THE BUILDING SYSTEM AS A STRATEGIC ASSET IN INDUSTRIALISED CONSTRUCTION

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The growing industry segment within construction focusing on industrialisation, meet new challenges traditional construction firms never have encountered. The choice of a building system (technical and process platform) defines not only what resources and technology are needed, but also the organisation within the company, its market position, and possible growth. Using a resource-based view, the building system can be seen as a strategic asset for an industrialised construction company. In this paper, the characteristics of a strategic asset is identified and used to analyse two building systems as being a strategic asset at two industrialised construction companies in Sweden. Two companies participated in the case study, one specialised contractor and one more general contractor, both active in the housing segment. The building system is clearly a strategic asset in all aspects for the specialised contractor, while the asset for the general contractor lies more in the organisational power of the company than in the technical solutions. The company strategy should therefore differ. The specialised contractor should strive to clarify and strengthen their total offer to the client, while the more general contractor should continue to exploit its human resources, moving towards a more unique offer to their client.

KEYWORDS: industrialised construction, building system, strategic asset, technical platform, process platform

INTRODUCTION

The development of a more industrialised approach in construction has led to investments in firm resources for the companies involved (Lessing, 2006). They challenge the flexible and temporarily organised construction set-up by using production lines and tries to organise their production according to a more steady flow creating economies of scale (Gibb 2001). The investment in production equipment can be heavy, but the actual resource consists not only of physical equipment but also human capital and organisational knowledge (Grant 1991). The resource can be labelled a building system or a technical platform for construction. A building system is the method used to fulfil a need on the market and contains a physical solution to the problem, an organisation to sell, produce and deliver the physical solution and a continuous build-up of experience of the system in people and organisation (Söderholm 2010). Construction companies can own one or several building systems. Owning and nurturing one building system renders the company to be organised throughout to support its building system. This can also be a risk when looking at the market position, since agility can be important to meet market fluctuations.

By organising the firm according to an industrialised approach, the company tries to gain a competitive advantage implementing a strategy that no one else uses. In this case, the strategy incorporates organising business according to a building system. The building system is seen as a strategic asset for the company in this paper. To sustain the competitive advantage the strategic asset must be unique so it cannot be easily copied (Barney 1991). Even very small

differences can affect the competitiveness, thus it is very difficult to copy another firms strategic asset since it constitutes physical, organisation, and human ingredients. A strategic asset that creates sustained competitive advantage was characterised by Barney (1991) as an asset being rare, perfectly imitable, of high value, and non-substitutable. The aim of this paper is to describe the building system of two industrialised construction companies as a strategic asset and thereby gain knowledge on their competitive advantages.

THEORY

Junnonen (1998) concludes that the rapid change in the construction industry's business environment has made strategic thinking more important for construction companies. Construction firms have mainly focused on effectiveness in separate projects and not on long-term strategies (Price and Newson 2003). Construction can be characterized as a business with high uncertainty (Winch et al. 1998) and a dynamic technological environment (through changing technology in projects). This situation favours a strategy with organic structures (Burns and Stalker 1961) that are flexible and low in task specificity (Chakravarthy 1982). Furthermore, focus in construction firms is often the price sensitivity of the client. The construction firms are then likely to develop a competitor orientation (Zhou et al. 2009) instead of a customer orientation. The competitor orientation is negative for sustaining a market differentiation advantage (ibid.). On a business level, two factors govern success: (Porter 1981; Porter 1985) put forward the market position and environmental forces on the market, while (Mintzberg 1979; Wernerfelt 1984; Peteraf 1993; Hamel and Prahalad 1994) pointed to the importance of the internal resources. Hamel and Prahalad (1994) also stressed the connection between organisation alignment and market success, which was supported by Edelman et al. (2005) in examining the relationship between firm resources, strategy and firm performance. Small firms fit their strategies to their resource profile (ibid.). The environmental model of competitive advantage assumes that heterogeneity can never occur between firms because all firms have the same possibility to obtain any strategic resource others might have, since resources also are highly mobile (Barney 1991). In dynamical environments "superior profitability is more likely to be associated with resource and capability-based advantages than with positioning advantages resulting from market and segment selection and competitive positions based upon some form of 'generic strategy" (Grant, 1996), which favours the use of a resource-based view to understand how competitive advantage is sustained in construction.

