INTEGRAL VISION: A NOVEL APPROACH TO IMPROVE THE EFECTIVENESS OF LEAN CONSTRUCTION THEORY AND PRACTICE

Ignacio Pavez[1], Vicente González[2] and Luis F. Alarcón[3]

ABSTRACT

Currently, most of management approaches coming from engineering have been focused on the exterior world, it means, everything that can be see (structures-processes-outcomes). This situation has created a low sustainability of these management approaches and tools, because they forget central aspects of people behavior both in individual and collective domains. Therefore, some efforts to integrate the organization's interior and exterior world have been carried out, with the aim of looking at the organization's interior world (personality-emotionality-values-culture) as a design space coherent with effective management practices focused on the exterior world, as lean construction. This article describes and analyzes the revolutionary theory of *integral vision* proposed by Ken Wilber, as a framework that embraces different insights, theories and practices in such a manner that strengthen the discipline of project management under lean construction perspective. Thus, it can be argued that, if lean construction wants to evolve towards an effective management practice, needs to include some elements of integral vision, in order to make compatible human and technical development inside the organization or project. By doing so, lean construction has to strength research areas related to people, which so far have received little attention.

KEY WORDS

Integral vision, lean construction, lean management, organizations.

[1] Research Engineer, MSc, Production Management Center (GEPUC), Pontificia Universidad Católica de Chile, Santiago, Chile. E-Mail: ipavez@ing.puc.cl

[2] Postdoctoral Fellow, School of Engineering, Pontificia Universidad Católica de Chile, Santiago, Chile. Lecturer, School of Construction Engineering, Universidad de Valparaíso, Chile. E-Mail: vagonzag@uc.cl

[3] Professor of Civil Engineering, PhD, Pontificia Universidad Católica de Chile, School of Engineering, Department of Construction Engineering and Management, E-mail: lalarcon@ing.puc.cl

INTRODUCTION

Currently, most of management approaches coming from engineering have been focused on the exterior world, it means, everything that can be see (structures-processes-outcomes) and/or measure. This situation has created a low sustainability of these management approaches and tools, because they forget central aspects of people behavior both in individual and collective domains (Pavez and Alarcón, 2008).

It acquires more relevance when one wants to implement these management approaches, since the execution is always performed by people who have their own interests, personalities and worldviews (Beck and Cowan, 2005). And also, whom work in a specific culture with collective interests, values and ways of relationships (Beck and Cowan, 2005; Schein, 2004).

To deal with this situation, some efforts to integrate the organization's interior and exterior world have been carried out, with the aim of looking at the organization's interior world (personality-emotionality-values-culture) as a design space coherent with effective management practices focused on the exterior world (Barrett, 2006; Kofman, 2006), as lean construction.

This article describes and analyzes the revolutionary theory of *integral vision* (Wilber, 2001, 2007), as a framework that embraces different insights, theories and practices in such a manner that strengthen the discipline of project management under lean construction perspective. We discuss how the Last Planner System (LPS) can be viewed from an integral perspective, what have been the goals of lean construction under this point of view and how the project and contractor organization can apply this approach into the planning process.

From this analysis can be argued that if lean construction wants to evolve towards an effective management practice, needs to include some elements of integral vision, in order to make compatible human and technical development inside the organization or project. By doing so, lean construction has to strength research areas related to people and culture (interior world), which have received so far little attention.

BACKGROUND: THE NEW SCIENCE AND ORGANIZATIONAL COMPLEXITY

Never before in history have we had access to so much information. The knowledge, understandings and experiences from every sector of society, scientific communities and every human culture (past and present) are available to every people in every place in the world (Wilber, 2007). At the same time, humanity had never faced in the history social, environmental and economic challenges so complex and intricate as today. In fact, technological development and resources exploitation is arriving to a limit that do not make sustainable the human development, if it is not accounted a fundamental paradigm shift in the way in which the people see and interpret the reality (Tolle, 2006).

