

## QUALIFYING PEOPLE TO SUPPORT LEAN CONSTRUCTION IN CONTRACTOR ORGANIZATIONS

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### ABSTRACT

The consolidation of the lean construction theory demands the application of its concepts and principles in practical situations, but until now most of the implementations have been very fragmented. They have focused mainly on the improvement of project performance through the application of new tools and methodologies, leaving aside organizational and human issues. This paper proposes a way to support lean construction in contractor organizations, both creating a Lean Construction Professional Profile (LCPP) (seeking what competencies are needed) and expanding the focus centered on projects to address organizational and human issues that are necessary to carry out a sustainable and successful implementation. Several research activities were carried out: an assessment of what skills Project Managers (PMs) need, a study of how construction PMs use their time, and an analysis of the best practices coming from the outcomes of executive's studies in management science, construction industry and lean construction. Extracting the main contributions and similarities of each approach, and taking the premise of the holistic development of people as a key element, five areas of competence and knowledge were identified: (1) enterprise vision, (2) lean vision, (3) technical capacity, (4) management capacity and (5) social competence. From the five competence-knowledge areas the LCPP was defined, considering first mental models that drive acting (enterprise vision and lean vision) and then sorting the competences needed in their complexity.

### KEY WORDS

Organization development, human resource development, project manager, lean construction, executive work.

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## 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 and Granja, 2004). They have focused mainly on the improvement of project performance through the application of new tools and methodologies, leaving aside organizational and human issues. Despite this, in latest years this area has been taken more serious both by the academics and practitioners, increasing the number of publications related with these issues.

In the case of Chilean implementations, more than twelve construction companies under the guidance of a University research team have carried out a collaborative research to implement “Lean Construction Practices” (LCP). These companies have committed to work together on several implementations (identify and reduce waste, performance measuring systems, benchmarking, last planner system, 4D modeling, and subcontractors evaluation methods, among others), enhancing their levels of productivity, improving the reliability of work flows, identifying their main causes of wastes, improving the involvement of middle managers and improving the management control (Alarcón et al, 2005a).

In spite of the good results achieved during the implementation phase there were some factors that hindered it. Assessing their five years of LCP implementation companies realized that their major problems had been related with human, cultural and organizational issues. To cope with it, companies decided to guide their collaborative efforts related to LCP to an *organization development* program (French and Bell, 1996) centered in their professional staff, including aspects like: (1) review of the project managers role, (2) review of the organization’s performance evaluation systems, (3) redesign of their site-organization to achieve LCP goals, (4) redesign of their incentive programs, and (5) the development of training program for their professional staff to become a “lean organization”.

The main objective of this paper is to propose a way to support lean construction in contractor organizations, both creating a *lean construction professional profile (LCPP)* and expanding the focus centered in projects to address organizational and human issues that are necessary to carry out a sustainable and successful application of lean construction in contractor organizations.

## ANALYZING THE IMPLEMENTATION OF LEAN CONSTRUCTION

### ASSESSING THE EXTENT OF THE IMPLEMENTATIONS

We would like to begin with a brief assessment of the extent of the implementations to put in context why the research was carried out.

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 (Table 1). According to definitions showed in Table 1, Chilean implementations can be classified on the first scenario (fragmented tools applications), mainly because professionals that carry out implementations in the field do not have a good understanding about lean construction philosophy (mainly concepts and principles) and because they focus on short-term implementation of lean tools wishing a real-time improvement of process and project performance.

Table 1. Lean implementation scenarios (Adapted from Picchi and Granja, 2004)

Scenario	Description
Scenario 1: Fragmented tools applications	Is the most frequent pattern observed in construction companies, and means the fragmented application of lean tools, without a rigorous consideration of lean principles and concepts (lean thinking). <i>The focus is put on lean tools application in specific project.</i>
Scenario 2: Integrated job site application	Represents a major step towards a wider application of lean thinking in job sites: the systematic applications of the five lean principles combined with tools use driven by a future state value stream mapping designed to improve flow. This is no notice of implementations in construction with the amplitude of scenario 2. In this scenario <i>the focus is put both on tools and principles.</i>
Scenario 3: Lean enterprise application	Is the application of lean philosophy to the job as a part of a company-wide transformation. In this scenario <i>the focus is put simultaneously on tools, principles, the project and the enterprise as a whole.</i>

**CRITICAL FACTORS AND BARRIERS OF THE IMPLEMENTATION**

Diverse factors influenced the implementation of the LCP, where human and organizational aspects became important barriers that obstructed the efforts of implementation and affected the team synergy (Alarcón et al, 2006). A summary of these factors are showed in Table 2.

