

# CHALMERS



## The Value Chain Concept Applied on a Construction Project Development Process - A Case Study of Lead-Times in Construction of Residential Buildings

*Master of Science Thesis in the Master Degree Programme, Design and Construction  
Project Management*

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CHALMERS UNIVERSITY OF TECHNOLOGY  
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## ABSTRACT

Lead-times in the construction of new residential buildings are considered long. Comparisons also show that there are large variations between projects. With more knowledge on how time is used in the project process and on what hindrances that affect the process, effort can be made to shorten lead-times. The concept of value is initially discussed in the theoretical framework. After that the value chain is presented as a way to visualise the processes. Furthermore, it is discussed how the concepts of the value chain can be applied in the construction industry. The purpose of this study is to examine lead-times in a construction project process to identify possible hindrances so that a more time effective process can be achieved. 12 projects have been studied at one construction company, which have, over several years, gradually standardised its project development process. Interviews have been made with the project manager at each project. First, the times for the major stage-gates in the process has been identified. Secondly, the project managers have described each project with emphasis on what disturbances has affected the process. Hindrances in the project development process have then been discussed with the project managers at a workshop. The study shows large variations in lead-times for several of the sub-processes. One conclusion is that the value chain, as a concept, can be applied on a construction process to be able to shorten lead-times, if there are clear guidelines on what to measure. One observation is that the identified external disturbances affect the pre-construction process, more so than the internal disturbances. The study also highlights the need for an arena for knowledge transfer among the project managers and for a need to evaluate the existing stage-gates.

Keywords: construction industry, value chain, value, time utilisation, project process

Värdekedjekonceptet Tillämpat på en Projektutvecklingsprocess i Byggbranschen  
- En Fallstudie av Ledtider i Nybyggnation av Bostadshus  
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## SAMMANFATTNING

Ledtider vid byggandet av nya bostäder uppfattas som långa. Jämförelser visar också på stora variationer mellan projekt. Med bättre kunskap om hur tiden används och om vad som bromsar upp byggprocessen kan insatser göras för att korta ledtiderna. I det teoretiska ramverket behandlas inledningsvis begreppet värde. Därefter presenteras värdekedjan, som ett sätt att visualisera processer. Vidare behandlas hur idén med värdekedja kan tillämpas i byggindustrin. Syftet med studien är att analysera ledtider i byggprojekt och att identifiera hinder för effektiva byggprocesser. Kartläggningen har genomförts vid 12 byggprojekt inom ett byggföretag, som successivt under flera år har standardiserat sin projektutvecklingsprocess. Intervjuer har genomförts med projektledaren i varje projekt. Dels har tidpunkten identifierats för när de mest väsentliga milstolparna i processen uppnåtts. Dels har projektledarna beskrivit förloppet i varje projekt med särskild tonvikt på vad som hindrat processen. Dessa hinder har sedan diskuterats med projektledarna vid en gemensam workshop. Studien visar på en stor variation i ledtiderna för flertalet delprocesser. En slutsats är att värdekedjan, som koncept, är applicerbar på byggprocesser men att klara riktlinjer för vad som ska mätas behöver etableras för att kunna arbeta vidare med att förkorta ledtider. En iakttagelse är att de identifierade externa störningarna påverkar projekteringen mer än de interna störningarna. Studien visade också ett behov av en arena för kunskapsutbyte mellan projektledarna och ett behov av att utvärdera befintliga milstolpar.

Nyckelord: byggindustrin, värdekedja, värde, tidsutnyttjande, projektprocess



# TABLE OF CONTENT

1	INTRODUCTION .....	1
1.1	BACKGROUND .....	1
1.2	PURPOSE AND LIMITATIONS .....	2
2	THEORETICAL FRAMEWORK.....	5
2.1	VALUE IN CONSTRUCTION.....	5
2.1.1	Value in the Case Study .....	6
2.2	THE VALUE CHAIN CONCEPT .....	6
2.2.1	Widening the View .....	8
2.2.2	A Construction Perspective .....	9
3	METHODOLOGY .....	11
3.1	LITERATURE REVIEW AND THEORETICAL FRAMEWORK.....	11
3.2	THE CASE STUDY .....	11
3.2.1	Quantitative Data Collection .....	11
3.2.2	Interviews.....	12
3.2.3	Workshop.....	14
4	FINDINGS .....	15
4.1	THE CASE COMPANY.....	15
4.1.1	The Project Development Process.....	18
4.2	THE PROJECTS .....	19
4.2.1	Summary of Project Disturbances.....	30
4.3	PROJECT MANAGERS' VIEW ON THE PROJECT DEVELOPMENT PROCESS .....	32
4.3.1	Project Manager at JM .....	32
4.3.2	JM's Structured Project Development Process .....	32
4.3.3	Project Design .....	34
4.3.4	Pre-Construction .....	35
4.3.5	Production .....	36
4.3.6	Summary of Hindrances and Improvement Proposals .....	36
4.4	WORKSHOP.....	37
4.4.1	Internal Hindrances .....	38
4.4.2	External Hindrances .....	41
5	DISCUSSION.....	44
5.1	HOW CAN THE VALUE CHAIN CONCEPT BE APPLIED, WITH A TIME PERSPECTIVE, ON A CONSTRUCTION PROJECT DEVELOPMENT PROCESS?.....	44
5.1.1	Strategic Relevant Activities.....	45
5.1.2	Competitive Advantage.....	46
5.1.3	The Applied Value Chain.....	47
5.2	HOW MUCH, AND WHY, DOES THE LEAD-TIMES DIFFER BETWEEN CONSTRUCTION PROJECTS? .....	48
5.2.2	Project Design .....	48
5.2.3	Pre-Construction .....	50
5.2.4	Production .....	52
5.3	HOW DOES HINDRANCES IMPACT TIME UTILISATION IN THE PROJECT DEVELOPMENT PROCESS? .....	55
5.3.2	Internal Hindrances .....	56
5.3.3	External Hindrances .....	58
6	CONCLUSIONS AND RECOMMENDATIONS.....	59
7	REFERENCES .....	61







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# 1 Introduction

How much effort does construction companies in Sweden put into the improvement of their project processes? Are the project managers allowed to improvise and use their creativity as the projects proceed? It is argued that one way to improve construction processes is to increase the knowledge of how time is used (Josephson and Chao, 2014). This can be done by focusing on lead-times, which in general are considered as long and with large variation between construction projects in Sweden.

This study is based on the idea that construction projects consist of large investments regarding time and capital and it is therefore important for companies to handle the project process as efficient as possible, to continuously improve them and to get the highest value possible from the amount of time that is put into them. It is further believed that project managers possess invaluable knowledge of this process, because in their position they get a holistic view of the projects.

To do this evaluation a construction company in Sweden, mainly active in the larger metropolitan areas, has been studied. The company focuses on building small houses and residential buildings and has worked extensively to structure and standardise their project development process.

## 1.1 Background

Construction is a project-oriented industry where stakeholders have different goals but have to compromise in order to complete the project successfully (Bertelsen and Koskela, 2004). The project manager becomes the facilitator who has the holistic perspective of the project. A general definition of construction is presented by Bertelsen and Koskela (2004):

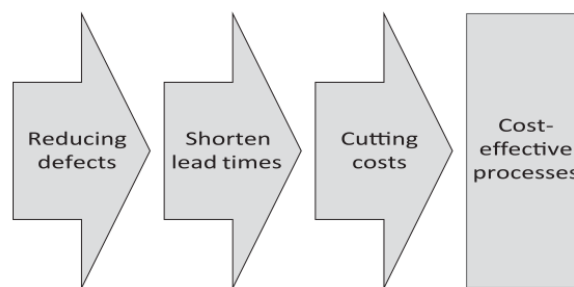
*“Construction is complex production of a one-of-a-kind product undertaken mainly at the delivery point by cooperation within a multi-skilled ad-hoc team.”*

Because buildings are unique, the design and the production needs to be synced and correlated not only by materials or equipment but also by information (Bertelsen and Koskela, 2004). Construction is not an industry of solely production, in relation to manufacture, but a value creating flow of work. However, this flow is of dynamic nature with a high degree of complexity, which puts pressure on managers to plan the project step by step. Unfortunately, to break down the project into activities have created the picture of a linear process, which have resulted in an unrealistic model of the reality. Instead it should be viewed as parallel processes with inter-dependent activities.

In order to improve the construction industry it is recommended that time is highlighted because there are analyses that show large variations in lead-times within construction projects (Josephson, 2013, Josephson and Chao, 2014). One relevant method to use in project settings is the value chain concept, which can differentiate new construction of residential buildings since it takes the whole process into account. Even though the relevance of the value chain concept in the construction industry was acknowledged in the early 90's there are researchers in present time arguing that it is still an area where more attention is needed (Betts and Ofori, 1992, Lindfors, 2000, Josephson and Chao, 2014). Further, the complexity in construction projects leads to a high amount of

uncertainty, especially in the early faces, this uncertainty reduces with time since required information is shaped and edited (Winch, 2001). The process of reducing uncertainty is highly connected with the value creation within the project.

As visualised by Josephson and Chao (2014) there are basically three ways of making a construction process as cost effective as possible; reducing defects, shorten lead-times, and cutting costs (Figure 1). The earlier in the process the action is taken the greater is the impact on the cost effectiveness. Josephson and Chao (2014) also argue that it is necessary to investigate the time aspect to improve the construction process, as lead-times seem to vary a great deal between projects. However, cutting lead-times at any cost is not the ultimate goal, as time is also needed to meet quality and customer expectations. Rather, the focus should be on removing obstacles in the project process. Moreover, the predictability of investments in construction would be higher with shorter lead-times.



**Figure 1: Strategy for developing cost-effective processes (Josephson and Chao, 2014)**

## 1.2 Purpose and Limitations

The purpose of this study is to examine lead-times in a construction project process, from a value chain and project manager's perspective, to identify possible hindrances. The aim is to be able to identify areas where improvement is needed to see if time can be better utilised in the project process.

The purpose and aim is fulfilled through these research questions:

- How can the value chain concept be applied, with a time perspective, on a construction project development process?
- How much, and why, does the lead times differ between construction projects?
- How does hindrances impact time utilisation in the project development process?

The project process has been limited to the parts where the studied company have the most influence. This includes the processes from project design until a finished building, excluding acquisition of land, detail plan work with the municipality, and after market related inquiries. In order to get a holistic view of the project process the perspective of it was limited to that of the project managers since they are responsible for the project during the whole process. Furthermore, the collected data, through interviews and workshop, are based on personal opinions. The region, where the study is conducted, made the selection of the 12 projects.

Since the projects vary in time and the project development process has changed over time the process for each project is slightly different. The lead-times, which are



presented for each project, have therefore been limited to the sub-processes; Project Design, Pre-Construction, Sales and Production.



## 2 Theoretical Framework

In order to introduce a theoretical framework to the subject this chapter is divided into two parts. The first part defines value in construction and further presents the chosen definition of value for the study. The second part presents the original concept of the value chain and then further develops the concept through processes and lastly in the context of construction.

### 2.1 Value in Construction

The delivery of value should be a cornerstone in all construction projects (Thomson et al., 2003). The essence of this statement, that the final product should be of use and fill a need, might seem obvious at first. However, as much as the term value is frequently used in a construction context, to represent the client's needs, goals and expectations, and there is a consensus that this is the primary objective for a project, there is a lack of a consistent definition of what value involve (Wandahl and Bejder, 2004). Furthermore, even if this dilemma of definition was solved, for whom should the value be created? Is value primarily for the client and customer? The simple answer is no, or as Wandahl and Bejder (2004) puts it:

*“... the building industry as a trade needs to do more than fulfilling buyer's needs; each company must secure their own future existence by gaining a net profit.”*

This too is value. As presented in Porter's (1985) generic value chain this value can be represented by the margin, which is part of the total value. In the next paragraphs follows a review of the different attributes, and attempts to formulate a common understanding of value.

To start with one has to understand the decisive difference of value and values, this is not solely a question of singular and plural (Thomson et al., 2003). Put simply values are the principle by which people are guided and live by, it represents core beliefs, morals and ideals of the individual. Hence, values are more related to human behaviour and to the society, or an organisation, that a person belongs to rather than to a product or service (Wandahl and Bejder, 2004). However, values and value are not unconnected, rather the contrary. Thomson et al. (2003) argues that values are the basis of how value is assessed, since values affect how one views the world and therefore how product and services are valued.

In their review of value in a construction context Salvatierra-Gardio and Pasquire (2011) categorise five attributes of value: objective, subjective, relative, context dependent and dynamic. *Objective attribute*, as the word implies is a part of value that is not influenced by personal feelings or opinions, it represents facts. This is a predominant view in construction and represents the inherent qualities and property associated with a certain product or service. This provides some limitations as it, to a large extent, disregards the connection between the persons who is going to use the product and the product itself (Thomson et al., 2003). *Subjective attribute*, in contrast with objective, has a strong correlation with, and is affected by, (personal) values, as it is an individual and personal perception of value. *Relative attribute* means that this aspect of value is comparable, the same product or service can inherit different value depending on what opportunities it entails, and thereby the value can range from useless

to long awaited. This means that nothing has value on its own but only when it is compared to other choices, products or services. Value also has a *dynamic attribute* that comprises the time aspect, describing that the value can vary through, for example, a project process. Finally, value is also *context dependent*, that is, it can be measured different depending on the current situation. Wandahl (2005) provides an example:

*“... think of a simple stone. The stone has no value in itself until you know in which context you should use the stone. If you need a stone for a road barrier, a big stone would have great value. On the other hand, if you need a stone to play ducks and drakes with, perhaps a small flat stone would be of value.”*

### **2.1.1 Value in the Case Study**

Despite continuous research in the area no universal theory of value has emerged in construction, however, there are some traditional parameters such as cost, quality and function (Salvatierra-Gardio and Pasquire, 2011). Furthermore, since the economic crisis of 2008 the construction industry has been regarded as a high-cost industry further motivating a redefinition of old standards. As mentioned earlier the objective view in combination with customer-focused activities is common in the industry resulting in a focus to deliver the values to satisfy customers at a specific time.

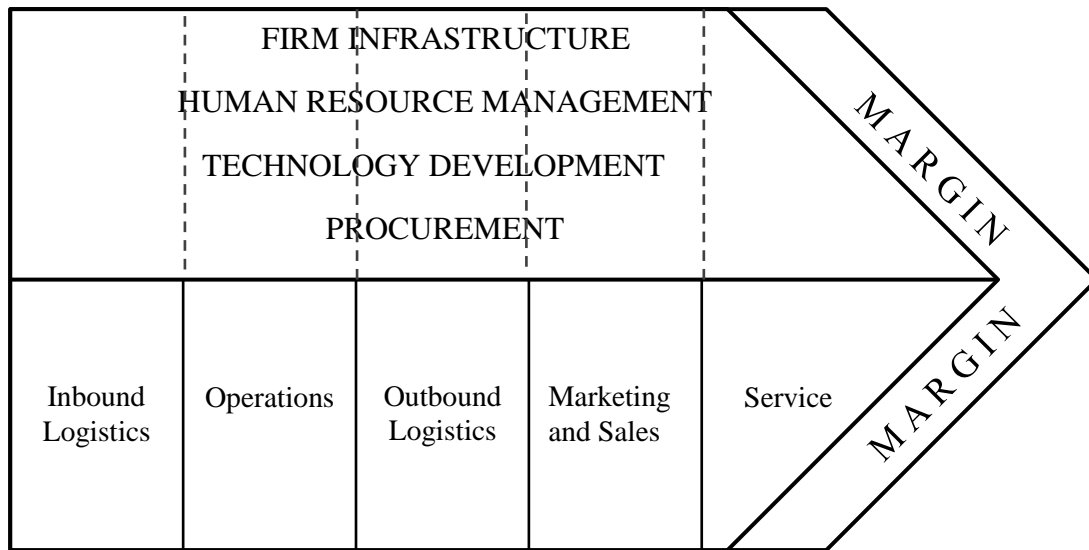
However, there are some advantages of using a traditional value, for example, cost as an indicator of how efficient value is being delivered in a project process. In contrast to more subjective aspects of value, cost is easier to measure. Because as Wandahl (2005) argues: the subjectivity of, and difficulty to explicitly express, value makes it problematic to measure since you cannot measure what you do not know. Besides, for value to be efficient to management it must be measurable. Additionally, since this study is of the project process itself in regard of lead-times, with less consideration of the production process, and more emphasis on planning, on a project manager level, time to completions of different stages is one way to measure and thereby enable a comparison. Furthermore, as shorter lead-times, due to identification and removal of hindrances, results in lower costs (Josephson and Chao, 2014), it is reasonable to use time as a unit of comparison. However, there are limits on how much one can shorten early lead-times, as it will affect the amount of later problems.

## **2.2 The Value Chain Concept**

The value chain is a systematic way of dividing the firm into strategically relevant activities in order to understand its competitive advantage (Porter, 1985). The sources of competitive advantage, e.g. strengths and weaknesses of the firm, can thereby be analysed through the activities and the firm's position in its industry be strengthened by reducing cost in those activities. The model is developed through a view of an activity-based firm where the activities provide the bridge between strategy and implementation.

Emerging from this theory of the value chain model (see Figure 2) where the outlines of the arrow symbolises the total value of the product or service (Porter, 1985). The margin is the difference between the total value and the cost of performing the activities. The activities are divided into two groups where the lower part of the arrow symbolises the primary activities, which are directly related with producing the product and value for the customer. Further, the upper part of the arrow symbolises the supporting activities, which, as the name suggests, provides the primary activities with, for example, human

resources. The dotted lines give a hint of the fact that supporting activities may be associated with a primary activity.



