environment.

This point of view has been criticized by some authors (Green, 2000), but most important, has produced some problems and barriers that hindered lean construction implementations (Alarcón et al., 2006). Regarding the situation exposed above, hereinafter is presented a background of the lean construction implementation embracing the Chilean and the international context (Picchi & Granja, 2004; Seguel, 2004; Pavez, 2007).

ASSESSING THE EXTENT OF THE IMPLEMENTATIONS: INTERNATIONAL SCENARIO

According to Picchi and Granja (2004), it is possible to identify three different lean implementation scenarios related to the extent in which lean principles and tools are applied. These scenarios are: (1) fragmented tools application, (2) integrated job site application and (3) lean enterprise application. Regarding these scenarios, the authors say that the construction industry is in the first scenario, because there is a lack of knowledge and domain of lean principles, and the focus is put on applying specific tools to specific projects. There is not international evidence about higher levels of implementation in the construction industry.

CHILEAN IMPLEMENTATIONS OF LEAN CONSTRUCTION: THE PROCESS OF CHANGE

Chilean implementations have been characterized by a change process guided by a research team from the Production Management Centre of the Universidad Católica de Chile (GEPUC). This process has had the aim of generating in-house capabilities to apply lean construction in the companies. The change process has three phases, differentiated by the degree of participation (and the implementation responsibility) of the research team and the company team. These phases are: (A) university team responsibility, (B) shared implementation responsibility, and (C) company responsibility.

		Implementation scenarios (Picchi & Granja, 2004)		
		Scenario 1 Fragmented tools applications	Scenario 2 Integrated job site application	Scenario 3 Lean enterprise application
Implementation Phases (Seguel, 2004)	Phase A University team responsibility	● Company 2		
	Phase B Shared implementation responsibility	● Company 1 ● Company 3 ● Company 4		
	Phase C Company responsibility	● Company 5 ● Company 6		

Figure 1. Framework to classify lean construction implementation (Chilean current state and challenges).

CHALLENGES FOR CHILEAN CONSTRUCTION COMPANIES

Lean construction implementation, as an innovation process in a discipline in growth, brings new challenges through time. Organizations get experience and new abilities, but better adaptations to get better results are always needed. In order to maximize benefits and to minimize waste due to the learning process, a framework that combines the two perspectives of lean construction implementation is presented in a matrix where six companies that are currently implementing lean construction were classified (Figure 1), according to the extent of their implementations (Picchi & Granja's perspective) and their implementation phase (Seguel's perspective).

According to the framework presented in Figure 1, companies need to evolve from "Scenario 1" to "Scenario 3", but for doing so they need to generate capabilities to

support this change. In this sense, people play the most important role, because they have to support the change process and get the competences to apply lean construction in the transformation of the whole enterprise.

RESEARCH METHODOLOGY

The research methodology had five steps. It started with a theoretical analysis of executive roles, then an empirical analysis of executive's roles to reinforce the previous analysis, then a draft of a model for validation purposes, after that a validation of the proposed model by an expert panel, and finally the consolidation of the definitive model by analyzing the lean expert's opinion. Figure 2 shows the research methodology and its steps.

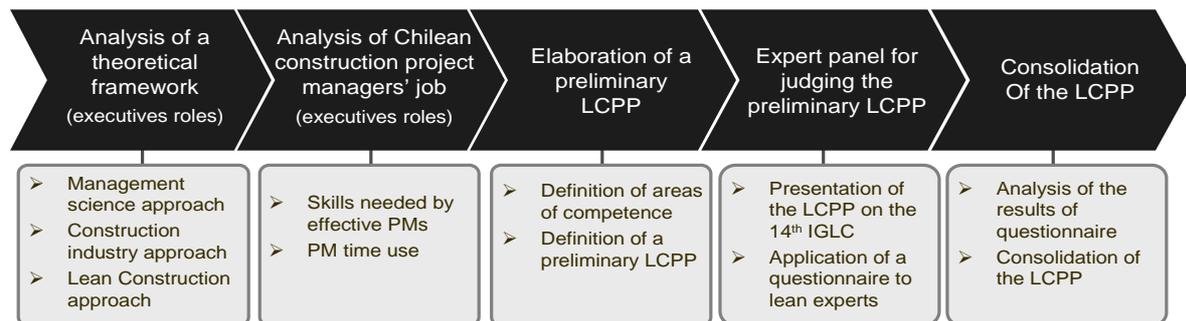


Figure 2. Research Methodology.