From a resource-based point of view, the company's internal resources are as important as the market position (Flanagan et al. 2007). A firm can be regarded as a collection of resources and competitive advantage is created when these resources are utilized effectively (ibid). Resources can be both tangible and intangible: financial, physical, human, technological, reputation, and organisational (Grant 1991). Not all resources are strategic assets or critical resources (Flanagan et al. 2007). Rangone (1999) presents a method to identify strategic assets and quantify their link to the strategy in an SME. The resource-based view on core competence is valid in construction (De Haan et al. 2002) and identification and strengthening of strategic assets develops a firm's core competence (Flanagan et al. 2007). Wright et al (2001) describes the strong relationship between strategic human resource management and the resource-based view. Using internal resources to capitalise on core competence differs from fitting into a market niche and is referred to as market stretch (Hamel and Prahalad 1994; Johnson et al. 2008). The strategic assets support one or several of a firm's basic capabilities; the innovation, production and market management capabilities

(De Haan et al. 2002; Rangone (1999)). The firm-specific resources or strategic assets should meet the criteria of being valuable, rare, imperfectly imitable, non-substitutable and imperfectly mobile and gain their strategic advantage through being difficult for competitors to imitate thus creating heterogeneity and immobility as a competitive edge (Barney 1991), table 1.

Table 1 Characteristics of a strategic asset to create heterogeneity and immobility leading to a sustained competitive advantage

Rareness	**Imitability**
The asset is not common with current and potential competitors. Not common means that the no of firms possessing the asset is less than the no of firms needed to create perfect competition dynamics	The asset cannot be obtained by others. This could be due to unique historical conditions, a socially complex setting or a link that is causally ambiguous i.e. not easily understood by others (Dierickx & Cool 1989)
Substitutability	**Value**
The asset cannot easily be substituted for another solution. For a substitute to be an alternative, it must be both valuable and rare or non-imitable.	The basic condition for an asset is that it is valuable and exploits opportunities or neutralises threats in the environment. In other words an asset should be effective.

The characterization of the building system in Söderholm (2010) as not only being built up of a technological competence, but also of cooperative capabilities is recognized by Tyler (2001), who defines the cooperative capabilities as competencies in information processing, communication, knowledge transfer, intra- and interunit coordination, the ability to develop trust, and negotiation. As knowledge is integrated into the building system, communicating this knowledge to the client is a crucial success factor in tendering. Communicating knowledge and its value can be difficult and pose a risk (Ndofor and Levitas 2004).

METHOD

The empirical data is deducted from two cases in the Swedish building industry. The method of case study was selected for two main reasons (Yin, 2003). Firstly, strategic action in relation to a building system must be studied in its real life context. Secondly, this research is exploratory, seeking evidence of a strategic asset rather than hypothesis testing. The end goal is to develop a survey to characterise a strategic asset and the case study is used to generate preliminary data that can build up a questionnaire in a later study. Barney et al. (2001) suggested qualitative case studies as a method to empirically verify the theory of sustained competitive advantage in their retrospective of the development in research since the first publication of the theory (Barney 1991).

Problem formulation

The aim of this study is to describe the building system as a strategic asset thereby gaining an understanding of its competitive advantage. A building system can be managed in several

ways; it can be proprietary and integrated into one company or it can be delivered by a sub-contractor, thus more open and less integrated into a company.

Selection of cases

Two criteria were used to select the case study companies. Firstly, the companies in the study must support a building system and have this as their strategy to gain a competitive advantage. Secondly, the companies needed to have a differing strategy when it comes to integration of the building system into the company. A choice was made to incorporate two companies; Lumi: 'one company – one building system with large integration' and Noin: 'one company – several building systems with less integration'.

Data collection

Data was collected in several ways. Interviews and workshops were used in earlier studies to collect data on the design process of Lumi, (Jansson 2010; Meiling 2010) and on the interaction between design and suppliers of Noin, (Sardén 2005; Cigén 2003). Archival analysis of documentation of building projects and working processes were also studied for both companies. The studies of Noin were complemented with supplementary interviews during 2010 to update any changes in building system strategy since 2005. The data revealed information on the building system and especially the interaction between the client and the company when adapting the building system to a specific project. The data from these earlier studies were re-used in the current study to support the analysis of a strategic asset.

Data analysis

The data was analysed confronting the theoretical framework of a strategic asset with the results of interviews and archival material. The imitability, rareness, value and substitutability of the building system were analysed.

In describing the cases, the basic capabilities proposed by de Haan et al (2002) and Rangone (1999) were used; innovation, marketing and manufacturing.