**Figure 2: The Generic Value Chain (after Porter, 1985)**

In order to define these activities Porter (1985) has set up three limitations: they should have different economics, a high potential impact on differentiation and represent a significant or growing proportion of cost. Within these limitations three additional categories arise: direct activities, which create value, indirect, which makes direct activities possible, and quality assurance activities. Further, the concept of value in this context is defined, as “the amount buyers are willing to pay for a product or service”. However, in choosing the activities there is room for judgement where to place what activity within the overall rule, which is that the order of the activities should as much as possible, follow the process flow.

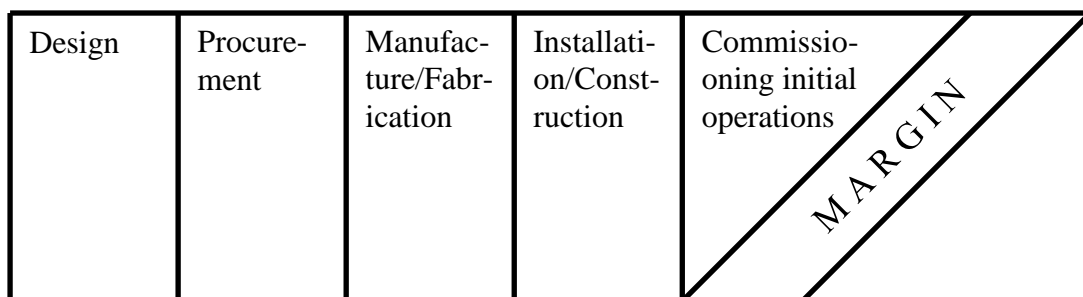
As the name value *chain* implies there are linkages between the activities, which are of importance since the performance of one activity within the value chain has impact on at least the one that follows (Porter, 1985). For example, if the raw material bought is of high quality it may facilitate the production and vice versa. These linkages can contribute to the competitive advantage in two ways: either through optimisation or coordination. In order for any of these two to happen there must be an information flow between the activities and a communication aiming at understanding each other’s needs in relation to the strategy of the firm. For example, the coordination of linkages may lead to that materials are delivered in slot times instead of “whenever during the day” or the optimisation contributes to less package materials in transport since the goods are handled carefully enough on the construction site that extra packaging material is not needed.

Taking the concept of linkages one step further places the value chain of one firm in relation to other firm’s chains creating what is called vertical linkages (Porter, 1985). For example the value chain of a supplier has an impact on the manufacturer because the quality or delivery method of the supplier might lead to additional work, which does not create value for the end customer but increases the cost. If then a mutual understanding for each other is developed synergies in both firms’ value chain can be created ending up in “win-win collaboration”.

### 2.2.1 Widening the View

From this generic value chain model, which purpose is to be applicable in a range of industries, variations and interpretations has developed in order to analyse different industries (Porter, 1985). However, the criticism claims it to be too focused on a manufacturing setting with the assembly line as a role model, which gives it lower applicability to, for example, service industries (Yeo, 1991, Armistead and Clark, 1993, Kippenberger, 1997). Nonetheless, one emergent perspective is that of the process-based firm, which argues that the focus should be moved from who is performing the activities to the activities itself (Rainbird, 2004). In this sense the view of the symbolic choice, the *chain*, as mentioned above, is extended into highlighting that there are “weak” and “strong” links in a value chain where a firm applying this model should focus on finding the ones where it is strong in relation to competitors.

As a complement to the process-based view the concept of the project value chain offers a “process-oriented soft systematic approach” in order to move the focus from operational- to strategic management (Yeo, 1991). Of interest in this model (see Figure 3) are the former primary activities, which have become the productive activities (processes) within a project process. Processes are defined by Hammer (2001) as: *an organised group of related activities that together create a result of value to customers*. It shows the connection between the activity-based theory and the process-based but also points out that a firm needs to ensure that each activity within the process is relevant and therefore contributes with more value than costs (Chivaka, 2007). However, because “value” is dependent on the customers’ perception of value it is necessary for the firm to adapt its processes, and thereby also activities, to the changing customer expectations (Rainbird, 2004, Gertner, 2013).



**Figure 3: Project Value Chain Processes (after Yeo, 1991)**

To be able to meet the demands of the customers’ perception of value, the determination of the strategic activities starts with the identification of those (Chivaka, 2007). Further, it is also important that there is a connection between the activities and the firm’s strategy and that the firm focus on the activities in which they perform well. These are not new thoughts in comparison with Porter (1985) but relating them to processes means drawing away the attention from the physical transformation. Instead it gives room to the more complex interdependencies between involved parties such as the processes or customers, which can facilitate an easier understanding of the problems that might arise in between of what Porter (1985) called activities (Kaplinsky and Morris, 2001, Chivaka, 2007).

The linkages between the activities are opportunities for competitive advantage and should not be managed independently but coordinated (Reimann, 1989, Kippenberger,

1997, Chivaka, 2007). It is further argued that sharing activities, whereas seeing them as processes, increases throughput and reduces unit costs (Hergert and Morris, 1989). Expressed in a stakeholder perspective: it is the same as trying to build a great company without support from all the stakeholders, there is no sustainability in that (Freeman and Liedtka, 1997).

In the project value chain, Figure 3, it becomes more important that a manager mobilises and uses the resources rather than owning or acquiring them (Rainbird, 2004). Further, this balance between different processes needs to be managed both in case of misaligned goals and what resources they get in order to create a well functioning value chain (Freeman and Liedtka, 1997, Chivaka, 2007, Johnson et al., 2011). In order to secure that the critical activities are prioritised, regarding resources, it is important to acknowledge the differences in the three types of activities, direct, indirect, and quality assurance, since it can be the indirect activities that holds the competitive advantage, and therefore are critical, because they are not as easily copied by competitors (Reimann, 1989, Patten, 2008).

There is an uncertainty about in what processes, or activities, the competitive advantage lies and the internal activities are unobservable in regard to how much the customer is willing to pay for it and therefore how much value it generates (Hergert and Morris, 1989). Further, it can be a problem to distinguish what both processes and activities contribute with to the total value. Despite this it is not the exact value coming out of the value chain that is the point of the analysis but rather asking the right questions and the procedure to visualise the value chain. The insights that managers get by the analyse of what activities that both creates profit and are in line with the company's strategy is of worth. There is also a need for interpretations to be done by the analyst in order to adapt the value chain model and in regard to the available data.

### **2.2.2 A Construction Perspective**

In the construction industry the usual method to work is in projects that are delivered by more or less temporary teams (Lundin and Söderholm, 1995). This means that the project has a pre-determined start and end that should be delivered by the assigned temporary team. The team is supposed to handle uncertainty, hindrances that arises and conflicts, which results in the need for the team to be synchronised and to allocate time. Construction is further qualified as a repetitive activity, even though the product itself can be a one-of-a-kind, rather than unique, since the team knows approximately what to do and who will perform the activities in contrary to the unique activities where no one has the direct experience of how to solve the task.

The value chain, like strategic planning and other management tools, is seen as a must in order to survive as a construction company because of the high level of uncertainty and risk within the industry (Betts and Ofori, 1992). To do this successfully the company needs a transparent project process, which is facilitated by the right information in the right time and place (Lindfors, 2000). Not only for optimising the existing processes and activities but also to visualise what activities in the project process is creating value and which are not.

Construction is management-intensive because of the high number of decisions taken on a daily basis, both on the construction site and in the office (Betts and Ofori, 1992). In this sense it both hinders and facilitates strategic management because the result is dependent on the quality of the managers ability to cooperate. One strategy to create this

quality is a coherent process model, which can increase the project managers ability to control the projects throughout the process (Lindfors, 2000). A result of the control is that the ability to improve the process by shortening times and cutting cost should increase.

In order to gain competitive advantage within the construction industry differentiation is highlighted as vital together with the fact that aspects other than the price of the product are becoming more important (Betts and Ofori, 1992, Josephson and Chao, 2014). The strategy on how to deliver these differences and qualities becomes important for construction because it is based on projects in a changing environment. There is however a tendency to confuse strategy with planning giving too much focus on budgets and forecasts and being a part of the larger value system with other firms, such as subcontractors, may create problems when trying to optimise the linkages in the value chain. Another obstacle is the tendency that construction companies focus on quantity instead of quality when there is an increase in their workload (Lindfors, 2000). This drives the focus away from the value creating activities and rather intensifying the workload by not following the strategy.



## 3 Methodology

Twelve construction projects are compared, from a lead-time perspective, to be able to find recurring problems and points of improvements in the project process by raising the knowledge of how it is used today. Moreover, six project managers lead the projects and it is in their perspective the project process is viewed upon. To get a holistic view of the project process the study is divided into five parts; literature review, collection of lead-times, interview with project managers, workshop with project managers, and finally a concluding discussion with recommendations.

### 3.1 Literature Review and Theoretical Framework

A literature review was carried out to get an understanding of what is already known about the research field and what theories are suitable, this is a way of legitimising the research (Bryman and Bell, 2007). For this study Porter's (1985) value chain was examined. First, Porter's original definition and application on the manufacturing industry was studied. In his book *Competitive Advantage*, Porter examines how to identify what activities contributes to a firm's success by (1) assessing its overall position in the industry and by (2) determining what activities within the firm that creates value for the end-user and differentiates it from other firms. He visualises this in a generic model, the value chain. Secondly, to get examples and a deeper understanding of how the value chain can be applied to other industries, such as construction, and on processes, additional research articles in the field was studied, this is summarised in the theoretical framework. Furthermore, the concept of value, and the connection to time was studied to be able to measure the lead-times.

### 3.2 The Case Study

A case study design has been chosen since the main feature of this study is an examination of the project process itself. This corresponds to Bryman and Bell (2007) definition of a case study design, which is to execute a detailed and intensive analysis of a single case. This single case could be an organisation, a location, a person, an event or, as we have chosen to interpret it, a process. One could argue that it is in fact a comparative design, where two or more cases are compared to find parables or similarities (Bryman and Bell, 2007). However, since twelve projects are compared, the comparison of lead-times is only one part of the complete study to understand the process.

Of the three data collection parts, collection of lead-times, interviews and a workshop, the second and third can be considered to be of a qualitative research approach and the first to be associated with quantitative research. One description of a qualitative approach is that it is centred on words instead of numbers and focuses on the creation of theory through research, the emphasis is on understanding the studied world through the eyes of its participants (Bryman and Bell, 2007). Two common methods in qualitative research are interviews and focus groups. Quantitative research, on the other hand, focuses on quantification in the data collection and it takes an objective view of the world instead of the view of the beholder.

#### 3.2.1 Quantitative Data Collection

To be able to compare lead-times in the project process twelve projects, which were selected by the region of the company and ranged from 2008 to present time (2014), were studied. Through the project process there are a number of stage-gates that has to

be fulfilled to continue onwards with the process, these stage-gates were used as the base when choosing lead-times for the study. In addition to the official stage-gates two more activities, Basic Cost Estimate and Production Cost Estimate, were chosen as a complement as they are critical for the process to move onwards. These were later found not implemented in most of the examined projects.

For the collection of lead-times a self-completion questionnaire was sent out via e-mail to the responsible projects managers. This kind of questionnaire is one of the most common for gathering data for social survey research (Bryman and Bell, 2007). There are some pitfalls when using a self-completion questionnaire, as the respondents cannot ask for explanation if any of the questions are unclear. Furthermore, the respondents cannot be asked any follow-up questions to gather additional data. However, if any ambiguities would arise the matter could be settled easily as the office was located on the same floor as the project managers at the office building. Additionally, as the next part in the study was the interviews, clarifications and follow-up questions could be asked there.

This type of survey was chosen because of the kind of data, lead-times, needed initially. Because it would be a waste of time during the interviews to ask for the lead-times for each project; furthermore, the lead-time data was used to get to know the projects and to shape the structure of the interviews. Another reason is the time perspective; one cannot remember exact dates five years after a project is completed so the project managers had to get time to check their notes.

In the questionnaire the date or timespan for eleven different stage-gates or activities were asked for. The lead-times asked for were based on the official stage-gates in the company's structured project process. These lead-times spanned between; (1) Project Programme, (2) Internal Review of Programme Documents, (3) Review Committee Review of Programme Documents, (4) Project Run-Through Before Pre-Construction, (5) Review of System Documents, (6) Basic Cost Estimate, (7) Project Run-through Before Sales, (8) Completed Construction Documents, (9) Detailed Production Cost Estimate, (10) Project Run-Through Before Production, and last (11) Approved Final Inspection, see Figure 5.

To get an understanding of the company and the project process various organisational documents, localised in the company intranet, were studied. This is a common way to build up a description and history of the organisation in a case study (Bryman and Bell, 2007). However, it is important to consider the fact that the one writing organisational documents often have one view in mind, a view that might not correspond with all situations or employees. Because of this, documents should not single-handed be accounted as the objective description of reality, but in conjunction with other sources of data, such as interviews, they contribute to a holistic view.

### **3.2.2 Interviews**

To complement the lead-time questionnaire and get a deeper understanding of the lead-time variances within the projects an interview study was conducted with the six responsible project managers. The interviews were held in a conference room at the company and, depending on how many projects each project manager was responsible for, the duration of the interviews ranged from one to two hours. The interviews were tape-recorded, as memory notes, as recommended by Bryman and Bell (2007).

For the preparation and execution of interviews Kvale and Brinkmann (2009) has described and divided the process into seven steps:

1. *Thematising* – This is when the purpose and conception of the topic is formulated. In this study this equals the research questions with an emphasis on a deeper understanding of why lead-times differ in some projects and what general thought the project managers have of the project process. The focus is on *what* and *why*.
2. *Designing* – Have these seven steps in mind when designing the study, the design focuses on what kind of knowledge is tried to be attained. The interviews were divided into three topics; (1) a small exercise with the aim to get the interviewee going and to collect data of when in the project process the project manager spends most time on the project and in what processes there are most potential for time optimisation. (2) Interview questions with regard to the company's structured project process and (3) Interview question with a focus on specific project data and the collected lead-times for each project that the project manager had/is responsible for.
3. *Interviewing* – Conduct the interviews according to this interview guide. As stated the interview were held in a conference room at the company. The reason for this was that this should be a neutral area, in relation to an office, where the interviewees could focus on the questions.
4. *Transcribing* – Transform the interview from audio to text. In this study there were no complete transcription made. However the interviews were recorded and extensive notes were taken during the interviews. Each recording were listened through after each interview and then complemented with further notes.
5. *Analysing* – Choose what methods are appropriate for the analysis of the interviews; this should be coupled with the purpose and subject of the study. To be able to analyse the outcome of the interviews the same breakdown as in the interviews were used. The input on the project process was compiled in one chapter, and the project specific information was compiled to get a more holistic view of the projects and as a complement to understand the collected lead-times.
6. *Verifying* – Is the interviews reliable and valid? Reliability refers to if the results are consistent and validity refers to if the interview deals with the intended topic. The interview revolved around the predetermined questions with additional follow-up questions to get clarifications and deeper understanding of topics raised by the project managers. The interviewees were encouraged to talk freely around the asked questions.
7. *Reporting* - Report the result in alignment with scientific criteria. The result is compiled in the findings-section and analysed in the discussion-section.

In qualitative research, interviews is one of the most frequently used methods of data collection; this is due to its flexibility compared with, for example, extensive (and time consuming) participant observations (Bryman and Bell, 2007). There are basically two types of interview setups for qualitative research, unstructured and semi-structured interviews. The unstructured interview often concerns one topic or question and the interviewee is then allowed to talk spontaneously of this subject, in its execution it draws high resemblance to a conversation. A semi-structured interview, on the other hand, follows a predetermined interview guide. All questions/topics that the interviewer want answered are in the guide, however, the order might not be the same for all interviews and follow-up questions as well as detours are encouraged. Nevertheless,

what the interviewee views as important in explaining the studied events, or issues, must be emphasised. In this study the semi-structure has been chosen, as it is preferred when a comparison of several cases (projects) is conducted or else it is hard to determine the outcome of the interviews.

For the creation of an interview guide there are some essential elements that were used to get the most out of each interview; (1) create topics to arrange the questions under, so that there is a flow in the interview, (2) regard your research questions in the creation of topics and interview questions, (3) try to use the same vocabulary as the intended interviewees, (4) beware of leading questions, and (5) put the interviewees in a context (age, position etc.) to be able to analyse their answers (Bryman and Bell, 2007).

### **3.2.3 Workshop**

In the workshop the data from the questionnaire was compiled and presented for the project managers. The project managers were allowed to respond to the findings and come up with ideas and possible explanations. This was the final step of the data collection.

The purpose with the workshop was to get the project managers to think about the project process, to define, for them, relevant hindrances within the process and to analyse these hindrances to come up with proposals for solutions. The solution proposals had two focus areas, what the project managers themselves could do and what the company could do to make the process more time efficient. First the previous gathered information, lead-times and partly the interviews, were presented to show what had been done so far and to get the project managers into the right mind-set of time and time utilisation. Secondly, each project manager was given six empty post-it notes and were asked to write down six hindrances, as they perceived them, in two categories, three internal and three external. These notes were then collected and put on the whiteboard. The project managers then each got to vote on three hindrances in each category that they would like to talk about. Third, after the vote was made the participants were divided into two groups and were asked to come up with solutions for the two hindrances, in each category, that got the most votes. At the end of the sessions these solutions were presented and discussed in the whole group.

