

# **THE FIRST AND LAST VALUE MODEL: SUSTAINABILITY AS A FIRST VALUE DELIVERY OF LEAN CONSTRUCTION PRACTICE**

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## **ABSTRACT**

The work described in this paper forms part of the final stage of a PhD research aimed to widely visualise Value in the construction industry. In this way, a conceptual model was proposed to visualise the return of Value from the construction industry over society and the legacy of this sector for future generations. The First and Last Value model—F&LVM— includes the delivery of Value spans across two different contexts: First context refers to Value delivery for the cure of environmental & social issues (First Value), and Last context deals with Value delivery at production level, linked to transformation activities or what needs to be done – the work (Last Value). This paper aims at underlining the potential of Lean Thinking for addressing environmental issues, where sustainable practices are proposed as a first level strategy of current Lean Construction practices. Additionally, it is proposed that Society depends on construction industry outputs and that it should be considered in addition to particular interests, if the potential of the construction industry is to be fulfilled.

## **KEY WORDS**

Lean Construction, Lean Thinking, Society, First Value, Last Value, Value.

## **INTRODUCTION**

The concept of Value has been largely recognised as one of the most difficult concepts to be investigated in the construction sector. Its several features, definitions, equations and models convert this concept into an infinite and somewhat confusing universe to explore. Consequently, the concept of Value has become an ongoing concern through construction sector. Aimed at visualising the concept of Value in a wider perspective from the early stage of projects, previous investigation identified two central constraints in current literature and practice (Salvatierra-Garrido et al. 2009; Salvatierra-Garrido and Pasquire; 2010; Pasquire and Salvatierra-Garrido, 2010):

- Lack of an overarching understanding of Value; and
- Predominance of a customer-focused perspective of Value.

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To contribute to construction sector' performance, different aspects of Value were investigated to propose a comprehensive model of Value:

- Return of Value from construction industry to the society; and
- Different features of Value.

As physical outputs, building & infrastructure projects represent environmental & social issues from different domains or perspectives of Value. As a result of the legacy construction projects leave in society, topics such as sustainability, health & safety, reduction of carbon emissions, etc. have been used as an indicator to measure construction sector performance. However, there is an important group of universal issues such as social insertion, unemployment, educational levels, creation of citizenship, avoiding marginalization, socialisation, etc. which have not been commonly considered as a return of Value from construction industry to the entire society. The F&LVM was developed to visualise the universe of Value in a broader sense in the construction sector. Accordingly, delivery of Value spans across two different contexts: First and Last Context. First context refers to Value delivery through addressing environmental & social issues (First Value) Last context, on the other hand, deals with Value delivery at production level, linked to transformation activities or what needs to be done – the work (Last Value).

At present, Lean Construction—LC has demonstrated the potential to consider the environment as a customer to be satisfied (Houvila and Koslela, 1998). In the same way, society has been recognised as an essential but still misrepresented party which should be part of current construction management perspectives. According to LC experience, different authors have underlined the need to consider society as a direct customer of construction industry (Koskela, 2000; Emmitt et al. 2005; Bertelsen and Emmitt, 2005; Höök, 2006; Forsberg and Saukkoriipi, 2007; Alves and Tsao, 2007; Koskela et al, 2008). However, despite the impact of the construction industry over the society as a whole, most efforts have been used to satisfy a reduced group of customers, where economical perspectives predominated. Therefore, to enhance Lean potential, sustainability is proposed as a first level strategy of the construction industry.

Finally, this paper will present:

- An overview of current limitations of Value and proposed features to widely visualise this concept;
- Description of the F&LVM; and
- Sustainability as a First Value delivery of Lean Construction practices.

## **LIMITATIONS OF VALUE AND PROPOSED FEATURES TO WIDELY VISUALISE THIS CONCEPT**

As mentioned in the previous introduction, two central constraints in the construction sector experience and Lean practices were identified:

### **LACK IN AN OVERARCHING UNDERSTANDING OF VALUE**

At present, the concept of Value has been discussed broadly within different academic fields including applied and social sciences. As a result of its subjective nature and several features, different definitions, equations and models have been proposed to deliver Value in the construction sector. Consequently, different theoretical and practical perspectives have guided construction sector performance to the satisfaction of particular customer requirements. Results achieved to date demonstrate that this concept has been investigated largely from its objective and measurable nature, where several product attributes such as cost, quality, function, etc. have been commonly linked to Value.