The following discussion encloses the new scientific approaches to understand the reality with the aim of dealing with the increasingly human problems. Also, it will be addressed the topic of organizational complexity as a starting point to realize why the integral vision should be involved to the novel management theories as lean construction.

THE NEW SCIENCE

Because of the complexity of structural and social changes created by the evolution of the global society, scientists from various disciplines are reformulated how doing science. These scientists state that to deepen and broaden the scientific method is necessary to gather data more subtle than the one captured merely by the senses (quantitative measurements and observations), which come from the person (self) that develops the scientific activity. In other words, a new synthesis among science (third-person view), social transformation (second-person view) and the evolution of self (consciousness / first-person view) is required (Scharmer, 2007).

This framework has emerged on the management field from two major turns in the field of social sciences during the last half century. The first one, usually referred as the "action turn", was pionered by Kurt Lewin and his followers in a variety of approaches to action science (Argyris, et al. 1985) throughout the second half of the 20th century. The second one, in turn, was developed in the late 20th and early 21st centuries and is often called the "reflective turn". It puts emphasis on the observer role into the scientific phenomena and highlights the fact that biologically is impossible to get the truth given the limitations imposed by our own biology (Maturana and Varela, 1992; Scharmer, 2007).

Considering the previous discussion, the challenge of the new science, for the different action fields, is to produce a synthesis linking the three viewpoint (*science* – let the data speak, *action research* - you can´t understand a system unless you change it and the *evolution of consciusness* and self - iluminating the blind spot), with the purpose of understanding the reality from a more comprehensive, deep and integral perspective (Scharmer, 2007).

ORGANIZATIONAL COMPLEXITY

Another challenge faced by people, organizations and modern society, is the increasingly level of complexity and change. Otto Scharmer (2007), based on Peter Senge's works in organizational learning, proposes a model which specifies three types of complexity: dynamic complexity, social complexity and emergent complexity (Figure 1), which are complemented by themselves and evolve in time.

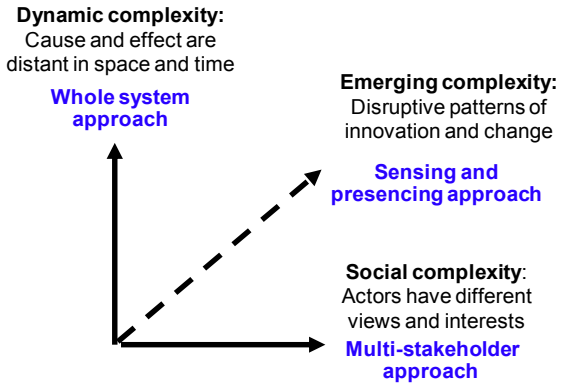

Figure 1: Three Types of Complexity (Scharmer, 2007)

Dynamic complexity appears when there is a systematic distance between cause and effect in space or time. The longer and more complex is the chain of cause and effect, the higher the dynamic complexity of the problem. If the dynamic complexity is low, it can be dealt with piece by piece. If the dynamic complexity is high, a "whole systems" approach that puts sufficient attention to cross-system interdependencies is the appropriate approach.

Social complexity is a product of diverse interests and worldviews among stakeholders. The lower the social complexity, the more we can rely on experts to guide decision and policy making. The greater the social complexity, the more important is to employ a multi-stakeholder approach to real problem-solving, that includes the entire relevant stakeholder' voices.

Emerging complexity is characterized by disruptive change. Challenges of this type can usually be recognized by these three characteristics: (1) the solution of the problem is unknown, (2) the problem statement itself is still unfolding and (3) who the key stakeholders are is not clear. When the future cannot be predicted by the trends and trajectories of the past, we must deal with situations as they evolve. The greater the emerging complexity, the less we can rely on past experiences. We need a new approach – one that builds on sensing, presensing and prototyping emergent opportunities (Scharmer, 2007; Senge et al. 2008).

The characteristics of construction projects present the three types of complexity proposed by Scharmer (2007). Dynamic complexity, for instance, can be appreciated by means of uncertainty as cause and variability as effect, since both cause and effect are distant in time. A common practice that has proved to be ineffective, which does not consider this type of complexity, is the "making do" conceptualized by Koskela (2004).