All project managers, except one, were present at the workshop and in addition the project development manager attended as well, in total six persons.

## 4 Findings

This chapter presents the results from the study of the organisational documents, the data collection of lead-times, the interviews, and the workshop. Section 4.1 presents the case company and describes its project development process. Further, section 4.2 presents each of the 12 projects studied with focus on project specific facts and disturbances that affected the lead-times. Extra attention is put on lead-times that are longer or shorter than average. Section 4.3 presents another result from the interviews and revolves around the project managers' view of the project development process; the section is divided into the different stage-gates within the process. Section 4.4 presents the workshop and the hindrances that the project managers together rated as those with the most impact in the project development process.

### 4.1 The Case Company

JM is a developer of housing, meaning that they own the entire process from acquisition of land until the building is finished and throughout the guarantee time. They mainly operate within major metropolitan areas mostly in Sweden but also in Norway, Denmark, Finland and Belgium (JM, 2012). They are one of the five major building companies within Sweden and had a net turnover of 12,480 billion SEK and 2,386 employees in December 2012 (JM.se, 2014). Additionally, they build mainly for private customers who buy their apartments. There are six regions at JM: Region East, West, South, Stockholm North, Stockholm South and Stockholm City. In the explanation of JM's strategy there are some key words, in relation to this study that appears: "leading project developers, product quality and good profitability" (JM, 2012).

The foundation of JM's value creation is, according to themselves, their knowledge about the customers' expectations and how those needs are met through effective processes. Figure 4 shows JM's total project development process, market process and value chain (JM, 2012). It is in the overlap between the planning/detail plan/building permits and pre-construction where the most value is created, according to JM, this is where the ideas are transformed into plans and blueprints. During the pre-construction the pre-construction manager at JM work together with an architect until the blueprints are approved. Further, consultants are hired within, for example, structural engineering and ventilation. The purchasing supervisor procures subcontractors simultaneously as the site manager plans the operations on site. The production process starts when a predetermined target percentage of reserved residential units are reached and the execution of the plans continues until occupancy.

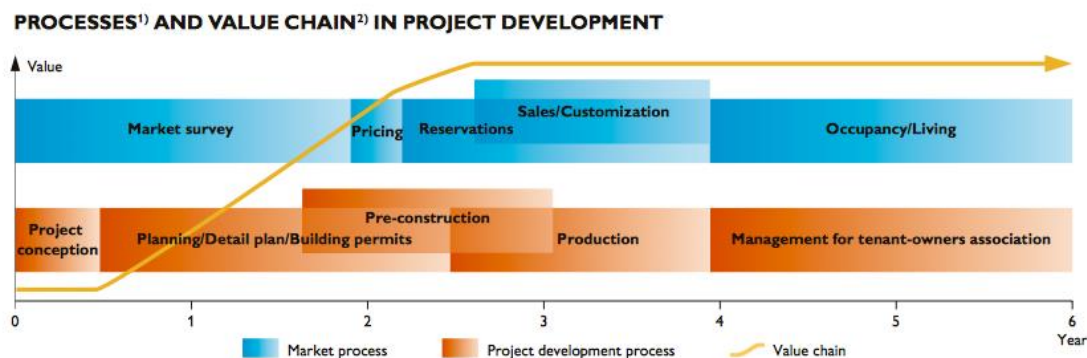


Figure 4: Processes and value chain in project development (JM, 2012)

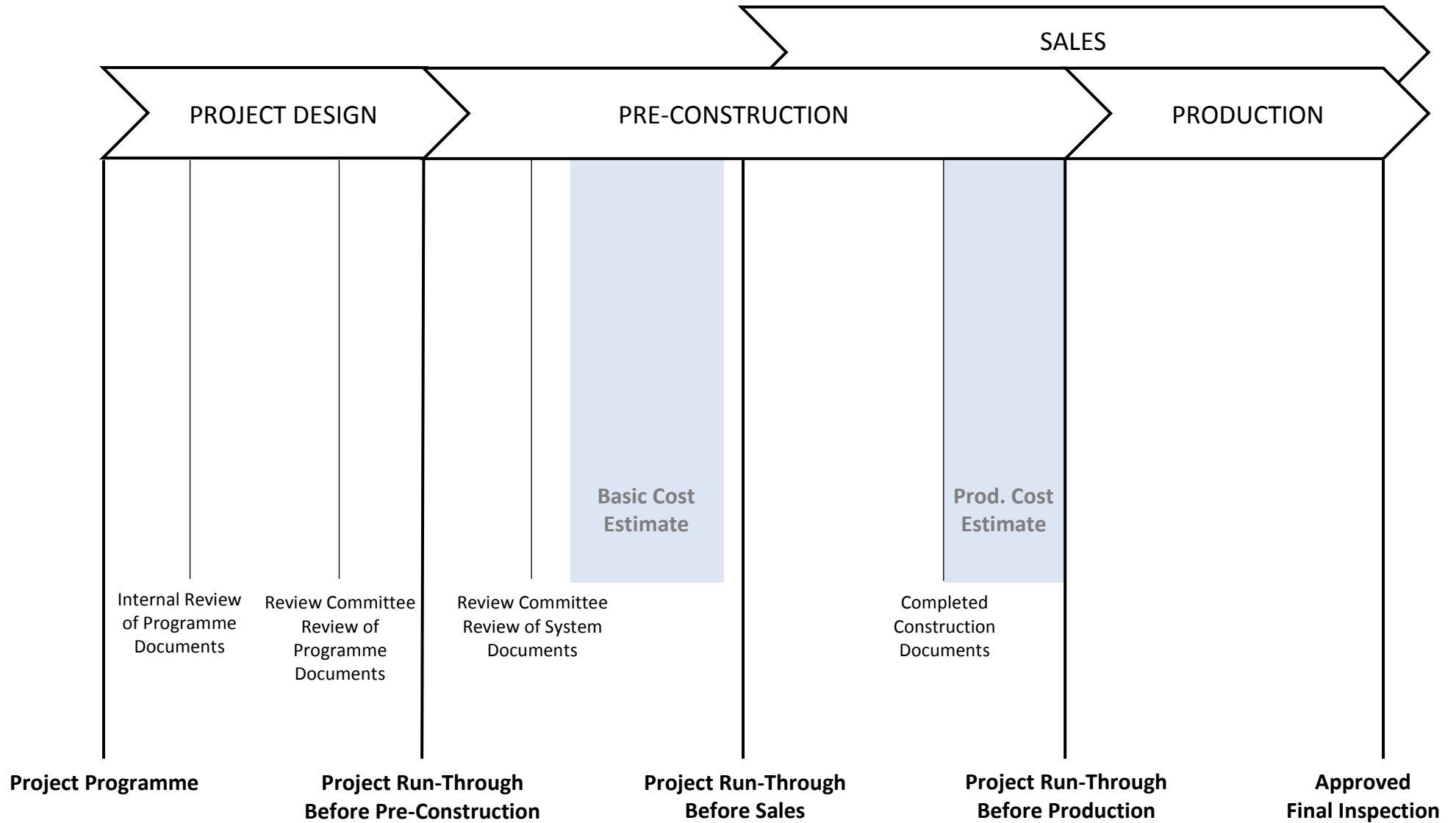
To be able to manage the entire project process (the whole value chain) is described as an advantage in relation to competitors, the steps in the project development process is connected to stage-gates in order to create a controlled, structured and profitable process (JM, 2012).

Since 2003 JM has worked with an overall strategy, Structured Project Development, which consists of several strategic initiatives that have been implemented over the years and/or are on going (JM, 2012). The first step was when JM decided to structure the pre-construction process and the result was standardised procedures in order to govern the process in a way that facilitates defined and standardised products. Since then there have been several other strategic initiatives with the purpose of structuring the project development process in order to become quicker and more cost efficient. The ones of interest in our study are, Structured Pre-Construction included, Structured Sales, Structured Production and Structured Project Design.

The Structured Sales mainly involve a process orientation within the operational system that was substantiated with a review and the definition of the sales activities in chronological order. As a supplement there was procedure descriptions connected to the activities. This was done in 2008 and four years later, in 2012, the same procedure began with the project design process, this was done to make the pre-construction process more efficient. However, the chapter in the operational system in which the project managers are active is not process oriented yet.

The Structured Production started in 2010 and is the most comprehensive project since it involves a larger number of employees on different levels within the organisation. It therefore contains three parts; a process orientation of the operational system, procedure descriptions supplemented with installation instructions, and a system for uniform scheduling. The procedure descriptions and installation instructions are developed in collaboration with the craftsmen and contain detailed information on how to, for example, build an exterior wall or mount a window. The system for uniformed scheduling includes cycle times, which means that the project produces a certain amount of apartments in a month.

In summary, Structured Production creates a unified way of working that ensures that the product is built in a certain way, which is well documented, and that the materials build in are the same every time, for example because of guarantee reasons. If something goes wrong, independent of where in the process, there is a high traceability and the problem can be resolved within all products produced during that time.



**Figure 5: A schematic visualisation of the part of JM's project development process that has been examined**

### 4.1.1 The Project Development Process

To be able to understand and explain the complex project development process, which also is the work process of the project managers at JM, a visualisation based on interviews and the study of organisational documents, was designed. It is important to note that the part of the process that has been examined is not the same as JM's entire project development process but is a limited part; the visualisation only contains the processes that are relevant for this study. The final version is presented in Figure 5 and contains the four processes Project Design, Pre-Construction, Sales and Production. Further, the eight stage-gates are placed in order of execution together with three additional events; the point of completed construction documents, the basic cost estimates and the production cost estimates. In order for the project to precede the project managers need an approval from different levels within the organisation at the different stage-gates, in practise this is a meeting where a checklist is gone through and a paper is signed. The further information is as well a result of interviews, with for example the project development manager and the study of organisational documents.

The project design process starts with the Project Programme, which is a document that contains the concretised ideas of what the project shall become. The consideration for the project manager is how to maximise the utilisation of the property within the restrictions of the detail development plan. This document becomes the guidelines for the architect, which then begins to create the visual appearance of the building(s) and the layouts. During the project design there is first an internal review of the programme documents where the project is reviewed. After changes has been made according to the internal review the programme documents are sent to the review committee, which consists of pre-construction managers and project managers and is centrally based at the head-quarters, with the assignment to ensure that JM's standardised construction procedures are followed to keep a high level of quality in all the projects conducted within the JM Group. Everything from functional measurements to choice of façade is reviewed and the project team is required to follow, or ask for permission to deviate from, the review group's recommendations.

The pre-construction process starts with the Project Run-Through Before Pre-Construction where more technical solutions are decided. Further, more detailed time plans for the project have been created, the economy is considered more thoroughly and system documents are created. When this stage-gate is approved the project starts to allocate more resources and hence costs more money, because more specialists are involved and the financial value invested in the project has risen. During the pre-construction process the project goes through a second review with the review committee where the system documents are evaluated. This review has the same function as the earlier with the difference that the documents are more comprehensive. Furthermore, there is a balance of when to conduct the two reviews, the review committee review of programme documents and review committee review of system documents. On one hand it is preferable to perform them as early as possible to have time to take into account as many of the committees views as possible, on the other hand enough material has to be created so there is something to review. After the review the Basic Cost Estimate should be done, which means that the project manager decides a slot time together with the cost estimator, approximately eight weeks, for the project. The Basic Cost Estimate is conducted to ensure that the project manager's early estimations of the project's economics still is valid, if this is not the case some of the decisions or conditions have to be changed so that the project becomes profitable. It is



important to understand that the rest of the project does not stand still during this activity, other pre-construction activities continuous forward parallel to this activity.

The sales process begins with the Project Run-Through Before Sales, which can be situated anywhere in the pre-construction process as long as there is enough known about the project to create the sales material. Certain aspects of the pre-construction has to be done to know enough of the project to be able to enter the sales with the right information, since it is hard to make changes the building plans and apartment layouts when the apartments have been sold. There are a lot of external factors, for example, the financial market and the residential market situation that can impact the position in time for the start of sales. Additionally, the individual project has to be adapted to the entire region's sales plan. This is a tactical aspect of this stage-gate, which does not necessarily correspond with the project development process. Furthermore, the activities in the sales process are not directly connected with the pre-construction or production process since the sales process is more focused on the customers, meaning the potential buyers of the apartments or houses and the market, whereas the pre-construction and production are more focused on the execution of the project. However, the processes are connected by mainly the target percentage of sales, which have to be reach in order for the production to start and that enough pre-construction material is need to be able to create the sales material. The project can also be divided into different, smaller, sale stages that, because of the percentage mentioned earlier, this also divides the production into stages.

The pre-construction process becomes divided in this model, but not in practice, by the Project Run-Through Before Sales but as explained in the previous paragraph, and seen in Figure 5, it is two in part parallel processes. For the later part of the pre-construction the project becomes even more detailed and the documents becomes ready to use in production when the construction documents are completed. After that the Production Cost Estimate can be conducted, which has the same procedure as the Basic Cost Estimate but takes approximately four weeks.

The production begins with the Project Run-Through Before Production and in this stage the project is, on paper, ready to be produced. However, the project may be divided into the start of groundwork and the start of building production where the first one can start even though the pre-construction process is not finished. This can also apply if the project is divided in production stages. The whole production organisation as well as the project economics and sales percentage should be in place when this stage-gate is passed. Lastly, when the building is finished the final inspection is carried through. A professional inspector performs this procedure and afterwards a statement is conducted, which either approves the inspection or has remarks that the company has to correct. The inspector approves the final inspection when all the remarks are corrected; in our model this marks the end of the production.

## **4.2 The Projects**

In this section the twelve projects are explained through the information given by the project managers during the interviews. The projects are first presented with their respectively characteristics in Table 1. A summary of the projects' lead-times is illustrated in Figure 6. Further each project is separately described in order to give a context and explanation. After the project descriptions a summary of the hindrances, both external and internal, are presented in the Table 2 and 3.

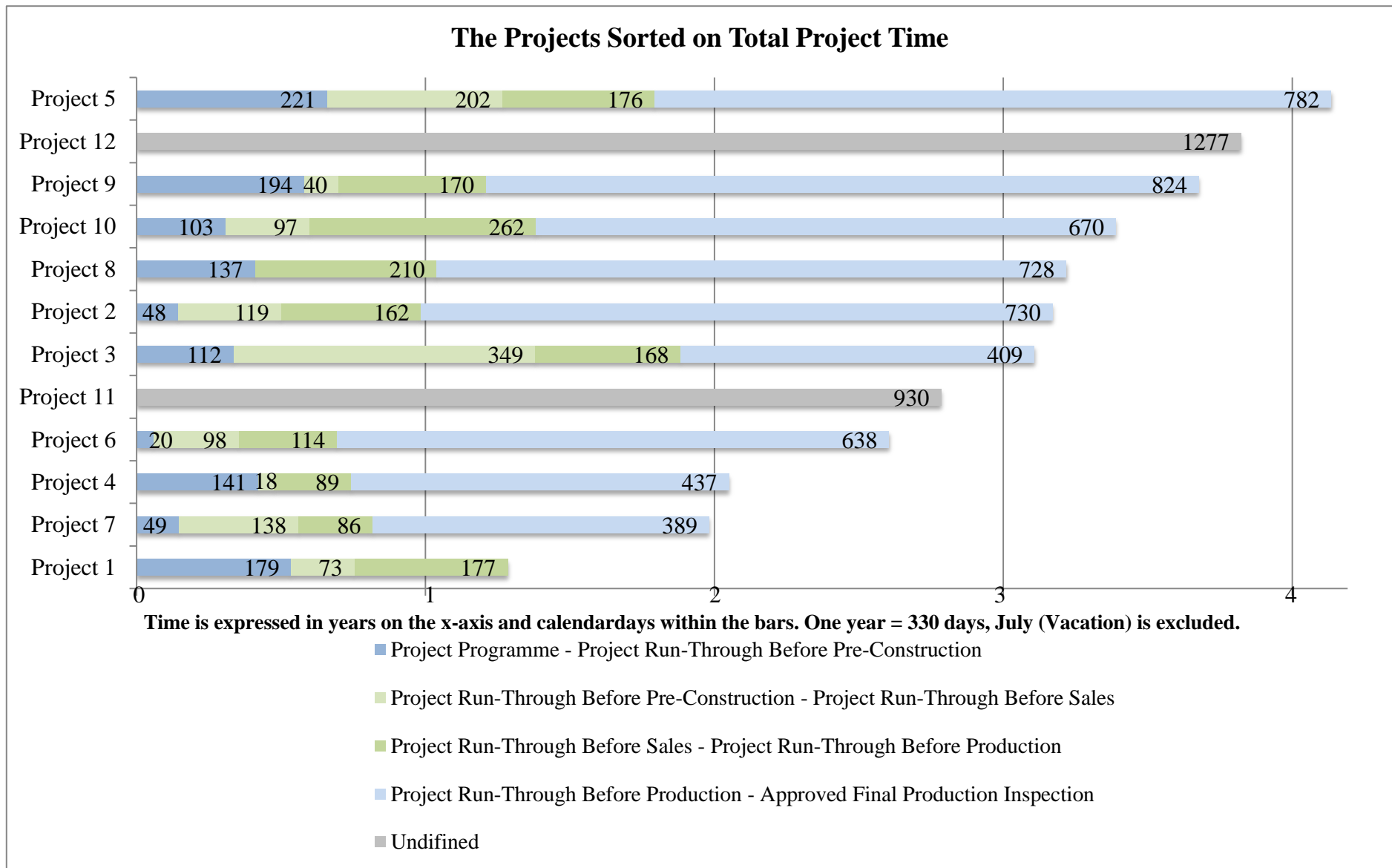
The total lead-time compilation (Figure 6) shows the collected lead-time data from the twelve projects, sorted on total project length. The first dark blue bar represents the Project Design lead-time, both of the green bars represent the Pre-Construction lead-time and the shift from light green to a darker green indicates that the Sales has started, and the last light blue bar represents the Production lead-time.