### **FREQUENT CUSTOMER-FOCUSED PERSPECTIVE OF VALUE**

Over the years, Value delivery has been associated mainly to the tradeoffs between customer requirements and product attributes. Thus, it has been argued that “Value is generated through a process of negotiation between customer ends and means. The first role of the designer is to make explicit to customers the consequences of their desires, subsequent to which customers may choose to modify their ends” (Ballard and Howell,1998:4). Additionally, in supply chain, customer has been commonly understood as the party that pays for the satisfaction of particular requirements. At present, modern practices expand this narrow notion of customer to include stakeholders in current practices from the early stage of construction projects. Thus, early interaction of different parties representing particular Value judgements is understood as an opportunity to achieve agreed Value perspectives and deliver the best possible Value. To contribute with construction sector’ performance, different aspects of Value were investigated to propose a new model of Value.

### **RETURN OF VALUE & LEGACY FROM THE CONSTRUCTION INDUSTRY TO THE SOCIETY**

This phenomenon, not explored sufficiently, is understood as an opportunity to visualise the concept of Value from a wider perspective considering the impact and legacy of the construction industry over the entire society. From this Value can be understood as an “oscillating” concept (Figure 1). Thus, Value delivered for a particular building project impacts society as a whole and consequently the judgements of Value for future building projects, and so forth. Therefore, Value is moving constantly between particular construction projects and the society.

### **DIFFERENT FEATURES OF VALUE**

In order to address Value in the construction sector in a better way, its diverse features — objectivity, subjectivity, relativity, dynamism, context dependence — should be considered. Experience demonstrates that Value has been mainly understood as an objective concept. Thus, numerous measurable attributes such as cost, quality, function, etc. have been linked to Value.

## DESCRIPTION OF THE F&LVM

Aimed at visualising the concept of Value from a wider perspective, the following section describes the main features of the F&LVM.

### THREE DOMAINS OF VALUE IN THE F&LVM

In the F&LVM, Value is delivered from the interaction of three of its domains:

- **Production and Delivery capacity:**

This domain represents the activities performed by the construction industry. Consequently, there is a close relationship with planning and controlling project activities. Additionally, this domain promotes the ethical and responsible management of human, monetary and natural resources.

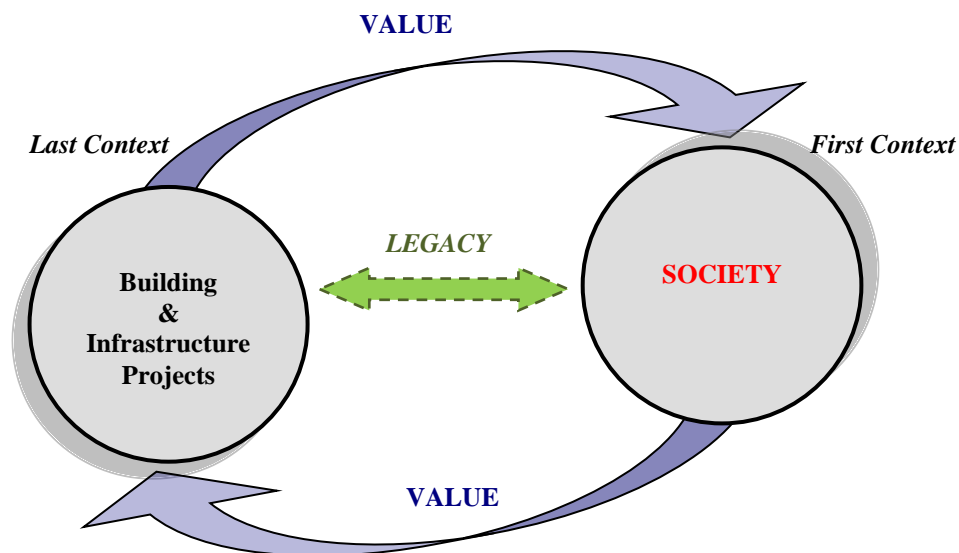


Figure 1: Value as an “oscillating” concept

- **Stakeholders’ perspectives:**

This domain represents the particular perspective of Value from different individuals or organisations involved in construction projects. Commonly, monetary terms have prevailed over this domain and most efforts have been used to deliver products where time and quality are managed in terms of cost.

