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*Mejoramiento de la  
Efectividad de Nuevas  
Filosofías de Administración  
de Construcción usando la  
Teoría Integral*

# Improving the Effectiveness of New Construction Management Philosophies using the Integral Theory



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## Abstract

Currently, most management approaches coming from engineering focus on the external world, i.e. everything that can be seen (structures-processes-outcome). This situation has created low sustainability for 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 inner and outer world have been carried out, in order to design the organization's inner world (personality-emotionality-values-culture) as a space that facilitates the incorporation of effective management practices focused on the external world, such as lean construction. This article describes and discusses 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 strengthens the discipline of project management under the lean construction perspective. A production planning and control tool termed Last Planner System, which was based on lean construction principles, is used to illustrate the impact of integral vision over lean construction and project management. As a conclusion, it can be argued that if lean construction wants to evolve towards an effective management practice, the inclusion of some elements of the integral vision is needed, in order to make human and technical development inside the organization or project compatible. To achieve the above, lean construction must strengthen those research areas related to people, which so far has received little attention.

**Key words:** Integral vision, last planner, lean construction.

## Resumen

*En la actualidad, la mayoría de los enfoques de gestión provenientes de la ingeniería se han centrado en el mundo exterior, o sea, todo lo que se puede ver (estructuras-procesos-resultados). Esta situación ha creado una baja sustentabilidad de estos enfoques y herramientas, pues olvidan aspectos centrales del comportamiento individual y colectivo de las personas. Dado esto, se han realizado diversos esfuerzos para integrar el mundo interior y exterior de la organización, con el objetivo de diseñar el mundo interior (personalidad, afectividad, valores, cultura) como un espacio que facilite la incorporación de prácticas de gestión eficaces centradas en el mundo exterior, como la construcción lean. Este artículo describe y analiza la revolucionaria teoría de la visión integral propuesta por Ken*

*Wilber, como un marco de referencia que permite fortalecer la disciplina de la administración de proyectos bajo el enfoque de la construcción lean. Para ilustrar el impacto de la visión integral, se utilizó una herramienta de planificación y control de producción llamada Sistema del Último Planificador, que está basada en los principios de la construcción lean. Como conclusión puede afirmarse que, si la construcción lean desea evolucionar hacia una práctica de gestión eficaz, debe incluir algunos elementos de la visión integral, con el fin de hacer compatibles el desarrollo técnico y humano al interior de la organización o el proyecto. Para lograrlo, la construcción lean debe fortalecer las áreas de investigación relacionadas con las personas, las cuales hasta ahora han recibido poca atención.*

**Palabras clave:** Construcción lean, visión integral, último planificador.



## Introduction

Currently, most management approaches coming from engineering have been focused on the external world, it means, everything that can be seen (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 work in a specific organizational culture and have their own interests, personalities and worldviews (Beck and Cowan, 2005).

To deal with this situation, some efforts to integrate the organization's inner and outer world have been carried out, with the aim of designing the organization's inner world (personality-emotionality-values-culture) as a space that facilitates the incorporation of effective management practices focused on the external world (Barrett, 2006; Kofman, 2006), such as lean construction, a new management philosophy that have reached great impacts in the construction industry.

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 strengthens the discipline of project management under lean construction perspective. A production planning and control tool termed Last Planner System (LPS), which is based on lean construction principles, is used as example to illustrate the impact of integral vision over lean construction and project management. We discuss how 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, it is necessary to strengthen research areas related to people and culture (inner 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 environmental exploitation is jeopardizing human development if it is not accounted a fundamental paradigm shift in the way in which people see and interpret the reality (Tolle, 2006; Senge *et al.* 2008).

The following discussion encloses new scientific approaches which seek a new way to understand the reality for 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 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 reformulating 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 management 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 pioneered by Kurt Lewin and his followers in a variety of approaches to action science (Argyris, *et al.* 1985) throughout the second half of the 20<sup>th</sup> century. The second one was developed in the late 20<sup>th</sup> and early 21<sup>st</sup> centuries and is often called the "reflective turn". It puts emphasis on the observer role into the scientific phenomena and highlights the fact that is impossible to get the truth given the limitations imposed by our own biology (Maturana and Varela, 1992; Scharmer, 2007).

