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Integrating ISO 21500 Guidance on Project Management, Lean Construction and PMBOK

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Abstract

This paper develops a proposal for the combination of the Standard ISO 21500 Guidance on Project Management and the Project & Construction Management Systems, with emphasis in their integration with the PMBOK and the Lean Construction philosophy. The Project & Construction Management is studied from a global point of view, connecting, matching, supplementing, and/or combining the tools, techniques, and practices of the afore-mentioned management systems, applied to construction projects. Within this framework, the stakeholder participation is analyzed during the application of Integrated Project Delivery (IPD) and Target Value Design (TVD); as well as the sequences in which the processes, inputs, and outputs relate in time, originating variants in the effort for the achievement of optimum compatibility.

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Keywords: ISO 21500; Lean Construction; Integrated Project Delivery; Target Value Design; PMBOK

1. Introduction

Since the beginnings of the Lean Construction philosophy, much has been written about its compatibility with traditional management systems. Some authors state that there are philosophical differences between them, while others affirm that they are compatible. What all systems have in common is that they apply continuous improvement or the quality circle and, therefore, they are all compatible with ISO standards, especially with the ISO 9000 quality standard; this shows that no ISO standard brought them all together. *"ISO 21500 Guidance on Project Management provides guidance for project management and can be used by any type of organization, including public, private or*

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community organizations, and for any type of project, irrespective of complexity, size or duration." [1]. It could be said that the ISO 21500 was created as an answer to the growing globalization of the projects, and the need to establish common principles and make them compatible with the most applied standards and management systems in the world. Likewise, their application to any organization or project is sought.

2. ISO 21500 Guidance on Project Management, PMBOK and PRINCE2

2.1. ISO 21500

"This International Standard provides high-level description of concepts and processes that are considered to form good practice in project management. Projects are placed in the context of programmes and Project portfolios, however, this International Standard does not provide detailed guidance on the management of programmes and project portfolios. Topics pertaining to general management are addressed only within the context of project management. Figure 1 shows how project management concepts relate to each other. The organizational strategy identifies opportunities. The opportunities are evaluated and should be documented. Selected opportunities are further developed in a business case or other similar document, and can result in one or more projects that provide deliverables. Those deliverables can be used to realize benefits. The benefits can be an input to realizing and further developing the organizational strategy." [1].

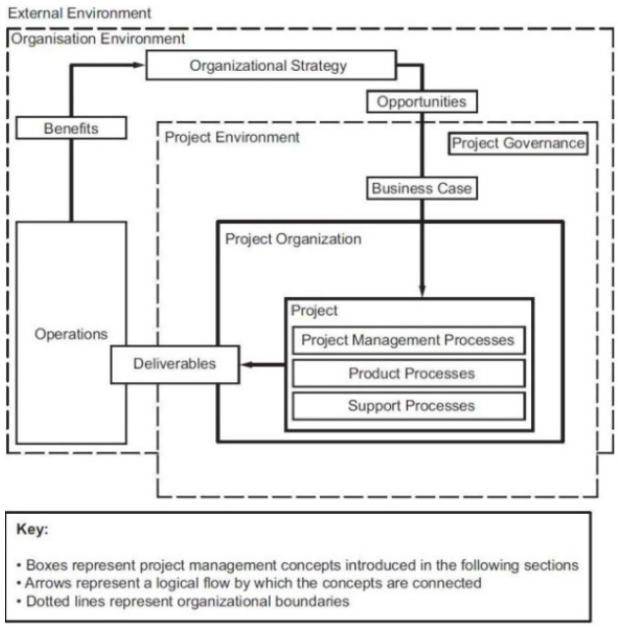

Figure 1: Overview of project management concepts and their relationships [1]

Besides, strategic goals may guide the identification and development of opportunities. Selection includes consideration of various factors, such as how benefits can be realized and risks can be managed, among others. The project stakeholders should be described in sufficient detail for the project to be successful; and the roles and responsibilities of the stakeholders should be defined and communicated based on the organization and project goals.

2.2. Compatibility of the ISO 21500, PMBOK and PRINCE2

The ISO 21500 points out that project management processes do not specify a chronological order to carry out the activities [1]. Processes may be combined and arranged in sequences according to what the management system has anticipated. This is very important when some of the processes involved interact and change their traditional order, as well as their cost and design, for example.