Table 2. Critical factors of the implementation and barriers related with people

Critical factors	Barriers related with people
Time	The role of site/office manager
Training	The importance of commitment
Organization	Resistance to change
Parallel implementation with other improvement programs	Self-criticism
Problematic projects	Short term vision

**ORGANIZATION DEVELOPMENT NEEDS**

As showed above, there were some factors that hindered the implementation and most of them were mainly related with soft management issues. These factors were called “barriers to the implementation.”

Taking into count these barriers, companies realized that their major problems were related with human and organizational issues, so the mechanic vision of the improvement centered in specific improvement tools, has changed towards an organic view of the improvement, where human and organizational issues play an important role.

This change of view motivated the companies to guide their collaborative strategic efforts about LCP to an *organization development* program, that included aspects like: review of the Project Manager (PM) role, review of the organization’s performance evaluation systems, redesign of their site-organization to achieve LCP goals, the redesign of their incentive programs and the development of a training program for professional staff to become a “lean

organization". The methodology followed to carry out the organization development work was based in its three classical stages (French and Bell, 1996): diagnosis, intervention (planning the action and implementation) and evaluation.

The results of the organization diagnosis (first stage) showed the precarious existing systems to manage the human resources in these companies. Some results of this diagnosis were: lack of procedures to structure the site-organization, poorly defined functions, poorly defined incentives policies, lack of formal procedures to develop performance evaluation, poor information flow to lower levels of the organization and lack of qualified personnel according to the current challenges of construction work (Alarcón et al, 2005b).

The main reasons that caused these failures seems to be: lack of knowledge about human behavior in productive organizations, lack of application of existent techniques related to Human Resource Management (HRM), lack of functional areas related with HRM into the companies and lack of qualified personnel to manage human aspects of the organization in the staff of the companies.

The failures found in this research coincide with international studies where HRM in the construction industry is classified as personnel administration<sup>3</sup> and where it is pointed out that one of best investments to improve the current state of the construction industry is Human Resource Development (HRD) (Loosemore, Dainty and Lingard, 2003).

From the HRD perspective, training is one of the most important aspects to enhance people and organization development, because it powers technological and organizational change, contributes to the effectiveness of approaches that enhance quality and flexibility, and has a positive correlation with productivity improvement (Guerrero and Sire, 2001).

According to this understanding of training and with the changes that organizations must handle to implement LCP, some researchers have studied different ways to learn and teach lean construction (Hirota et al, 1999; Powell, 1999), because it implies new ways of thinking and managerial skills related to: team building (Buch and Sander, 2005), process orientation (Koskela, 2000), leadership (Orr, 2005; Howell et al, 2004), reliable commitments (Macomber and Howell, 2003), social competences (Lantelme, 2004) and the enhance of the conversation's sense (Macomber and Howell, 2003).

## **SEEKING A LEAN CONSTRUCTION PROFESSIONAL**

The literature about the profile of lean construction professional/worker is scarce and insufficient if we acknowledge that lean construction as a management philosophy must address in its conceptualization the necessary skills and/or competencies to apply the new philosophy in a good way, taking advantage from the soft area of knowledge that helps to support the application of the hard concepts associated to, among others: value generation process, waste reduction, variability reduction and creation of a reliable work-flow.

When this link does not exist (soft-hard management issues) it creates a vacuum in the system when we want to apply concepts, principles and tools of lean construction in the field

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<sup>3</sup> Personnel administration can be characterized by work fulfilling the law, centered in cost reduction instead of improving employee productivity, treating people as any other factor of production and generating ad-hoc solutions when some special requirement related to HRM is presented.

and creates a gap between what you achieve and what you can achieve. This gap becomes evident when you see the barriers that appear when you implement the system (e.g. Table 2). Those lead to loss of *latent performance*<sup>4</sup> and could be classified as an eighth waste<sup>5</sup>.