The challenge of the new science, is to produce a synthesis linking these three viewpoint (*science* – let the data speak, *action research* – you can't understand a system unless you change it and the *evolution of consciousness* and self – illuminating the blind spot), with the purpose of understanding the reality from a more comprehensive, deep and integral perspective (Scharmer, 2007).

### Organizational complexity

The increasingly level of complexity and change is another challenge faced by people, organizations and modern society. 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.

*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's voices.

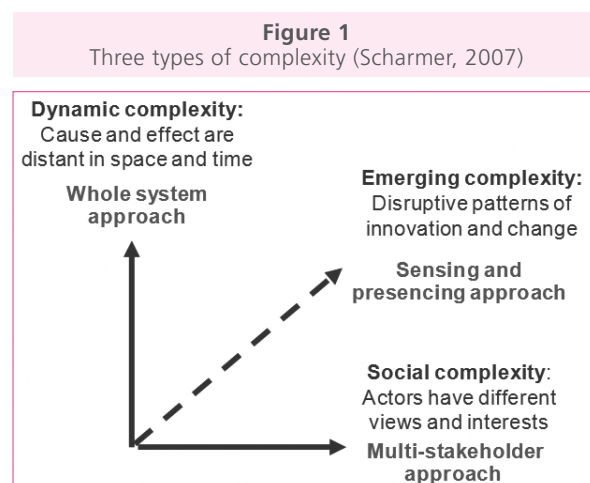
*Emerging complexity* is characterized by disruptive change. Challenges of this type can usually be recognized by these three characteristics: (1) the solution of the problem is unknown, (2) the problem statement itself is still unfolding and (3) who the key stakeholders are is not clear. When the future 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, presencing and prototyping emergent opportunities (Scharmer, 2007).

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 by multiple stakeholders (owners, contractors, architects, designers, community, etc.), whom have different interests, values, education and worldviews. 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 with the difficulties that are presented in its design and development.

Nevertheless, most of the scientific developments in construction management have been focused on reducing and working to the dynamic complexity, leaving aside the other two relevant areas of the organizational complexity. On the other hand, we have been able to empirically observe that most companies have problems to deal with the dynamic complexity (sometimes they cannot see it), but 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 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 about people 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 to understand 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 (I) and collective (we) 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 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 (integral) way. 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, this article will address only its core element, 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).



	INTERIOR	EXTERIOR
INDIVIDUAL	<b>Consciousness</b> <i>"What I experience"</i> <i>Fields of study:</i> "I" subjective realities. Eg. Self and consciousness, states of mind, psychological development, mental models, emotions, will.	<b>Behavior</b> <i>"What I do"</i> <i>Fields of study:</i> "It" objective realities. Eg. Brain and organism, visible biological features, people behavior, people performance, job task.
COLLECTIVE	<b>Culture</b> <i>"What we experience"</i> <i>Fields of study:</i> "We" inter-subjective realities. Eg. Shared values, culture and worldview, webs of culture, communication, relationships, norms, customs.	<b>Systems</b> <i>"What we do"</i> <i>Fields of study:</i> "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)

These four perspectives are embedded in every major language in the world, 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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).

## Lean construction and last planner review

Lean construction advocates for adding-value to the value stream pursuing perfection and reducing waste. Value is understood from a productive standpoint, such as activities that contribute to the transformation of raw materials to final products satisfying the customer's requirements, which are called adding-value activities. In contrast, those activities or actions that not provide customer's value as idle time, rework, excessive craft movement, among others, are known as non-adding value activities and represent waste

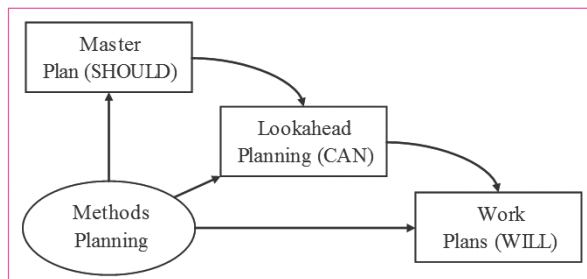
in a production system. Seminal developments from Toyota production system allow stating for a new production and management paradigm termed as lean thinking (Womack and Jones, 1996) which has served as theoretical framework to lean construction (Koskela, 2000). As a result, lean construction has become a strong field into the realm of construction management, due to the positive impacts that have reached in term of project performance (Alarcón *et al.*, 2005; González *et al.*, 2009; Liu and Ballard, 2008; among others).

