TRANSFORMATION–FLOW–VALUE AS A STRATEGIC TOOL IN PROJECT PRODUCTION

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ABSTRACT

The paper investigates the use of the Transformation-Flow-Value theory as a strategic tool in the development of the project production firm. When producing products such as ships, focus on value more than on cost may be the best approach, but in service industries such as construction, focus on flow may often be a far better approach than just looking at the costs.

The paper presents a simple, general financial model to support this argument and not least to assist the reader in conducting similar analyses in his own company.

KEY WORDS

Transformation-Flow-Value, Strategy, Business approach, Financial model

INTRODUCTION

Bertelsen and Koskela (2002) proposed the use of the Transformation-Flow-Value theory (the TFV theory (Koskela, 2000)) as an approach to the management of the three aspects of production in construction. Since then this approach has more and more been adapted throughout the industry, albeit in full in very few projects.

Recently the first author has once again taken the idea of using the TFV theory in practice and studied its application to the strategic planning of the development of a specific project producing company, and the principles recommended are partly 'converted' to a business novel about a construction project (Bertelsen 2009). This novel also introduces the concept of Construction Physics (Bertelsen et al, 2007) in practise[3]. It is these ideas that are presented in this paper.

The paper introduces a simple model for the strategic analyses, a model that can be established with adequate accuracy in any company within hours. It proceeds by discussing the strategy development process, and compares it to common practice as observed by the authors. It concludes by asking some key questions to the management of either contracting companies or project managers. Both parties may learn from this.

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[3] Construction Physics is inspired by Hopp and Spearman's Factory Physics (2000) but differs in two important aspects: Firstly it recognizes the complex nature of the construction process and thus its unpredictability and secondly it considers all the flows feeding the construction process and not only the flow of work as is usually the case or the flow of work and crew as done by Goldratt (1997). Construction Physics is thereby a firmer basis for a general logistic approach to the project management (Bertelsen, 2009)

The paper is an industry paper and does as such not present research but merely knowledge new to part of the industry. Most of the ideas have been known, understood and used for years in the manufacturing industry, but are apparently not studied in the construction industry context and in similar project production industries. Construction Physics (Bertelsen et al, 2007) is still new to most practitioners as well.

To spice the paper a number of cases from the first author's lifelong experience in project production are mentioned briefly as footnotes, since most of these are not documented scientifically.

TRANSFORMATION-FLOW-VALUE REVISITED

The seminal explanation of the nature of the production in construction is the Transformation-Flow-Value (TFV) theory (Koskela, 2000). Besides Last Planner (Ballard, 2000) Koskela's dissertation is probably the work most often quoted within the lean construction body of knowledge. The TFV theory explains beautifully the nature of construction and opens up the readers understanding of the three different perspectives.

However, while fine in a historic perspective, TFV may not be the best approach when dealing with project production in practice, as done in this paper and in Bertelsen and Koskela (2002). The theory as such is not challenged seriously, but is – inspired by Shingo (1988) and the first author's own experience – changed in its wording to: Value–Flow–Operation as discussed in the following.

VALUE

Value is put first, as value is the objective of any production. Value for somebody but value for whom and what is the value? These are obvious questions that should be asked at the outset of any project or production. Understanding and defining value must be the first step, recognizing however that different value perceptions manifest themselves in the construction design process, and that focussed facilitation might then be appropriate (Thyssen, 2010).

FLOW

While Shingo (1988) uses the term Process, Koskela chooses the term Flow, which is more descriptive in a scientific understanding, and indeed more useful in project production. Understanding and improving the Flow, the flow within the value chain, should be the next step in forming a strategy, as it is the process that generates the throughput and therefore the desired value. It is here bottlenecks and their influence on the throughput Goldratt (1984) comes into the picture as a source for inspiration, turning the view at the critical flow (Bertelsen et al, 2007). Jacob et al (2010) introduce by a business novel the concept of *Velocity* – speed with a direction – and this idea is very useful in practice as well. Speed is of little value if not improving the over all value stream.

OPERATIONS

Operations are the third and last issue in understanding the project process. And it should indeed be the last step: 'Do the right things before doing things right' as

Shingo advocates (Shingo, 1988). Jacob et al (2010) describe a possible chaotic outcome of improving the operations efficiency by lean methods, if the flow and its bottlenecks are not managed diligently.

And by this the scene has been set for a new approach to the strategy development.

A GENERAL FINACIAL MODEL

In this section a general financial model is introduced. It is a model that one should expect to find and see used throughout the project production industry, but which the first author in his fifty years of practice – not least within the construction industry – has seldom met or seen used in strategic planning.

THE MODEL

The model is based upon a simple break down of the cost of production in the project producing company, and the model investigates the bottom line impact of a certain change of each of the three parameters: Value, Process and Operations respectively.