Social complexity is one of the most important characteristics of a construction project, since it is developed with multiple stakeholders (owners, contractors, architects, designers, community, etc.), whom have different interests, values, education and worldviews, among others. This impedes the coordination and produces problems in the achievement of the project objectives, generating conflict and mistrust in teams.

Emerging complexity can also be seen as a property of construction projects. Since projects have a character of prototype, they often require innovative and creative solutions (leaving past patterns) to cope the difficulties that are presented in its development.

Nevertheless, most of the scientific developments in construction management have been focused on reducing and working the dynamic complexity, leaving aside the other two relevant areas of the organizational complexity.

In practice, we have been able to empirically observe that most of the companies have problems to deal with the dynamic complexity (sometimes they cannot see it) and the major part of the problems in the construction phase emerge by the social complexity proper of this industry. This meaningfully affects project management, company operations and the incorporation of new management practices, especially if it challenges the current action patterns as lean construction.

THE INTEGRAL FRAMEWORK: OVERVIEW

Ken Wilber is perhaps one of the most translated academic authors in the United States. His integral theory is the result of over 30 years of inter- and transdisciplinary scholarship in which Wilber and others have begun to integrate and synthesize knowledge and research

from many domains of inquiry, including: biology, psychology, sociology, anthropology, philosophy, systems thinking and Eastern and Western—as well as ancient and modern—spirituality (Brown, 2005). Ken Wilber says:

> "The whole point about any truly Integral approach is that it touches bases with as many important areas of research as possible before returning very quickly to the specific issues and applications of a given practice… An Integral approach means, in a sense, the 'view from 50,000 feet.' It is a panoramic look at the modes of inquiry (or the tools of knowledge acquisition) that human beings use, and have used, for decades and sometimes centuries. An Integral approach is based on one basic idea: no human mind can be 100% wrong. Or, we might say, nobody is smart enough to be wrong all the time. And that means, when it comes to deciding which approaches, methodologies, epistemologies, or ways of knowing are 'correct,' the answer can only be, 'All of them.'… Since no mind can produce 100% error, this inescapably means that all of those approaches have at least some partial truths to offer an integral conference, and the only really interesting question is, what type of framework can we devise that finds a place for the important if partial truths of all of those methodologies?... To say that none of these alternatives are 100% wrong is not to say that they are 100% right. Integral approaches can be very rigorous in standards of evidence and efficacy, a rigor that some holistic approaches let go of too quickly in an attempt to be 'all inclusive" (Wilber, 2005).

Integral theory was developed by Ken Wilber as a response to a knowledge vacuum which is related to the lack of integration of different cultures and disciplines, providing a more complete map of people about themselves and the world around them.

On the basis of an exhaustive analysis of the explanation patterns from different disciplines and cultures, Wilber proposes a more comprehensive model for looking at the reality. In this sense, he proposes that the explanations made by people should be supported by an integral view, which pursues to blend the internal world (personality, emotionality, consciousness, culture, system of values, among others) as well as the external world (behaviors, social structures, technology, among others) of the studied phenomena in the individual and collective domains.

Wilber's model, referred as AQAL, comprises five central elements (quadrants, levels, lines, types and states), which represents how the different cultures and disciplines of knowledge have explained the world during the history. From these elements, Wilber proposes a model that allows differentiating and integrating them into a coherent whole, with the purpose to observe and intervene in all phenomena the man is confronted in a most comprehensive way (integral). This model is framed into the work of "new science" which has spread its application to a broad spectrum of problems and disciplines (sustainable development, governance, education, medicine, psychology, business, future studies, leadership, politics and religion, among others) (Brown, 2005).

Because of complexity and extent of integral theory, in this article will be address only its core element (according to our judgement), referred as "Four Quadrant".