STEP 1, ANALYSIS OF A THEORETICAL FRAMEWORK

The aim of this step was to fully understand the executive's job. For obtaining a complete vision of the problem, considering the lack of literature about this issue in construction, the theoretical framework included three perspectives: management science, construction industry and lean construction. Figure 3 shows a selected literature related to this issue.

The analysis of executive roles was centred on identifying the key elements to build a today's executive profile. This analysis allowed to identify four elements that characterize their job, related to the abilities required to perform this position in these days. These elements are showed in Figure 4.

It is important to notice that the conceptualization of each element was mainly provided by the management science approach and Lantelme's (2004) research; and it was supported by the others authors to verify it adaptation to the construction scenario.



Figure 3. Theoretical framework.

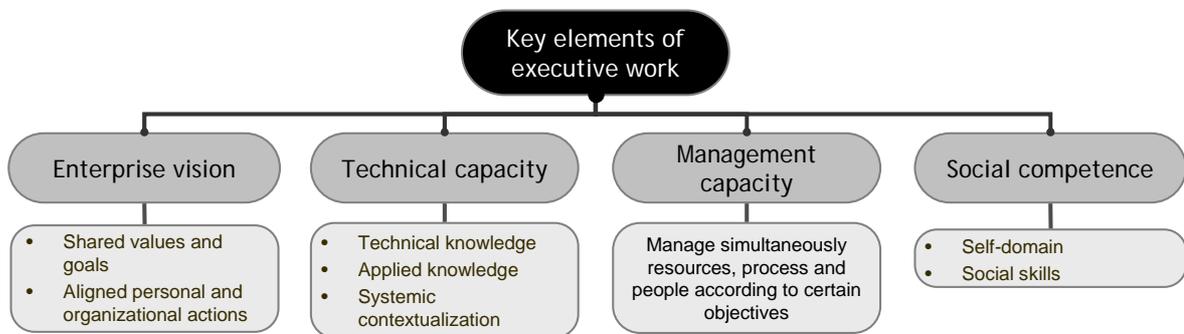


Figure 4. Key elements of executive's work: analysis of the theoretical framework.

STEP 2, EMPIRICAL ANALYSIS: CHILEAN CONSTRUCTION PROJECT MANAGERS JOB

Once the conceptualization of the key elements of executive's work was ready, it was wished to support this theoretical conceptualization with empirical data coming from Chilean companies. For doing so, a study of PM role in Chilean contractor organizations was made (Pavez, 2007; Alarcón & Pavez, 2006). This included: (1) skills needed to be an effective PM, and (2) PM's time use.

This study confirmed the appropriateness of the elements identified in the theoretical framework, because it was possible to classify the results obtained in the previous defined categories (see Table 2). An interesting finding from this analysis was the fact that enterprise vision did not appear as one of the competences areas that PM's need, which is similar to the outcomes of other studies in the construction industry. One of the problems with this situation is the lack of alignment between organization, project and people purposes, which is a vital aspect of any organization that wants to be effective in their work.

Table 1. Empirical evidence to support the theoretical analysis of executive's work.

Empirical evidence from Chilean reality	Enterprise vision	Technical capacity	Management capacity	Social competence
Skills needed to be an effective PM (Pavez, 2007)		✓	✓	✓
PM's time use (Alarcón & Pavez, 2006)		✓	✓	✓

STEP 3, ELABORATION OF A PRELIMINARY LCPP

Through the outcomes of previous steps a preliminary LCPP was built, with the purpose to validate it by the lean expert's panel. The definition of the preliminary LCPP embraced basically the definition of competence areas and grouped them in a consistent model called LCPP (Pavez & Alarcón, 2006). Two premises were considered to build this model: (1) the LCPP must include all the competence areas identified in the theoretical and empirical analysis; and, (2) the LCPP must be representative of all construction professional's positions.