On the other hand, the ISO 215000 wisely eliminates the processes' tools and techniques, leaving the way open for specialists to combine and apply the tools and techniques that best suit the project, selecting them among the various management systems. This is especially useful in construction projects. When a specialist uses a system that has a guidebook or manual which recommends or suggests specific tools and techniques for processes, a barrier may be created to use one that is better than others; thus, the perspective of the great variety of innovating tools and techniques that exist —which are increasingly being generated worldwide— may be lost. Moreover, the ISO 21500 does not describe the processes' inputs and outputs, and does not mention the stages of a project; this increases the capacity to self-adapt to any management system, including those used in construction projects. This flexibility in input, output, stages, tools, and techniques would allow the incorporation of other additional elements to those commonly used in the conversion of conventional processes.

It can be stated that PRINCE2 and PMBOK do not compete with each other; both methodologies are compatible if used appropriately. PMBOK is a methodology that shows all the information required from the point of view of its authors, such as the tools and techniques, and the sequence used for process execution [2]. PRINCE2, on the other hand, provides guidelines about how to use such information [3]. The ISO 21500 perfectly harmonizes this compatibility.

All projects require a business justification which, based on ISO 21500, PRINCE2 or PMBOK, will be documented in the Business Case, explaining the reasons why the project should be started, the existing business options, expected costs, risks (threats and opportunities), benefits, possible wastes, terms, and projected investment, among others. The purpose of a Business Case is to justify the expenses of the project by identifying the benefits. In order to do this, one must pinpoint the business problem and its alternative solutions, recommend the best solution, and describe the implementation approach.

PRINCE2 recommends the creation of a preliminary Business Case, which collects all the data available to be used as reference to start the analysis of a project. It will be later replaced by the final one, which will be updated throughout the life cycle of the project.

According to PMBOK, the Business Case is an external document prepared beforehand; it forms part of the input data required to set up the Project Charter. It is not necessary for the sponsor and the future manager of the project to participate in its preparation.

Although the ISO 21500 is similar to the PMBOK, it is also intrinsically different due to the reasons discussed in this article. The compatibility of the tools, techniques, and the management system practices used in construction, such as the PMBOK and PRINCE2, among others, could be started through the ISO 21500.

3. Lean Construction, Target Value Design (TVD) and Integrated Project Delivery (IPD)

3.1. Evolution of Lean Construction philosophy

Since Laurie Koskela published his technical report TR72 in 1992, giving rise to the Lean Construction philosophy, this trend has evolved. According to Koskela [4], due to these traditional managerial principles, flow

processes have not been controlled or improved in an orderly fashion; this has led to complex, uncertain, and confused flow processes, expansion of non-value-adding activities, and reduction of output value.

In 2000, Ballard [5] stated that the Lean Project Delivery System (LPDS) emerged from theoretical and practical investigations, and was in a process of on-going development through experimentation in many parts of the world. *"In recent years, experiments have focused on the definition and design phase of projects, applying concepts and methods drawn from the Toyota Product Development System, most especially target costing and set based design. ... In the Lean Project Delivery System, it is assumed that the job of the project delivery team is not only to provide what the customer wants, but to first help the customer decide what they want. Consequently, it is necessary to understand customer purpose and constraints expose the customer to alternative means for accomplishing their purposes beyond those they have previously considered, and to help customers understand the consequences of their desires. This process inevitably changes all the variables: ends, means and constraints."* [6].

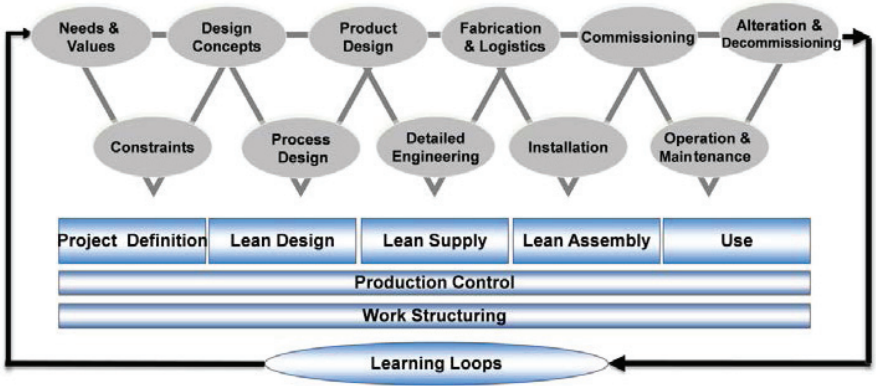

Figure 2: Lean Project Delivery System ([6] and [7])