THE FOUR QUADRANTS OF INTEGRAL FRAMEWORK

A key element of Integral Theory is the *four quadrants* (Figure 2), which represents the four irreducible perspectives available to anyone. This model is an analytical framework that brings together the interior, exterior, individual and collective dimensions of reality in a

balanced and systematic fashion. Integral Theory's essential message is that every occasion or event arises in these four quadrants *simultaneously* (Wilber, 2007).

These four quadrants are four distinct dimensions of reality, or four unique ways of looking at the same occurrence. They are represented as: *individual interiors* (Upper-Left quadrant: UL) like psychology and consciousness; *individual exteriors* (Upper-Right quadrant: UR) such as behavior and the physical body; *collective interiors* (Lower-Left quadrant: LL) like culture and worldview; and *collective exteriors* (Lower-Right quadrant: LR) such as systems and the physical environment. The quadrants can also be referred to, respectively, as *Consciousness* ("What I experience"), *Behavior* ("What I do"), *Culture* ("What we experience"), and *Systems* ("What we do").

The four quadrants are a simple way to organize the innumerable subjective and objective dimensions of individuals, societies, and the environment. These dimensions have been intensely investigated by literally hundreds of major paradigms, practices, methodologies, and modes of inquiry. They represent the four principal perspectives, or domains, of "being-in-the-world" (Wilber, 2007).

These four perspectives are embedded in every major language in the world, 1st, 2nd and 3rd person pronouns. For example, they arise as "I," "We," "It," and "Its." Thus, the UL, or Consciousness quadrant, represents the way that any "I" sees the world. The LL, or Culture quadrant, represents the way any "We" sees the world. The UR, or Behavior quadrant, represents the way "It" is seen. The LR, or Systems quadrant, represents the way "Its" are seen. By combining the "It" and "Its" domains (the Right-Hand quadrants, UR and LR, Behavior and Systems) into just "It" (Brown, 2005). To clarify this point Wilber says:

> "These dimensions of being-in-the-world are most simply summarized as self (I), culture (we), and nature (it). Or art, morals, and science. Or the beautiful, the good, and the true. Or simply I, we, and it… And the point is that every event in the manifest world has all three of those dimensions…. an integrally informed path will therefore take all of those dimensions into account, and thus arrive at a more comprehensive and effective approach—in the "I" and the "we" and the "it"—or in self and culture and nature. If you leave out science, or leave out art, or leave out morals, something is going to be missing, something will get broken. Self and culture and nature are liberated together or not at all" (Wilber, 2005).

	INTERIOR	EXTERIOR
INDIVIDUAL	**Consciousness** *"What I experience"* *Fields of study:* "I" subjective realities. Eg. Self and consciousness, states of mind, psychological development, mental models, emotions, will. UL	**Behavior** *"What I do"* *Fields of study:* "It" objective realities. Eg. Brain and organism, visible biological features, people behavior, people performance, job task. UR
COLLECTIVE	LL **Culture** *"What we experience"* *Fields of study:* "We" inter-subjective realities. Eg. Shared values, culture and worldview, webs of culture, communication, relationships, norms, customs.	LR **Systems** *"What we do"* *Fields of study:* "Its" inter-objective realities. Eg. Social systems and environment, visible social structures, economic systems, processes, material behavior, structural behavior.

Figure 2: The Four Quadrants of Integral Model. Adapted From Brown (2005) and Wilber (2007)

In next sections, we will explore the advances and challenges of lean construction from the integral vision' point of view and how this approach could be applied in construction and project management.

A BRIEF REVIEW OF LEAN CONSTRUCTION

Lean construction advocates by adding-value to the so-called value stream pursuing the perfection and reducing its wastes (any action that not provide customer's value). Seminal developments from Toyota production system allow stating for a new production and management paradigm termed as lean thinking (Womack and Jones, 1996) which has served as theoretical framework to lean construction (Koskela, 2000). The consolidation of the lean construction theory demands the application of its concepts and principles in practical situations (Koskela, 2000). In such a way, there is a lot of evidence showing the positive impacts on project performance from application of several lean construction principles and tools (Alarcón et al, 2005; González et al, 2009; Liu and Ballard, 2008; among others). However, most of the implementations have been so far very fragmented (Picchi & Granja, 2004), i.e, they are been focused on some principles and/or specific tools neglecting a full integration of lean construction in different topics as supply chain, planning and control, production design and management, safety, culture and human aspects, etc.

