

The Lean Construction Professional Profile (LCPP): Implementation in Chilean Contractor Organizations

Ignacio Pavez¹, Luis F. Alarcón²

¹Relaciona Consultores, Santiago, Chile

¹Weatherhead School of Management, Department of Organizational Behavior, Case Western Reserve University, Cleveland, USA

²School of Engineering, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, Santiago, Chile

¹ignacio.pavez@case.edu; ²lalarcon@ing.puc.cl

Abstract- The consolidation of lean construction requires the active engagement of people able to implement this management philosophy. Therefore, a pioneering research study was carried out to define a Lean Construction Professional Profile (LCPP), which identifies three areas of competence that need to be developed simultaneously: enterprise vision, technical competence and social competence. This article presents an initial implementation of the LCPP in Chilean contractor organizations, based on the identification of the competences required by project team members' roles. Also, new developments of the model are discussed, in order to provide recommendations for implementing the LCPP inside construction companies. Results revealed the coherence of the model in terms of what construction companies expect of their project staff and how—through the identification of specific competences—it is possible to address the three elements of lean management: business purpose (enterprise vision), processes (technical competence) and people (social competence). In the future, it is expected to obtain data which will allow organizations to manage individual performance according to the LCPP and implement the model in other human resource management processes.

Keywords- *Lean Construction; Lean Management; Human Resource Development; Competences*

I INTRODUCTION

The consolidation of lean construction (LC) theory demands the application of its concepts and principles in practical situations^[1], but until now, most implementations have been very fragmented^[2]. They have been mainly focused on the improvement of project performance through the application of new tools and methodologies, leaving aside human, organizational and cultural issues^{[3], [4]}.

This fragmentation has been widely recognized in problems related to the implementation of new management systems, or any kind of change initiative that involves some change in behavior^{[5], [6]}. Consequently, it is necessary to educate and/or train people so they can deal better with these situations, supporting the learning of new skills/behaviors with adequate vision, processes and organizational structure^{[6], [7], [8]}.

In the case of Chilean construction companies, the social side of LC implementation has become increasingly important in the last decade^[18]. Thus, a group of companies—supported by the Center for Excellence in Production Management (GEPUC) at Pontificia Universidad

Católica de Chile—decided to carry out an *organization development* (OD) research program^[8] as a foundation to improve the effectiveness of their collaborative effort to implement LC^[9]. Under this program, the creation of an adequate profile of competences for the professional staff of the companies was one of the main lines of work, because it was shown in previous research that they were the key actors for reaching successful LC implementations^{[10], [11]}. The first stage of the OD research program identified a Lean Construction Professional Profile (LCPP) with three areas of competence to develop simultaneously: enterprise vision, technical competence and social competence^{[3], [9]}.

An initial implementation of the LCPP is presented in this article based on the identification of the competences required by project team members' roles in each competence area proposed by the LCPP. Also, new developments of the model are discussed in order to provide some recommendations for implementing the LCPP in construction firms.

Results have allowed visualizing the coherence of the model in terms of what the company expects of their project staff and how, through the identification of specific competences, it is possible to address the three elements of lean management: business purpose, processes and people^[12].

In the future, it is expected to obtain data which will allow organizations to manage individual performance according to the LCPP and implement the model in other human resource management processes, with the aim of reaching more effective LC implementations both at the project and at the organizational level.

II BACKGROUND: THE LEAN CONSTRUCTION PROFESSIONAL PROFILE (LCPP)

From an academic perspective, research about the LCPP arose from the need to fill a gap found in the literature regarding the role of people in lean management systems. From a practical standpoint, however, the aim of LCPP research was to help Chilean contractor organizations to improve the effectiveness of LC implementations. Thus, an active collaboration between academics and practitioners was developed, in order to strengthen LC implementation by using the scientific method. Consequently, empirical data

were obtained from Chilean construction firms, but the creation and validation of the model included the expert opinion of internationally renowned LC scholars [3], [9].