Orihuela, Orihuela and Ulloa [8] have found convenient to classify the design tasks in three types, using the theory of TFV (Transformation, Flow and Value) proposed by Koskela [9]:

- *"Internal Operational Tasks: These are in charge of the design team and their resources and times can easily be estimated. For example, data collection regarding Site Conditions. These tasks can be regarded as flow activities.*
- *Internal Creative Tasks: Tasks that are the design team's responsibility, but whose times are more difficult to estimate due to their own creative nature. For example, the Design Concepts generation. These tasks can be regarded as value-generating activities.*
- *External Tasks: Tasks which are not part of the design team's responsibilities and whose times are variable since they are made by external individuals or entities. For example, approval of the structures project by the municipal entity. These tasks can be regarded as transformation activities.*

Such classification will help us to make a better estimation of time and more effective and fair control and follow up. It will also reduce conflicts that may arise due to lack of precision to meet deadlines, both within the design team cluster and between the design team and the owners." [8].

Waste reduction and value creation for the customer are the main goals of this philosophy.

3.2. Target Value Design (TVD) and Integrated Project Delivery (IPD)

"Target Value Design (TVD) is a disciplined management practice to be used throughout project to assure that the facility meets the operational needs and values of the users, is delivered within the allowable budget, and

promotes innovation throughout the process to increase value and eliminate waste. Target Cost is the cost goal established by the delivery team as the "target" for its design and delivery efforts. The Target Cost should be set at less than best-in-class past performance. The goal is to create a sense of necessity to drive innovation and waste reduction into the design and construction process" [10]. Figure 3 shows the fluidity of funds across subsystems. According to AIA California Council [12], Integrated Project Delivery (IPD) is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication, and construction. Integrated Project Delivery principles can be applied to a variety of contractual arrangements, and Integrated Project Delivery teams will usually include members well beyond the basic triad of owner, designer, and contractor. At a minimum, an integrated project includes tight collaboration between the owner, architect/engineers, and builders ultimately responsible for construction of the project, from early design through project handover. Figures 4 and 5 show the differences between integrated and traditional project delivery.

The team is invited to participate within a flexible contractual management framework, aimed at building Win-Win relationships of trust. Once the team accepts, it starts interacting through a collaborative routine in which BIM tools are used, which will allow to analyze each alternative posed by the stakeholders, seeking not to exceed the target cost of each stakeholder in the event adjustments are required. IPD, TVD and BIM are used simultaneously.

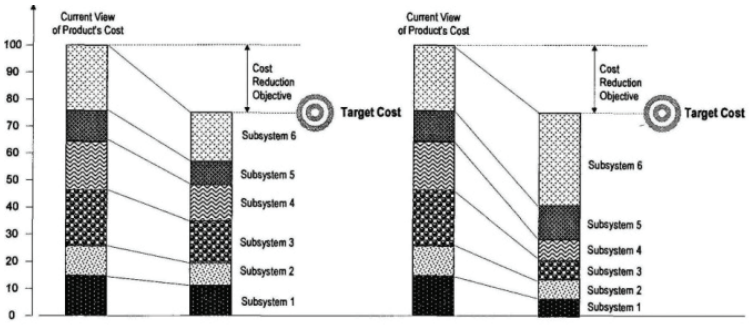

Figure 3: Fluidity of funds across subsystems [11]

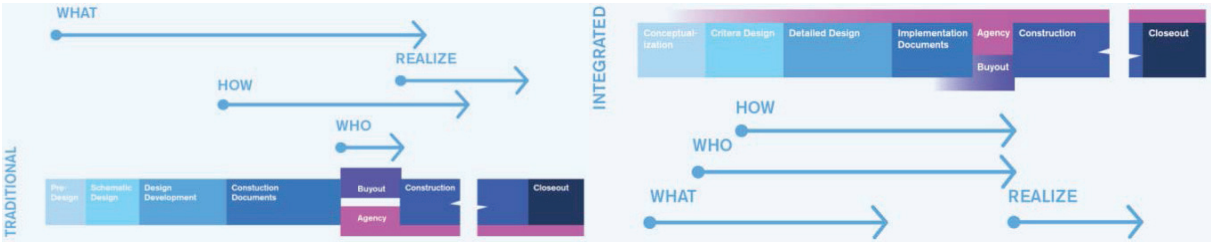

Figure 4: Differences between integrated and traditional project delivery [12]