On the other hand, most of lean construction researches have been intended to improve project performance through the application of new tools and methodologies, i.e. they have been technical-driven, leaving only a very little portion of research and "interest" to human, organizational and cultural issues (Alves and Tsao, 2007; Pavez & Alarcón, 2008). This situation has been widely recognized in problems related to the implementation of new management systems or every kind of innovation that involve some changes in the classical ways of acting (Kofman, 2006). Therefore, it is necessary to educate people and/or train them so they can deal better with these situations, supporting this course of action by the adequate

vision, processes and organizational structure (Kofman, 2006). Also, the contact of people with new systems, tools, methodologies, principles, etc. demands an in-deep and active analysis of the new interactions and impacts that can emerge as a result of new work methods, procedures and social processes, which simultaneously influence the performance. If these elements are neglected, only damages at project, organizational and people level can be expected.

Therefore, it seems to be that a new and drastic approach should be taken to face management issues in construction even from the lean construction standpoint. Not only a "fragmented" and "technical" view should be had into account, but also a more integrated view in which people is the core. Thus, lean construction as a novel, innovative and main theoretical framework for production management in construction must promote and guide the necessary changes to the integration.

INTEGRAL THEORY APPLIED TO PLANNING THROUGH LPS

"The best way to do is being" said Lao Tsu 2,500 years ago. His council is still valid today, even when this opposes to our instinctive attitude. To achieve specific results (product), it is necessary to act in a way that allows producing these results (processes), and to act this way, it is necessary to be (platform), i.e. the type of person or organization able of generating such conduct (Kofman, 2006) (Figure 3).

Typically, which attracts our attention is what we can see (effect), that is, something that prevents us from perceiving the importance of what remains hidden (case). We concentrate on the results (have) and forget the process (do) necessary to achieve these results. We have even less consciousness of the infrastructure (be) which underlie these processes, and provides the necessary skills for its operation.

Making consciousness in the way how to get the results is another aspect related to the integral theory (see Figure 2), since it puts the emphasis on integrating into a coherent whole internal and external aspects of our reality.

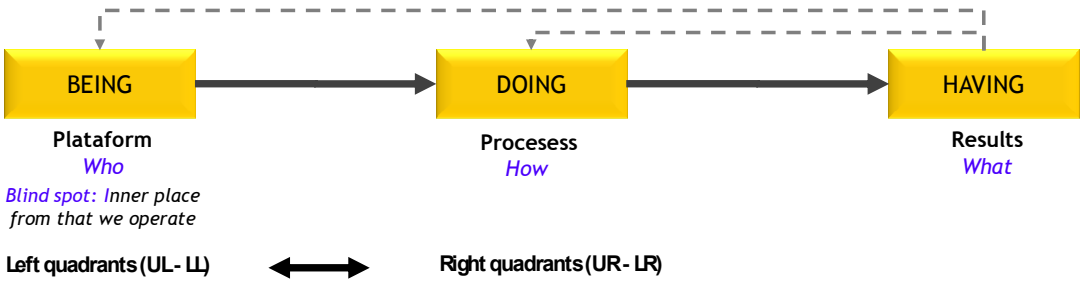

Figure 3: Being-Doing-Having Model and Integral Theory

The implementation of the integral theory on planning under the lean construction viewpoint will be analyzing the Last Planner System (LPS), given its wide application in the lean research community.

This system, given the elements that contains and the principles that suports, was designed to manage the dynamic complexity of the construction processes, reducing the uncertainty and the variability of construction process through the stabilization of the work environment (Ballard, 2000).