Another way to see it is through the conceptualization of Picchi and Granja (2004) about the lean implementation scenarios (Table 1), where whatever the state of the LCP in the organization is, there is always a chance to achieve the third scenario and integrate principles, concepts and tools both in the project as in the enterprise as a whole.

#### **METHODOLOGY TO BUILD THE “LEAN CONSTRUCTION PROFESSIONAL PROFILE”**

The methodology carried out to build the LCPP, was based on a combination of outcomes coming from two sources: (1) an empirical study of PM role in Chilean construction companies and (2) theory of executive roles.

The aim of this methodology was to provide a holistic view of professional roles in construction companies. Taking into account the current state of these practices in the field (PM study) and improve them by conceptualizing what requirements are not performed in a good way and/or what are needed, according with the best practices on executives roles coming from management science, construction industry and lean construction.

#### **DELINEATING THE “LEAN CONSTRUCTION PROFESSIONAL PROFILE”**

The executive role in the organization work has been a great matter of study in management sciences due to its importance for company success. Special relevance has been put on the manager role and on leadership as one of the major issues that should characterize the work of today's professionals according to the economic and market dynamics.

In construction industry the role of the PMs as central role for project success has taken more importance in the academic side, so several studies have been carried out to find the necessary competences to perform this role in a better way. Lean construction has already approached this topic in recent years, mainly trying to find or conceptualize some characteristics of a *lean leadership*.

As a part of the current study, in the organization diagnosis stage, an assessment of what skills PMs need was carried out (Alarcón et al, 2005b) and a research of how construction PM's use their time was recently completed (Alarcón and Pavez, 2006). These studies investigated what skills PM's need, the most important functions in their role and how cultural, organizational and environmental issues affect their performance.

#### **MANAGEMENT SCIENCE APPROACH**

Management science approach has the most varied and deep approach regarding the study of executives roles and leadership. Among the most important findings from this approach are:

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<sup>4</sup> The authors call latent performance a performance that is potentially reached but due to the failures in the process or in a system as a whole (whichever they were) is not reached. A condition, nevertheless, is that this failures must be manageable with improvements made by people.

<sup>5</sup> According to Macomber and Howell (2004), an eight waste is a waste that is different from the 7 wastes proposed by Ohno and in most cases are related to social and organizational issues like not using people's talents, underutilized people's capabilities and not taking advantage of people's thoughts, among others.

the importance of enterprise vision in top executive's role (Drucker, 2004), the difference between soft and hard competences and how their differences are both necessary and complementary (Mintzberg, 1990), the importance of communication in their job (Mintzberg, 1990; Covey, 2005), the importance of social skills (Goleman, 2004), the different ways of how officer executives lead (Farkas and Wetlaufer, 1996), what are the key activities of their role (Drucker, 2004; Mintzberg, 1990), leadership hierarchies (Collins, 2001), the need of systemic thinking and the capacity to consider global contexts (Gosling and Mintzberg, 2003) and the importance of self-confidence and integrity (Covey, 2005; Goleman, 2004).

All these approaches highlight the fact that as higher the hierarchic position of a person is, more important social skills and communication are. It is also emphasized that a directive's capacity to motivate their employees building a sense of organization on shared values is required as well as the executive's self-confidence and personal integrity.

#### **CONSTRUCTION INDUSTRY APPROACH**

Construction industry has enhanced the importance of PMs for project success and development, stating that project success depends directly on the leadership qualities of PMs and their ability to bring the best out in their team (Dainty et al, 2005; Dulaimi and Langford, 1999).

Most of the investigations have been centered in studies of leadership and in defining the necessary skills to work as PM, defining skills as a series of different characteristics, behaviors and traits necessary for effective job performance. Also, certifications schemes are developed and studied, stating that PMs must qualify in different variables like knowledge, experience, personalities and skills (Pannenbäcker et al, 2002).

