

VALUE CHAIN MANAGEMENT IN CONSTRUCTION: CONTROLLING THE HOUSEBUILDING PROCESS

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ABSTRACT

Managing the complexity of the housebuilding process, in terms of differentiating between value and non-value adding activities, forms part of the current work in the research project 'Value chain management in construction'. The research project includes an investigation of the possibilities for improvement in the value chain, in terms of time, cost, and quality within a major housebuilding company in Sweden. One hypothesis is that project success is linked to the extent to which the company is able to manipulate its value chain to add value for the customer, whilst improving its internal management. In order to be in a position to understand the true extent and complexity of a project process, extensive functional models have been created using a computer-based tool. This first pass through the organisational infrastructure has produced detailed 'as-is' models of the functions needed to perform a project. Other techniques and tools have been used during this first mapping of the process, for instance analysis and auditing of company specific documentation and structured interviews with process actors. The preliminary results of this project already point to areas of considerable scope for improvement, which are under examination.

KEY WORDS

Value chain management, process modelling, process initiatives, housebuilding, information flows, Total Commitment

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INTRODUCTION

Increasing demands in housebuilding from customers concerning quality, environmental issues, time and cost reductions, have made the importance of controlling the value chain a key issue. As a consequence of this, information and communication flows have become more important to control, when attempting to reduce development times. Delivering the right information at the right place and throughout the entire process will help to eliminate a high number of non-value adding activities. These new demands necessitate a more transparent housebuilding process, competent personnel (education and training), and an ability to perform changes necessary to survive in a competitive market. Large housebuilding companies today all too often suffer from inadequate information and communication inside and between divisions and divergent procedures of handling the project process. A focus on processes, or collections of tasks and activities that together transform inputs to outputs, allows organisations to view and manage materials, information, and people in a more integrated way (Gavin, 1998). To be able to perform any dramatic improvement in the housebuilding process, it is important to have a clear understanding of the current process, which can be illustrated by process models. There are a number of methods and techniques available for process modelling, which helps companies to describe their processes and to structure their information. The IDEF0 and Dependency Structures Matrix (DSM) methods will only be mentioned in this paper.

The increasing average age in the housebuilding sector also makes the mapping of today's processes relevant from a lesson's learned perspective. The question "who is going to manage projects in ten years when all the old managers are retired?" is highly pertinent and should not be neglected when speaking of process development. One way to capture this experience is to map the current 'as-is' project process.

What is actually needed to fulfil the above demands is an organisation that has the ability to survive and prosper in a competitive environment of continuous and unpredictable change. This makes the time ripe for a thorough re-evaluation of the entire housebuilding project process from business idea to occupation. This paper aims to show how the modelling of the project process of a Swedish housebuilding company was performed. The second and third sections of this paper will explain the research project 'Value chain management in construction' and outline the method of study for the process modelling of a house building company. In the penultimate section the use of process models and development areas are discussed. The final section presents the conclusions and the preliminary results of this two and a half-year research project.

VALUE CHAIN MANAGEMENT IN CONSTRUCTION

The expression 'value chain management' is defined as "the manner of controlling, handling, and directing a sequence of activities a company carries out to create products/services that increase profit, decrease time and cost, and improve quality for the company and generates profit/value for the customer (Lindfors, 2000). Where value is defined as "a quantity, which grows when customer satisfaction increases or expenses associated with a product decreases (Lindfors, 2000)." By using the term value chain management, it is implied that value has to be added at all points in the process.

The research project 'Value chain management in construction' intends to examine and re-evaluate today's housebuilding process and together with industry produce and establish a single, coherent process model. The project plan for the project starts with the creation of a detailed 'as-is' process model, from business idea to occupation. This is then

followed by the creation of a 'to-be' model, which will be created by the interpretation of company specific goals and strategies, an evaluation of the 'as-is' model using scientific methods and the use of existing management innovations and manufacturing philosophies. This implies that the model will be used as a platform for further research in the area of value chain management.

The 'to-be' model will then be used to show how management innovations can help to optimise costs in the value chain and reduce time consumption in the housebuilding process. This will finally result in a practitioner's guide for time and cost effective housebuilding. The project started with a mapping of the housebuilding process from a management perspective, having NCC Housing's Total Commitment² stand as a model of how it is performed today. The mapping makes it easier to manage the complexity of the process. As a side product of the main purpose of the project, this first phase has already proved useful in terms of quality control. The next phase intends to eliminate non-value-adding activities in the project process and develop it to cover the whole value chain. Thoughts about how improvements of the process can be made are directed in the direction of management / business systems, and improvements from a Quality Function Deployment (QFD) process perspective. This paper contains a real-life case study of the project process of a house building company. In the research project 'value chain management in construction' the Total Commitment project process was modelled and analysed.