When the LPS is applied the emphasis is put on how it is carried out the planning meetings, seeking generate "reliable" commitments, leaving the responsibility for the plan implementation on last planners and engaging to the different actors of the organization in each of the levels (weekly plans, lookahead planning and master plan). Here, social complexity appears, but is not part of the system design neither in its constituent elements nor in its implementation.

Whereas the most complex of LPS is its implementation, this paper studies the LPS from an integral standpoint, focusing into the elements of the four quadrants which could support the on-site LPS implementation.

LOWER-RIGHT QUADRANT: "WHAT WE DO"

In the LPS, this quadrant is largely defined, since the system elements are clearly explained (Master Plan, Lookahead and Short Plans) and the necessary process to carry it out. Different indicators are stated (PPC, RNC) and actions are taken from their analysis (constraint analysis, plan execution, corrective actions, among others).

UPPER-RIGHT QUADRANT: "WHAT I DO"

In the system design are specified roles for participants in the organization and/or meetings, indicating the key actions that should be carried out by each participant through specific commitments. These actions are: commitments of plan implementation, commitments for the constraint analysis, maintenance of indicators and generation of meeting acts, among others.

Implicit aspects in the system design, being not trivial aspects, are the people capabilities. Some questions that lead to the reflection here and increasing the effectiveness of the LPS application in work are: What knowledge, abilities and/or attitudes do need people that will use the system?, How does the system implementation affect the people welfare on field?, What are the conversations necessary to generate productive meetings?, What are the individual activities that has more impact in the success of system application?

UPPER-LEFT QUADRANT: "WHAT I EXPERIENCE"

This quadrant, as most of the management systems in engineering, is practically not taken into account or is superficially mentioned when the system implementation is discussed. Subsequent researches to the creation of the LPS have partially addressed this issue (Macomber and Howell, 2003; 2004). However, we believe that further exploration is still necessary.

The boundaries of this phenomenon are very wide and varied, by which we will focus on two topics detected as relevant to the project development: worldviews and emotions.

WORLDVIEWS

People differently understand and look at the world (Beck and Cowan, 2005; Kofman, 2006). Biologically, every human being is different, and this condition limits the access to an "objective reality" that can be shared among people (Maturana and Varela, 1992). Our experiences, our life history, our culture, our education, etc., are creating a particular way in which we see the world and interpret the reality, generating problems of understanding between human beings.

In the case of LPS, this produces coordination difficulties in planning meetings and promotes the historical trend of imposing activities rather than create commitments, due to the fact that most of the people tend to ignore these differences and act on the basis of their own worldview (Beck and Cowan, 2005).

This situation shows a great opportunity to improve the effectiveness of planning as well as LPS, since a basic condition for developing high performance teams is to work knowing the strengths of having different points of view (different worldviews) and not to work from their difficulties (social complexity). Unfortunately, this does not spontaneously happen, since it is required to distinguish the different worldviews, and then, to work over these to achieve the potential benefits of this human condition (Beck and Cowan, 2005).

EMOTIONS

The emotions can be defined as predisposition for action, which arise from the interaction between the individual and its environment. In other words, the analysis that makes a person respect to his environment physiologically produces an emotional state, which affects the decisions and actions that the person is willing to take (Maturana and Varela, 1992; Goleman, 1995).

In the LPS implementation, we have detected the underlying emotion of fear in most of the teams starting its implementation, which creates problems in: the reliability of commitments or work plans and their relationships. However, when LPS properly starts, one can observe a noticeable change in the emotionality of the team, since it begins to interact from the trust, cooperation and enthusiasm.

When the LPS is implemented from a purely technical viewpoint, produces a delay in the emotional transformation of the team, because the traditional ways in which the relationships between the different organizational hierarchies are manifested in construction are based on the emotion of fear.

Therefore, it is important to consider in the implementation design, a way to provide to the team (from Project Managers to supervisors) the necessary distinctions to observe these emotional states and work properly on them. We have seen that the enthusiasm is the key emotion to promote the LPS as the engine of continuous improvement and spread its potential for action to improve the projects performance.