Most of the research carried out in the construction industry indicates that the PM profile must address quite different competences, from technical and management capacity (validated mainly by the experience) to soft competencies. These include decision making, communication, leadership, motivation, time management, change management and negotiation. (Dainty et al, 2005; Odusami, 2002). More over, in a competency-based model for predicting construction PMs performance, "self-control" and "team leadership" were the most predictive competencies of superior performance (Dainty et al, 2005), suggesting that soft competencies are more important than technical ones.

#### **LEAN CONSTRUCTION APPROACH**

Under lean construction perspective the research focus has been put on the characteristics of lean leadership (Orr, 2005, Howell et al, 2004), trying to address to current practice of project management aspects related to site-organizational changes (Buch and Sander, 2005) and the importance of reliable commitments in project conversations (Howell et al, 2004; Macomber and Howell, 2003).

Lean leadership has been approached on one hand by nine lean leadership behaviors coming from the Toyota Production System. In this system leaders are not necessarily top and senior managers, but people who are trusted and respected and able to inspire others to follow them (Orr, 2005). On the other hand lean leadership was approached by the linguistic action concept where conversations are the core of the organization work and works via making and keeping commitments. In this type of leadership, the master skill is listening (Howell et al, 2004).

In both conceptions hierarchies must be eliminated and replaced by the concept of team, where the leader's work consist of inspiring people (leading by example), recognizing their contributions to project performance, committing employees to quality standards, center their focus on the process and enabling trust by conversations.

According with the aims of this study, a very close related research was carried out in Brazil by Lantelme (2004). This study was tried to identify the development of management competencies trough experiential learning, qualifying managerial positions to introduce management innovations (lean construction) in the construction industry.

The result of this research was a model of management action and competence where four knowledge domains were identified: (1) technical-instrumental knowledge, (2) systemic conceptualization, (3) self-knowledge and self-domain, and (4) social-transformation interaction. These four knowledge domains build two competences: technical competence (1 and 2) and social competence (3 and 4) (Lantelme, 2004).

#### **STUDY OF THE PROJECT MANAGER ROLE IN CHILEAN CONTRACTOR ORGANIZATIONS**

The research about the PM role in Chilean construction companies had two complementary studies:

1. The first study allowed identifying the skills that PM's need. This study was a part of an organization diagnosis (Alarcón et al, 2005b). Among the activities carried out in the diagnosis, a "focus group" with PMs to identify the main skills they must own was executed. Later on, a questionnaire that merged these skills with others provided by specialized literature (Oduami, 2002) was developed. This questionnaire was applied as a part of semi-structured interviews where 16 PMs evaluated the importance of each skill for they job and which of these skills were the most difficult to apply by themselves.
2. The second study was a specific study about PM's time use (Alarcón and Pavez, 2006). It allowed characterizing the PM's job, identifying their main activities, general characteristics of their job, their frequent interrelationships and communication means used, and time use dysfunctions related to personal, team, cultural and organizational issues. To reach it, in a first stage a "focus group" with PMs was developed, where the main tasks in which they were involved were established. According to these tasks, an evaluation form was developed in which the PM had to assign a time percentage dedicated to each task during the week. Also they had to evaluate the task relevance by marking with an "X" whether he/she should have done it or not. In this stage 16 people were involved. In a second stage, a time management workshop for PMs was done in which problems related to time management were discussed in detail. After that, a three-day follow-up was done to seven PMs in which each one of them had to write down his/her tasks every 15 minutes, obtaining a total of 21 days for analysis purposes.

The results of the first study were similar to those that other investigators obtained where social skills are considered more important than technical ones. In this study, the most important

skills identified were decision making, leadership and motivation, team work, time management and delegation. The most difficult to apply were time management and delegation.

The results of the second study show that the general characteristics of a Chilean PM's job are: (1) great variety of themes that he/she must handle simultaneously, generally associating each one of them with quick decision making; (2) extensive workday, averaging 11.3 hours per day; (3) great number of different people to whom he/she must relate to (in some days more than 15, without considering the people that work inside the project); (4) great number and intensity of communication tasks that he/she must carry out everyday, averaging nearly 75% of his/her work-time interacting with other people; and (5) absolute responsibility of the project's outcome, even replacing the tasks of subordinates in extreme cases such as an illness.