In doing this, the model takes an overall view in stead of just looking at the project. The reason is that most of the benefit from improved velocity may not show up in project accounting, but in the company's total account only, because the benefit stems from higher throughput in the form of more projects completed with the same resources.

Thereby the old 'wisdom' that increasing earnings in project production must take place by increasing profit on each project is challenged.

Basis

Figure 1 shows a frozen picture of the model.[4]

The model is divided into four main segments each with its own objective. The upper segment establishes the basis while the next three analyses the effect of improving either the Value generated or the Process (flow) efficiency, or reducing the cost of operations, the three parameters usually available for management actions in order to improve the business.

[4] The black framed boxes are numbers that may be changed by the user as part of the process.

Financial Model														
						Base Case								
	Imp.	Profit	# Units	Unit price	Total	Total cost	Fixed 40%	Wages 20%	Variable 40%	Total	Total profit		Incr.	Ratio
Base case		5%	10	100	1.000	950	380	190	380	950	50	5%		
						Value								
Impact of pct.change						50%	50%	50%						
Value increase	10%		10	110	1.100		399	200	399	998	103	**9%**	**205%**	**2,1**
						Process								
Impact of pct.change						0%	50%	100%						
Flow increase	10%		11	100	1.100		380	200	418	998	103	**9%**	**205%**	**2,1**
						Operations								
Impact of pct.change						80%	10%	0%						
Cost reduction	10%		10	100	1.000		350	188	380	918	82	**8%**	**165%**	**1,6**

Figure 1: The Financial Model

Basis

Looking at the basis for the example company – the upper segment – one sees in the left hand box that this company produces 10 units with a sales price of 100 each making the total turnover 1.000 with a profit of 5%.[5]

The 5% profit on the turnover gives a production cost of 95 per unit or 950 in total as shown in the middle box.

The production costs are divided between 40% fixed (Permanent facilities and equipment, management, staff etc), 20% cost and wages varying to a certain degree with the production throughput, and 40% directly variable (Materials etc).

Besides the profit (which is much lower) similar figures are often found in the Danish construction industry.

Value

In the Value segment a 10% value increase is investigated. The increased value is yielding a 10% higher sales price or 110 per unit or 1.100 in total. However, the value is not obtained for free. It is in this case assumed that it will demand an increase of all three cost elements of 50% of the value increase or 5% of the total say by more staff, better sales service and higher material quality as shown in the middle box.

[5] Usually the profit is calculated as turnover minus cost divided by the turnover but for easier discussion of the impact of different profit margins it is here made an input, making the costs a calculated number. The true profit is therefore 5.26% in this case.

The effect of this value improvement is shown in the right hand box and it is a profit of 9% instead of the 5% in base case or a profit improvement by a factor 2.1 because of the increased volume.

One may speculate whether this is possible within construction in general, where procurement as a rule is based upon lowest price, but when possible is an interesting albeit difficult route to pursue.

Process

The third segment investigates the effect of improving the Process – or rather the flow – and thereby the throughput with application of the lean principles in mind. Again a 10% improvement is looked at, but here the fixed costs stay more or less at the same level, the wages increase with 50% of the process improvement (in Denmark because of the use of piece rates yielding higher salaries with improved productivity), while the cost of materials obviously grows with 100% of the throughput increase.

Again the effect – as seen in the right hand box – is a remarkable growth in profit, here the same as in the value case.

However, while the ten percent value improvement may be hard to obtain, and probably often impossible in ordinary construction, a ten percent flow improvement is what lean construction offers as a minimum. Setting out one should rather aim for twenty percent within the first year in our opinion.[6]

Operations

The bottom segment considers the usual approach: Cutting costs. Again 10% is used as the outset, but as most managers may know, it is never possible to cut all costs. Here it is assumed that the fixed cost may be reduced by 80% of the 10% at the outset or 8%, wages by 10% or only 1% and materials not reduced at all.

Even though there is an effect – a profit improvement by a factor 1.6 – this may come in a very expensive way. Cost cutting often focuses on reduction of middle management as they are seen as a cost in the bookkeeping, while accountants are seldom reduced in the process. However, even though a reduction of middle management may be possible if Last Planner™ is diligently introduced it should never be the objective in its own right. Middle management is the key to the efficient logistics that should support the Last Planner process through the Look ahead planning.

USING THE MODEL

ESTABLISH THE MODEL

The figures for the model should be easily available from the accounting. If it is not possible in general, then make an analysis of a handful of projects, or use the sample figures as an outset for a discussion with the key staff, and adjust as required. The key question may be the sensitiveness in relation to the tested improvement initiatives, but again: Start with rough figures and refine as needed.

[6] A 20% improvement in this case will render a 13% percent profit or a profit improvement by a factor 3.1.