LCPP research was carried out for three years as a line of applied research that a group of Chilean contractor organizations—who belong to a learning community supported by GEPUC as a research-based institution—were deploying to implement LC in a more effective way [9]. The research revealed a generic profile of competences for lean construction professionals called LCPP, which consisted of

two main elements (Figure 1): (1) *Competence Areas* (CA) and (2) *Lean Management* [12]. The relationship between these elements is that CAs define the “big areas” in which lean professionals need to be competent, and *lean management* provides the focus for the CAs to be more effective in applying lean construction (and drive the transformation of the lean organization). Figure 1 shows a model of the LCPP and Table I describes the model in a more detailed way.

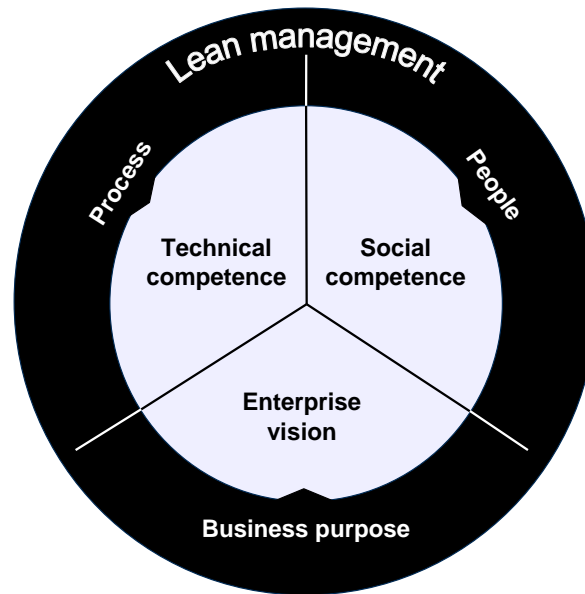


Fig. 1 Lean Construction Professional Profile - LCPP [3]

TABLE I DETAILED DESCRIPTION OF THE LCPP (ADAPTED FROM [9])

Competence Area	Definition	Key Elements	Relationship with <i>Lean Management</i>
Enterprise vision	Shared vision of values and goals that allow people to be connected and inspired by the future of the organization. It implies that people will be willing to make decisions based on company objectives (business purpose) or, at least, put company needs before individual interests.	<ul style="list-style-type: none"> Understanding of strategic business issues and client needs. Shared organizational values and goals. Organizational needs. 	<p><u>Business purpose</u></p> <p>According to lean management theory this competence area should help to embrace a very good understanding of the business purpose, in order to allow the alignment of operational activities with client's needs and expectations.</p>
Technical competence	This is the basis of proficient professional work. It embraces the concepts, theories, rules, methods, tools and technologies that people mobilize to carry out their job and to solve problems of professional activity. For lean construction professionals, it implies acquiring competences in construction techniques, project management and lean management tools.	<ul style="list-style-type: none"> Construction techniques Project management Lean management tools and methodologies 	<p><u>Processes</u></p> <p>According to lean management theory, people's technical competence should help to reach operational excellence by making the value stream more effective, with the aim of delivering to the client what he/she really wants, without waste.</p>
Social competence	Is the ability to inspire people in order to move them to the desired performance scenario, bringing the best of their own capacity. It allows developing the informal organization in a proper way, by focusing and taking advantage of the conversations and social networks that the organization produces. It is a key element for creating high performance teams and it acquires more relevance the higher one's position in the hierarchy.	<ul style="list-style-type: none"> Self-management Relationships management 	<p><u>People</u></p> <p>According to lean management theory, people's social competence implies the ability of creating (and sustaining) highly committed work teams, which can assure excellence in all the critical operational processes along the value stream.</p>

It is important to notice that if lean management does not infuse the CAs proposed by the LCPP (see Figure 1), the model could be a generic profile of competences for construction professionals. This is an important consideration, because it allows speculating that CAs do not differ in essence, but in the way they are applied according to the paradigm of action in which people are immersed^[9].

III IMPLEMENTATION OF THE LCPP IN CHILEAN CONTRACTOR ORGANIZATIONS

Once the LCPP was created (beginnings of 2007), it was presented to the Chilean construction companies that were part of the learning community for implementing LC, in order to move forward with the OD research project and to explore the application of the model in their human resource management processes. After that, from the eight companies that at that time constituted the group, three chose the implementation of the LCPP for their 2007 LC research agenda and two achieved a comprehensive application of the model.