METHOD OF STUDY

The first phase of the research project 'Value chain management in construction' was the creation of a process model describing the housebuilding process as it appears today. Process modelling is a means to systematically describe the activities, their relationships and information flows of a process (Karhu, 2000). Due to the knowledge that visual models can better achieve process understanding, a graphical approach was decided upon. In order to be in a position to understand the true extent and complexity of the housebuilding process, an 'as-is' process model describing the project process of a Total Commitment for house building was created using computer-based tools [Platinum BPWin and MS Excel spreadsheets].

The process model was built using the IDEF0 technique, relationship matrices, the DSM method, and interviews with relevant practitioners. Alternative modelling methods were considered, i.e. the scheduling method, the simple flow method and IDEF3, but were found to meagre for the purpose of the modelling. "The IDEF0 technique supports the need of modelling the process in a formalised manner to be able to compare and refine the modelled process. It can be argued that IDEF0 only focuses on the formal communication of specified information. DSM, on the other hand, focuses on informal communication (Malmström et al., 1998)." By combining the two techniques useful insights were reached with little additional work.

The initial process model was developed using the input obtained by the analysis of available company specific documentation and by interviews carried out with process actors. The model was later modified according to the information gathered from an extensive case study of the actual 'as-is' scenario. The modelling started with a need to

² The Total Commitment is NCC Housing's name for development/construction 'promises' covering the process from the business idea to customer support. The Total Commitment is a concept where the same company controls the process from the early stages to occupation, making it possible to manage the project in the best possible way.

list the activities, which form the process of a Total Commitment of housebuilding. To satisfy this need a document study was performed. At this stage company specific documentation, i.e. the business system (quality assurance system and environmental management system), Total Commitment documentation, and the company's construction control system were studied. As a result, a list with over 350 main activities was produced. To be able to transform this information into an IDEF0 process model, both ICOM's (input-control-output-mechanism) and dependencies between activities had to be clarified and specified. The inputs and outputs were defined to explain changes in the information exchange/flow, the controls to cover company specific control and support documentation, and the mechanisms to cover the involvement of the company's process actors. Using the ICOM's in this certain way made it possible to capture a number of process model perspectives in one single model. The mapping has captured the functional perspective, which clarifies what activities are carried out and the information flows in the process. The behavioural and organisational perspective has also been captured, which clarifies where in the project process the activities are executed and who is participating. The final perspective that is covered is the information perspective, which clarifies what and where information is processed.

To be able to map the ICOM's for each single activity, two different matrices were created to capture mechanisms and informal inputs and outputs. The formal inputs-outputs-controls were derived from company specific documentation and interview with process actors. The first matrix was created to capture the participation of process actors (mechanism) in activities and the other one to map dependencies (DSM) (informal inputs and outputs) between activities. Both matrices have then been distributed to relevant practitioners directly engaged in the project process, who have been given free scope to describe how they carry out in the housebuilding process. By compiling the results mapped by the matrices an 'as-is' model has been created, which reflects a good abstraction of reality (see figure 1).