From the analysis of the previous steps four competence areas arose (enterprise vision, technical capacity, management capacity and social competence), but analyzing the lean theory (Koskela, 2000) and publications related to lean construction training (Hirota, 2001; Hirota and Formoso, 1998), it was possible to appreciate that in conceptual terms there was another variable not previously considered. This variable was lean vision, which means the knowledge and work vision that lean professional's need to perform under lean construction principles (which imply new ways of acting and thinking).

Once the five competence areas were conceptualized, the LCPP was defined and presented on the 14th IGLC annual conference for validation purposes (next step). Figure 5 shows the preliminary LCPP (Pavez, 2007; Pavez & Alarcón, 2006).

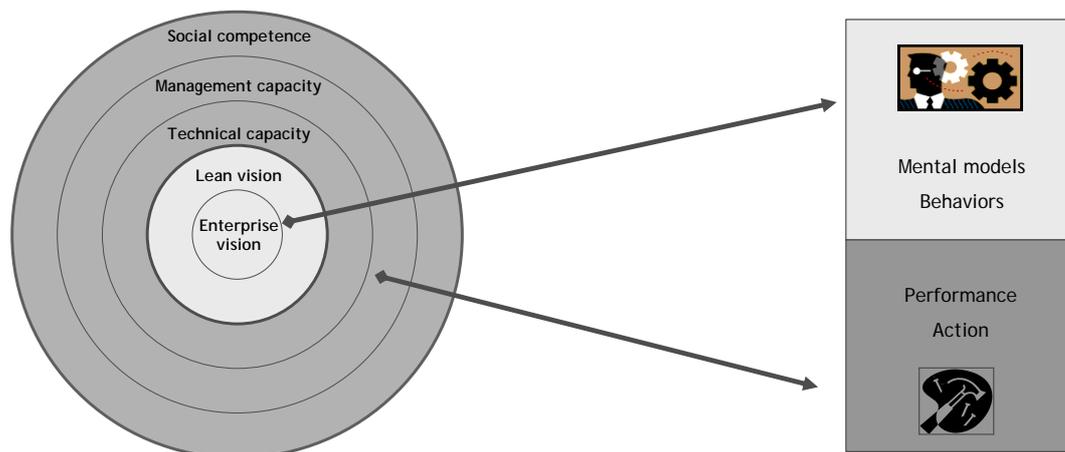


Figure 5. Preliminary version of the LCPP (Pavez, 2007).

STEP 4, EXPERT PANEL FOR THE PRELIMINARY LCPP

This was the first step for the consolidation of the LCPP and it was made by an expert panel composed by six lean experts (Table 3). For doing so, the preliminary LCPP was exposed on the 14th IGLC annual conference (Pavez & Alarcón, 2006). Informal

conversations with several experts were held on the conference, and then, a formal questionnaire was sent by e-mail to analyze three issues: (1) the importance of the competence areas for a lean professional, (2) the adequateness of the competence areas proposed, and (3) the definition of specific competences associated to each competence area (Pavez, 2007). Table 2 shows a brief of the answers provided by the lean experts, which includes an explanation of the evaluation form and the main answers related to each variable.

Table 2. Brief of the expert's answers upon the preliminary LCPP.

Variable	Evaluation form	Brief of the expert's answers
Importance of the competence areas	The evaluation of the importance of each competence area was made by a 5 points Likert scale, where: 1 = "Not important at all"; 2 = "Not too important"; 3 = "Indifferent"; 4 = "Important"; and 5 = "Very important".	<p>1.1 All the competence areas were classified as important (all the competences were qualified upon 4.4 points).</p> <p>1.2 Management capacity could be viewed as a "commodity".</p> <p>1.3 Enterprise vision and social competence are important, independent of lean.</p>
Appropriateness of the competence areas	This variable was evaluated by the following question: Are the competence areas adequate to embrace all the competences needed by "lean construction professionals"?	<p>2.1 The individual responsibility with the society and the environment should be included.</p> <p>2.2 The difference between competence and capacity is not clear.</p> <p>2.3 In conceptual terms management capacity and social competence are difficult to separate.</p>
Specific competences required by each competence area	For this item it was requested to make a list of the specific competences (grouped by each competence area) they believe are necessary to perform as a "lean professional".	<p>3.1 Lean vision is very similar to management capacity. Lean is management.</p> <p>3.2 The specific competences associated to management capacity were very similar to the social competences identified. Therefore, both competence areas were not separate under lean expert's point of view.</p> <p>3.3 The competence areas "enterprise vision", "technical competence" and "social competence" were well conceptualized and understood.</p>