The implementation was based on the elaboration of a competence-based performance evaluation system grounded in the LCPP. In so doing, a set of work meetings with company's experts were carried out, and specific tools to define the competences associated with each CA were applied. The research objectives, the research methodology and the main results of the study are presented in detail in the following sections.

A. Research Objectives

The main objective of this research was to introduce the LCPP into the companies with the aim of:

1. identifying the best way to implement the model in construction companies;
2. obtaining empirical data about the specific competences that each CA must have, differentiated by role;
3. refining the LCPP model based on a real implementation;
4. exploring how to link the LCPP with different human resource management processes, such as personnel selection, performance evaluation and professional development, among others.

B. Research Methodology

Given the need to explore a solution for an increasingly important problem for Chilean construction firms, an action research methodology was adopted as a theoretical background^[13]. As the name indicates, it is "research in action", whose purpose is to carry out investigation that is more effective in practical terms. In other words, it has to solve a real problem, improve the conditions in which the intervention was applied and, at the same time, create scientific knowledge^{[8], [14]}. Important characteristics of this approach, relevant to its application in this study, are: it

possesses elements that link it with the scientific method; there exists close collaboration between researchers and practitioners; and the researcher plays an active role in the system under study, because he/she is not only an observer but an agent of change^{[8], [9]}.

It is important to notice that this study constitutes a subsection of the OD research project previously mentioned, so the research methodology explained here is one part of the methodology used in the whole investigation. Thus, the research design follows the same logic of the OD research project, but is specifically driven by the aims and objectives of the current study. Consequently, based on the action research theoretical background, and the general context in which the study is immersed, the research methodology for implementing the LCPP consisted of three phases: (1) definition of general conditions, (2) development of the solution and (3) internal validation.

1) Phase 1: Defining the General Conditions:

This is one of the most important activities of the action research methodology because the close relationship between researchers and practitioners requires defining the working approach and the responsibilities of each part involved before beginning the study. In so doing, three activities are important: (1) understanding and delimiting the problem to solve; (2) establishing a common language, which implies explaining the technical concepts behind the study and the way in which people must interact; and (3) putting together the work team (company team and research team) which is going to direct the fieldwork, based on technical criteria. Regarding the last point, it is recommended that each company's team has one person representing senior management (enterprise/strategic vision), one person representing the human resource management staff, and two people representing the positions involved in the work (in this case, the professional staff of the company).

2) Phase 2: Developing the Solution:

This phase involved a series of specific activities, each of them designed to meet the conceptual requirements of the CAs proposed by the LCPP. The first stage, called "analysis of antecedents", was oriented to completely understand how the companies have approached each CA, in order to design the subsequent steps based on a solid understanding of each company's initial position. The second stage, called "fieldwork", consisted of a series of individual and group interviews of people in various project site roles, as well as a deep review of the outcomes of previous research which identified the social competences required by construction professionals^[9]. The third stage, called "collective construction", consisted of a series of specific activities focused on defining—with the help of the companies—the specific competences for each CA, based on the information collected in previous stages and the business knowledge held by each firm. Figure 2 shows a summary of the activities carried out, according to the stage involved.

Activities carried out	Competence areas of the LCPP		
	Enterprise vision	Technical competence	Social competence
Analysis of antecedents	<ul style="list-style-type: none"> Enterprise strategy Mission, vision and values of the organization Core competences 	<ul style="list-style-type: none"> Organizational structure Role descriptions Performance evaluations 	<ul style="list-style-type: none"> Organizational structure Role descriptions Performance evaluations Dictionaries of generic competences (internal and/or external)
Fieldwork	<ul style="list-style-type: none"> Does not exist 	<ul style="list-style-type: none"> Individual interviews of site staff Group interviews of site staff 	<ul style="list-style-type: none"> Competences required by construction professionals [9] Project Manager's time use [9]
Collective constructions	<ul style="list-style-type: none"> Workshop to define the central competences of the company (with senior management) Application of the <i>core/organizational competences model</i> 	<ul style="list-style-type: none"> Definition of the responsibility matrix for a typical project, based on the central processes carried out by the company Application of the <i>functional competences model</i> with a process approach 	<ul style="list-style-type: none"> Definition of the social competences required by the roles analyzed, based on a dictionary of generic competences made by GEPUC Application of the <i>generic competences model</i> adapted to construction work