More specific outcomes were that nearly a third of the workday (35%) was spent in meetings, around a 35% of interrelationship time was spent with people who did not work on-site and 54% of the interrelationship time was spent with people that did not belong to the company. Despite external elements that cause their time management dysfunctions, their personal failures were: inability to say no, lack of prioritization, unclear perception of their main functions, problems with delegation capacity and lack of qualification in management's "soft" subjects that empower the time use.

According to the results obtained, among the main challenges for PM role are: (1) the eminently social character of their work, in which their social skills are fundamental due to their impact in PM's performance, and (2) the importance to qualify them in "soft" management issues (personal and social skills) to perform better their job and their relationships.

### **DEFINING THE "LEAN CONSTRUCTION PROFESSIONAL PROFILE"**

According to the issues explained above, there are some important characteristics of the PM role that must be considered carefully to build a *lean construction professional profile* (LCPP), seeking to improve project and organization performance.

The study was centered in on-site professional roles due to their importance for project outcomes. The PM role was studied deeper because it is the most complete and complex role in site-organizations, so starting from there it is possible to reduce and extract some characteristics and requirements to fulfill the other site-organization roles.

Extracting the main contributions and similarities of each approach, and taking the premise of the holistic development of people as a key element, five areas of competence and knowledge were identified (Figure 1a). The ways in which each one must be built and developed (sorted in concentric circles) define the LCPP (Figure 1b).

Figure 1 shows the way LCPP was built. From the five competence-knowledge areas (CKA) the LCPP was defined, considering first mental models that drive acting (enterprise vision and lean vision) and then sorting the competences needed in their complexity order looking for a holistic development of the professionals at work. In the following paragraphs it is explained why this order of CKA was selected.

1. *Enterprise vision (EV)*: This is the first element of the LCPP because to reach effectiveness the whole enterprise and people who built it need to share common values and goals. If people and organization do not share common values and goals people do not feel comfortable in their work and the organization can not extract the best of their capacity. Enterprise vision must drive people acting to reach enterprise goals.



2. *Lean vision (LV)*: The lean philosophy is a new way to think and work, so it is necessary to change the typical way of acting to apply the new philosophy in the right way. It is necessary to change mental models and/or the way of thinking, so it will not possible to achieve the practice of lean construction in its full potential.
3. *Technical capacity (TC)*: This is the base of the professional knowledge. It contains concepts theories, rules, methods, tools and technologies mobilized to carry out the work (in general terms) and solve problems from the professional activity.
4. *Management capacity (MC)*: Is similar to technical capacity, but involves relationships in a broader context. Here it is necessary to move resources, to generate communication channels, to have a systemic view of the process and to connect the individual work with the organization work (how my work is a part of a bigger picture and how it can contribute). It is necessary to know resources, processes and people, and how they must be connected to obtain best results.
5. *Social competence (SC)*: Social competence is cited like the difference between competent managers and leaders. It allows to develop management capacity in a better way and to make difference in performance due to the fact that organizations are social systems. It implies moving people in the desired direction, motivate them and extract the best of their own capacity. It allows developing the informal organization in the right way, which means the conversations and social networks that organization produces.

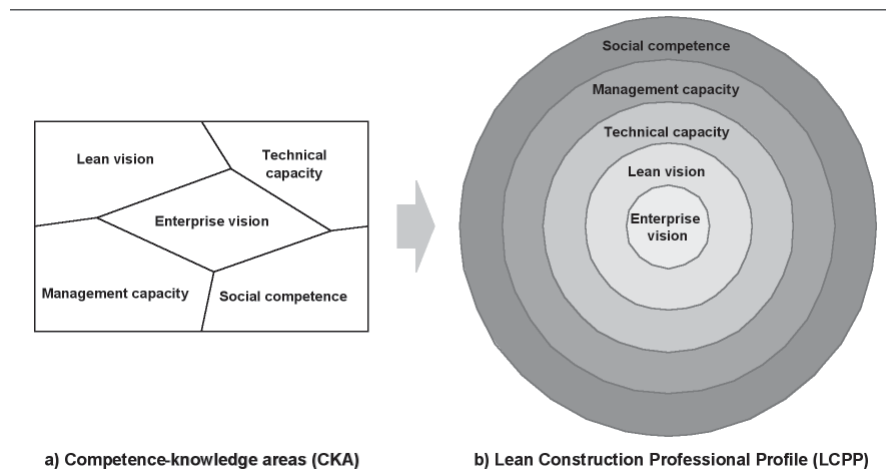


Figure 1. Lean Construction Professional Profile (LCPP)