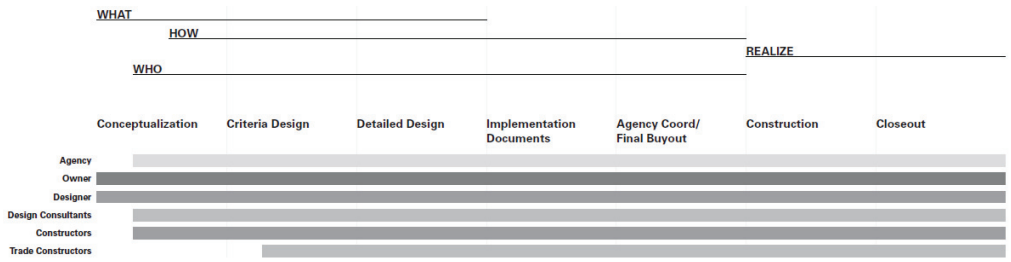

Figure 5: Shifts of when different aspects of the project are resolved ("Who, What, How, Realize") and shifts of when different project participants become involved. [13]

4. Integrating IPD, TVD, ISO 21500, PMBOK and PRINCE2

According to PMBOK, the Business Case is an external document prepared beforehand; it forms part of the input data required to set up the Project Charter. It is not necessary for the sponsor and the future manager of the project to participate in its preparation. This is different from the IPD-TVD, where the role of the interested parties is essential.

PRINCE2 recommends the creation of a preliminary Business Case, which collects all the data available to be used as reference to start the analysis of a project [3]. It will be later replaced by the final one, which will be updated throughout the life cycle of the project.

Through an analogy with the IPD-TVD construction projects, in addition to having the market costs of the project, the estimators establish in advance the probable costs to be incurred by contractors and subcontractors. This would be equivalent to the preliminary Business Case. In fact, in Project Definition Phase, Ballard [14] proposes a Business Planning in order to:

- *"Assess the business case (demand, revenues), taking into account the cost to own and use the facility (business operations, facility operations, facility maintenance, adaptability, durability) as well as the cost to acquire it.*
- *Determine minimum acceptable Return on investment (ROI) or maximum available funds --set the allowable cost for the facility. ..."*

Each alternative may be built virtually with the use of the BIM; everyone will be able to see and understand the processes generated.

According to Ballard [14], *"... If expected cost exceeds available funds or violates ROI, attack the gap with innovations in product/process design, restructure commercial relationships, etc. ... If expected cost still exceeds available funds or violates ROI, adjust scope by sacrificing lesser ranking values. ... Continue alternating meetings and TVD workshops as time allows and time is needed to develop, explore and select alternative product and process designs".*

Once the satisfaction conditions of all the stakeholders are met, the project is validated by all the parties involved, thus agreeing on the final project. This would be equivalent to the Business Case.

The Business Case of IPD-TVD, together with the updated contractual documentation, would be equivalent to the Project Charter of the ISO 21500.

Figure 6 shows the main processes of ISO 21500 involved in Project Charter of IPD-TVD.

Subject groups	Process groups				
	Initiating	Planning	Implementing	Controlling	Closing
Integration	4.3.2 Develop project charter	4.3.3 Develop project plans	4.3.4 Direct project work	4.3.5 Control project work 4.3.6 Control changes	4.3.7 Close project phase or project 4.3.8 Collect lessons learned
Stakeholder	4.3.9 Identify stakeholders		4.3.10 Manage stakeholders		
Scope		4.3.11 Define scope 4.3.12 Create work breakdown structure 4.3.13 Define activities		4.3.14 Control scope	
Resource	4.3.15 Establish project team	4.3.16 Estimate resources 4.3.17 Define project organization	4.3.18 Develop project team	4.3.19 Control resources 4.3.20 Manage project team	
Time		4.3.21 Sequence activities 4.3.22 Estimate activity durations 4.3.23 Develop schedule		4.3.24 Control schedule	
Cost		4.3.25 Estimate costs 4.3.26 Develop budget		4.3.27 Control costs	
Risk		4.3.28 Identify risks 4.3.29 Assess risks	4.3.30 Treat risks	4.3.31 Control risks	
Quality		4.3.32 Plan quality	4.3.33 Perform quality assurance	4.3.34 Perform quality control	
Procurement		4.3.35 Plan procurements	4.3.36 Select suppliers	4.3.37 Administer procurements	
Communication		4.3.38 Plan communications	4.3.39 Distribute information	4.3.40 Manage communications	

Figure 6: Main processes of ISO 21500 involved in Project Charter of IPD-TVD (Adapted from [1])

Besides, Figure 7 shows flexible ISO 21500 process group interactions with representative inputs and outputs for IPD-TVD. ISO 21500 points out that the projects' management processes do not specify a chronological order to carry out the activities. Additionally, Figure 8 shows flexible relations between ISO 21500, TVD and IPD (adapted from Ballard [14]).