Fig. 2 Development of the solution - Phase 2 of the research methodology

To better understanding this phase of the study, it is worth noting that the specialized literature about competences highlights four models: 1) core/organizational competences, 2) distinctive competencies or the competency model, 3) generic competences, and 4) functional competences^{[15], [16], [17]}. These four models overlap in conceptual terms with the generic definition of the CAs proposed by the LCPP, so the activities carried out in this phase bring out the essential aspects of each model and adapt some specific elements to the context and the aims of this research.

More specifically, to define the specific competences of the *enterprise vision*, we used the model of *core/organizational competences*^{[16], [18]}, adding the organizational values promoted by the company; to define the *technical competences* we used the model of *functional competences*^[15], but using the *process approach*; and to define *social competences* the model of *generic competences* was used, based on previous research in the area^[9] and commonly-used dictionaries of competences^{[15], [19]}.

3) Phase 3: Internal Validation and Communication:

Once the previous phase was accomplished, the results were conveyed to the relevant actors in each company, with the aim of receiving their feedback and to incorporate their most important recommendations. This was an iterative process—as action research recommends^[14], which resulted in the final version of the LCPP for each company. After that, the outcomes of the study were communicated to the entire organization in order to incorporate them into the company's work practices.

C. Results

For the purpose of this article, the most important outcome is the profile of competences defined by each company, so specific issues related to the performance evaluation system will be omitted. The process to implement the LCPP, however, was different for each company, so the results include a table which compares the process in each of them (Table II). The competences associated to the LCPP in each company are presented in detail in Figure 3 and Figure 4.

TABLE II CHARACTERIZATION OF THE COMPANIES AND AN ASSESSMENT OF THE WORK-MEETINGS

		Company 1	Company 2	Company 3
Description	Specialty	Housing	Housing High-rise building	Housing Industrial facilities
	Size	Medium	Medium to large	Large
	Age	48	18	27
	Type of company	Family	Partnership	Partnership
Work Meeting Evaluation	Company work group members	CEO Operations manager Chief of quality assurance Human resources administrator	Project director Chief of quality assurance Human resource management assessor	Operations manager Lean facilitator Project manager Personnel administrator
	Number of meetings	8	10	18
	Frequency	Every week	Every two weeks	Every two weeks
	Duration	2.5 - 3 hours	1.5 - 2 hours	1 hour
	Attendance	100% of the meetings	90% of the meetings	50% of the meetings

	Enterprise vision	Technical competences	Social competences
Project manager	<ul style="list-style-type: none"> Organizational alignment Teamwork Technology and control 	<ul style="list-style-type: none"> Strategic planning of the project Cost control Technical capacity Orientation to results Continuous improvement and innovation 	<ul style="list-style-type: none"> Personal effectiveness Communication Leadership
Foreman		<ul style="list-style-type: none"> Human and material resources management Technical quality and productive process management Safety prevention Results orientation 	<ul style="list-style-type: none"> Personal effectiveness People guidance
On-site personnel administrator		<ul style="list-style-type: none"> Fulfillment of administrative processes Outward administration Fulfillment of remuneration processes 	<ul style="list-style-type: none"> Personal effectiveness
Warehouse administrator		<ul style="list-style-type: none"> Procurement management Administration of the on-site warehouse Control and distribution of materials to site 	<ul style="list-style-type: none"> Personal effectiveness

Fig. 3 Results of the implementation in Company 1

	Enterprise vision	Technical competence	Social competence
Project manager	<ul style="list-style-type: none"> Organizational alignment Client orientation Social and environmental awareness 	<ul style="list-style-type: none"> Production and quality management Technical knowledge 	<ul style="list-style-type: none"> Teamwork Delegation Time management and personal effectiveness Negotiation and conflict resolution Communication Leadership and decision making
On-site manager			
Chief of technical office			

Fig. 4 Results of the implementation in Company 2

1) Case 1: Implementation of the LCPP in Company 1:

Company 1 is a medium-sized family firm, with 48 years of existence, focused on the social and economic housing market. The work carried out in this firm was focused on their permanent project team: project manager, foreman, on-site personnel administrator and warehouse administrator.