**Table 1 Characteristics of the projects.**

\* = Not yet finished

\*\*= No complete lead times

Project no.	Start/End Year	Number of apartments and houses	Residential area (m <sup>2</sup> )	Tot. project time (days)
1	2012/-	89 apartments in one residential building divided into two main bodies	*	*
2	2010/2014	119 apartments in one residential building divided into two main bodies	8,321	1,059
3	2008/2011	24 apartments in two residential buildings	2,115	1,038
4	2011/2013	33 terrace- and link houses	4,413	685
5	2010/2014	86 apartments in two residential buildings	6,368	1,381
6	2010/2013	58 apartments in two residential buildings	3,937	870
7	2010/2012	38 one-storeyed houses	3,523	662
8	2009/2012	126 apartments in one residential building	7,531	1,075
9	2010/2013	131 apartments in one residential building	8,714	1,228
10	2010/2014	86 apartments in one residential building	7,493	1,132
11	2009/2011	42 apartments in one residential building	2,929	930**
12	2009/2013	29 apartments in one residential building, 27 split level houses and 6 terrace houses	7,229	1,277**



**Figure 6: Compilation of Project Lead-Times**

## **Project 1**

This is the most recent project in this study, started in June 2012, and it is scheduled to be complete in approximately two years time. The project manager has been with the project from the start of the project design. It is a residential building that consists of 89 apartments separated into two main bodies, which also includes two commercial premises and a two-level basement. Both of the basement levels are located beneath water level.

### *Characteristics*

This far into the project the project manager can only see one downside and that is that the balconies are too small compared with customer expectations, but not compared with the standards of JM's review committee. The project was handed over by the project manager to this study as an additional project, even though it has not yet been completed. However, as it is the newest project it has gone through the latest iteration of JM's project development process, unlike most of the other projects. For this reason it is interesting to include it as a point of comparison.

### *The Process*

The first part of the pre-construction process, before the sales start is among the shortest of the studied projects, however in this case it has not affected the total pre-construction time as with Project 8 and 9. On the contrary, it has one of the longest pre-construction lead-times.

## **Project 2**

In total, this project contains one residential building divided into two main bodies, the buildings are split level houses and the entire project consists of 119 apartments and an underground garage with 59 parking lots underneath the yard. This project was a reboot of a cancelled project in 2008/2009 and the current project manager, who was new at JM at the time, entered the project during the work with the detail plan.

### *Characteristics*

There are some features that make this project special; as there was an old industrial building, made out of bricks, on the site. Before the project got cancelled the original idea was to preserve the old structure and build apartments within it. However, after the reboot the decision was made to demolish the old buildings and instead reuse the old bricks in the new façade, brick by brick, this was deemed a more economical solution and was necessary to get the project going.

In this project, the project manager also assumed the role of pre-construction manager, which is highly unusual as it is two fulltime responsibilities. The reason was that all the ordinary pre-construction managers were occupied with other projects. This is something that the project manager himself feels that he has not succeeded with as well as he wanted, the workload was simply too high, and this arrangement is not something the project manager will try again. There were some pre-construction misses that affected the production in the sense that the project manager had to be more active than usual during the production.

The project manager estimates that the project is an extremely complex project, partly because of misjudgement of ground conditions but also because of the reuse of the old

brickwork. Furthermore, the structural design (prefabricated elements) used for this particular building is different from what is commonly used within the company.

#### *The Process*

As this was a reboot of a cancelled project a project programme already existed when the project manager entered the project. Much of it could be reused and that is why this lead-time is one of the shortest, 48 days, of the projects. However, the project manager explains that this is not representative of how the project development process is structured currently, now more time is needed. Furthermore, from the start the ground conditions were estimated to be satisfying, however there was a need to remove some of the underlying rock to make room for the buildings. When this was done it was discovered that the rock underneath was of lower quality than expected and extensive, unplanned, strengthening of the ground was needed before the actual construction of the buildings could start.

For the sales the project was divided into two smaller stages. This is a tactical manoeuvre, as roughly 30% of the apartments have to be sold or booked to get permission to start the production. This division into two sales stages further means that the production is divided into two stages.

The use of the construction method with pre-fabricated elements led to that the team could not use the developed “structured production” technique for the construction of the buildings. With this in mind, and the fact that the project manager has long experience from project management in other organisations, it is the project manager’s opinion that JM’s construction organisation is somewhat inexperienced and has needed a lot of guidance from the project manager throughout the construction process. The pre-construction misses also required extra attention from the project manager, misses that the construction organisation could have coped with if it had been more experienced, according to the project manager.

### **Project 3**

This project was initiated in early 2008 and it started out as 24 exclusive apartments in two residential buildings located five meters from the ocean. The project manager became involved after the project programme was set and started with the design during the process of having an approved detail plan. However, when the system documents were finished and the construction documents were in progress the project became re-designed due to the financial crisis 2008/2009.

#### *Characteristics*

Since the property was bought with an old industry building this had to be demolished and the ground had to be decontaminated. This also meant that connections to water and sewer were already in place.

The project manager underlines that when there are specific characteristics in the project, such as the ocean near location in this one, they need to be considered at an early stage. Further, when the project includes operations that are new to the team, or subcontractors, it is important for the project manager to be more active throughout the process. The same goes for deviations in the conditions of the project or in the team constellation.

#### *The Process*

The project manager gave the architect quite loose restrictions during the project design that resulted in a layout proposal with separated areas for kitchen, dining- and living rooms. This is not an effective way to use the square meters and in retrospect, and with more experience, the project manager feels that it would have become a more time efficient process with clearer directions.

For JM it was important to keep their staff occupied during the crisis but in order to still be profitable the project needed to be re-designed. This led to major re-work since the project was nearly ready for the production. The re-design involved a reduced level of exclusivity by, for example, build one balcony for each apartment instead of two and with a smaller size. The re-work of the pre-construction added 234 days to the 115 days that was already spent on the pre-construction. In the end the project ended up to be profitable.

There is no direct explanation to the fact that the production is short in relation to the other projects, according to the project manager. Even though the production team were fewer than usual, because of the crisis, which resulted in that the project manager became more involved in the production process than usual. The method used to construct the building, is the same as used today in JM, and there were the usual complications with groundwork. Further, the site manager shortened the time plan for the production halfway into the production process, which resulted in minor mistakes because the craftsmen worked “on top of” each other. Further, the exposed location of the property affected the production time and the project manager expresses that it would have been possible to start a bit earlier with the indoor applications if there would have been a weather protection tent in place.

## **Project 4**

The project started in 2011 and contains 33 houses, terrace- and link houses (131-137m<sup>2</sup> each), in a new exploited area. They are one of JM’s standardised house types that they have developed, and can be reached within an internal database. There have been two different project managers responsible for this project; the shift was in the pre-construction process, during the sales. They perceived the transfer as friction free even though the second project manager could have saved some time if the reasons behind decisions made earlier had been known to him.

### *Characteristics*

Within the company the usage of standardised house types have been discussed on and off but during the project design of the project it was seen as positive. They result in a more effective process because of mainly two reasons; first the cost estimates and blueprints are finished, which means that mistakes that can be made during the pre-construction process is reduced because the standardised house type is used and edited, second there is not endless variations of effective layouts in square-formed houses, which makes it unnecessary to take the time to develop a new layout every time. However, there is a lower differentiation between the houses that can affect the esthetical impression of the neighbourhood.

The later project manager expressed that the first project manager and pre-construction manager both are experienced, which affects the project development process positively. They decided to differentiate the houses by, for example, rotate the roofs and use different façade colours, however, the later project manager thought that the sale

maybe could have gone even better if the houses had been even more differentiated in size. Another point of improvement for Project 4 was that when they decided to change parts of the standardised house, this was not as thought through as if they had designed the house from scratch, this has resulted in some technical mistakes. The product is more thoroughly worked with when created from scratch, but takes more time.

### *Process*

In the project design for Project 4 the standardised house type was adjusted to fulfil the restrictions in the detail plan. Since a lot of the pre-construction work with the houses was already done most of the effort was to place the houses on the building lot. After the adjustments the houses was modified enough not to be classified as the standardised house type, this made it possible for the project manager to deviate from the framework agreement and procure from the “spot-market” with today's prices, which was proved successful because of the lower market price. The project manager also questioned the choice to have framework agreements on houses and not just on residential buildings because this product is not as frequently built.

Production of wall units in this project was mainly done within a factory and then transported to the construction site. This makes the process time efficient and the fact that the houses are almost identical also affects the production time positively. As a result of using the standardised house type and modify it the whole project time is short in relation to the other projects and especially the pre-construction process.

## **Project 5**

The project was initiated in early 2010 and the project manager took over the project from a colleague when the sales had begun. The project consists of two residential buildings, each contains 43 apartments distributed on 10 floors, and the site was a mountain slope located in a residential area.

### *Characteristics*

The ground conditions, in a narrow site, meant a lot of cooperation between the project manager and the other two contractors who were also at the site. For example, JM started with their rock blasting and then had to wait until the others had blasted to make room for their buildings and then come back to the site and continue to build. The road to and from the site also had a restriction of how much weight the trucks could transport at the same time. This also added time since they needed to increase the number of transportations, which made the site more crowded.

The buildings were fully prefabricated and the method was to place the elements with a construction crane. The usual method is to build the two buildings simultaneous with one crane but in this case they needed to first build one and then move the crane before starting on the other because of the narrow site layout.

### *The Process*

The project design process is a bit longer than projects where concepts could be re-used. Because several aspects need to be considered, which takes time, and fewer lessons from former projects can be directly applied according to the project manager. The project manager draws one lesson from this project's production, which is not to dismiss technical questions at an early stage. There are, for example, questions about the responsibilities from each of the three contractors on the site since the buildings were only 70 cm from each other. Because of these potential problem areas there is always a

need to work closer with each other than one can think. When reflecting on Project 5 the project manager's view is that it ended up well even though it has been a lot of phone calls from external stakeholders, such as neighbours, and site managers from the other companies.

## **Project 6**

This project, initiated in the year of 2010, is basically a copy of Project 11 and is located in the same geographical area. It contains two residential buildings in five floors with 58 apartments. There is a basement under one of the buildings and parking lots is therefore offered on ground level. The project manager became involved during the project design.

### *Characteristics*

The project manager reflected upon the consequences of the choice not to use basements under both the buildings. Since it is easier to build a basement than the underground shafts needed for the installations and it could therefore have saved time if that method had been used instead. Further, the project became more complex because of the fact that it was variations in the ground because of spots of quick clay.

### *The Process*

During this project JM did not work with the project programme in the way that is done today. The short number of days it took is therefore realistic, not only because the requirements of the project programme was lower then but also since the product is a modified copy of Project 11. Much of the work had therefore already been done in the previous project, especially since it is located at the same area, a lot of the content is the same or similar in the project programme and therefore also in the pre-construction process. Another explanation is that the Project Run-Through Before Sales was set with a quite tight schedule, which meant that the project needed to proceed rather quickly.

The relatively long production time is partly explained by the ground conditions, which are hard to forecast, and partly because the selling pace was low. This also affected the production pace and since a craftsmen team of concrete workers left the company the project manager used contracted personnel during one summer in order to fulfil the time plan even though that is not preferable.

## **Project 7**

This is the only project that is targeted at seniors, from 55 years of age and above, and was initiated in early 2010 and contains 38 one-storeyed houses. In total there have been three different project managers responsible for the project, whereof the two later still works at JM. The first manager left the company in a reorganisation; by this point the project had entered the early stages of pre-construction and was handed over to the second project manager. The third project manager got the project late in the process, when some of the houses were built and 25-30 of them already was sold.

### *Characteristics*

It was a local senior association who took the initiative for the project, and it was realised through JM. A collaboration with a modular house manufacturer started early in the project development process, they contributed with an expertise and could quickly generate a first draft of how the houses could be designed. However, this early collaboration later resulted in some disagreements since there was a lack of contracts to



regulate it, which subsequently led to that the bargaining room shrank for JM. The project manager, which did not start the collaboration but worked with the contracts, takes this as a lesson to not put all the responsibility on one consultant.

JM had a new employee who got to work with the project through both the pre-construction and production process, as a way to learn the process and get to know the company. The project manager perceived this as positive since this person transfers knowledge of the project from the planning stages into the execution and further recommended this for all projects.

#### *The Process*

The pre-construction is long for a project of this type and size, 224 days. This is partly explained by an intermission in the middle of this process. The cause of the intermission was that the cost estimate did not add up with the required yield, in total the intermission was approximately two and a half months long. In the end it ended up to be a successful project in regards of financial margin and high customer satisfaction. During the production JM only had a site manager and some foremen on site while a contractor performed most of the work, this was a way to keep control over the site instead of using the contractors site manager and foremen and thereby limit risks.

### **Project 8**

This is a residential building project consisting of 126 apartments. The project was initiated after an internal reorganisation in 2008/2009 and due to this there were a lack of new projects in the pipeline and JM was in need of a project to occupy its project teams. The project manager, which is one of the more experienced project managers within JM in the region, entered the project from the start and stayed with the project to the end.

#### *Characteristics*

In the area where the project is located there were a high level of vacancy for larger apartments (for three or more people), however the project manager identified a shortage of smaller apartments. The decision to go for smaller apartments and some of the choices of kitchen units was initially criticised, internally, but has later been viewed upon as a success with fast sales as a result.

The project manager states that one aspect that stood out during the project was that the project manager has to represent the will to drive the project forward; no one else will do that. Furthermore, it is the project managers' responsibility to act as a guiding compass by having the project as a whole in mind. All the sub-divisions, such as sales department, production department, and consults, have their own agenda and reasons to do things differently.

#### *The Process*

The project was divided into four sales stages, with the first containing approximately 20 apartments, and a total of two-three production stages. During the project design there was a large focus on apartment layouts, especially for the first sales stage. Because of this focus the project team had enough material to initiate the sales of the first 20 apartments as soon as the project design was completed while the rest of the project was still in pre-construction. The result of this is that the first pre-construction process is zero days and the total pre-construction is one of the shortest of all the studied projects. To release a small amount of apartments for sale is a tactical choice from the project

manager to get the project going and enter production as soon as possible, which was particularly important in this case. There were no major problems with the production, nothing unexpected happened. The ground conditions were not the most favourable, however this was expected.

## **Project 9**

It is located in the same geographical area and is a sister project to Project 8; Project 9 was initiated when the first project entered production, in the first quarter of 2010. It is the same project manager and the same project team as previously, with the exception of a couple of consultants, and the project manager was responsible for the project from start to completion. In total this project contained 131 apartments with the addition of two commercial premises, a basement and an underground garage, and it is the largest of the studied projects in terms of residential area.

### *Characteristics*

There were a lot of repetition from the preceding project but the target group was somewhat different, which resulted in slightly larger apartments. In hindsight the project manager feels that this project was unnecessarily similar to Project 8, they could have made changes and improvements to differentiate them more, without it becoming more expensive, but at the time the decisions not to do so felt effective at the time. According to the project manager this repetition is not common practise in JM, this is one reason why they have structured the project development process, and most of its sub-activities, so that they can effectively create different projects without copying earlier designs but still be effective. The project manager feels that the repetition made this project somewhat dreary and unchallenging, it felt like doing the same project all over again. It is the project manager's opinion that this affected the motivation negatively for the entire project team and production crew.

### *The Process*

The first sale stage in Project 9 was small, 30 apartments, just like in Project 8 and for the same reason, to start sales early in the project development process. And just like the previous project this resulted in one of the shortest total pre-construction lead-times of all of the studied projects. However, in retrospect they did not choose the right, the most sought after, apartments for sale stage one, and this resulted in a slower sale pace than expected and also forced the second sale stage on to the market earlier than initially planned.

During the part of the interview concerning this project the project manager further explained the tactic of an early, but small, sale stage. It is explained as a way of both testing the market and creating an interest. This allows for a longer total sales period as the pre-construction continues for the rest of the project, thus more activities in the process can run simultaneously. There are some things regarding this to have in mind and the project manager always tries to release the most sought after apartments in the first sale stage. It also requires the project manager and the project team to be allowed to set the date for the sales themselves. Furthermore, the benefit is faster time to market; however, it can create some minor complications for the production crew, with more and smaller production stages.

This project has the longest production time, however, according to the project manager there were no problems during the construction, the long time is rather explained by the scale of the project and the fact that there is a large basement and underground garage.

## **Project 10**

This project was initiated in 2010, and it is three residential buildings within a larger, newly developed, residential area. The building contains of 86 apartments and there is a garage in the basement. The project manager entered the project from the start of the Project Design. Furthermore this was project manager's first project at JM.

### *Characteristics*

The project had a detail plan that was more restricted than usual, for example, the number of floors, building aesthetics, amount of parking lots and gross area. Therefore, the project manager perceived the restrictions as if everything was decided on forehand. Further, the site had ground conditions such as decontamination and because the ground consisted of clay extensive piling was needed. There were also restrictions regarding water pressure as the building is located near water and the water level is expected to rise. Therefore the need for piles were high not only to prevent the building to sink but for it not to rise from the water pressure underneath. JM also used waterproof concrete in the basement for the same reason.