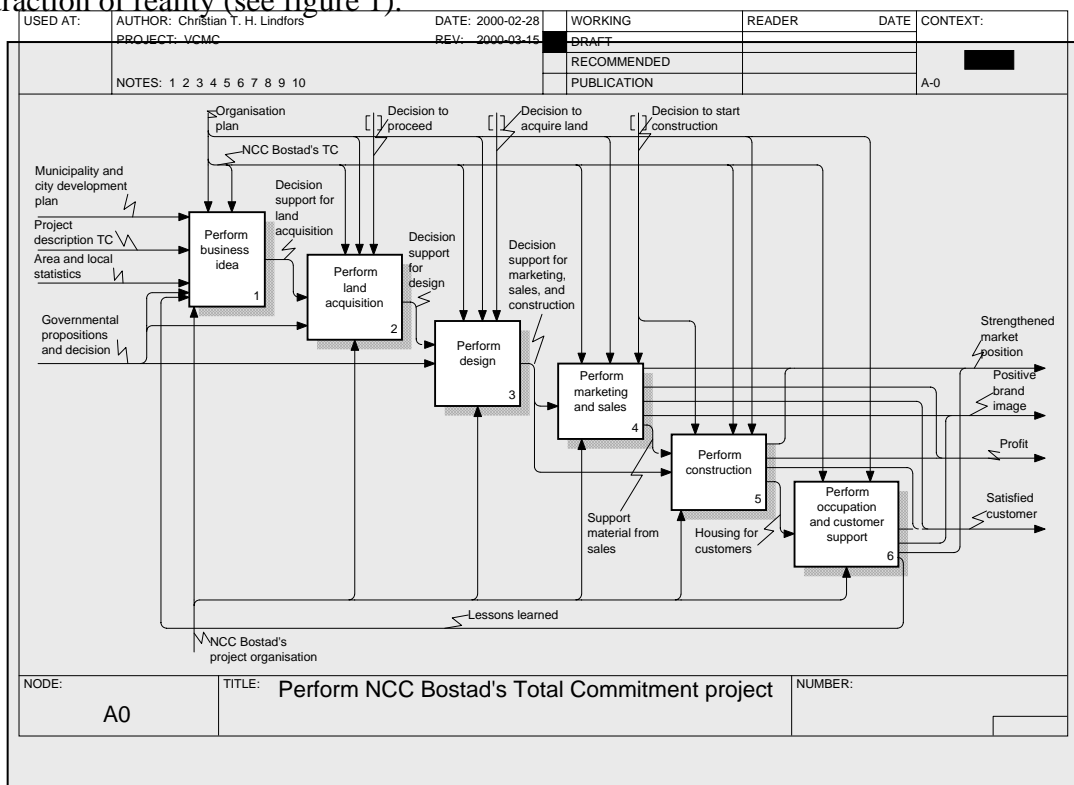


Figure 1: The 1st tier process diagram view of the Total Commitment project process model

As a side product, activity participation lists have been derived from the results captured by the process actor participation matrix. The activity participation list has later been used to serve as a platform when creating role-activity diagrams. This has also led to an insight of how the organisation has to change to support this new process initiative.

PROCESS MODEL INSTANTIATION AND DEVELOPMENT

Completing the mapping of the current project situation does not imply the end of the process initiative, merely the beginning. Instantiating and developing a process model is where most companies today fail to deliver, when attempting to become more process oriented. The failure can be explained by their inability to understand their own value chain. Instead of focusing on their main value chain, i.e. their customer-to-customer (CTC) or order-to-order (OTO) process, there is a tendency to focus on too many sub-processes simultaneously. This makes the mapping work, too resource demanding. The model of the current 'as-is' project process of Total Commitment, which is referred to in this paper was mapped according to the CTC view. Atkin (1998) states that "just how much improvement is possible will depend on the extent to which the value stream can be identified and manipulated to deliver against customer demands." That is why it is so important to try to understand the entire value chain not only parts of it. This argument can also be strengthened by Porter's (1985) comment that the value chain is not a series of independent activities – it is a system of interdependent ones.

For a housebuilding company to improve its performance and ways of doing business, it should start by looking at itself. This must be done before "jumping on the wagon" of new management and business innovations, three-letter-acronyms and other trends, e.g. business process re-engineering (BPR), supply chain management (SCM), e-business, e-commerce, customer relationship management (CRM) and total customer focus. The self-assessment can be accomplished by mapping the internal value chain in the form of a process model. When mapping the value chain, the portraying of the information flow is of great significance. The information flow tie together the value chain with the supply chain (see figure 2), bringing together the internal value chain with suppliers' value chains. When the company has established an understanding of its own process, it can start focusing on the above mentioned entities and the customer's value chain, which encircles and controls the very existence of the housebuilding company.