One of the lean construction tools which has had major influence in construction is the Last Planner System (LPS). Figure 3 shows the project planning levels where LPS act: (i) 'Initial Planning or Master Plan' (long term period), which produces the initial project budget and activities schedule, and provides a co-ordinating map that 'pushes' completions and deliveries onto the project. (ii) 'Look Ahead Planning' (breakout of Master Plan in a medium term period), which details and adjusts budgets and schedules 'pulling' resources into play. (iii) 'Commitment Planning or Work Plans' (short-term period), which regards the activities and schedule work that will be done on-site according to the status of resources (labour, material, equipment, work space, etc.) and prerequisites (complete work of upstream activities) (Ballard and Howell 1998).

The traditional management approach for Work Plans is to define activities and schedule work that WILL be done, prior to the start of that work, in terms of what SHOULD be done from a Master Plan (See Figure 3). Activities are identified, timed, and sequenced so as to best serve the project objectives. Design squads, or production crews (production units), are being committed by management to do (WILL) whatever the schedule says SHOULD be done, with no real consideration for what they are actually able to do (CAN stated in Look Ahead Plans in Figure 3), at any specific point in time. Then, waste such as idle time or ineffective work, among others, could affect production units due to unforeseen variations of workflow (flow of resource and prerequisites).

**Figure 3**

Project Planning Levels. Adapted from Ballard and Howell (1998)



LPS overcomes the limitations of traditional management providing a stable and reliable production environment in projects, decreasing workflow variability and creating reliable Work Plans to derive maximum project benefits. LPS has two components: production unit control and workflow control. It is designed to increase productivity by identifying bottlenecks and encouraging Work Plans by the people at the work-face. The overarching criterion is that activities should only be committed if they CAN be performed (e.g. all resources and prerequisites that are needed must be available).

Production control could be understood as a mechanism for transforming what SHOULD be done into what CAN be done, thus forming an inventory of ready work from which a Work Plan can be formulated (WILL). Thus, Work Plans will be based on achievable assignments and ideally serve as a commitment to what WILL actually be done. The critical criteria for the assignments are that they should be well defined, in the right sequence, consist of the right amount of work and are achievable.

The function of workflow control is to be proactive in causing work to flow across production units in the best achievable sequence and rate, using Look Ahead Plans. Various specific processes are undertaken such as activity definition, constraints analysis, pulling work from upstream production units, and matching load and capacity (i.e. activities that tailor their labour resources to the available work produced by LPS). In practice, LPS allows participants to view the resource (e.g. work space) and prerequisite allocation of others so that conflicts can be anticipated. Resource and schedule information can be integrated and constraints can be tracked as part of the total work package management.

LPS approach provides forward information for control because it forces problems to the surface at the planning stage, identifying and acting over Reasons for Non-Completion (RNC) of Work Plans. Also, LPS measures

and controls planning reliability by means of the PPC, a ratio between actual completed activities and planned activities of Work Plans. More details about LPS can be seen in Ballard (2000).

LPS has been applied in numerous projects around the world in the last fifteen years and performance improvements have been reported on a wide range of construction projects (González *et al.*, 2008). A basic assumption of the system is that an increase in planning reliability, measured through PPC, should improve project performance and particularly, labour productivity. In other words, LPS improves project conditions increasing planning reliability to reduce, for instance, waiting and idle times in craft workers. Thus, LPS allows reduce waste and increases the incidence of adding-value activities by means of improving the productive work.

However, most of the implementations of lean construction principles and tools (included LPS) have been very fragmented (Picchi & Granja, 2004), i.e. they have 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. 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 Model of Learning and Getting Results (IMLGR)

“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 4).

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

Being aware on the way of how results are getting, is another important issue related to the integral theory (see Figure 2), since it puts the emphasis on integrating into a coherent whole the internal and external aspects of our reality.