When the project manager looks back on the project the time requirements that were set should have been questioned. The reason for that they were not questioned was explained by the level of experience of the project manager, today he would have reacted. Further, the importance of time planning and especially to create a clear product directed to a clearly defined market in the early (project design) instead of rushing the project forward was highlighted.

### *The Process*

During the project design the project manager experienced that the specifications and restrictions made the process more complex and slow. Given that this was the first project for the project manager it went well and the relatively long pre-construction process is seen as reasonable because of the size and complexity of Project 10. However, it would have been preferable to use more time in the early phase in order to have a shorter pre-construction. When this project was executed there was a difference in the Project Run-through Before Sales, the pre-construction process did not need to be as finished as it needs to be today.

## **Project 11**

This was a reboot of another cancelled project and was initiated in the beginning of 2009. It is among the smaller residential building projects in this study and contains 42 apartments. The project manager took over the project from a colleague in 2010.

### *Characteristics*

During this time JM experienced a reorganisation with a new regional manager and a high degree of personnel left the company. The market at this time was, as mentioned before, not stable due to the financial crisis. Project 11 was started because the company needed to produce in order to keep the organisation somehow busy since JM did not have any projects on the market at this time.

### *The process*

The project manager is satisfied with the result of the project but underlines that during this period the operational system was not yet implemented and the products was just produced, there was more responsibility on the project manager and less control from JM. The lead times for this project is therefore not as compatible with the other project since the stage-gates and procedures did not exist as they do today.

## **Project 12**

This project was initiated in 2009 and is divided into four sales and production stages. Three stages have been completed so far and consist of one residential building with 29 apartments, 27 split level houses and six terrace houses. The current project manager joined the project between the completion of stage one and when the interior designs were to be made in stage two and three. There had been another project manager before but that person left the company.

### *Characteristics*

The first stage was the terrace houses and 17 of the split level houses; they were priced at a high price for the area but they all sold quickly. This was thought of as a good indication of the market interest, however when the second and third stage, containing the 10 split level houses respectively the residential building, was put up for sale the interest was low and it was a long struggle to sell all of the homes even though the prices were cut. Because of the sales problem the fourth and final stage was put on hold.

According to the project manager it is hard to explain what caused the sudden drop in interest in the area, one explanation could be that the financial crisis of 2008/2009 occurred and people in general became more careful of how they spent, and invested, their money. This was not the only project in the region that encountered problems and other property developers are experiencing similar situations. Furthermore, the area where the project is located is some kilometres outside of the nearest city thus a car is necessary for those living in the area. These reasons could explain why the interest and sales in the project stagnated.

### *The Process*

As mentioned above the original project manager was replaced when the project was in production and the fourth stage was put on hold due to lack of interest, in addition to this JM decided to close down the entire department who was responsible for the project and leave the market and the current project manager is the only one remaining. Because of this, and the fact that it does not seem like this project has followed a predetermined project development process, like the one examined in this study, it has not been possible to collect lead-time data that corresponds with our model or to JM's current project development process model.

## **4.2.1 Summary of Project Disturbances**

From the information gathered in the interviews disturbances that have affected the specific project processes has been identified and categorised. First it has been determined if the disturbance is of internal or external nature. The internal disturbances are conditions set by JM or effects of decisions made internally at JM while the external disturbances are unforeseen occurrences or consequences of someone else's (outside of JM) decisions. Furthermore, the disturbances have also been assigned to certain categories to make it easier to present and discuss the disturbances. In the two tables (2

& 3) below the project external and internal disturbances, as described in the project description above, are presented. The disturbances are categorised and associated with specific project(s), shown in the right column.

**Table 2: Summary of External Project Disturbances**

<b>Ground Conditions</b>	<b>Project</b>
Two basement levels beneath water level	1
Unplanned strengthening of underlying rock because of a misjudgement	2
Spots of quick clay	6
Water pressure, piles needed to prevent both “sinking and rising” of building	10
<b>Site Specific</b>	
Old industrial building made out of brick on the site. This was demolished and the brickwork was reused in the new building	2
Industrial building on site that had to be demolished and the ground decontaminated	3
Narrow construction site	5
The site was shared with two other contractors	5
Weight restriction for main transportation road	5
Exposed position near the ocean	3
More strict detail plan requirements than usual	10
<b>Market Conditions</b>	
Low selling pace	6
Unstable market due to financial crisis of 2008/2009	11, 12
The Pre-Construction process was restarted because of the financial crisis of 2008/2009	3

**Table 3: Summary of Internal Project Disturbances**

<b>Technical Issues</b>	<b>Project</b>
The use of prefabricated elements is uncommon at JM, this made the construction more difficult than usual	2
Some technical changes to the standardised house that affected living environment	4
Large basement and underground garage	9
The choice of shafts instead of a basement made the production longer	6
<b>Project Specific</b>	
Miscalculation of cost estimate and yield, which delayed the pre-construction	7
Too close and early collaboration with a modular house manufacturer	7
Architect got too loose restrictions with the layouts	3
Miscalculation of the selling-price, which prolonged the sales process	12
Did not choose the sought after apartments for sale stage one	9
Lower motivation because of unchallenging/repetition, both project team and production crew	9
<b>Organisational Factors</b>	
Small production organisation	3
Inexperienced production organisation	2
All the pre-construction managers were occupied, the project manager therefore assumed this role, which led to a high workload	2
Regional reorganisation at JM	11
Less control over the project development process from JM	11, 12
Internal criticism to build small apartments from the review committee	8
<b>Project Managers</b>	
Project managers was not involved with the project from the start	3
Two different project managers	4, 5
Three different project managers	7
Change of project manager, quit the company	12

## 4.3 Project Managers' View on the Project Development Process

This chapter describes the project managers' view of the project development process; displayed in the model in Figure 5 on page 16, in a chronological order. When the project managers were asked about the process, during the interviews, the questions concerned: why they think JM has structured the process, what the intranet operational system adds to their work, how they make time plans, how the workload affects project outcome, and how much of their time they spend on other things than work directly with the projects. In addition they were asked to speak freely about the model of the project development process, and at the end of the interview to add anything they thought was worth mentioning of the process. As a result of this method some of the stage-gates were not mentioned during any of the interviews, and thus neither are they mentioned in this chapter. The chapter starts with a description of what a project manager at JM is.

### 4.3.1 Project Manager at JM

During initial interviews with the project development manager (the project managers immediate supervisor) information about what it involves to be a project managers at JM was gathered. The role of the project manager within the studied region on JM is to have financial responsibility for the project and to lead a team of experts with different responsibilities. The team constellation varies throughout the project development process and depends on whose expertise is required. It is always the project manager who has the last word and decides over their projects, they also make their own time plans for all processes and activities. However, some resources are delegated and coordinated on a regional level, such as cost estimates, sales, interior design, and production. Traits that are premiered among the project managers are leadership skills such as to be driven, creative, structured, explicit, and to have a good knowledge of people. The main undertaking of a project manager is to delegate the work, anything not delegated the project manager have to do himself/herself. There is no generic model on how they should work; rather each project manager can perform their work in their own way. However, there are expectations on what they are supposed to deliver throughout the process and, additionally, there are stage-gates where certain activities have to be finished for the process to continue. To keep track of these stage-gates they have a operational system on the company intranet, this is a visualisation of the project development process and it contains supporting and governing documents. A governing document has to be approved and signed in order to continue with the process, i.e. a stage-gate, and this document contain the criteria for approval. Whilst a supporting document can be an example of how a project schedule can look like. Furthermore, it can vary from project to project where in the process the project manager becomes affiliated with the project. In some projects it can be as early as in the Acquisition Phase whilst in some it is when the Project Programme is created.

### 4.3.2 JM's Structured Project Development Process

When asked why they think JM structures the project development process the project managers gave quite similar answerers. The answers revolved around *predictability, clarity, control, profitability, achieving the right product, quality, and as a way to prevent the same errors to be made again. Predictability* was described as the ability to

predict what stage-gates will occur, when they will occur, what they require, and how long time the process will take. It is also a way to ensure an equivalent way of working among the project managers. This goes for *clarity* too; it should become a well-defined process so that it is well known what process will come next and who is responsible for what, such as customers, pre-construction or interior design. It is a tool to drive the process onwards; the stage-gates become a path to follow so that the project managers do not have to invent the steps for them themselves every time. The *control* is to make sure that governmental- and internal requirements are met and to keep track of the process along the way. *Profitability*, JM would ultimately not put the effort into structuring the project development process if it would not ensure yield. After all, cost control is important in a profit-making organisation. *The right product* has been achieved before; however, one project manager said that with a structured process this will be done faster and there would be a higher degree of certainty that the right product is achieved from the start. This is also linked to *quality* and the *prevention of making the same errors* more than once, as it becomes easier to identify if something has gone wrong and where in the process the fault occurred. Additionally, most of the project managers mention the structured project development process as a guide, and somewhat educational, for new employees and for persons that have not formerly worked with the project development process. During the interviews two of the project managers talked about the use of key numbers or cycle times, as used in production, as a way to structure the project development process and to help set the time plan.

There are mixed thoughts of the project development process and the strategic decision to structure it among the project managers. One of them thinks that it is an impressive feature, especially the level of details; for example, there are guidelines for how to work with the architect. As a result of this the project manager thinks JM produces residential buildings that appeals customers and eventually results in satisfied end buyers. As all activities throughout the process are defined a wish to also clearly define who or whom is responsible for each activity was uttered during the interviews. However, according to another project manager this level of detail can be an obstacle. The requirements can sometimes be perceived as internal discouragement, like there is too much control and bureaucracy from higher up in the hierarchy. In addition to the advantages some of the project managers also describe areas where caution is needed. According to one project manager it is not suitable to dictate exactly how each manager should work, there have to be room for creativity. However, it is favourable to orient the work around processes. Another project manager takes it one step further and says that with an experienced project team with skilled member a structure is not needed, the process will continue forward anyway.

During two of the interviews it was also brought up how and in what order the project development process had been, or should have been, structured. One of them argues that it was logical to start with the smaller parts, such as pre-construction, sales, and production as these sub-processes makes up for the whole project development process. Additionally, the project development process contains too much freedom and complexity to be structured, it is, for example, easy to predict how long time a concrete slab will take to cast but it is impossible to say how long time it should take for an architect to generate appealing floor plans and facades. While the other project manager argues that it would have been more suitable to start with the entire project development process as a whole and then break it down in its components instead of how it was done.

### 4.3.3 Project Design

This part of the process is where three of the project managers see opportunities and believes things can be changed, as it affects the rest of the project development process, and one project manager regards it as an unexplored area when it comes to time utilisation. It is also mentioned as the most exciting and engaging part of the project development process. Furthermore, this process is highly dependent on how much time other contemporaneous projects requires, it is easy to postpone the project design of a new project and instead spend time on an on going project. Additionally, the project design process is not as structured, or described in detail, as the other processes. For example, there is no guidance on how to achieve an architectural document from a project programme.

A lot of the work done in this process is of creative nature, such as to create layouts, to maximise the usage of the property according to the detail plan, and to name the project. It is an intensive period, however, much time is also dependent on the consultants. There are, for example, a limit on how much one can pressure the architect time wise and still expect a satisfying result.

Several of the project managers express a wish to have more time for this process, most of them agree on why this would affect the project development process positively and some of them have thoughts on how it should be done. One of the project managers say that the project design should not be extended so that it pushes the completion of the project further into the future; rather this process should be allowed to start earlier. The stated benefit of a longer project design is that the project has to be allowed to grow in this process, with a more well-defined project programme as a result. This would then lead to a smoother and faster work in later stages. Furthermore, the impact of changes that arise in the project development process depends on when they arise; the later in the process a need to change occurs, the harder it is to implement the change without time delays. This is also an argument for a longer project design, so that these kinds of changes occur as early as possible in the process.

#### *Project Programme*

If the Project Design is considered as one of the most important processes from a project manager's perspective, then the project programme is one of the more important activities. It is explained as where the project is set and there is a worry that if this activity is stressed the processes that follows will suffer and be longer as a result, and it is argued, as mentioned above, that if this activity is allowed to take more time lead-times further on in the project development process might be shorter, especially the pre-construction process. It is expressed that the time for the project design is too short today; if a reboot of a project is necessary it should be made in this process to save as much resources as possible. One project manager "head start" on this activity if the possibility is given, and this becomes a form of time buffer.

#### *Review Committee Review of Programme Documents*

The reviews in general are effective as they put pressure on the project team so that necessary documents are produced in time. Two of the project managers state that this review is well-situated, time wise, in the process. However, the result of the review is often presented too late, too close to the Project Run-Through Before Pre-Construction, in order to be able to edit potential change proposals. As a result, according to one of the project managers, this stage-gate often has to be postponed.



#### 4.3.4 Pre-Construction

The most important work for the project manager during the pre-construction is to be a part of the creation of sales material, as the operational responsibility for the pre-construction process lies with the pre-construction manager. Furthermore, it is highlighted as an advantage, from a project manager's perspective, to work with the same pre-construction manager from project to project. Two project managers express that this process is already kind of tight and as slimmed down as possible.

##### *Review Committee Review of System Documents*

This is often mentioned as a useful routine; however, there are some opinions on the kind of alterations and changes that the review committee demands. Sometimes it is perceived as the feedback from the review committee is based solely on opinions, and not on internal or governmental requirements. The committee should trust the project team's expertise when it concerns details of a particular project, for example expertise such as market knowledge, utilisation of the detail plan, and technical decisions. Furthermore, some of the required changes could have come in the earlier review, when the project programme was reviewed. This extends and complicates the process. This quite extensive review of the project system documents was introduced in a time when more control over the projects were needed but one project manager feels that it might be time to loosen it up a bit again.

The review is in the right place in the project development process but according to half of the project managers there is often too little time to implement the changes before the Project Run-Through Before Sale. A change at this time in the process often affects many things and might require the project team to redo parts of the pre-construction work, which ultimately risk the project to be delayed. It can also change the underlying conditions for the sales material.

##### *Basic Cost Estimate*

This activity's function is explained by one of the project managers as to control that the project is not too expensive to go through with. Estimated costs for the execution of the project are calculated, and if the cost does not correspond with the expectations this has to be corrected. However, as further explained, it is not in this process the cost of the project is set, much of the decisions that control the final cost is made as early as in the project programme.

Two project managers express that the Basic Cost Estimate is way too long, however, they have two different explanations for this. The first explanation is that more time is needed when the project programme is set, so that it can be more detailed. If it is more detailed it is easier, and hence faster, to make the Basic Cost Estimate. The second explanation has to do with altering power balances within the company. Lately the importance, and therefore the power, of the production department have increased. Because of this, they can assert more influence over activities they control, such as cost estimates, and as a result of this they have demanded more time for them. For comparison the basic cost estimate has previously been approximately about half of the eight weeks and was perceived as more dynamic, however, the project manager also recognises that it was previously of lower quality but thinks there could be a middle ground.

##### *Project Run-Through Before Sales*

For at least two of the project managers this is one of the more crucial activities, as they use it to determine the project time plan. The Project Run-Through Before Sales is by them looked upon as fixed in time, to get the date for other stage-gates they count backwards respectively forwards. Another project manager works with it in a different way, instead of viewing it as a fixed position the start of sales can be divided into several smaller stages. This pushes the first sale stage earlier in the process, so that more work, sale and pre-construction, can occur at the same time, hence shortening the project development process. This is also a way to test the market and the project manager in question always tries to start with the best apartments to create a desire on the market.

The use of sales stages is not uncommon among the other project managers either; it is a tactical manoeuvre that allows production to start sooner since there is an internal requirement that a fixed percentage of the apartments have to be booked or sold for production to commence. However, one should have in mind that when a project is divided into stages it should not be taken for granted that the whole project will be executed, as highlighted by the project manager for Project 12.

### **4.3.5 Production**

This is the process where five out of the six interviewed project managers says that they spend less time on the project, compared with previous processes. However, according to one of them there is a high degree of work just before the production starts; the project has to be pushed through many meetings.

Two of the project managers regard this process as a fixed date, which dictates the rest of the project time plan, in contrast to two of their colleagues, mentioned above, who uses the Project Run-Through Before Sales as a way to determine the project time plan. Another project manager says that this lead-time is dependent on how well previous lead-times have proceeded. Furthermore, one of the project managers perceives the production department as somewhat inexperienced and because of that needs more guidance from the project manager.

### **4.3.6 Summary of Hindrances and Improvement Proposals**

The table (4) that follow summarises hindrances and improvement proposals that has been highlighted by the project managers during the interviews; in other words, it is their own personal opinions. The table present the hindrances and improvement proposals in the same order as they have been mentioned in the text above. The hindrances are divided into categories to associate them with processes or activities in the project development process, when this is done it become clearer where in the project development process the hindrances occur.

**Table 4 Summary of Hindrances Identified in the Interviews**

<b>Hindrance</b>
<i>General</i> There is too much bureaucracy and some internal requirements are perceived as internal discouragement.
<i>Project Design</i> A large proportion of the time is dependent on consultants (e.g. architect).
<i>Review Committee Review of Programme Documents</i> The result of the review is delivered too late and too close to the Project Run-Through Before Pre-Construction.
<i>Review Committee Review of System Documents</i> Some remarks from review committee are perceived as solely based on opinions and not on internal or external requirements. Further, some major remarks could have been presented in earlier reviews (for example, review committee review of system documents)
<i>Basic Cost Estimate</i> It takes too long time (8 weeks) and is not as dynamic as before.

