EXPLORING THE APPLICATION OF LEAN PRINCIPLES TO A CONSTRUCTION SUPPLY CHAIN

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1 BACKGROUND & IDENTIFICATION OF PROBLEM

The characteristics known in construction are often seen as peculiarities of the industry and prevent the attainment of flows as efficient as in manufacturing. The construction industry knows two typical problems resulting from high levels of fragmentation and low levels of repetition: lack of control and decreasing performance. Despite the critical role of a client, parties on the supply side – the lower tiers of the construction supply chain – are believed to be able to develop into more integrated systems, independently from the demand. Contractors are willing to develop closer relationships, but implementing SCM seems a long-term, complex process and requires a certain level of understanding and therefore learning throughout the supply chain.

This paper sets out to explore possibilities and examines the results of a step towards successful SCM in construction. It describes the advantages of the application of some important Lean principles, by presenting the differences within the processes needed to deliver one construction 'product' in two different ways – with a product- and project-focus. The combination of lean applied to the management of supply chains is believed to generate outstanding business performance. Lean thinking challenges to fundamentally rethink value from the customer, which includes the identification of the 'entire' value stream. It must go beyond the firm to look at the whole: the entire set of activities entailed in creating and producing a specific product. Flow is created in order to accomplish tasks continuously from raw material to finished good rather than departmentalised, in batches.

2 RESEARCH AIM & METHODOLOGY

The aim of the study is to investigate the effect value-stream thinking and flow, two important Lean principles, have on the collaboration within a supply chain and the SCM activities initiated by a main contractor. This way it provides readers with the necessary insights to take an important step towards the implementation of SCM in construction.

The main contractor involved in the research has initiated the integration of its supply chain and decided to form long-term agreements with suppliers in its key supply categories. The study, conducted in the Netherlands, involves case study research and comprises the following combination of data collection: Semi-structured interviews – where the emphasis is towards investigating a phenomenon within a context, and detached observation. For this research an experiment was proposed, where the supply chain was challenged to adapt a product-focus within a project, rather than the project-focus generally known in construction. This means that tasks were performed continuously from foundation to the delivery of one completed product. The studied supply chain focuses on housing and the study was conducted on a project existing of 40 houses. Part of the project was constructed as Case I, the experiment, and the other part as Case II, the traditional situation.

Data collection was largely based on primary data and gathered from semi-structured interviews with two key representatives – at management and project level – from each organisation involved. This approach is qualitative and investigates dependencies, barriers and

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points of improvement following from both cases. The study also used detached observation of the processes needed to produce one construction 'product' in two different ways, based on the activities of the workers on site. Through the use of Multi Moment Analysis (MMA) on site, the study examines the differences in lead times of all activities, and the amount of value-adding activities performed.

3 Research findings & Conclusions

The research findings outline important information about all the processes needed to produce one construction 'product' (see Table 1). The biggest difference is found in the delivery time, or in other words lead time, of this product – 20 days versus 50 days in the traditional process – and relates to the flow within the activities of all individual organisations versus the continuous flow of activities on the product. Where the value/waste ratio within these activities remains rather the same – the two biggest types of waste can be appointed to motion of personnel and waiting times within the activities – a lot of extra waste can be defined as 'waiting' time of the product between the activities of all parties.

Table 1: A comparison of the two cases.

Supply Chain Actor	Discipline	Activities Case I (Experiment)			Activities Case II (Traditional)			Number of employees involved	Value/waste ratio
		Lead time	Start	End	Lead time	Start	End		
T00	Main contracting	20 days	1	20	50 days	1	50	2	12/88
T01	Production of foundations	1 day	1	1	1 day	1	2	2	17/83
T02	Production of concrete	3 days	2	4	10 days	3	13	5	13/87
T03	Production of roofing	6 days	4	9	17 days	17	34	2	22/78
T04	Installation technology	17 days	1	17	48 days	1	48	5	34/66
T05	Production of frames	1 day	18	18	1 day	48	48	2	34/66
T06	Production of frames								
T07	Finishing	15 days	2	16	22 days	21	43	5	35/65
T08	Finishing								
T09	Tiling	7 days	12	18	8 days	36	44	4	15/85
T10	Tiling								
T11	Production of doors	1 day	18	18	1 day	48	49	2	39/61
T12	Contractor of storages	11 days	1	11	12 days	38	50	5	21/79

This research provides the supply chain with information on how to improve its processes – both as individual organisations and as a supply chain – and eliminate waste. Additionally, it shows differing dependence in the two cases between the activities needed to produce a construction 'product' and deliver it to the customer. In case of continuous flow (Case I), supply chain actors become a lot more dependent on each other and therefore, tend to support each other by helping and/or taking over activities outside their usual scope, beyond the boundaries of their organisation. Moreover, it creates a learning loop of correct implementation of all discoveries onto the next product.

This paper gives an example and the results of the combined application of lean principles to SCM, where a supply chain based on long-term collaboration, is trying to integrate their activities.