Figure 4 represents what we termed as the Integral Model of Learning and Getting Results (IMLGR), which is a practical approach for applying the integral model in organizations. This model makes a link between being, actions and results, but also it illustrates the process of learning that comes from the way in which people ask themselves about why they get certain results.

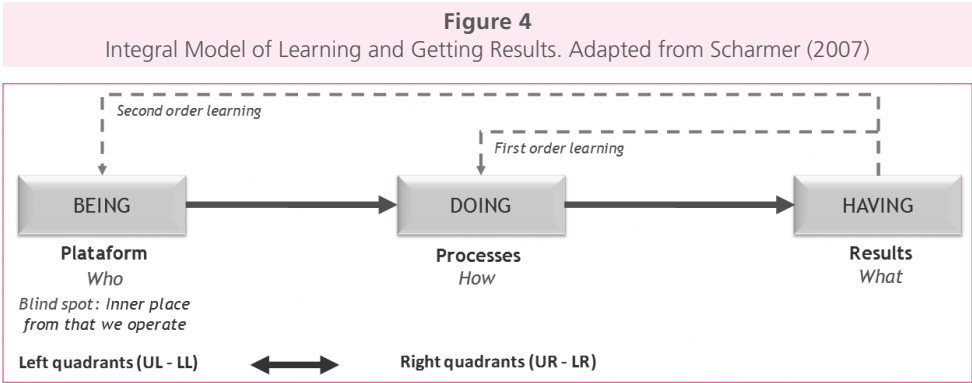
Thus, learning could be arise in two modes: the first order learning, focused in the actions that trigger the results, and the second order learning, which ask for the characteristics of the person (or group of people ) who produces the results.

From these two modes of learning, the first order learning is the typical mode of learning coming from engineering, which is more superficial and traditional. The second mode of learning is deeper and not easily to address, because it works with the non-linear character of human behavior (social and emerging complexity). This mode of learning, however, allows people and organizations acquiring a deeper understanding about what prevent them of getting better results, because it allows inquiring of which actions are available and which not, regarding to the particular observer that they are.

Finally, to apply the IMLGR, some important concepts should be understood to properly address and overcome the issues related to the left quadrants of the integral theory (what “I” experience and what “We” experience), which are illustrated by the “being” element of the IMLGR. In particular, we need to understand three important concepts: worldviews, emotions and organizational culture.

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 observer. In other words, a particular way in which we see the world and interpret the reality that commonly generates problems of understanding between human beings.



## Emotions

Emotion can be defined as a *predisposition to act* which arises from the interaction between the individual and his 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). The emotions are commonly gathered by certain events and they are experienced with temporary changes in our whole body (chemical changes, physical postures, specific thoughts, etc.). Sometimes, however, some emotional states are permanent in a person independent of the changes on his environment. We call this kind of permanent emotional state, *mood*. Both emotions and moods are important for the observer (being), because they allow that certain actions are available and others not.

## Organizational culture

Organizational culture 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). Worldviews and emotions (especially moods) affect significantly the organizational culture, since both contribute to shape the “collective observer” of the organization (other name for organizational culture). Also, the organizational culture affect the worldviews, emotions, processes and results, since the nature of the organizations is complex and dynamic. In next sections, we will explore the challenges of lean construction from the integral vision’ point of view and how this approach could be applied in project management.

## Research methodology approach

Discussion in this paper is basically theoretical. Therefore, its research approach is also theoretical, focusing on those issues that involve the application of integral vision over lean construction at a conceptual level. Further research is necessary to explore the practical implementation of the issues addressed in this paper, which would represent its final test.

The following are the research methodology stages: 1) Literature Review; 2) Selection and definition of a specific domain within lean construction: production planning and control applying the LPS; 3) Application and analysis of integral vision impacts over lean construction, using the selected domain; and 4) Discussion of results.

## Integral theory applied to planning through LPS

The implementation of the integral theory on planning under the lean construction viewpoint is carried out by analyzing the Last Planner System (LPS), because of its wide application in the lean construction community (Gonzalez *et al.* 2008).

LPS, given the elements that contains and the principles that supports, was designed to manage the dynamic complexity of construction projects, reducing the uncertainty and the variability of construction’s processes through the stabilization of the work environment (Ballard, 2000).