- **Social perspectives:**

This domain represents the social perspectives of Value considering environmental & social issues. In this way, governments are considered responsible for the promulgation and control of public policies aimed at the welfare of the population. Thus, the role of services and ruling agencies is fundamental to the creation of Value for the entire society.

## **FOUR PERSPECTIVES OF VALUE IN THE F&LVM**

The F&LVM considers delivery of Value in the construction industry from a wider perspective including the interaction between requirements of construction projects, stakeholders and social perspectives. These perspectives should be based on ethical behaviour and legal procedures. Thus, the delivery of Value should consider the following perspectives:

- **Technology:**

In the construction industry, technical aspects are linked to the answer to two essential questions:

- Are we able to deliver a product or service?; and
- What can we do to differentiate our product or service?

To create construction projects (Requirements), production and delivery capacity should make the most of available resources to satisfy different perspectives of Value. Therefore, the technological perspective here includes key concepts such as innovation, productivity, flexibility, expertise, skills, ability, knowledge, customization, enhancement, etc.

- **Economics:**

The concept of Value from the stakeholders' perspectives has been broadly linked to monetary terms and to the questions:

- What do we want?; and
- What price are we able to pay?

The stakeholders' universe in the F&LVM comprises all parties representing the common economic perspective of Value (clients/customer, constructor, subcontractors, designers, consultants, etc). Therefore, this perspective is linked to the trade-off between money and other attributes of products, such as time, quality, function, etc. The economic perspective of Value depends on what desires or objectives we want to satisfy. Thus, the usual economic agenda can be associated to monetary terms such as return of capital, profitability, cost reduction, etc.

- **Environment:**

The construction industry has demonstrated an increasing concern about environmental issues and the impact of its practices over the ecosystem (biodiversity). In this way, modern concepts such as sustainability (responsible use of limited resources), social responsibility (environment, local communities, working conditions, and ethical practices), and the Triple Bottom Line (People, Planet and Prosperity), etc. have been associated to ethical and responsible practices. These are crucial for the performance of the construction sector as here the use of limited natural resources is huge in comparison to other industries. Thus, this perspective of Value is linked to the question:

- How do our activities & products impact our planet (biodiversity)?

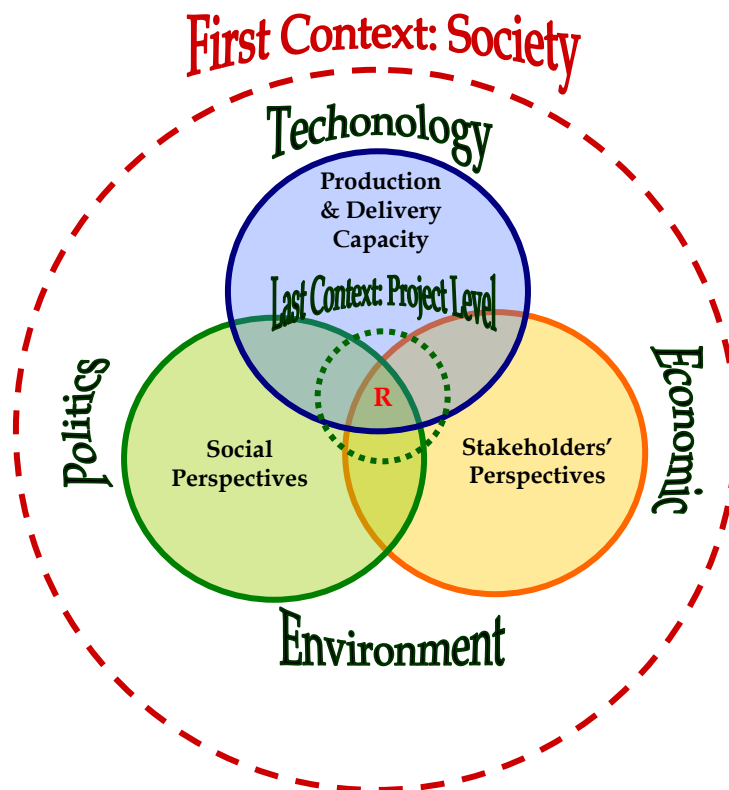
Therefore, the environmental agenda can be based on topics such as pollution, reduced carbon emissions, physical waste, land use, community health, etc.