Table 3. Lean experts profile.

Expert	Country	Experience in construction	Academic experience	Experience in lean construction
Expert 1	Brazil	20	28	10
Expert 2	Brazil	24	20	9
Expert 3	USA	11	19	11
Expert 4	USA	40	20	20
Expert 5	Brazil	30	22	10
Expert 6	Israel	8	9	6

1. Clarifications of the concepts used to define each competence area

One of the critiques on the preliminary LCPP was the lack of purity in the use of the terms competence and capacity. To clarify these concepts with the aim of elaborating the definitive model, both concepts were differentiated in terms of their generality or specificity (Hirota, 2001; Lantelme, 2004). In this sense, the specialized literature uses the term *competence* for knowing how to do in the job context (specificity), while the term *capacity* is more generic and not necessarily related to the job (Hirota, 2001; Lantelme, 2004). Regarding the differences in the use of these terms, for the final model the term competence was adopted, because the aim of the LCPP is to help to improve the practical implementation of lean construction.

2. Holding the well understood competence areas

Three of the five competence areas were well understood by lean experts, so it was decided to hold these competence areas as the base of the final model. They accomplish the two essential conditions: conceptual clarity and relevance (Table 2). These three areas were: *enterprise vision*, *technical competence* and *social competence*.

3. Redefinition of the misunderstanding competence areas

The main problem associated to the conceptual clarity of the LCPP's competence areas was the misunderstanding of *lean vision* and *management capacity*. In the case of *lean vision*, lean experts say that it merges elements of technical competence and social competence, and in essence people "manage" under lean principles. So that, it represents a combination of three competence areas: technical competence, social competence and management capacity.

On the other hand, *management capacity* was understood very close to social competence, because the modern concept of management implies a systemic interaction between resources, processes and people. Moreover, lean experts say that *management capacity* involves some elements of the three clear competence areas: enterprise vision, technical competence and social competence (with emphasis on social competence).

For the constitution of the definitive LCPP, due to the situation exposed above, it was decided to remove *lean vision* and *management capacity* and configure a new concept: *lean management*. The elaboration of this concept, however, implied a rigorous revision of lean management theory to find a concept that could be consistent with the competences areas needed by a lean professional.

Analyzing different theoretical approaches for the definition of *lean management* (Koskela, 2000; Womack & Jones, 2005; Macomber & Howell, 2003) a novel understanding of this concept was found, defined in terms of what an organization needs to be a lean organization (objective of this work) (Womack, 2006). In this sense, a recent article published by the lean enterprise institute, states that the key to reach good results and to evaluate the success of companies that are applying lean production is focusing on three elements: business purpose, processes and people (Womack, 2006).

According to Womack (2006), to be a lean organization it is necessary to start by asking about *business purpose*, which always has two aspects: what you need to do better to satisfy your customers and what you need to do better to survive and prosper as a business. Once the business purpose is clear, it is necessary to assess the *processes* providing the value the customer is seeking. In other words, design *processes* to assure that all of the actions required going from start to finish in responding to the customer

need are being carried out in a good way (value stream). Finally, brilliant processes addressing business purpose don't just happen. They are created by teams led by some responsible person. Therefore, the next question is about *people*, in order to assure that all of the processes are executed in the right way.

The definition of *lean management* concept as proposed by Womack (2006) was surprisingly close to the competence areas defined to be the basis of the LCPP. Therefore, this concept was adopted to be the focus of the definitive competence areas (enterprise vision, technical competence and social competence) to differentiate them from the focus that competence areas could have in professionals who do not work under lean principles.