When the LPS is applied, however, the social complexity appears, but it is not properly addressed by the design of the system itself. Therefore, whereas the most complex of the 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 implementation and how the IMLGR serves to this purpose (Figure 4).

## LPS and the Integral Model of Learning and Getting Results (IMLGR)

The involvement of the above-mentioned concepts related to worldviews, emotions and organizational culture is crucial to understand the importance of the integral theory to analyze the different production management approaches, because it allows seeing the interactions between individuals, technological infrastructures and social processes that always come together simultaneously on the daily operation of the organization.

LPS assume that if it is applied carrying out each of the proposed activities, we will finally obtain a successful project in terms of time, cost and productivity, leaded by the improvements in variability levels and work environment stability. An issue that appears commonly hidden, however, is the “being process” behind the actions which are carried out when the LPS is implemented. It means, team worldviews, team emotions (and moods) and the organizational culture. Figure 5 illustrates the IMLGR applied to the LPS.

LPS allows several improvements and impacts at planning and project levels, in Figure 5 this can be understood as the *having dimension* of the IMLGR. At planning level, the main LPS results are stable working environment and low variability. At project level, time, cost and productivity target results are expected if the planning results are achieved.

Several actions are designed to achieve the planning and project goals, which are in the doing dimension of the IMLGR (Figure 5). These actions are termed as *trigger* and *base actions*. *Trigger actions* are key LPS processes that allow its sustainable implementation and higher level of improvement in the whole system. On the other hand, *base actions* provide the basic framework, from a technical viewpoint, for the implementation of the LPS. Although these actions are fully implemented, however, this does not assure a successful LPS implementation (Calderón, 2003).

Finally, as a result of several years of implementation, the authors have seen two mainly different approaches to the “being process”: high performance and medium-low performance approaches (Figure 5). The difference between these two approaches can be explained through the way in which worldviews and emotions are addressed by the project team. In particular, we have seen that “*high performance approach*” is often built by an organizational culture which expand the capacity of the team members, being characterized by worldviews centered in the mutual respect (we call that, following the work of Kofman (2006), ontological humility, which means the recognition of the other as a legitimate other that have different ways of looking at the world) and emotions (moods) based on love (trust, enthusiasm, among others). This approach promotes stronger trigger actions and, consequently, better planning and project results. On the other hand, “*medium-low performance approach*” has an organizational culture that prevents the full expression of the team members’ capabilities. This approach is led

by a worldview that we call arrogance (lack of mutual respect, manifested in expressions as: “I have the reason and you don’t”, “I have access to an objective reality so you are wrong” or “do what I say”) and emotions based on fear (control, distrust and resignation, among others).

Enhancing LPS through the 4 quadrants of the Integral Theory

By using the IMLGR, we have illustrated the potential impacts of manage the implementation of LPS under an integral viewpoint. Now, we will discuss the use of the integral theory as a framework to improve the effectiveness of new construction management philosophies, as lean construction. At this point, we promote an understanding of management as an integral, complex and dynamic phenomenon, which implies to look at it through “the integral glasses”. An example of our proposal is made by using the LPS, which is analyzed under the four quadrants of the integral theory. Table 1 shows this analysis, providing: what in each quadrant is sought, what important elements are needed to address and what tools are useful to work in each quadrant.

Table 1 is a useful tool for being aware of what is an integral approach to project planning and control under lean construction perspective, which combined with the IMLGR, provides a valuable framework to implement LPS or any other management tool on-site.