**Table 5 Summary of Improvement Proposals in the Interviews**

<b>Improvement Proposals</b>
<i>General</i> Clearly define who or whom are responsible for each activity.
<i>Project Design</i> Prolong the Project Design to create fewer problems in later processes with a faster process as the result.
<i>Pre-Construction</i> It is time efficient to work with the same pre-construction manager from project to project.
<i>Review Committee Review of System Documents</i> Loosen up the restrictions from the review committee, as this level of control is not needed anymore.
<i>Basic Cost Estimate</i> If more time is spent on the Project Design the programme documents can be more detailed, hence it should be easier and faster to make a basic cost estimate. Further, create a middle ground of how it used to be and how it is now.
<i>Project Run-Through Before Sales</i> Start early with a first sale stage so that more of the pre-construction and sales can run parallel.

## 4.4 Workshop

At first a brief presentation of what had been gathered during the lead time collection and interviews were presented for the project managers. This was to remind them of what the workshop was about and to get them into the right mind-set for the task at hand. During the workshop the five project managers and the project development manager were asked to each write down three internal and three external hindrances, as they perceive them, in the project development process. They then got to present their

individual hindrances for the group, after the presentation each project manager got three votes for each category, internal and external, and voted for the hindrances that they perceived as most important. A summary of these hindrances is presented in Table 5, sorted by internal and external. After the vote the group was divided into two smaller groups and the two hindrances in each category that got the highest amount of votes were discussed, with the goal to further define them and to come up with outlines for solutions. When the group discussion ended there were a final group discussion where the two groups presented their solutions. These definitions and solution outlines are presented in each category, internal and external, after respectively table with all the hindrances that were mentioned during the workshop.

#### **4.4.1 Internal Hindrances**

The internal hindrances presented below are those that were mentioned during the workshop. Further, the hindrances are sorted in the order of how many votes they got in the right column of Table 6, with the hindrance with the highest amount of votes first. In addition to how many votes they got it is also presented how many times each hindrance was proposed as a result of the individual work at the end of each hindrance description. The two internal hindrances that got the most votes are further described and a solution outline for each hindrance, created at the workshop by the project managers, is also presented.

**Table 6: Summary of Internal Hindrances from the Workshop**

<b>Internal Hindrances</b>	<b>Votes</b>
<p><i>Workload</i> In the perspective of the project managers other on going projects, as well as non-value adding activities, were mentioned. Furthermore, the coordination of several fully booked calendars of other managers was brought up as delaying factors. (Three project managers proposed this hindrance.)</p>	5
<p><i>Centralised Control</i> The perception was that many decisions regarding the project are taken higher up in the organisation than the project manager and to prepare internal presentations was mentioned as time consuming. (Three project managers proposed this hindrance.)</p>	4
<p><i>Cost Estimate</i> The scheduled time for the Basic Cost Estimate, eight weeks, was thought of as too long. Another aspect was that if it is a question of lack of resources. (Four project managers proposed this hindrance.)</p>	4
<p><i>Profitability Focus</i> The project managers discussed different managers' focuses and a common understanding of the profitability for the projects was requested. For example, the pre-construction managers with a technical focus may not consider the profitability first in decisions but a rather better technical solution. There were no uncomplicated view of it, since every position has its area of expertise, but rather that it would be perceived as the project team aimed for the same goal if the profitability were more present. (One project managers proposed this hindrance.)</p>	3
<p><i>Project Reviews</i> Both the subject of Internal Review of Programme Documents and the reviews conducted by the review committee was described as containing too much opinion regarding the project and that generates more deviation handling and discussions. It was also mentioned as a part of the increased centralised control. (Two project managers proposed this hindrance.)</p>	1
<p><i>Framework Agreements</i> The scheduled time for certain procured services were described as too long. For example, one new service needed to be ordered six weeks in advance in relation to prior when only three weeks were needed. All those time slots that need to be considered can create a longer project time. (One project managers proposed this hindrance.)</p>	1
<p><i>Creation of Apartment Layouts</i> The complexity of creating a well functioning layout that considers as much of the surrounding factors as possible is time consuming and can therefore not be rushed. (One project managers proposed this hindrance.)</p>	0
<p><i>Deviation Handling</i> There were different opinions regarding how complicated it was to apply for deviations. However, it is time consuming because the amount of deviations "needed" for every project was something all the project managers agreed about. (One project managers proposed this hindrance.)</p>	0
<p><i>Initial Cost for Land</i> When the cost for land is high it was in some cases perceived as a higher pressure on the project manager to make the total project profitable. (One project managers proposed this hindrance.)</p>	0
<p><i>Shortage of Production Managers</i> To change key persons during the project was perceived as costly because much knowledge is lost. In order to make that visible it was discussed as an option to raise the budget prognosis instead of "hiding" it within higher production costs. (One project managers proposed this hindrance.)</p>	0

### *Workload*

This is in many ways a matter of planning and as one project manager puts it: “I can do all the projects at JM simultaneously, each project will take way longer time, but I can do them all.” To be a project manager is an independent job and the project managers dictates over the time. However, it is up to each project manager and the project development manager to make sure that the workload is not too high. There have to be a balance, if there is too much to do it will affect the outcome negatively, as well as if there is too little work to be done. During the group discussion one project manager suggested that it should be examined how much time is spent on a project, by a project manager, during a year that is value adding, indirect value adding, and waste.

In connection with the workload the level of bureaucracy and administration was discussed. One project manager questioned if the top management at JM understands how much time it takes for all the project managers to prepare the documents needed for presentations and for project run-throughs. The argument was that all this time adds up to several million SEK each year. Further, the department of aftermarket was discussed as an area in which the project managers felt that they do not always make rational decisions because it is not as prioritised as questions regarding on going projects. Another aspect of after market is that the project managers have the responsibility for projects, which have been managed by project managers’ that have left the company.

### *Solution Outline for Workload*

One proposed solution was to take time and start with the Project Programme earlier than what is currently done to spread the workload over time.

The responsibility for questions regarding aftermarket could be transferred to one “project manager” at that department instead of being spread on the project managers. To give the aftermarket department more resources was argued to probably save money instead of the project managers not giving the problems their wholehearted attention.

To decrease the workload of the project managers a proposal was to hire assistant project managers, which then could manage more of the administrative work. This was however a brief idea and not developed much further.

### *Centralised Control*

It was mentioned that there is a strong connection between the way the project development process at JM is controlled and the high standard of quality. However, in addition to being rated as one of the major hindrances there were a number of arguments against this strict control. Most frequently discussed were the reviews, both the Review of the Programme Documents but especially the Review of the System Documents. It was expressed by some project managers that there is a dejected atmosphere surrounding the later. Even though the project have been thoroughly presented and reviewed in earlier reviews, during the Project Design, it could still result in a large number of remarks and objections. Furthermore, once again it was mentioned that the feedback from the Review Committee sometimes is based more on opinions rather than internal and governmental requirements. This view was complemented with the argument that the project managers in this region better understands the local market conditions and that decisions regarding this should not be handled centrally. In summary there was a consensus that the role and the power of the project manager is being reduced.

Regarding stage-gates in general it is perceived as there is a lot of them. However, as one project manager said, when someone is prompted with the challenge to name one document that is not needed throughout the process the result is often none. Another aspect of the stage-gate documents within the operational system was that they need a review since there are activities which appear too late in the process. For example, the choice to use a certain type of wall is mentioned in the document for Project Run-Through Before Production even though it affects decisions made earlier, the proposal is for it to be mentioned in the Project Run-Through Before Pre-Construction instead.

Who and how many attends meetings were also an issue that was raised during the discussion. It was questioned if meetings where the project manager presents the project are an effective discussion forum since it was perceived not to generate that much opinions or criticism that adds any insight. Further the outline of the meetings, which are connected to who is attending it, was discussed. The argument was that with fewer people a richer discussion would be facilitated.

#### *Solution Outline for Centralises Control*

First of all, since it is the project manager who owns each project and therefore is responsible for all the outcomes, financial included. It should be the project managers that have the final say when it comes to decisions that are based on conditions on the local market and on opinions.

Secondly, after some reasoning it was proposed that the last review, the Review Committee Review of System Documents, could be discontinued. The argument was that the earlier reviews could be more thorough, and that most of the remarks from the last review could have been highlighted in the first two. Furthermore, the last review is (should be) centred on governmental requirements such as functional measurements and safety regulations, and there are already other governmental systems, such as review of building permit, in place to make sure that these mistakes are not made. Most of the resources, from JM, should be concentrated on reviewing the project in the initial stages so that basic decisions, such as apartment layouts, are set from the start. To get more relevant input on the project the proposal to instead have a meeting where the project managers in this region discussed around projects were raised. Since they are active in the same market and have the same type of projects.

#### **4.4.2 External Hindrances**

The external hindrances presented below are those that were mentioned during the workshop. Further, the hindrances are sorted in the order of how many votes they got in the right column of Table 7, with the hindrance with the highest amount of votes first. In addition to how many votes they got it is also presented how many times each hindrance was proposed as a result of the individual work at the end of each hindrance description in the table. The two external hindrances that got the most votes are furthered described and a solution outline for each hindrance, created at the workshop by the project managers, is also presented.

**Table 7: Summary of External Hindrances from the Workshop**

<b>External Hindrances</b>	<b>Votes</b>
<i>Detail Plan</i> Requirements in the detail plan and to work with the municipality was expressed as time consuming and calls for patience. (Five project managers proposed this hindrance.)	6
<i>Competence Level of Consultants</i> Re-work because of a consultants mistake is perceived as too usual and the relationship to the consultants were discussed as too well/close. (One project manager proposed this hindrance.)	4
<i>Building Permits</i> The handling time at the municipality is perceived as long and the communication is not effective or consistent and opinions can be changes between the meetings. (Four project managers proposed this hindrance.)	3
<i>Noise Requirements</i> This was explained as unclear regulations, which was hard to understand even for experts. The forecasts were especially pointed out as a difficult area. (Two project managers proposed this hindrance.)	2
<i>Market Conditions</i> Factors such as the interest rate, financial market and purchasing power of households have an impact of the choice when to start the sale of the project. Thereby it also affects the time plan of the project. (One project manager proposed this hindrance.)	1
<i>Collaboration with competitors</i> When, for example, sharing a construction site additional communication is needed and each other needs have to be considered in the own schedule. (One project manager proposed this hindrance.)	0

#### *Detail Plan*

Many aspects of the work with the detail plan were discussed during the workshop, and even though most of this is done during earlier processes in the project development process it affects the processes that follows. Aspects mentioned were that the process with the municipality is slow and that it can result in plans that are too restrictive and hard to implement. One possible explanation was that they perceive the administrators to be inexperienced, which leads to that the conditions change between meetings since they have deliberated with more experienced colleagues. Further, the time plans from the handlers are often based on unclear activities, which cannot be said to start or end at a pre-determined date, such as the time period for appeals.

The project managers state that to work with a counterpart such as the municipality, which does not have the same view of deadlines and budgets, is frustrating. They perceive that the municipality continue to work until they run out of money and then they ask for more, the same goes for time, which is different from a private actor such as JM.

#### *Solution Outline for Detail Plan*

There were two solutions proposed on how to be more proactive regarding the detail plan. The first solution was to have one project manager that is responsible for each municipality or region, in addition to his or her regular responsibilities. In this way that project manager becomes well known in the municipality and is not “just another representative from JM”, which should make it easier to influence the detail plan



process. The second solution is to create a new specialist position at JM with the sole responsibility to work with municipalities and detail plans. However, this would reduce the overall responsibility of the project manager and that might result in that the project manager is less familiar with the project. Another fear was that this solution would make the role as project manager dull with less possibility to affect the project. In addition there was several project managers that stressed the fact that they find it exciting to work with the project during this process and that the project development manager partly has the role explained above.

In order to have a better collaboration with the municipality a proposal was to be clearer about what expectations they, as private actors, have on the municipality and also to ask for more detailed time plans and budgets.

#### *Competence Level of Consultants*

One aspect of this was that the relationships with some consultants might be so well established that it is hard to set demands and to negotiate, which can negatively affect the project as it is more comfortable to let a mistake slip than to confront. Another aspect was that when something in the consultants work is wrong it is first paid for when it is produced as blueprint, then if something turns out to be wrong during the production and the consultants has to investigate it at site, and then finally when it is re-done by the consultant. Further, the re-work for others, such as sub-contractors, is seldom paid by the consultants that have caused the fault.

The project managers also discussed the fact that different departments have different focus when decisions are taken or choices are made. For example, when discussing technical choices there can be a struggle between cost and perceived quality or a “good solution” instead of seeing different solutions in a wider perspective that together becomes costly for the project. This view was discussed as more natural for the project manager to have than for example a consultant since he or she wants to perform as well as possible.

#### *Solution Outline for Competence Level of Consultants*

It was proposed to exert more control over the consultants with financial consequences, the proposition was to clearly link costs of additional work performed by the sub-contractors to the changes (PM) made in the system documents because of consultant error. However, to perform this task would take up too much time for the project managers and therefore, it was suggested that this could be performed by the pre-construction managers as it is them who has the most contact with the consultants. In addition to this a regulatory framework for how to manage consultants and conflicts was requested. In addition the opinion not only to choose company but also to choose person when hiring consultants was stressed as a further way to extend the cost awareness perspective. Further, it was argued that cost awareness has to be stressed at all departments at JM.

## 5 Discussion

In this chapter the theoretical framework is used to discuss the findings. The chapter is structured around the three research questions. The first question connects and evaluates the value chain from the theoretical framework and JM's project development process. The second question revolves around the collected lead-times and what affects them, and the third and final question focuses on the identified hindrances and solutions in the project development process.

### 5.1 How Can the Value Chain Concept be Applied, With a Time Perspective, on a Construction Project Development Process?

This research question discusses the connection between the theoretical framework and the result. The starting point is therefore value, in a time perspective, followed by arguments to why the application is reasonable in this case and lastly an attempt based to apply the value chain concept on the project development process is shown.

Value is defined as cost in both Porter's (1985) value chain and in the process-oriented value chain (Yeo, 1991). The concept of it is seen from the customer's perspective as how much they are willing to pay for the product (Porter, 1985), which is problematised by Bejder (2004) where the companies net profit is lifted as value. To both have a process, which meets the customers' need and to create profit is expressed in JM's annual report (JM, 2012) but the margin is not shown in their value chain, Figure 4. One explanation is that the x-axis represents time, and not cost, but the yellow line expresses value but does not leave any margin visible. However, to focus solely on costs will not have as great impact on the process as shorten lead-times according to Josephson and Chao (2014), who argues that to reduce defects and shorten lead-times have a greater impact on the cost effectiveness than to just cut costs. The perspective of value therefore needs to be complemented with other aspects than cost, such as time, in the context of construction. However, Wandahl (2005) argues, that it has to be measurable to be of use for management and when considering Salvatierra-Gardio and Pasquire's (2011) objective attribute, time can be seen as a fact even though it could also have dynamic attributes and is thereby measurable. For example, the project managers perceived that the centralised control was needed before but now it has lost some of its value, to get an ad-hoc project development process under control, and therefore could be loosen so that there is room for creativity. Within JM, time is not measured in terms of lead-times in the project development process even though there is a value chain in place, and time could therefore not be seen as a prioritised value. This became obvious when the lead-times for the twelve projects and eleven stage-gates were asked for, there were a large variation among the projects in how many of the stage-gates that was possible to get a date for. In the end the collected data was enough to compare the dates for five stage-gates in ten of the twelve examined projects.

To break down the value chain as described by Porter (1985) there are especially two concepts to sort out in relation to the case company and time as a "new" value definition, first the strategically relevant activities and then the competitive advantages. The purpose of this is not to generate a certain number but to ask the right questions and visualising the value chain, as presented in Figure 7.

### 5.1.1 Strategic Relevant Activities

According to Chivaka (2007) it is important that the activities are connected to the strategy of the company in order to focus the company in one direction. The Structured Project Development (which aims at the three key statements: Leading Product Developer, Product Quality and Good Profitability) at JM connects the company with Rainbird's (2004) view of the process-based company since JM have process oriented their activities, as visualised in the operational system. In this research Yeo's (1991) project value chain and not Porter's (1985) manufacturing industry based value chain has been used since the construction industry revolves around projects with a start and end (Lundin and Söderholm, 1995) in contrast to the manufacturing industry's continuous manufacturing, and therefore move towards the strategic perspective.

When JM explains their value chain in the annual report (JM, 2012) the processes where the most value is created is in the initial phases, which corresponds to the Project Design and the Pre-Construction. If considered that the order in which JM have chosen to structure their processes; first pre-construction, followed by procurement, sales, production and finally project design, it is rather based on how much cost each process consumes and not on what activities they perceive contributes with the most value. There were different opinions during the interviews regarding the order of the structuring and the different activities in the processes, which are more or less easy to measure and predict. However, there is no guidance in the theoretical framework regarding where to start when evaluating the value chain, rather the importance is to actually do the evaluation at all (Porter, 1985).

JM's Structured Project Development creates a coherent process model, which according to Lindfors (2000) can increase the ability to control the projects. Further, a transparent project development process, as advocated by Lindfors (2000) as well, need an information flow in place both to optimise activities and to visualise which ones are creating value. In this sense the project managers have a key role to understand what information is needed and when it is needed in the project development process. As both Rainbird (2004) and Gertner (2013) argue it is not only the customers' expectation of value that changes, and creates a need for the company to adapt. In order to facilitate the profit the project managers', or other employees, perception of value adding activities in the process can change. There are examples both in the interviews and the workshop where project managers perceive certain stage-gates as internal discouragement and that it might have been needed once but that the conditions, over time, have changed. Chivaka (2007) goes further and points out that a company need to ensure that each activity contribute with more value than it costs, which in this study means that the required time input must be in proportion to the benefits that the activity creates. The question then is if the Structured Project Development, and all its stage-gates, has led to that? In relation to time there are at least three areas where this has been discussed: review of system documents, creativity and basic cost estimate.