This firm was the most committed company, fully collaborating with the research team on all activities and committing to the continuous participation of the whole company group in all work meetings. The outcomes regarding the LCPP, separated by role, are shown in Figure 3.

This case shows, as the LCPP proposes, a common set of competences for *enterprise vision*, which operationalize the business purpose infused by the company's values and its core competences^[18]. The *technical competences* varied according to the project team role because it was necessary to differentiate the processes that people were in charge of based on the critical activities they need to carry out to

assure the effectiveness of the value stream. Finally, due to the characteristics of their business (social and economic housing market) and the level of education of the project staff (just the Project Manager had completed undergraduate studies), they decided to focus the cluster of *social competences* on the skills that would allow people to be more effective and productive at work. In this process they realized that "personal effectiveness", defined as a combination of four behaviours—self-criticism, responsibility, proactivity and time management—was the key competence to facilitate coordination and to promote trust among on-site workers, so it was preserved for all positions.

The LCPP for this company fits its original theoretical conceptualization very well, because it confirmed the speculation of having a common set of competences for enterprise vision, a set of competences differentiated by role for the cluster of technical competences, and a combination of a common set of competences, and others differentiated by role, for the cluster of social competences.

2) Case 2: Implementation of the LCPP in Company 2:

Company 2 is a medium-large-sized firm, with 19 years in the market of housing and high-rise buildings. The focus of their work was the on-site professional team, because they had previously identified the key actors for sustaining a lean culture as being the project manager, on-site manager and chief of the technical office.

In this case, the company had a profile of competences previously developed, so the work was focused on reviewing it according to the guidelines of the LCPP. Based on that, the work carried out consisted of redefining the existent competences using the structure of the LCPP and adding some new competences not previously taken into account.

Because of the existing profile of competences in use by the company, the redefinition of the competences was based on the generic competences model^[15] and enriched by the outcomes of a previous study focused on the competences required by Chilean construction professionals to be proficient at work^[9]. The competences associated with the LCPP for this company are shown in Figure 4.

This case is interesting because the logic behind the construction of the LCPP was totally different from the previous one. This company had always required employees in the roles studied to hold a university degree (civil engineering or civil construction), and had recently begun requiring them to attend a career development program. This program consisted of starting as Chief of Technical Office (1 to 3 years), then progressing to an On-Site Manager (2 to 4 years) and culminated in Project Manager (more than 6 years of experience, depending on the characteristics of the project). This characteristic of the company made it possible to build an equivalent version of the LCPP for all the roles studied (see Figure 4), differentiated by the extent to which each competence needs to be deployed by each role (they used a scale from 1 to 5 for this purpose). This differentiation was especially important—as theory suggests—for *social competence*, because it has been demonstrated in previous studies to help to distinguish among average and high performers^{[20], [21]} and is associated with a successful professional career^[22]. Based on the link between the LCPP and the career development program, this company required, for example, the expression of “leadership and decision making” at Level 5 for Project Managers, at Level 4 for On-site Managers, and at Level 3 for Chief of Technical Office.

Finally, it is important to mention that, although this case challenged the original conceptualization of the LCPP (as explained in the previous case), it added a new understanding of how the context and the characteristics of the company make the LCPP contingent on the specific situation in which it need to be applied.

3) Case 3: Implementation of the LCPP in Company 3:

In spite of starting the work before other companies, Company 3 did not achieve a complete implementation of the LCPP. For that reason, instead of showing partial results, we would like to highlight the importance of having the

commitment of the company group and the senior management team with the research project. If the commitment and support to both groups do not exist, it becomes very difficult to reach positive and long-lasting results. Also, the possibilities to take advantage of the action research methodology are reduced, because the knowledge ought to emerge from the close collaboration between researchers and practitioners^{[8], [14]}.