LOWER-LEFT QUADRANT: "WHAT WE EXPERIENCE"

This quadrant, like the previous one, is not present in the design of management systems in engineering, despite being as important as the system itself. This quadrant exposes the organizational culture, which can be described as the pattern of basic assumptions that a

particular group invented, discovered or developed, in the learning process to solve their problems of external adaptation and internal integration. They worked well enough to be considered valid, and therefore, be taught to new members of the group as the correct way to perceive, think and feel in relation to those problems (Schein, 2004).

Since culture is generated by interactions with a certain group of people, we can observe that projects have a "double-cultural vision", the project itself and their company's history. During the project life cycle, its human group generates a shared history and a special way of looking at issues facing the organization, which may facilitate or block the systems and/or management tools implementation as LPS.

In practice, we have seen that the role of the external facilitator for the implementation process is crucial to identify, question and change the cultural patterns that inhibit the LPS implementation. However, it is a hard task and a complete change in the course of a single project is usually not achieved.

In terms of cultural management practices or tools, there are several widely used and validated models such as the cultural types by Cameron and Quinn (2006) or the values-based cultural transformation by Barret (2006). Both models have been implemented in Chile for organizational culture diagnosis (Arriagada, 2002), before the implementation of lean systems, showing valuable information about which areas should be strengthened and which aspects should be " off "to increase the success likelihood in implementing the system.

In terms of LPS implementation, we have not applied the tools of cultural management as part of an integral implementation system yet. However, we believe that generating a shared vision of cultural group and how this affects team and project performance has a tremendous potential.

DISCUSSION AND CONCLUSIONS

Lean construction implementation, as an innovative process in a discipline in growth, brings new challenges everyday. Organizations are continuously acquiring experience and new abilities, but they are always in search for new approaches to get better results.

Most of lean construction researches have been intended to improve project performance through a technical-driven approach (right quadrants) leaving only a very little portion of research and “interest” to human, organizational and cultural issues (left quadrant). From the integral model standpoint, this approach allows only a partial view of the phenomenon, which limits the development of a discipline in growth.

By exposing the basic concepts of integral theory and a simple description of their potential application on the LPS, it was illustrated the large number of issues that remain hidden, when one wants to implement management systems or tools under a purely technical point of view. Also, it is shown the potential of involving the quadrants (I and We) in the analysis of management systems implementation, which means explicitly incorporate the behavior of people, individual and collectively, in the development of management systems.

Regarding the integral model principles, it has been begun the design strategies for implementing the LPS, which have been well received by those involved in pilot projects and have allowed observing the impact of such approaches can have in the effective implementation of new management systems and lean construction.

We believe that incorporating a holistic way of intervening organizations (companies or projects) can have a major impact on the development of the lean construction theory and practice, because many of the problems that arise in practice are product of human and organizational barriers.

Finally, our interest is to settle in the lean community the debate on how to incorporate into its theoretical and practical discussion new trends that are currently guiding the management scientific studies and how to contribute to the society sustainability through practices that incorporate a more holistic view of physical (It), social (We) and individual (I) systems.

REFERENCES

Alarcón, L.F., Diethelm, S., Rojo, O. and Calderón R. (2005). "Assessing the Impacts of Implementing Lean Construction". Proceedings 13th Annual Conference of International Group for Lean Construction, Sidney, Australia, July 19th – 21th.

Alves, T. and Tsao, C. (2007). Lean Construction – 2000 to 2007. *Lean Construction Journal*, 3, (1), 46-70.

Argyris, C., Putnam, R. and McLain, D. (1985) *Action science*. Jossey-Bass, Inc, San Francisco, USA, 510 pp.

Arriagada, R. (2002) *Propuesta metodológica para la adopción del lean production en una organización municipal*. MSc Thesis, School of Engineering, Department of Construction Engineering and Management, Pontificia Universidad Católica de Chile, Santiago, Chile.

Ballard, G. (2000). The Last Planner System of Production Control. *PhD's Thesis*, School of Civil Engineering, Faculty of Engineering, University of Birmingham, Birmingham, U.K.