WORKING WITH THE MODEL

In developing a strategy, each of the three parameters should be considered individually: Where may we improve and how much? What will the impact be as calculated by the model using our own figures?

VALUE

The starting point should be Value.

However, this aspect of the company strategy is most often forgotten in construction, even though quite often the value may be increased through a very small effort in terms of cost of production. Being on budget and schedule are value parameters, which may be reached through diligent focus on the process which anyway is the primary key to improving the financial result, and awareness of the client's value parameters in general, and not least in the specific case should be part of the strategy.[7] There are often simple actions at hand.[8]

Maybe this is just a matter of the client's satisfaction, but it will motivate him to come back, saving marketing costs in the long run.

However, with the exception of design and build contracts, added value is often hard to get paid for directly in traditional construction.[9]

PROCESS

The Process should come next. Remember Shingo: *Do the right things before doing things right.* (Shingo, 1988)

While Shingo states the approach, it is Eliyahu Goldratt (1984) that shows the means. His message is to identify the bottleneck, ease it and subordinate the rest of the production to the bottleneck. In the transient world of construction the last part may be difficult to do while the first part: Identify and ease the bottleneck is highly important. Again, this is often quite simple and may be done with little or almost zero costs and it generates an enormous effect on productivity and thus on earnings for all parties involved.[10] [11] [12]

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[7] At the third LCI congress in Berkeley 2001 a US general contractor presented a concept aimed at remodeling office facilities for major corporations within banking, insurance, it etc. They put great focus on schedule making it possible to undertake the projects during weekends only, causing no shut down of the daily operations at all.

[8] If the client by a mistake has bought 5.000 packages of green copying paper, it will be of value requiring all reports, minutes etc in this project be printed on green paper provided by the client. This will by the way make it easier to identify the papers in the mess on most desks throughout the organization.

[9] The case is quite different in Shipbuilding, where an new and more efficient design may get much higher prices even though the construction and materials costs are nearly the same.

[10] Building Logistics was a Danish experiment carried out in the early 1990'ies where the flow of materials was considered the critical one and consequently put under a systematic control with methods quite similar to Last Planner. The outcome was an up till twenty percent increase in productivity. (Bertelsen and Nielsen, 1997).

[11] At a domestic building project in Copenhagen the crane was found to be a bottleneck in the flow of materials. A simple booking system solved the problem and assured reliability in the flow of materials.

Understanding and managing the process – the flow – is of paramount importance, and the new position: Process Manager as proposed by Bertelsen and Koskela (2002) is therefore seen more and more often in lean project management at least in Denmark.

OPERATIONS

Last the organisation and its costs of operations should be considered.

However, most often this is the first issue on the agenda: How do we cut our costs? The construction industry is most often totally cost fixated. One reason may be the tendering and contracting system, which tempts to reduce overhead costs and overload the total production system as discussed by Bertelsen and Sacks (2007) causing huge delays in all the streams feeding the process and thus hampering the flow by generating new bottlenecks.

Another often seen action is to cut the costs of middle management, as it on the books is seen as an expenditure. But knowing Last Planner and understanding the importance of the Look Ahead Planning as control of the logistics, saving middle management increases failures in the supply system feeding the process and thereby causes waiting, make do, and delays. (Koskela 2004)

Unfortunately the accounting department often plays a too big role in the strategy making within the project production industry.[13]

DISCUSSION

The paper is highly based on the first author's experiences from his work in the project production industry and it may thus be biased. However, the ideas presented and the model introduced have been implemented in practice, albeit not as much as may be desired. Project production has a cowboy nature: Get out there and fight the Indians no matter how they look, instead of reflecting on the issues to be managed.

Gemba – observe and reflect – is a Toyota term very useful in the strategy process. To observe and reflect is often a fine way to get along. Forget the third of the working time at the construction site that generates value (Nielsen and Kristensen, 2001) and focus on the non value producing work and ask: *Why?* Not once, but five times as done by Toyota.

CONCLUSION

The paper presents a simple theory based approach to establishing a strategy for the management of project producing companies such as found in construction, shipbuilding, IT, entertainment and probably in many more places. Project production is becoming increasingly more important, as mass production more and more

[12] At a shipyard workers access to the ship in the dock was by narrow gangways for up to eight floors. A person elevator as known from construction sites placed on the outside of the boat solved the problem.

[13] When the first author introduced Last Planner to a group of top executives in a major industrial company, the response by the CFO was: If the crew leaders take over the planning, we can save 50 foremen. And it was very hard to convince him, that resources made free should be used on improving their highly unreliable flow, not least from outside vendors.

becomes robotised. A deeper understanding of the nature of the project production and its management is therefore needed.

Improving business must quite often come from improving velocity and thereby throughput, a challenge for project managers always asking for more time. In doing this company managers may understand the velocity concept and convince their project managers that faster project completion is the real route to profit.

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