- **Politics:**

Governments allocate their resources according to the critical objectives they want to achieve, for example: economic growth and improvement of people’s quality of life. Besides, there are several other objectives such as continuance of current governments (pleasing voters), international recognition, stabilization of national economy, etc. As noted, construction industry plays an important role in micro and macro economies, and therefore, governmental objectives should be based on the population’s welfare meeting targeted social needs. In this way, the role of services, planners and ruling bodies becomes critical to deliver and satisfy social needs and consequently, to achieve political perspectives of Value. Therefore, from a political agenda, delivery of Value is associated to governmental goals. So, this perspective of Value is linked to the question:

- How are public resources allocated?

Finally, from the interaction of all previous elements, the F&LVM is graphically summarised as follows (Figure 2):



**R:** Requirement (Construction projects)

Figure 2: The F&LVM

## **SUSTAINABILITY AND LEAN CONSTRUCTION PRACTICES**

Over the years, the construction industry has been using a huge quantity of limited natural resources and, as noted, this situation has originated increasing concern for the welfare of future generations. In this way, it has been underlined that “business organizations are being called upon to take responsibility for the ways their operations impact societies and the natural environment. They are also being asked to apply sustainability principles to the ways in which they conduct their business.” (Quinn and Dalton, 2007:21). According to UK Government, the goal of sustainability is to “enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations.” (www.defra.gov.uk). From LC experience, researchers have argued that “while traditional design and construction focus on cost, performance and quality objectives, sustainable design and construction add to these criteria minimization of resources depletion, minimization of environmental degradation, and creating a healthy built environment (Kibert 1994).” (see Houvila and Koskela, 1998:3).

These authors clearly expand traditional construction management perspectives focused mainly on the balance of cost, time and quality. Similarly, other authors have also underlined the need to adapt current production process in order to deliver sustainable projects (Klotz et al. 2007; Bae and Kim, 2007). Thus, the potential of LC in the cure of environmental issues has been also linked to clean construction and reduction of carbon emissions. In this way, it has been argued that:

- “The ‘lean’ concept that tries to reduce or eliminate non-value-adding activities must be integrated into these new approaches brought by global sustainable development issues, mainly environmental ones.” (Degani and Cardoso, 2002:7).
- “Between 10 and 20% of all the raw materials delivered to a construction site end up in skips. This has a significant impact on CO2 emissions as those skip loads also represent a waste of the embedded energy in the construction industry is aware of the issues of waste and sustainable development, and is adopting a new approach, ‘Lean Construction’, to reduce waste in construction supply processes.” (www.carbontrust.co.uk).

Previous experience demonstrates that high cost linked to implementation of sustainable practices can be compensated with other operational savings. Thus, Lean practices can also minimize waste and increase Value in sustainable projects delivery. In this way, customer and environmental needs are used to guide lean processes in the construction of future projects (Lapinski et al. 2006). Usually, Value in LC terms has been broadly linked to waste reduction and customer satisfaction. Thus, under an environmental perspective, any kind of waste, such as defects; over-production; unnecessary processing; unnecessary people moves; unnecessary movement of material; waiting; inventories; designing something that does not meet client's needs, also negatively increases the impact of our environment (Degani and Cardoso, 2002).