#### *Review of System Documents*

To be able to measure the time that the review of system documents made by the review committee takes, sufficient documentation would have been needed. When the lead-time collection was conducted the date was asked for but the result was that this is not documented, one explanation is that it was not implemented in all of the twelve projects. However, the time it takes to discuss questions that regard the local market conditions

with the committee, which the project managers perceive as their own expertise and decisions, could be seen as not value adding. Since the perception that the committee overstep its duties may impact to what extent the project managers are prone to change the project according to the review committee's remarks. Even if a change would make it a more attractive product. From the project managers point of view this is a case of misalign goals where they and the review committee have different views of what the goal is with the reviews, which hinders the value chain from being well functioning according to Freeman and Liedtka (1997), Chivaka (2007) and Johnson et al. (2011). Further, if the value chain is not well functioning this results in a lower margin.

### *Creativity*

Creativity is seen as a trait that JM wants their project managers to have and it is described that they can perform their work in their own way. Further, the project managers would prefer more time in the Project Design because it is a creative process of producing layouts, maximising the usage of the property etcetera. The result of more time in the Project Design is explained as a smoother flow in later processes in the project development process to make them shorter. When it comes to the project manager's opinions with regard to the Structured Project Development there are positive features described when the other parts, than Project Design, of the process is in focus, but when it comes to the project managers own process it becomes more differentiated. Most of the project managers argued that it should be a creative, and thereby personal, process while one stated that it could be totally structured with the use of cycle times in the entire process, as in production. Consequently, there are basically two views of what to do with the project development process, either to loosen some of the control and allow more creativity or to continue and structure it even more. Or, there can be a combination where both models are allowed. However, if there is a contradiction to have one process for each project manager and at the same time be able to predict, control, achieving the right product and the other reasons for structure (4.3) then the question is: how much does the creativity cost JM? It might be that the creative freedom is not needed in JM's business concept of structuring the project development process or that it is crucial to deliver a product in line with the customers' expectations.

### *Basic Cost Estimate*

The Basic Cost Estimate is another control on the projects. However, one project manager stated that it is not here the budget for the project is set but earlier, in the Project Design. This activity has previously been shorter but of lower accuracy, however, it seem as if the project managers were satisfied with this result. There is in that case eight weeks, which are scheduled for Basic Cost Estimate, that JM takes to make sure the project is in line with economical measures but that is seemingly unneeded from the project managers' point of view. However, as Lindfors (2000) states the control improves the ability to shorten lead-times and cutting costs, which might be JM's, as an organisation, goal.

## **5.1.2 Competitive Advantage**

Differentiation and other aspects than the price of the product are highlighted by Betts and Ofori (1992) as a vital competitive advantage in the construction industry. JM have differentiated themselves by focusing their efforts on one product, namely housing properties. Because of that they have the opportunity to focus on one general project development process and continuously improve it. However, that also means that when the market decreases, for example in times of recession, so does the whole company

since they cannot start to produce, for example, roads. This also means that JM takes on a great deal of risk. In order for them to achieve that the focus is on quality rather than quantity. The aim of the Structured Project Development is to increase the margin instead of raising the prices. Further, it is described by JM that owning the total project development process is a competitive advantage, which means that the synergies in the vertical linkages as explained by Porter (1985) stays within the company and therefore can more easily be applied and as well “double” the profit because it is not shared.

### 5.1.3 The Applied Value Chain

Throughout the report different value chains have been presented: first that of Porter (1985), seconds the process-based Yeo (1991) and third JM’s own. To be able to do an analysis there is a need to interpret and adapt the value chain in regard of the available data (Hergert and Morris, 1989). In an attempt to do this, through a merger of Porter’s (1985), Yeo’s (1991) and JM’s (2012) own value chain, the value chain in Figure 7 was created.

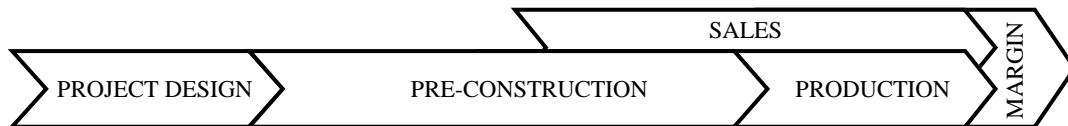


Figure 7: The Applied Value Chain

Figure 7 depicts a schematic value chain where the visual appearance of the processes, Project Design, Pre-Construction, Sales and Production, only represents a connection back to Figure 5. The reason that Pre-Construction has the double length was to create a symmetric model and has no other relation to the measured length of the process. The margin represents value with regard to cost and brings the connection back to Josephson and Chao (2014) where lead-times is a way to make the project development process more cost effective. Value could therefore be seen as a neutral concept when the process is viewed upon since the process will not vary regardless what kind of value is measured. Further, by focusing on either costs or time, as shown in this thesis, the margin could be increased or the price of the product lowered.

In this model there are no department that is responsible for each process in the value chain so that the focus lies on the processes themselves and not on who executes them, as described by Rainbird (2004). Further, the processes are arranged so that they follow the flow of the project development process, as recommended by Porter (1985), and they are the processes that contain the primary, productive activities in accordance with Yeo’s (1991) project value chain. When the process is regarded the view of JM and the theory does not differ, however, it is interesting to note that it is, in JM’s visualised value chain, the line representing how much value is created in the process that is named value chain, not the process itself. Further, the concept of margin highlights the fact that the processes should add more value than they take in order to be a profitable organisation. Even though that might not be the purpose of Figure 4 in relation to the theory it could be seen as a misinterpretation by JM.

The value chain with a time perspective does not differ in the embodiment because it is not in the view of the company, or project, that the differentiation lays, but in the perception of value. The model can therefore be applied but also evaluated since time is as measurable as money. However, as with money, the facts do not give the whole truth by themselves but further information is needed.

## 5.2 How Much, and Why, Does the Lead-Times Differ Between Construction Projects?

In the chapter that follows possible explanations of why certain lead-times, in the project total time compilation (Figure 6), stand out. As explained in the background (Chapter 1.1) there is not a large amount of studies conducted within this area of value chain and lead-times, which leaves some of the findings without theoretical explanation. However, the result from this section is in line with Josephson and Chao (2014) since a large variation in these lead-times is shown as is common among construction project in Sweden.

### 5.2.2 Project Design

This is the part of the project development process that has not yet been structured like the other processes (JM, 2012). There is an on going project at JM to do so, however, this has not been fully implemented in any of the studied projects. Furthermore, the project managers have mentioned this as the process of the project development process that requires the most amounts of freedom and creativity. This might be why this process has the largest relative time differences between the studied projects, as each project manager manages this process differently. To have six (the number of project managers) variations of one process is in contrast to Lindfors (2000) where one coherent process model is argued for when shorter lead-times are desired.

There are six projects that stands out when it come to the length of the Project Design, three that are long and three that are short. Project 5, 9 and 1 have significantly longer project design processes than average among the studied projects, and Project 2, 6 and 7 have shorter.

Project 5 is the project with the longest Project Design lead-time, 221 days, and it is also the project with the longest total project time. The project manager describes it as a project where no concepts of previous projects could be reused and, additionally, the construction method used, pre-fabricated elements, is not commonly used within JM. These reasons could in part explain why the Project Design is long as more time had to be spent to define the project and expertise on the construction method had to be gathered. However, there are no other factors that explains that this lead-time for Project 5 should be the longest; it is not the largest in term of residential area, neither is it the project with the largest amount of homes.

Project 9 has the second longest Project Design lead-time, 194 days, and the scale of the project can in part explain this. It is the largest, in regard of residential area, of all of the studied projects. However, the project was described as a sister project of Project 8 and that a lot of the same solutions was used. With this in mind one could argue that the Project Design should be more efficient and therefore shorter than that of Project 8, however, this is not the case. On the contrary it is almost two months longer. One internal disturbance was that the project was perceived as unchallenging because of the repetition, this could have affected the work with the Project Design. However, as much of the earlier material was reused this impact does not explain why Project 9 has a longer Project Design than Project 8. During the examination of the projects no other apparent factor than scale has been discovered that explains the long lead-time.

Project 1 is the most recent project and has therefore been through the latest iteration of the project development process, it has the third longest Project Design lead-time of 179 days. However, as this is only one project it cannot be concluded that this new iteration has affected the length of the lead-time. There has not been any internal or external disturbance that seems to have affected the Project Design in this project.

Project 2 and 6 has the two shortest Project Design lead-times, 48 and 20 days, but both can in part be explained by two factors. The first factor is that both projects are based on slightly modified project programmes from earlier projects. Project 2 was a reboot of a cancelled project and a large proportion of the same material was used for the design of the reboot and most of the changes regarded choice of technical solutions. Project 6 was basically a copy of Project 11 at the same site, hence most of the earlier material could be reused and, in contrast to Project 9, this has led to a shorter Project Design. The second factor concerns the way this process has previously been worked with, both project managers for these two projects says that it is not possible to work with the Project Design in the same way anymore. There are more requirements now as the Project Design has been more structured, and this takes more time. Furthermore, there are no external or internal disturbances for these two projects that affected the Project Design.

Project 7 has the third shortest Project Design lead-time, 49 days. A local senior association initiated Project 7 and there were a close collaboration with a modular house builder. The project manager stated that this close collaboration made it possible to generate the early material needed in the Project Design fast, explained as a vertical linkage by Porter (1985). However, it also had its drawbacks, as the regulation of the contract was inadequate but this did not affect the Project Design, however, it delayed the Pre-Construction process. There were no disturbances that affected the Project Design.

### *Conclusion*

There is not one explanation for the long and short lead-times that arises from the description of the projects above; it is rather a combination of factors. It seems, from the result of this study, that it is harder to find an explanation of why some of the Project Design lead-times are long than why they are short. Even though some guidance could be found by Lundin and Söderholm (1995) where construction is generally explained as repetitive but in Project 5 it was more unique, on the other hand that does not explain that Project 9 has the second longest lead-times but it is described more as repetitive than unique. The two shortest were a result of reuse of cancelled projects and it is therefore somewhat misleading to use these in a comparison of how long the Project Design should be. Furthermore, it has been harder to identify hindrances that have affected the Project Design lead-time, than for the other lead-times. This can be an indication that the projects are not as vulnerable at this stage of the project development process.

When this part of the project development process has been structured there might be a stabilisation in the length of this lead-time, which have support by Lindfors (2000) in the sense that increased control leads to the ability to improve the process. How long it will be on average can be affected by a number of factors, for example; how many requirements that has to be fulfilled, how extensive and how long the reviews will be, what size the project is, how high the workload of the project manager currently is, in what shape the market conditions are, and of how detailed the instructions on what to do

next is. If the most recent project, Project 1, is any indication of how long the process will be in the future it is slightly longer than the average of the studied projects.

### **5.2.3 Pre-Construction**

This is the first part of the project development process that got structured, finished in 2008 (JM, 2012). So if one benefit to have a structured process is to be able to on forehand say how long the process will be, as stated about structured production, then this should be manifested in the Pre-Construction lead-times. If this is the case the length of the Pre-Construction should have a correlation with the size ( $m^2$ , residential area) of the project. There are three projects, Project 3, 5 and 10, which stands out as long and four projects as short, Project 4, 8, 9 and 6 (see Figure 6).

Project 3 has by far the longest Pre-Construction 517 days, 139 days longer than the next project. It is also by far the smallest, in terms of residential area, of the studied residential building projects. However, four explanations, one internal and three external disturbances, of why the lead-time is so much longer than the other projects have been discovered in this study. These explanations are; (1) the project manager got involved in the project when the project programme already was decided, (2) the pre construction was restarted because of the financial crisis of 2008/2009, (3) the architect got loose restrictions for the creation of layouts, and (4) it was a ocean near location. The first (1) explanation was not mentioned by the project managers as a problem, however, it is more than likely that not all the knowledge of the project got transferred in the hand over. The second (2) explanation is the one with the most visible impact on the Pre-Construction lead-time as it adds 234 days of revision, this was an external disturbance that JM had little control over and the re-work was made to adapt to the rapid change in market conditions. The third (3) reason is mentioned by the project manager as an activity that could have been handled more time efficient and the final (4) explanation was something that also affected the early stages negatively according to the project manager. All these explanations add up to the longest pre-construction process of the studied projects.

Project 5 has the second longest Pre-Construction lead-time. However, in contrast to Project 3 no apparent explanations have been discovered. It is not apparent that the long Pre-Construction can be explained by the size (sixth largest) of the project, as larger projects, in terms of residential area, has been faster through this part of the process. The project manager could not come up with any reason when asked about it. However, the project manager took over the responsibility of the project when it had entered the sales process and might not have been fully informed about problems in the initial phases of the project development process. However, there are two external disturbances, site specific, which might have affected the Pre-Construction. The site was narrow and was shared with two other contractors; this disturbs the Production but has to be taken into consideration during the Pre-Construction too as it involves a lot of planning of how to execute the work.

Project 10 has the third longest Pre-Construction lead-time and when it comes to residential area it is the fourth largest. There were two external disturbances that affected the project at this stage: the strict detail plan and the planning of the extensive piling that was needed because of water pressure. The project manager explains that the long lead-time is reasonable as this was his first project at JM, and therefore was not as experienced of using JM's project development process and to handle the time demands, in addition to the size and complexity of the project.



Project 4 has the shortest Pre-Construction lead-time and is the fifth smallest project, in term of residential area. The project used JM's concept of standardised houses, this and the fact that it is small houses and not residential buildings could be the explanation to the short Pre-Construction lead-time. This project suffered two internal disturbances; there were a change of project managers in the pre-construction, during the sales, and changes of technical solutions in the standardised house concept. The second project manager highlighted that he could have saved some time in the process if he had known the reasons behind the decisions made earlier in the process.

Project 8 and 9 has the second shortest Pre-Construction lead-time, 210 days, in spite of being the third largest and the largest project. It was the same project manager for both projects, which are located in the same geographical area and are similar in appearance and execution. This project manager generally works with fast sale starts, which seems to shorten the Pre-Construction lead-time. One explanation of this could be that more activities in the sales and pre-construction processes can be carried out at the same time, with the result that the fixed percentage of sold/booked apartments are reached earlier in order for the production to start as soon as possible. However, there have also been disturbances that have affected both projects. Project 8 had to withstand internal criticism when they chose to build smaller apartments than what was usual; this meant that the project manager had to motivate this decision during the Pre-Construction. Project 9 had a large basement and underground garage, which is described as being time consuming. Furthermore, there were two more decisions that negatively affected the lead-time. First, the project manager chose, according to him, the wrong apartments to be released first on the market; this resulted in a lower selling pace than expected. Secondly, as a result of Project 9 being so alike Project 8 it became unchallenging, which might have resulted in a slower work pace according to the project manager. However, there were no external disturbances in any of the projects according to the findings in this study.

Project 6 has the third shortest Pre-Construction lead-time, 212 days, and is the fourth smallest project in term of residential area. This project is a slightly modified version of Project 11, and just like the Project Design some of the material from the previous project could be reused in the Pre-Construction too. There was one external disturbance that stands in direct relation to the length of the Pre-Construction lead-time: the low selling pace. As long as the fixed percentage of sold/booked apartments is not achieved the production cannot start. There were no mentioned internal disturbances in this project.

### *Conclusion*

There are smaller variations in the Pre-Construction lead-times than in the Project Design lead-times, with the exception of Project 3. This might be because the Pre-Construction has been structured for over ten years now. And it might be that this have created a certainty in the organisation of what is expected from this process and how long time it takes, this is further described by Betts and Ofori (1992) as vital for a construction company to survive.

When the projects with the longest and shortest Pre-Construction lead-times are examined more closely, with regard to size, no apparent pattern emerges. The longest lead-time belongs to the smallest project and two of the fastest lead-times belong to two of the largest projects included in the study, which is counterintuitive. This can be an

effect of that larger projects gets higher priority and is therefore assigned more resources. However, if the external and internal disturbances are compiled a pattern emerges. All three of the slowest projects have two or more external disturbances whereas all the fastest projects have none, with the exception of Project 6 that has one. This is summarised in Table 8 and accounts for all disturbances that affect the Pre-Construction lead-time. Furthermore, there is a preponderance of internal disturbances in the fast projects. From this at least two interpretations can be made, the first being that external disturbances, such as the financial crisis, has greater impact on the Pre-Construction lead-times and are harder to manage, and secondly that the internal disturbances do not seem to have as great impact on the process or that JM handles internal disturbances better than external. If this is the case it could be beneficial for JM to focus more on how to handle external disturbances when the projects of internal structuring is completed. On the other hand, it can be that the length of the lead-times is not always what is the most important, as in the case with Project 3, which became profitable even though (or because of) the long Pre-Construction lead-time. However, as this is a rather small sample group and, as mentioned above, explanations for this has not been found in the theoretical framework (Betts and Ofori, 1992, Lindfors, 2000, Josephson and Chao, 2014) it should therefore be viewed as tendencies rather than statistics.