LEAN CONSTRUCTION PROFESSIONAL'S PROFILE (LCPP)

Regarding the research methodology previously exposed, the definite LCPP was based on two elements: (1) competence areas and (2) lean management. The relationship between these elements is that *competence areas* define the "big areas" in which lean professional's need to be competent, and *lean management* provide the focus for the competence areas to be more effective in applying lean construction (and drive the transformation of the lean organization). Figure 6 shows a model of the LCPP and Figure 7 describes the model in a more detailed way.

It is important to notice that if lean management does not involve the competence areas (see Figure 6) the model could be a generic profile of competences for construction professionals. This is an important consideration, because it allows to speculate that competence areas do not differ in essence, but in the way they are applied according to the paradigm of action in which people are immerse.



Figure 6. Lean Construction Professional Profile - LCPP (Pavez, 2007).

Competence areas (CA)	Definition	Key elements	Relationship with <i>lean management</i>
Enterprise vision	Shared vision of values and goals that employees must have to align people and organization short and large term goals. It implies that people should be able to make decisions based on enterprise objectives (business purpose), that is, enterprise needs should be put over particular needs coming from the different organization actors that influence the decision.	<ul style="list-style-type: none"> - Understanding of strategical bussiness issues and client needs - Shared organizational values and goals - Organization needs 	<p><u>Bussiness purpose</u></p> <p>According to the <i>lean management</i> concept, this CA sholud be focused on the understanding of bussiness purpose (client needs and internal operation) to align actions and decisions for reaching this purpose.</p>
Technical competence	This is the base of the professional work. It contains concepts, theories, rules, methods, tools and technologies mobilized to carry out the work (in general terms) and solve professional activity problems. For the case of lean construction professionals it implies acquiring competences in construction techniques, project management and lean tools.	<ul style="list-style-type: none"> - Construction techniques - Project management - Lean tools 	<p><u>Procesess</u></p> <p>According to the lean management concept, people's technical competence should be focused on how processes can make the value stream more effective, with the aim of delivering to the client what he/she really want.</p>
Social competence	Is the ability to inspire people for directing them to the desired performance scenario by bringing the best of their own capacity. It allows developing the informal organization in the right way by focalizing and taking advantage of the conversations and social networks that the organization produces. It is a key element to create high performance teams and this acquires more relevance as people's hierarchy gets higher. For developing this competence area it is necessary to have a self-domain and social skills (leadership, team work, communication, etc.)	<ul style="list-style-type: none"> - Self-domain - Social skills 	<p><u>People</u></p> <p>According to the lean management concept, people's social competence implies the ability to co-build work teams and achieve their commitment to the organization processes to assure delivering to the client what he/she want.</p>

Figure 7. Detailed description of the LCPP.

CONCLUSIONS

Lean construction implementation, as an innovation process in a discipline in growth, brings new challenges everyday. Organizations get experience and new abilities, but they are always in need for new approaches to get better results. In the case of Chilean construction companies (Alarcón et al., 2006), but also in the international scenario (Picchi & Granja, 2004), the main needs for reaching better implementations have been associated to the improvement of organizational effectiveness, where the role of people is essential.

This research investigated the way in which people could support the transformation of the lean organization by defining the LCPP (Figure 6), which provide the competence areas needed by a lean construction professional (change agent) consistent with the elements of lean management; defined as a new understanding of how to be a lean organization (Womack, 2006).

Also, the conceptualization of the LCPP provides a good framework to drive people development inside construction companies, because it presents a complete model of the competence areas needed by lean professionals and a clear definition of the focus that each competence area must have (Figure 6 and Figure 7).

Finally, regarding the characteristics of the LCPP, important applications for the future could be the following: (1) identify specific competences for each competence area; (2) study the differences among professional's positions by each competence area; (3) define the most important competences in each competence area regarding the better way to support lean construction in contractor organizations; and (3) develop training programs to develop each competence area in the professional staff of the companies.

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