## HOW LCPP WORKS?

The LCPP was developed to state a holistic model of competences for people who work implementing lean construction. To explain how it works, the five CKA could be separate in two groups according to their main purpose. The first group (EV and LV) wants to state or change mental models and behaviors related to the way in which personal and organization work it is conceived by people, so it is desired that people who work under lean construction perspective think and act according the new paradigms that this new discipline compel, in agreement with organization vision and goals. The second group (TC, MC and SC) wants to state what capacities or competences people need to perform their job in an effective way, considering current requirements and best practices that construction work involve. Figure 2 exposes a summary of the operation of LCPP.



Competence-knowledge area	Implication	Operation – area of impact
Enterprise vision Lean vision	Mental models and behaviors that must drive people acting in organization <i>Generic Competences</i>	 Mental models Behaviors
Technical capacity Management capacity Social competence	Competences and capacities people have to develop and/or apply at work to reach high performance <i>Specific competences</i>	 Performance Action

Figure 2. Operation of LCPP.

## CONCLUSIONS

The consolidation of the lean construction theory demands the application of its concepts and principles in practical situations, but until now most of the implementations have been very fragmented. In the case of Chilean contractor organizations, the major problem in their implementations has been related with human, cultural and organizational issues, but to the social character of the construction work probably the same problem has appeared (or could appear) in other countries.

Considering the literature review and the implementation problems exposed in this paper, the link between hard and soft issues in lean construction still remains weak. So that, we must evolve the understanding of lean construction as a new management philosophy and develop new ways to merge hard and soft issues as an integrated knowledge framework that facilitate the application of lean construction in contractor organizations. Besides, it is necessary to view the company as a whole system where projects are branches or subsystems, and where integrated developments can lead the organization to become a *lean organization* (third scenario – Table 1). This kind of application of lean construction is a major challenge but it has major potential benefits too.

This work provides guidance and recommendations to strengthen the link between soft and hard issues, approaching an essential lean philosophy element: qualification and learning for continuous improvement. The definition of the LCPP would be a good way to understand the necessary steps to reach better lean implementation scenarios under a human perspective; and to add to the current knowledge of lean construction a way to support the transformation of today's contractor organizations to *lean contractor organizations*.