THE CASE OF LUMI

Company market and strategy

Lumi produces multi-family dwellings made up of volumetric modules. Lumi is a family-owned company of moderate size, 120 employees. The annual turnover is about 45 M€. Lumi was originally a sawmill, developed into an ordinary contractor and has since 1997 directed its production towards volumetric elements only. Lumi specialises in multi-family dwellings and their strategy is to take wholesale responsibility of the client from sales to completed building. They operate on the market of professional clients only i.e. they never sell directly to individuals only business to business. Through their technical solution they are able to address 85% of the market segment of multi-family buildings in Sweden. Lumi integrates sales, design, production and assembly of the building into one company. Their vision is to become the best contractor in the Nordic countries delivering industrially produced multi-family dwellings. Their key strategy is to take full responsibility for the client and his requirements from sales through design and production, thus offering the client full liability during the building process. Lumi works with design-build contracts only. Lumi does not nurture more than one building system and the entire company is organised to support the self-owned building system. The numbers of competitors using the exact same building system is less than 5 firms, but on the Swedish market of housing more than 30 contractors are active. The building system is quite rare and provides an almost unique offer in its

particular market segment. Substitutes generally cannot offer such low lead times, which leads to fast return on investments for clients.

Capabilities

Product development

The company as adopted a Lean way of working (Meiling et al. 2010). In effect, this leads to mistakes being displayed and used as experience feedback for making continuous improvements. Product development is a gradual activity performed partly within building projects and partly in research and development projects. The company has a long history of working together with universities and research institutes. The building system is today robust as a result. The cost level of producing the building systems makes it possible to offer prices generally 5% lower than competing building systems. The lower cost level limit has not yet been displayed. Ongoing work is directed towards extending the possibilities of building higher buildings to embrace even larger markets and to address the increasing demands on energy efficiency. The personnel (7 persons) involved in product development and design ranges from technicians with no academic training to one associate professor.

Marketing

The sales department (3 persons) has during the last 25 years built up a large contact network with returning and potential clients. Lumi has signed long term contracts with one of the largest clients in Stockholm. The contact network creates a socially complex situation, difficult for other companies to copy. To enter very early in the conceptual phase of a building project is crucial for the success of a specialised building system, since design decisions affect the possibility to use the building system efficiently. The most optimal timing is to enter the building project even before the building permit is given. The sales department is the project leader for the building project until the contract is signed and also performs estimation. During the sales process, the design department assists with technical solutions. The individual clients often have alterations during the design phase and those are handled by the project leader for design, which takes over the project from the sales department. During design, it is important for the project leader to sustain the building system by informing about limitations and possible alternative solutions to alterations suggested by the client.

Manufacturing

The design department documents the requirements from the client on drawings and specifications. Parts of the factory production are automated and the design department produces computer files that control the nailing portal. The design department consists of a multi-functional team working close together. Between 5-15 building projects are concurrently active in the design process at the same time in different stages of completion. Factory production does not start until finished drawings are produced.

The size of the modules is typically 4 x 8 x 3 metres (w x l x h). They have a simple light-weight timber frame, which is completed with insulation materials and covered with sheathing. The modules are produced in the factory during 3-4 weeks. Interior finishing and installation services are made in the factory as far as possible. The modules are finished to about 90% when leaving the factory and then transported to the building site where they are assembled into 2-6 storey buildings. On site completions takes 3-4 weeks. The on-site assembly is accomplished by own teams specialised at mounting the building system. The site manager purchases materials needed to complete the project on site directly.

THE CASE OF NOIN

Company market and strategy

Noin produces multi-family houses, but also possesses a wide range of other production capabilities such as civil engineering and commercial buildings. Noin has international branches as well and is one of the four dominating contractors on the Swedish market. Noin is to be considered a large size company as defined by EU. The company consists of several division and can be seen as a corporation. Noin's vision is to be leading when developing future environments for living, working and communication. Noin operate on the business-to-business market and have professional clients as their customers. The ability to solve almost any problem the client would have is part of the company strategy, but lately Noin has begun to organise design and production in technical platforms. Those can be regarded as a building system, but with less investment in physical equipment. Noin can deliver almost any building the market desires. Noin has a history of being mainly a contractor, but the current movement is to integrate upstream to establish closer relationships with the client. Along that line, design-build contracts increase as do partnering projects and self-owned construction. Design can be made in-house, but just as often by external consultants. Noin works both on open-bid contracts and design-build contracts. There is also a division for property development, which sometimes acts as the client for the housing division. Noin sustains several technical platforms at the same time, one is the housing platform. Many other contractors on the market can deliver equal products as Noin. Their strength is their size, which enables them to have strong internal resources and thereby also highly competent personnel.