Aimed at improving construction sector performance, earlier practices highlight the need to expand common customer-focused perspectives to deliver Value, in this way; it has been argued that:

- “Lean construction needs to identify sustainable values including economic, environmental and social value as critical factors in implementing sustainable construction.” (Bae and Kim, 2007:315);
- “Sometimes achieving value (economic, environmental, social, cultural and historic) is more important than reducing waste... (Vrijhoef and Koskela 2005).” (see Höök, 2006:586)

From this, the use of the F&LVM acquires importance in the promotion of sustainable development; where global issues should be elevated as a first level strategy of the construction sector. To achieve this objective, Lean Design can contribute to enhance client and social values from an early stage of construction projects. It is important to emphasize the interaction of different stakeholders towards the consideration of the expanded customer focused Value perspectives. Thus, the interaction of different domains and perspectives of Value provides an opportunity to consider society and future generations as potential customers.

### **SUSTAINABILITY AS FIRST VALUE DELIVERY IN THE F&LVM**

The F&LVM is proposed as a tool to visualise the total universe of Value in construction industry. Consequently, this model suggests an expansion or better differentiation of a common customer-focused perspective (“one who pays”) to benefit the entire society. In this way, sustainability is proposed as a First Value delivery of current construction sector strategies. As it was described, the F&LVM differentiates three domains of Value: (1) Production and Delivery capacity, (2) Stakeholders’ perspectives, and (3) Social perspectives. Thus, a global visualization of Value from an early stage of projects can help to use the production and delivery capacity in pro of universal topics, such as degradation of our ecosystem. Additionally, every part representing particular interests is mostly measured in monetary terms (Stakeholders’ perspectives in the F&LVM) is encouraged to perform ethical and responsible practices. Consequently, sustainable practices become an integral part of the social domain of Value.

Regarding the four perspectives of Value included in the F&LVM, the environmental perspective is linked to the question: How do our activities & products impact our planet (biodiversity)? Therefore, managing human, natural and monetary resources in the construction industry should be oriented to the achievement of common goals which satisfy the needs of stakeholders and society as a whole especially in public sector projects. In this way, the role of government is essential to regulate and encourage environmental friendly practices (policy development). “Building result from social needs and accommodate a variety of functions-economic, social, political, religious and cultural... by a society’s ideas, its forms of economic and social organisation, its distribution of resources and authority, its activities, and the beliefs and values which prevail at any one period of time.” (King, 1984:1).

The F&LVM aims at generating a continuous movement from an economical perspective “value for money” to a social perspective, where the welfare of the entire population can be used as a first level of strategies for the construction sector. At present, market competitiveness has generated an increasing concern about controversial topics such as preservation of natural resources, global warming, etc. consequently terms such as sustainability, natural capital (see Hawken et al. 2000),



Social Responsibility, Triple Bottom Line, etc. arise in current research construction agenda. However, this concern is not always reflected in common construction practices and society continue being a misrepresented part of common activities.

## **CONCLUSION**

As explored through previous sections, Lean practices in the construction sector can contribute to sustainable development. It has been largely stressed that sustainability is not only concerned about the responsible use of natural resources; these practices can also improve profitability and facilitate the relationship with stakeholders. This is a clear example of how stakeholder perspective of Value can be transferred to first level strategies in construction sector. However, some activities should be supported by all parts involved in Lean Construction projects. In this way, some ideas are underlined:

- To visualise Value from a wider perspective, where universal topics such as sustainability can be discussed, LD becomes a key activity from early stage of projects. Thus, different Value judgements can be addressed to achieve social welfare;
- Satisfaction of social & environmental issues should be managed as first level strategies of the construction sector. In this way, common customer notion linked to the figure “who pays” can be expanded as it has been demonstrated by authors mentioned through previous sections; and
- To expand current Lean potential, different interests should be differentiated. Thus, Value delivery activities can be pulled from a project focused to a global perspective.

Finally, it is important to reflect on the opportunity of construction sector to cure environmental & social issues. The importance of developing a wider view of Value for construction is being driven generally by the need for sustainability and the particular role of construction within society. There is no argument against the statement that activities of the human species ALL rely on some form of constructed facility and the more developed a country is the more this is true. It is also apparent that construction products (buildings & infrastructure projects) have an impact outside the immediate circle of stakeholders and that this impact has a very significant lifespan that often goes beyond the designed use or function. That means the legacy of our decision for future generations.

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