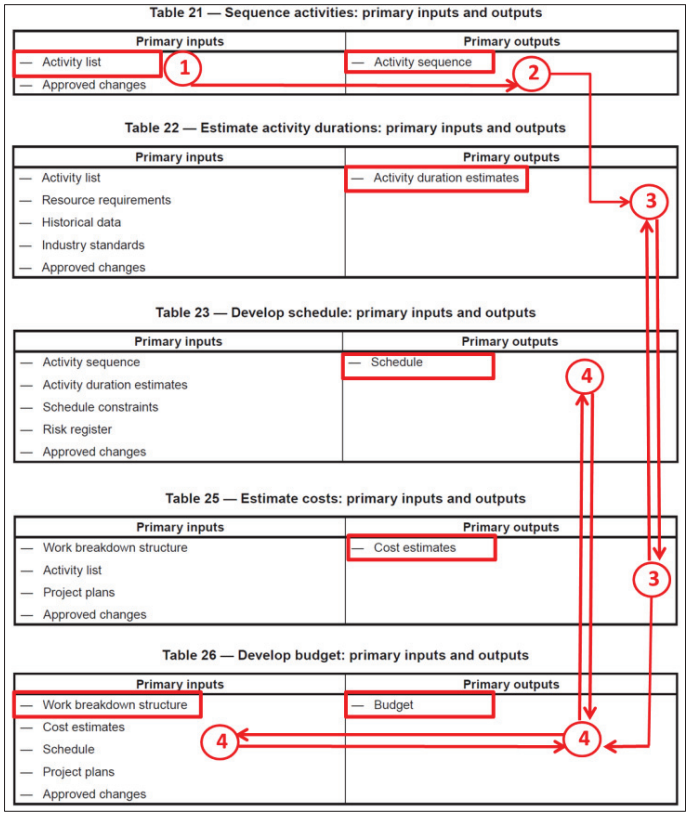

Figure 7: Flexible process group interactions showing representative inputs and outputs for IPD-TVD (Adapted from [1])

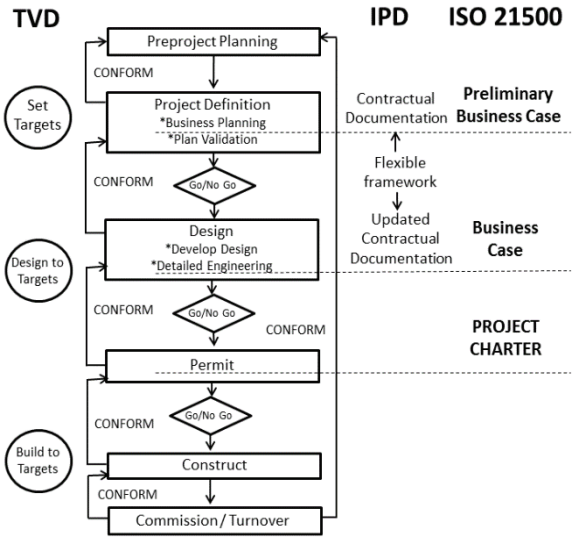

Figure 8: Project Phases, TVD, IPD and ISO 21500 (Adapted from [14])

Processes may be combined and arranged in sequences according to what the management system has anticipated. ISO 21500 does not describe the inputs and outputs of processes, which increases their capacity to self-adapt to any management system. This flexibility would allow the incorporation of other additional elements to those commonly used in the conversion of conventional processes.

5. Conclusions

The various management systems may be made compatible through the ISO 21500, as it allows sequences and the adaptation of processes to be carried out in a flexible way. The freedom to choose tools and techniques, and the flexibility to specify the processes' inputs and outputs help overcome the typical psychological barriers of specialists with deep-rooted preferences for a certain management system. Although the ISO 21500 is similar to the PMBOK, it is also intrinsically different due to the reasons discussed in this paper.

It can be stated that these management systems do not compete with each other; all methodologies are compatible if used appropriately.

The compatibility of the Lean Construction philosophy tools, techniques, and practices, as well as of the management systems used in construction, such as the PMI, PRINCE2, among others, could be started through the ISO 21500; this opportunity is a very clear line of research that should be developed as soon as possible. A step forward would be achieved in any scenario.

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