**Table 8 Disturbances in long and short Pre-Construction lead-times**

Long Pre-Con.:	Residential Area (m <sup>2</sup> )	Nr. Of External Disturbances	Nr. Of Internal Disturbances
Project 3	2115	3	1
Project 5	6368	2	1
Project 10	7493	2	0
Short Pre-Con.:			
Project 4	4413	0	2
Project 8	7531	0	1
Project 9	8714	0	3
Project 6	3937	1	0

Another thing that is worth to mention is that how the selling pace can directly affect the measured Pre-Construction lead-time, if the sales are slow they will prolong the Pre-Construction process in this way of measuring. As the Production cannot start even if all the blueprints are ready, since a certain percentage of the apartments in a project has to be booked or sold for the production to be allowed to start.

## 5.2.4 Production

JM has put a large amount of time and resources on the production process since 2010 when Structured Production started (JM, 2012), the result has been described as a distinct process with a high degree of predictability through the use of cycle times. This process has not been the focus of this study but it has been included to get a holistic view of the process, to see what impact the initial processes has on the production process, since Josephson and Chao (2014) argues that if lead-times early in the project development process is shortened “too much” it can affect later lead-times, in this case the production. In the two previous chapters the length of the lead-times has been the unit of comparison, however, in this chapter this is complemented with the production pace (m<sup>2</sup>/day), Table 9, to present a more nuanced discussion. However, the production

pace should not be confused with JM's production tact times, the stated production pace is only used in this report to analyse the lead-times.

**Table 9 Production Pace** \*= no measurable production pace available

Project	Production Pace (m <sup>2</sup> /day)
1	*
2	11.4
3	5.17
4	10.1
5	8.14
6	6.17
7	9.06
8	10.34
9	10.56
10	11.18
11	*
12	*

There are two projects that have a long Production lead-time, Project 9 and 5, and three projects that have a short, Project 7, 3 and 4 (see Figure 6). Project 9 has the longest Production lead-time in the study, 824 days, however, it is not unexpected as it is also the largest project in terms of residential area and this results in the third fastest production pace, 10.34 m<sup>2</sup>/day. There has only been two disturbances mentioned for this project that have affected the Production lead-time, the internal choice to have underground garage and basement, and the fact that there were a high level of repetition from Project 8 was seen as unchallenging for both the project team and production crew. However, compared to other disturbances, such as the financial crisis of 2008/2009, these two can be seen as minor.

Project 5 has the second longest Production lead-time, 782 days, however, it is only the sixth largest project in term of residential area and this results in the third slowest pace, 8.14 m<sup>2</sup>/day. Although, in contrast to Project 5 it has three external disturbances that has been judged to have high impact on the Production lead-time, and one additional internal disturbance. The external disturbances are: a narrow construction site, the site had to be shared with two other contractors, and there was a weight restriction on the main transportation road. All these disturbances, or attributes, make the construction site more challenging and time consuming to work at. It is also disturbances that are, in this case, impossible to remove, however, their impact can be minimised with close collaboration with the other present stakeholders at the site. The internal disturbance is that there was a change of project manager during the Pre-Construction, when the sales had begun, and this can end up in all knowledge of the project not being transferred, and this can prolong or delay decisions as argued above.

Project 7 has the shortest Production lead-time, 389 days, of all projects and it is the third smallest, in terms of residential area, and in addition it is a project that consists of only small houses. This results in the fourth slowest production pace of 9.06 m<sup>2</sup>/m. The houses were developed in collaboration with a modular house manufacturer and JM only had a small production management organisation in place at the site, it was mainly

one contractor who performed all the work. There is only one internal disturbance that could have affected the Production lead-time, over time there were three project managers responsible for the project, and no external disturbances. As this is a project that consists of small houses it is not possible to compare it with a residential building project, because the complexity level is lower.

Project 3 is a residential building project in contrast to Project 7. It has the second shortest Production lead-time, 409 days, and it is the smallest of all projects. Even though it is a residential building it has the slowest production pace of all projects, 5.17 m<sup>2</sup>/days. There are three disturbances that have affected the Production lead-time, two external and one internal. First, there were an industrial building on the site that had to be demolished and the ground had to be decontaminated, this had to be done before the construction of the new building could start. Secondly, the ocean near location presented tough weather conditions and the project manager believes that if a tent for weather protection had been used the production would have proceeded faster, as it were now the building had to be totally weather proof for work on the inside to start. Third, the production organisation that worked at the project was small.

Project 4 has the third shortest Production lead-time, 437 days, and it is the fifth smallest project, this results in the fifth fastest production pace of 10.1 m<sup>2</sup>/day. The only disturbance that affected the Production was that there was a shift of project manager in the pre-construction, the second manager said that the rest of the project development process would have gone smoother if he had known the reason for some of the decisions made previous to his engagement in the project. The above descriptions are summarised in Table 10.

**Table 10 Disturbances in long and short Production lead-times**

Long Prod.	Residential Area (m <sup>2</sup> )	Production Pace (m <sup>2</sup> /day)	Nr. Of External Disturbances	Nr. Of Internal Disturbances
Project 9	8714	10.56	0	2
Project 5	6368	8.14	3	1
Short Prod.				
Project 7	3523	9.06	0	1
Project 3	2115	5.17	2	1
Project 4	4413	10.1	0	1

*Conclusion*

It shows in the description of the projects with the longest and shortest Production lead-times that it becomes misleading to compare only the length of the projects' lead-times, because small project become overrepresented. Instead, as stated in the beginning of this section, the production pace has to be taken into consideration to compensate for the size of the projects. When this is done Project 10 and 2 becomes the fastest and Project 3 and 6 becomes the slowest. However, even when this is done there is no apparent pattern in the distribution of disturbances that has been judged to affect the Production lead-time, as seen in Table 11.

**Table 11 Disturbances in project with slow and fast production pace**

Slow Prod. Pace	Nr. Of External Disturbances	Nr. Of Internal Disturbances
Project 3	2	1
Project 6	1	1
Fast Prod. Pace		
Project 10	1	0
Project 2	2	2

From the gathered data in this study it does not seem as the identified disturbances have any decisive impact on the production pace. For example, Project 3 has two major external disturbances in the demolition and decontamination, plus the ocean near location and this seem to have affected the production pace. Although, compared to Project 2 that also have some seemingly major disturbances, both external and internal, such as the dismantling and reuse of the old brickwork and the unplanned strengthening of the underlying rock, plus the perceived inexperienced production organisation. However, production pace wise it is the second fastest. It could depend on tactical reasons; it might be that as Project 3 was constructed during the financial crisis that JM wanted to keep their production crew occupied and therefore worked at a lower pace. However, this has been discussed in the interview with the responsible project manager. There are some obvious differences both in Production lead-time length and in production pace but no connection has been able to be made with the identified disturbances and available theory.

### **5.3 How Does Hindrances Impact Time Utilisation in the Project Development Process?**

In this chapter the hindrances, which have been discovered through the workshop and the interviews, will be connected with how they can impact the lead-times. Again, this is based solely on the view of the project managers and the purpose is to present possible points of improvements for the company based on the result and theoretical framework. An overview of those hindrances that have been frequently mentioned as well as some of those that has never mentioned will be discussed. Further, other factors, which have been visible in connection with time utilisation through out the case study, will be discussed as well.

Those hindrances that have been mentioned in both the interviews and the workshop, or have been mentioned by several project managers or scored high in the workshop are those that will be discussed further. Those have been selected because of the frequency in which they appear and this have been seen as an indicator of the importance for the project managers as an entity. It is therefore interesting to show that there are activities or stage-gates that are never mentioned:

- Internal Review of Programme Documents
- Production Cost Estimate
- Completed Construction Documents
- Approved Final Inspection

It could be an indication that these are perceived as either not critical or as they are free from hindrances.

### 5.3.2 Internal Hindrances

Regarding the internal hindrance *workload* the perceived loss of quality in the decisions, for example, in relation to after market questions is supported by Lindfors (2000) who argues that the focus is driven away from the value adding activities and instead intensifies the workload by stepping away from the strategy. One area that is mentioned to be somehow suffering if the project manager's workload is too high is the Project Design because in this early process the work is much of a creative nature. Therefore more time was expressed as a solution to be able to form a more complete view of the project. In the lead-time collection there is a slight tendency, which supports this argument in projects 4, 8 and 9. However, the sample group of projects is too small to draw any conclusions from because those projects that deviates a lot, because of extraordinary occurrences such as the financial crisis, has a large impact on the total compilation. If it is allowed to extend the Project Design there has to be close follow-ups from JM to ensure that this in fact does result in shorter lead-times further on in the project development process.

In connection with the workload it has been described that the project manager does everything that cannot be delegated. There could be a difference in what activities are perceived by each project manager as delegable or not. Further, when the description of a project manager is compared to the project managers' perception of why JM structure the project development process there are at least two statements (see Chapter 4.3), which are interesting and contradictory:

*“There is no generic model on how they (project managers) should work; rather each manager can perform their work in their own way.”*

*“It (the structure) is a way to ensure an equivalent way of working among the project managers.”*

There is a difference in how the project managers perceive their work, as a creative and personal way of working, and how they perceive the purpose with the strategic choice to structure JM's project development process. Either there is a feeling of decisiveness and “freedom” within the structure or it is perceived as two different things. Because when the internal hindrance *centralised control* was brought up in the workshop rather the contrary was discussed where the power of the project manager was perceived as being reduced. This could be a reason not to delegate as much of the work as the project managers could then get the feeling that they transfers even more of their control to someone else, and when they do not delegate their workload increased. Furthermore, there seems to be a difference in opinion between the project development manager and the project managers of how much power, or right to decide, the projects managers have over the projects. According to the project development manager the project managers have full control over their projects and it is always the project manager that has the last word and decision-making authority in the projects. This dissonance in perception has to be corrected so that the goals of each activity is well known by all of the organisation's members with a smoother process and a more efficient value chain as a result (Freeman and Liedtka, 1997, Chivaka, 2007, Johnson et al., 2011). The balance between all the preferable outcomes from a structure and then the negative aspects of reducing the project managers' power because of the control is not an easy task to manage strategically, which was as well recognised among the project managers. Further, as Betts and Ofori (1992) points out, construction is a management-intensive industry that

is dependent on the managers' ability to cooperate, and with the stakeholder perspective presented by Freeman and Liedtka (1997) it is important to have the project managers, as well as the other employees, on board. The structuring can only take the company to a certain point but there must be a plan how the project managers, as well as every employee, should work within this structure. This was something that was requested during the interviews by one project manager, to clearly define who is responsible for each activity in the project development process.

The internal hindrances are connected with the internal activities, which Hergert and Morris (1989) claims are unobservable in regard to how much value they generate. This could also be an explanation to why it during the workshop was brought up that it should be measured how much one year of a project manager's work was value adding, indirect value adding and waste because the perceived feeling of the project managers is that some activities create a lot of administration that does not add any value. According to Reimann (1989) and Patten (2008) a company needs to secure that the activities are prioritised in regard of resources because it could be indirect activities that are critical and therefore needs more resources, as it might be in the case of aftermarket, this means that it is not always a new employee or restructuring that is needed but it could be a question of time, which is needed in order to be able to perform an activity properly. There might be a need within JM to go through the stage-gates that exists to identify if the value it adds corresponds to the amount of time the project managers spend on administration, meetings and presentations.

The *Basic Cost Estimate* is perceived not as a hindrance per se but the time, eight weeks, is argued to be too long. One reason could be that the production department, which is responsible for the cost estimates, have gained more power through the recent years focus on the production and can therefore exert its influence and claim more time for this activity. It previously took four weeks and was more dynamic but was of a lower quality and it is of course a balance between how much time it takes and what quality comes out of it, or in other words time spent versus value added. Or otherwise the purpose of it needs to be clarified because then the project managers may not perceive it as too long if they could see the benefits for them. The limitation of this report to focus on the perspective of the project managers mean that it has not been further discussed with a cost estimator or other part of the organisation. The question could still be of interest if there is a middle ground that at least one of the project managers believes or if it is a resource question, which means that it is a critical issue. On the other hand the slot time of eight weeks does not affect the project in a way that it is paused, still if it took seven weeks the project might be able to proceed one week faster earlier which would be much time counting several projects together.

Another area that is of similar nature to the cost estimate is the *reviews*. This is because again it is perceived to take unnecessary long time and the outcome of it, in this case, is highly questioned by the project managers. It is perceived as some of the remarks are not based on internal or external requirements, but rather on opinions. The project managers feel that the value the Review Committee Review of System Documents adds is minor, as these types of requirements are controlled through other control mediums such as laws and regulations through building permits. There is also the opinion that some of the remarks could have been presented earlier in the Review Committee Review of Programme Documents, and the remarks could therefor had been easier to incorporate. There was even the suggestion to remove the last review entirely, this goes in line with Hammer's (2001) definition of a process that can be turned around and instead read as

there are no place for non-value adding activities in a process. It does not only delay the project development process to add controlling stage-gates that could be removed and still produce buildings with high quality but it also takes energy from the project managers, energy that could have been used to improve the process instead. Again it needs to be further discussed and clarified within JM what the purpose of each review is and evaluate if that is what is conducted in those today. If that is the case, then the purpose and value of the reviews have to be understood by all parties concerned.

### 5.3.3 External Hindrances

Even though the initial idea was that the *detail plan* procedure was excluded from the report it was later, during the workshop, argued that it has an impact on the subsequent activities and in the process overview presented by JM, Figure 4, it can be seen that the detail plan is worked with during both the Pre-Construction and in the Project Design. Therefore it was discussed during the workshop anyhow. Because it is not their own process but the municipality's it becomes more a question of how to handle the contact with the municipality. Further, the *competence level of consultants* was raised as another external hindrance which was partly explained by the fact that the same consultants is often used and that the relationship therefore becomes a bit too close in order for the project manager to demand or negotiate of/with them.

As both these hindrances have an impact on JM's project development process, with regard of time, it is of importance to discuss them further. The relationships between the project manager and the municipality or the consultant vary between the different project managers, of course, but they all have the same position and partly maybe the same struggle. This and the fact that the project managers had a lot to discuss during the workshop can therefore indicate that an arena for the project managers to discuss these types of issues, as well as any other issue, is needed. This arena could be something like the workshop held for the project managers and used as a way to transfer knowledge between the project managers about frequently reoccurring problems.



## 6 Conclusions and Recommendations

This thesis shows the applicability of the value chain concept on a construction project development process. Further, it gives attention to this research area as called for by (Betts and Ofori, 1992, Lindfors, 2000, Josephson and Chao, 2014). The change of the concept of value from costs to time generates larger impact on the process, than cutting costs, and thereby increase the cost effectiveness (Josephson and Chao, 2014). The characteristics of the construction industry that facilitates the applicability of the value chain is that the activities are repetitive (Lundin and Söderholm, 1995), and that the industry is project-based and therefore suits with the value chain model presented by (Yeo, 1991).

JM's strategic decision to structure their project development process is aligned with the theory in at least two ways; first it is a way to get control over the process, both cost and quality wise, as the coherent process model presented by Lindfors (2000) and second the processes chosen are of strategic relevance, which follows the initial meaning of the value chain concept presented by Porter (1985). It is obvious that the project managers can see the benefits with the strategic initiatives for all the processes that have been structured so far. However, they have a harder time to visualise it in their own process, however they have acknowledged the additional control that the structuring has brought, the Review of System Documents and the Basic Cost Estimates are two examples of this. Because the thesis is limited to the perspective of the project managers the purpose of the implementation of these activities have not been asked for. However, the goals of the organisation and those of the project managers have to be aligned to increase the effectiveness in the value chain (Freeman and Liedtka, 1997, Chivaka, 2007, Johnson et al., 2011).

The result of the comparison of lead-times shows that projects are not as vulnerable to hindrances in the Project Design as in other processes that follows. Further, a tendency that external disturbances have a larger impact on the pre-construction than internal was shown. However, the gap in the research area makes it uncertain to draw any conclusions (Betts and Ofori, 1992, Lindfors, 2000, Josephson and Chao, 2014).

If JM wants to build further on the value chain concept with a time perspective, to evaluate their projects and processes, then it has to be decided what lead-times are appropriate to measure, and in what detail (Porter, 1985). Furthermore, there has to be criteria for what a successful project is since there needs to be a clear vision of what is to be achieved. This is done to avoid the pitfall when lead-times are just shortened for the sake to be short, so that the processes is not rushed and corners cut with lower quality as a result (Freeman and Liedtka, 1997, Josephson and Chao, 2014).

Based on this study there are two areas that JM can develop to further improve the project development process and the work of the project managers:

*An arena for exchange of ideas and knowledge for the project managers, based on the workshop in this study it became apparent that many of the problems the project managers face in their projects, and in the process, are the same, but that they seldom have the time to exchange this knowledge between each other. The cooperation between the project managers could thereby be facilitated and further improvements in the project development process be made (Betts and Ofori, 1992, Lindfors, 2000). Through this*

arena the project managers can identify hindrances and solutions outlines together. The result from this arena should then be acknowledged higher up in the organisation so that the project development process can be continuously improved so that time can be better utilised throughout the process.

*Evaluate the current stage-gates and activities so that they contribute with more value than they consume* (Hergert and Morris, 1989, Chivaka, 2007), and if the activities do contribute with more value than they consume the goals of the stage-gates has to be clearly communicated to the project managers and the rest of the organisation (Lindfors, 2000). This could also be one way to ease the project mangers perception of centralised control and to clarify their control and responsibilities. Furthermore, if activities are found that does not add sufficient value to the end product then the project development process can benefit, time wise, from the removal of these stage-gates or activities. This creates a more friction-free project process, with less perceived hindrances, so that time can be better utilised to create value for the end customer and the company.

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