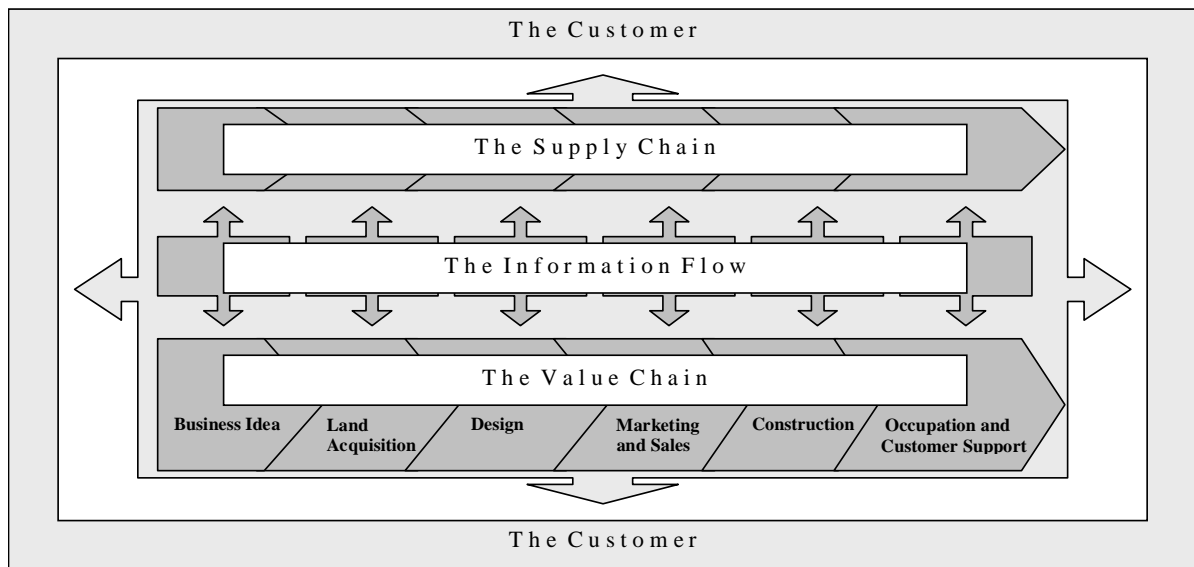


Figure 2: The central role of information flows when controlling the project process of Total Commitment.

The modelling work at NCC Housing has provided the company with a greater understanding of its present process, e.g. their different document systems have shown to be insufficiently integrated and work tasks are not adequately described throughout the organisation. Additionally, the model has and will help to define a shared view of the details in the process and serve as a foundation for further development of the process. The model also provides a good platform for discussions on process development and a future reference model. A standardised process can increase organisational flexibility. "When all business units are performing a process the same way, a company can easily reassign people from one unit to another to respond to shifts in demands. Its organisational structure becomes much more plastic (Hammer and Stanton, 1999)."

INSTANTIATION

The instantiation part of a process initiative is probably one of the hardest tasks to carry out. To instantiate is to represent by a concrete example. One way to instantiate the project process model is to let it act as a template for the project plan, which guides the project in reality. The project process model (see figure 1) guides project planning and project performance.

Feedback from project performance is then used to enhance and improve the project process model. One way to instantiate an 'as-is' process model is by having it as a starting point, when developing the business system, i.e. tying together the quality assurance system, the environmental management system, the construction control system, and other company specific systems.

The housebuilding company, studied in this paper, was just in the process of launching a new business system [Lotus Notes], during the same time when the mapping of the Total Commitment was being performed. After having realised the benefits of a business system, based on the value chain appearance, the decision was made to develop a project management database, which was based on the process model's activity based appearance. After having decided on having an activity-based appearance, thoughts about how far the development of the system could go were almost unlimited. The first edition

is based on the old document system related to activities. The second edition is going to take the system to a higher level of value chain management (see figure 3), extending the activity connection with relationships with other activities, and process actor participation. The first edition is now available for everyone inside the organisation and to those involved in company related projects. The main objectives when launching a new business system and a new project management database are to make things simpler, not simple.

ACTIVITY 32			
CONTROLS	INPUTS	MECHANISM	OUTPUT
<ul style="list-style-type: none"> Control- support documentation Routines and templates Information checklists etc. 	<ul style="list-style-type: none"> Result from Activity 5 Result from Activity 17 Result from Activity 31 etc. 	<ul style="list-style-type: none"> Project Manager Project Engineer Project Developer Purchaser Cost Estimator etc. 	<ul style="list-style-type: none"> Result to Activity 33 Result to Activity 48 Result to Activity 150 etc.

Figure 3: An activity based project management database appearance

The upper management of the housebuilding company has already located a number of benefits with the new project management database, which are:

1. One common tool and disposition for all national divisions
2. The system ties together the quality assurance system, environmental management system and the construction control system
3. Audits can be performed against one business system, e.g. ISO 9001 and ISO 14001
4. The process structure creates an easy adaptability throughout the entire project
5. The database mediates and guides the right information and documentation to the right place in the process
6. It enables experience exchange between projects

DEVELOPMENT

The development part of a process initiative is also a time and mind consuming experience and a hard task to carry out. The questions, “what do we want to accomplish, and how are we going to accomplish the ‘what’s’?” are of great importance when developing the process model for the better. Using the process model as a foundation for further development of the project performance will serve useful in the following development areas.

1. Minimising non-value-adding activities and maximising value-adding activities in the housebuilding process. Koskila (1992) defines non-value-adding activities (also called waste) as activities that takes time, resources or space but does not add value and value-adding activities as activities that converts material and/or information towards that which is required by the customer. The modelling procedure has given an indication of where little value is added to the process and points out areas where

value-adding activities may be introduced. By using the QFD method to evaluate the process model, a more thorough allocation of where little or no value is added, can be accomplished.