Barrett, R. (2006) *Building a Values-Driven Organization: A Whole System Approach to Cultural Transformation*. Butterworth-Heinemann, USA, 280 pp.

Beck, D. and Cowan, C. (2005) *Spiral Dynamics: Mastering Values, Leadership and Change*. Wiley-Blackwell, USA, 352 pp.

Brown, B. (2005). "Theory and Practice of Integral Sustainable Development". *AQAL Journal of Integral Theory and Practice*. Vol. 1, N°2, 2-39.

Cameron, K. & Quinn, R. (2006) *Disagnosing and changing organizational culture*. Jossey-Bass, John Wiley and Sons Inc, San Francisco, USA, 242pp.

Goleman, D. (1995) *Emotional intelligence*. Bantam Books, New York, USA, 384 pp.

González, V., Alarcón, L.F. and Molenaar, K. (2009). "Multiobjective Design of Work-In-Process Buffer for Scheduling Repetitive Building Projects". *Automation in Construction*, 18, (2), 95-108.

Kofman, F. (2006). *Conscious Business: How to Build Value Through Values*. Sounds True, Boulder, Colorado, USA, 325 pp.

Koskela, L. (2000). *An exploration towards a production theory and its application to construction*. VTT Technical Research Centre of Finland, Espoo.

Koskela, L. (2004). "Making-Do - The Eighth Category of Waste". *Proceedings 12th Annual Conference of International Group for Lean Construction*, Denmark, August 3-5.

Liu, M. and Ballard, G. (2008). "Improving Labor Productivity through Production Control." *Proceedings 11th Annual Conference of International Group for Lean Construction*, Manchester, U.K., 16-18 July.

Macomber H. and Howell G. (2003) "Linguistic Action: Contributing to the Theory of Lean Construction". *Proceedings of International Group for Lean Construction 11th Annual Conference*, Virginia Tech, Blacksburg, Virginia, July 22-24.

Macomber H. and Howell G. (2004) "Two great wastes in construction." *Proceedings of International Group for Lean Construction 12th annual conference*, Copenhagen, Denmark, August 3-5.

Maturana, H. and Varela, F. (1992) *The tree of knowledge*. Shambhala Publications, Boston, USA, 269pp.

Pavez, I. and Alarcón, L. F. (2008) "Lean Construction Professional's Profile (LCPP): implementation in Chilean contractor organizations". *Proceedings of International Group for Lean Construction 16th Annual Conference*, Manchester, UK, July 14-20.

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.

Scharmer, O. (2007) *Theory U: leading from the future as it emerges*. Society for Organizational Learning, Inc., USA, 533 pp.

Schein, E. (2004) *Organizational Culture and Leadership.* Jossey Bass Publishers, 3rd Edition, San Francisco, USA, 464 pp.

Senge, P., Scarmer, O., Jaworsky, J. and Flowers, B. (2008) *Presence: Human Purpose and the Field of the Future*. Broadway Business, New York, USA, 304 pp.

Tolle, E. (2007). *A New Earth: Awakening to Your Life's Purpose*. Penguin Group, New York, USA, 336 pp.

Wilber, K. (2001). *A Theory of Everything: An Integral Vision for Business, Politics, Science and Spirituality*. Shambala Publications, Boston, USA, 189 pp.

Wilber K. (2005) *The Integral Vision of Healing*. In: Schlitz M, Amorok T, Micozzi MS, editors. "Consciousness and healing: integral approaches to mind-body medicine". Elsevier/Churchill Livingston, St Louis, USA.

Wilber, K. (2007). *The Integral Vision: A Very Short Introduction to the Revolutionary Integral Approach to Life, God, the Universe, and Everything*. Shambala Publications, Boston, USA, 224 pp.

Womack, J. (2006) "Purpose, process, people." *Lean Enterprise Institute e-letter*, available in http://www.lean.org.

Womack, J. P. and Jones, D. T. (1996). Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Simon & Schuster, New York.