## REFERENCES

- Alarcón, L. F. and Pavez, I. (2006) "How Construction Project Managers use Their Time: Empirical Evidence in Chilean Construction Companies" *Proceedings of CIB W107, Construction in Developing Economies International Symposium*, January 18 – 20, Santiago, Chile.
- Alarcón, L. F., Pavez, I., Diethelm, S. and Rojo, O., (2006). "Preparing Contractor Organizations For Implementing Lean Construction" *CIB-ASCE 2<sup>nd</sup> Specialty Conference on Leadership and Management in Construction and Engineering "International Perspectives"*, Grand Bahama Island, Bahamas, May 4-6.
- Alarcón L. F., Diethelm, S., Rojo, O. and Calderón, R. (2005a) "Assessing the impacts of implementing lean construction" *Proceedings of the 13<sup>th</sup> annual conference of the International Group for Lean Construction*, University of Sydney, July 19-21, Sydney, Australia.
- Alarcón, L. F., Pavez, I., Bascuñan, C. and Diethelm, S. (2005b) "Diagnóstico organizacional en empresas constructoras chilenas." *IV SIBRAGEC- IELAGEC, Contrucao na América Latina: inclusao e modernizacao*, Porto Alegre, Brasil, October 24-26.
- Buch S. and Sander, D., (2005). "From hierarchy to teams – barriers and requirements in relation to a new organization of building sites" *Proceedings of the 13<sup>th</sup> annual conference of the International Group for Lean Construction*, University of Sydney, July 19-21, Sydney, Australia.
- Collins, J., (2001). "Level 5 leadership" *Harvard Business Review*, January, 66-76.
- Covey, S. (2005) *El octavo hábito: de la efectividad a la grandeza*. Editorial Paidós, Barcelona, España, 470pp. (spanish version of *The 8<sup>th</sup> habit: From effectiveness to greatness*, Free Press, New York).
- Dainty, A. R. J., Cheng, M., and Moore, D. R., (2005). "Competency-based model for construction project managers' performance" *ASCE Journal of Construction Engineering and Management*, 21(1), 2-9.
- Drucker, P. (2004) "What makes an effective executive." *Harvard Business Review*, June.
- Dulaimi, M. F. and Langford, D. (1999) Job behavior of construction project managers: determinants and assessment. *ASCE Journal of Construction Engineering and Management*, 125(4), 256-264.
- Farkas and Wetlaufer (1996) "The ways chief executive officers lead." *Harvard Business Review*, May-June.
- French, W. y Bell C. (1996) *Desarrollo Organizacional*. Prentice Hall, México D. F., México, 375 pp.
- Goleman, D. (2004) "¿Qué hace a un líder?" In: Lo mejor de Harvard Business Review, *Harvard Business Review*, January. (Spanish version of "What makes a leader?", HBR).
- Gosling, J., and Mintzberg, H., (2003) "The five minds of a manager". *Harvard Business Review*, November, 54-63.
- Guerrero, S. and Sire, B. (2001) "Motivation to train from the workers' perspective: example of French companies." *International Journal of Human Resource Management*, 12 (6), 998-1004.
- Hirota, E., Lantelme, E. and Formoso, C. (1999) "Learning how to learn lean construction concepts and principles." *Proceedings of the 7<sup>th</sup> annual conference of the International Group for Lean Construction*, Berkeley, California, USA, 26-28 July.
- Howell G., Macomber, H., Koskela, L. and Draper, J. (2004) "Leadership and project management: time for a shift from Fayol to Flores." *Proceedings of International group of lean construction, 12th annual conference*, Copenhagen, Denmark, August 3-5.

- Lantelme, E. (2004) “Uma teoria para o desenvolvimento da competência dos gerentes da construção: em busca de “consiliência””. PhD Thesis, Engineering School, Programa de Pós-Graduação em Engenharia Civil, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brasil, 288 pp.
- Loosemore, M., Dainty, A.R.J and Lingard, H. (2003). *Human Resource Management in Construction Projects*. Spon Press, Londres, UK, 344pp.
- Koskela, L. (2000). “An exploration towards a production theory and its application to construction”, VTT Technical Research Centre of Finland, Espoo.
- Macomber H. and Howell G. (2003) Linguistic Action: Contributing to the Theory of Lean Construction. *Proceedings of International Group of Lean Construction 11<sup>th</sup> Annual Conference*, Virginia Tech, Blacksburg, Virginia, July 22-24.
- Macomber H. and Howell G. (2004) “Two great wastes in construction.” *Proceedings of International group of lean construction, 12th annual conference*, Copenhagen, Denmark, August 3-5.
- Mintzberg, H (1990) “The manager’s job: folklore and fact.” *Harvard Business Review*, March-April.
- Odusami, K. T. (2002) “Perceptions of construction professionals concerning important skills of effective project leader”. *Journal of Management in Engineering*, 18(2), 61-67.
- Orr, C. (2005) “Lean leadership in construction.” *Proceedings of the 13<sup>th</sup> annual conference of the International Group for Lean Construction*, University of Sydney, July 19-21, Sydney, Australia.
- Pannenbäcker, O., Knöpfel, H. and Communier, J. (2002) *IPMA Certification yearbook*. International Project Management Association (IPMA), 32pp.
- Picchi, F. and Granja, A. (2004) “Construction sites: using lean principles to seek broader implementations.” *Proceedings of International group of lean construction, 12th annual conference*, Copenhagen, Denmark, August 3-5.
- Powell, J. (1999) “Action learning for continuous improvement and enhanced innovation in construction.” *Proceedings of the 7<sup>th</sup> annual conference of the International Group for Lean Construction*, Berkeley, California, USA, 26-28 July.