IV CONCLUSIONS AND RECOMMENDATIONS

Lean construction implementation, as an innovative process in a growing discipline, brings new challenges every day. Organizations gain experience and new capabilities, but they are always in need of new approaches to get better results. In the case of Chilean construction companies^[10], but also in the international scenario^[2], the main needs for reaching better implementations have been shown to be associated with the improvement of organizational effectiveness, where the role of people is essential^[4].

Research about LCPP addressed this challenge by identifying how people could support the creation of a lean culture. The LCPP proposes three CAs that lean professionals have to develop simultaneously—enterprise vision, technical competence and social competence—according to the three elements of the lean management—business purpose, processes and people^{[3], [9]}.

In this article an initial implementation of the LCPP using the action research methodology is presented. The outcomes can be analyzed from two perspectives: the implementation process and their results.

From the perspective of the implementation process, the most important discovery was the identification of the better techniques to develop each CA, because it strengthens and enriches the LCPP for future implementations and development. In all three cases in which the LCPP was applied, the results obtained were positive in terms of uncovering these better techniques. This situation was facilitated by the existence of proven tools provided by the well-established field of “competences”^[15], which applied to develop each CA of the LCPP.

Due to the good results obtained, we recommend the following: to define the competences associated with enterprise vision it is best to use the model of core competences^[18] or organizational competences^[16]; to define the competences associated with technical competence we suggest the use of the model of functional competences^[15] applying the process approach (typical of lean systems); and to define the competences associated with social competence we suggest using the model of generic competences^[15] adapted to the construction context (currently we are elaborating a dictionary of competences based on the competences identified in previous research^[9]), or the model of distinctive competencies (not applied in this context yet)^{[15], [20]}.

From the results perspective, it is important to note that the competences identified in this research capture the

essence of the three elements of *lean management*, which could facilitate the development of a lean culture (from a people perspective) if the LCPP is incorporated into the human resource management processes. Also, it was possible to identify two competences that in most cases are not considered by organizations but which the LCPP must have: *organizational alignment* (in enterprise vision) and *personal effectiveness* (in social competence). These two competences are important for the following reasons: the first one allows including the organization's values in the behavior expected of people, and the second one allows including some elements that precede an effective interaction, in other words, the elements of personal effectiveness^{[22], [23], [24]}.

Finally, regarding the characteristics of the LCPP, areas of development for future research are: studying the differences between roles for each CA, identifying the more relevant competences in each CA (to reach better performance and/or improve the creation of a lean culture), developing specific training plans for each CA, and implementing the LCPP in other human resource management processes (selection, incentives, professional development, organizational change, among others).

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Ignacio Pavez received his MS in Civil Engineering in 2007 from Pontificia Universidad Católica de Chile (PUC), where he specialized in project management and lean construction. Currently, he is pursuing a PhD in Organizational Behavior at Case Western Reserve University in Cleveland, USA.

He is a Business Partner at Relaciona Consultores, a consultancy firm specialized in strategy,

organizational transformation, organizational culture, leadership development, process improvement and business coaching. He started this firm in Santiago, Chile, in 2010. Before holding this position he was Consulting Manager of Organizational Development at the Center for Excellence in Production Management (GEPUC) at PUC, where he worked for 5 years. He has also taught in the Master's in Construction Management at PUC in Chile, and in the MBA program at Instituto Tecnológico de Monterrey in Ecuador. His current research interests include organizational culture, organizational development, corporate sustainability and the social dynamics of continuous improvement.



Luis F. Alarcón received a PhD, MEng and MS in Civil Engineering from the University of California at Berkeley, USA.

He is Professor of Civil Engineering, Director of the Master's in Construction Management and Head of the Department of Construction Engineering and Management at Pontificia Universidad Católica de Chile (PUC). His teaching focus is on project planning, project management, production planning and control, risk management and lean construction. He is also Director of the Center for Excellence in Production Management (GEPUC) at PUC, which specializes in lean construction research and implementation. His research and consulting activities concentrate on performance improvement in construction; project risk analysis; strategic planning for construction companies; decision support methodologies for construction projects, computer simulation and lean construction implementation. He has conducted research for government and private agencies in Chile and for the Construction Industry Institute in the US.