2. Personnel engagement. Involving personnel at all levels will boost improvements when starting to realise how poorly their company specific control and support documentation covers their need for information to manage the value chain.
3. Introduction of the concept of process thinking into the organisation. With this new understanding of processes, teams of people drawn from estimating, construction, sales, marketing, and other departments could team up to perform a project with full responsibility from business idea to occupation. The responsibility could include such highly specialised activities as generating documentation, producing advertising and developing training materials for facility managers. “A new management role would be created to oversee the process, the process owner (Hammer and Stanton, 1999).” An increased focus on process thinking facilitates the possibilities for a customer focused industrialised construction. This is made with the advantage of a flexible, company specific, building concept, with a high degree of prefabrication and an increased use of standardised modules. The arrangement ought to be flexible to the extent that the customer may get a house that is unique, with the help of various additions and extras.
4. Management system developments, i.e. a company specific Balanced Scorecard (Kaplan and Norton, 1996) and key business indicators (KBI) for the internal processes perspective. Companies have lately shifted the focus of their measurement systems from unit goals to process goals, and they have based compensation and advancement directly on process performance (Hammer and Stanton, 1999). Being able to measure the internal processes would increase the usefulness of the Balanced Scorecard dramatically.
5. Business system developments, i.e. tying together the quality assurance system, the environmental management system, the construction control system, other company specific systems, and using key performance indicators (KPI) to monitor process performance.
6. Process development in housebuilding. The model provides a good platform for discussions of process development and a common viewpoint of how the process is carried out.

CONCLUSIONS

This paper’s content indicates that the use of an accurate representation of the housebuilding process, with the help of an ‘as-is’ process model, would help a construction company to improve significantly its value chain. The preliminary results of this two and a half-year project show that already there is considerable scope for improvement. Further conclusions that can be made today from the creation of the ‘as-is’ process model is that the housebuilding process is complex. It is beyond human capability to understand fully the entire process without creating a representation of it. In this case

study, the representation of the project process was visualised as an IDEF0 process model created using a computer-based tool.

The roles inside the organisation have shown to be very diffuse concerning work tasks, e.g. at one division an activity can be associated to the division manager, whereas at another division the same activity is associated with the value engineer. The studied company's business system also lacks a comprehensive representation / description of the process, i.e. the different control and support systems lacks a unified platform. Instead the different systems run parallel without any vital integration. A unified picture among the employees of how the Total Commitment process is supposed to run is missing. Differentiation in organisational arrangements inside the same company makes development related work fairly complicated. A clear allocation of work tasks in an organisation facilitates or is a condition for development work to be carried through in an effective manner. The new launch of the activity-based project management database will probably start to clear up this diffuse picture, but large improvements are still to be made.

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REFERENCES

- Atkin, B. L. (1998). *Unravelling the value chain in construction*, Proceedings IGLC '98, Guarujá, Brazil
- Gavin, D. A. (1998). *The process of organization and management*, Sloan Management Review, Summer 1998, Volume 39, No. 4 [Online]. <http://mitsloan.mit.edu/smr/past/1998/smr3943.html> [5 January 2000]
- Hammer, M. and Stanton, S. (1999). *How process enterprises really work*, Harvard Business Review, November-December 1999, Cambridge, Massachusetts, USA, pp. 108-118
- Kaplan, R. S. and Norton, D. P. (1996). *The Balanced Scorecard: translating strategy into action*, Harvard Business School Press, Boston, Massachusetts, USA
- Karhu, V. (2000). *Formal languages for construction process modelling*, Proceedings of International Conference on Construction Information Technology CIT2000, The CIB-W78, IABSE, EG-SEA-AI, Reykjavik, Iceland, pp. 525-534
- Koskela, L. (1992). *Application of the new production philosophy to construction*, CIFE Technical Report no. 72, Stanford University, California, USA

- Lindfors, C. (2000). *Management innovations applied in the construction industry*, Competitive building, unpublished paper, KTH, Stockholm, Sweden
- Malmström, J. and Pikosz, P. and Malmqvist, J. (1998). *The complementary roles of IDEF0 and DSM for the modelling of information management processes*, Proceedings of the Fifth ISPE International Conference on Concurrent Engineering: Research and Applications, Tokyo, Japan, pp. 261-270
- Platinum BPWin. *Bpwin 2.01*, Logic Works, Graphic Layout Toolkit © 1992-1997 Tom Sawyer Software, Berkley, California, USA
- Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*, NY: The Free Press, New York, USA