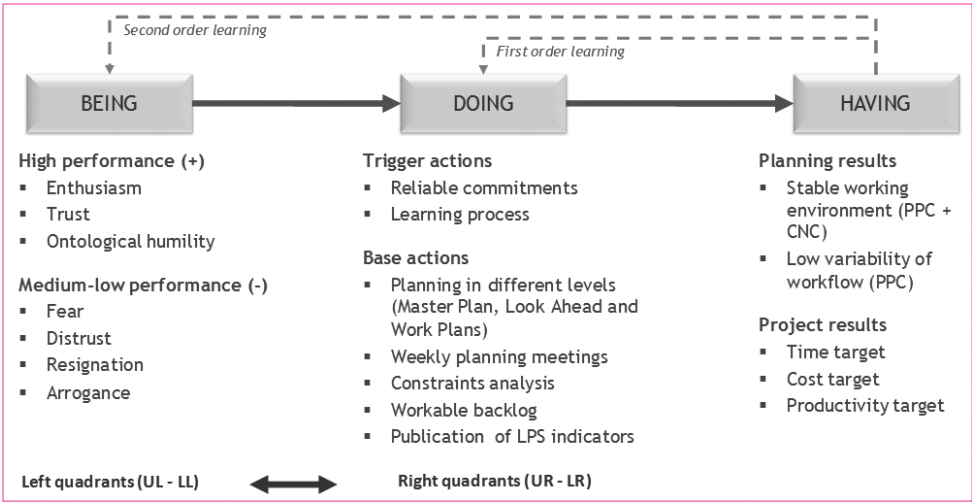


Figure 5  
LPS analyzed under the IMLGR



**Table 1**

LPS under the four quadrants of the Integral Theory

<p><b>Individual –Interior: Self and Consciousness</b></p> <p><b>Objective:</b> being aware of the subjective or internal experience that people have, working with the LPS within a project.</p> <p><b>Elements needed to address:</b> it is especially important to have the ability to identify and work, with the emotions (moods) and worldviews that support the “high performance approach” of being.</p> <p><b>Tools:</b> psychological types, self-questioning, introspection, goal-setting, emotional literacy training, and worldviews literacy training, individual motivation engaging, coaching.</p> <p>UL</p>	<p><b>Individual-Exterior: Behaviors and Actions</b></p> <p><b>Objective:</b> set up the specific individual behaviors that people need, working with the LPS within a project.</p> <p><b>Elements needed to address:</b> it is important to identify, and work, on the skills (behaviors) that support the implementation of the LPS, putting a special emphasis on which hold the trigger activities of the LPS. By doing so, it is necessary being aware the exterior expressions of the high performance worldviews and emotions.</p> <p><b>Tools:</b> competence framework, Lean Construction Professional's Profile (LPCC), team building practices, interpersonal skills training, speech acts, physics of coordination, measurable individual qualities.</p> <p>UR</p>
<p>LL</p> <p><b>Collective-Interior: Cultures and Worldviews</b></p> <p><b>Objective:</b> create an organizational culture that supports the “high performance approach” of being.</p> <p><b>Elements needed to address:</b> it is important to identify the shared values and beliefs that support the “high performance approach” of being, regarding social practices that supports healthy worldviews and emotions.</p> <p><b>Tools:</b> dialogue, inclusive decision making, consensus-based planning, organizational learning, trust building exercises, community visioning, storytelling, collective introspection, communication skills development.</p>	<p>LR</p> <p><b>Collective-Exterior: Systems and Environments</b></p> <p><b>Objective:</b> provide the structure and processes that support the LPS implementation.</p> <p><b>Elements needed to address:</b> it is important to be rigorous in the execution of each of the LPS activities (basic and triggers) and give the structural support for carrying out them in a good manner (e.g. good meeting rooms, accurate data, good bulletin board, appropriate performance indicators, good technological supports, etc.).</p> <p><b>Tools:</b> key performance indicators, lean practices, organizational design, physical infrastructure, systems thinking and complexity, quality tools.</p>

## 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 lean construction as a discipline in growth.

By exposing the basic concepts of integral theory and their application on the LPS, it was illustrated the large number of issues that remain hidden when management systems or tools are implemented under a purely technical point of view. In fact, this approach does not allow dealing well with the social complexity of construction projects, causing poor implementations and/or failures. Therefore, the involvement of all the quadrants in the

implementation of management systems is extremely important, focusing on the explicit incorporation of the inner realms of people (I and We) as a design.

Research conducted by the authors using integral strategies in pilot projects for implementing LPS, have been well received by teams involved in these projects. They have allowed observing the promising impacts of such approaches on the effective implementation of 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 comes from human and organizational barriers. Future research on LPS implementation that includes the integral vision impact as a subject of study should bring more additional evidence about the importance of this approach to support the successful implementation of best practices in construction.

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

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