Capabilities

Product development

The building systems used by Noin are handled by a specialised division of technical experts. They are 130 persons in total and gather engineers, Ph.D:s and specialists from the entire corporation. The task for the product development team is to solve problems occurring in the building projects and perform product development work to support the building systems. Supporting the building systems must be done without actually controlling the production of the elements constituting the system. Therefore, much of the development is not focused on technical questions since these are handled by suppliers, but more on process questions i.e. how should the building system be communicated and sustained through conception, design, element production and on site assembly. Experience feedback is a current issue, since formal contacts between product development and production are non-existent. Noin are competent to run their own product development projects and engage in cooperation with universities only for long-term theory build-up. The high competence of the product development team creates a sense of security with the client, neutralising much of the uncertainties experienced in building projects (Winch, 2001). Noin is one of the most experienced contractors when it comes to passive and energy efficient housing in Sweden.

Marketing

Noin's contact network on the construction market is vast; Noin has offices in every part of Sweden and is almost always a contender in open bidding. They are often invited to place bids in building projects and are attractive as partners when developing new solutions together with clients. Due to the company's long history on the Swedish market (since the turn of the 20th century), it has a unique historical condition creating a socially complex situation. The building systems are not unique in technical solutions and many alternatives exist. Noin strives to create a competitive edge through streamlining design, thus offering a more predictable and cost efficient product. The lack of a sales department to nurture the

technical platforms makes the coupling between customer needs and technical solutions less obvious. Integration of such a function is currently not part of the company strategy.

Manufacturing

The basic technology for housing is prefabricated flat concrete elements, delivered to the site from a material supplier. The company does not own the factory where the elements are produced. Instead they could own the design process (in an open bidding) and the assembly process on-site. The assembly on site is Noin's core business and much of the organisation is designed to support work on site. Regardless of contract form, the work on site is supported by 3D-models, drawings and specifications. Virtual construction is increasing steadily at Noin and integration with the building site is within the scope for this particular development. The work on site is not automated in any way. On site completions for a housing project takes about 12 months and includes interior finishing and installation of HVAC services. Buildings can be constructed from two to at least 20 stories high using the building system for housing, but market demand seldom requires higher buildings than 15 stories. Purchase of materials is made by the site manager with strong support from the purchasing department where long term contracts are sealed with larger suppliers. At times, there is a conflict between the site manager who wants a certain material type and the purchasing department who wants the site manager to follow the signed contract for a similar material type.

CASE ANALYSIS

The analysis follows the properties of a strategic asset presented in Table 1. These properties should lead to heterogeneity and immobility in the market segment (Barney 1991), thus creating conditions for a sustained competitive advantage through owning a strategic asset, in this case the building system.

Rareness

The rareness of the building system is much higher with Lumi than it is with Noin. The building system that Lumi offers is only sold by a handful of other firms, while the parts to the building system of Noin can be bought from a material supplier. Lumi thus have a strong position in presenting a unique product offer. When it comes to production capabilities, both Lumi and Noin can be considered rare, but for different reasons. Lumi for their specialised production facilities and Noin for their highly competent on site personnel and great power due to company size, which guarantees the availability of extra resources should anything go wrong. The competence and versatility in production is the property that makes Noin rare, but this property is more suitable for building projects of a more challenging character, not standard housing projects. Examples where Noin's production capabilities provide a competitive edge in housing could be where foundation works are difficult, where the building height is large, or the building technology challenging or new.

Imitability

Lumi's building system is not unique in terms of the technical solution. Nor are the tools and machines especially advanced and could easily be copied. The strongest property is their contact network with clients, which creates the base for running the repetitive production. This contact network is socially complex to sustain and the lead time before a contract is signed can 1-3 years, including the client's own sales process with inhabitants. The salesmen are continuously in contact with current and potential clients, detecting new building projects even before they are formulated.

Noin's building system is just as easy to copy when looking at technology. The building parts used are not even produced in a factory of their own, but are bought on the open market. The strength lies instead in the unique historical conditions created during a century, gradually building up Noin as one of the top contractors in Sweden. Therefore, the experience of working with the building system is very difficult to copy. Experience on assembly is a core competence with Noin, which has on site assembly as its core activity. The gradual experience currently gathering with the product development department will further decrease imitability of the building system.

Substitutability

Lumi's and Noin's building systems could be substitutable for each other. Both offer value to the client, in Lumi's case combined with both rareness and low imitability and in Noin's case combined mostly with value. Many other options on building systems also exist. It is more a matter of what the client's preferences are than an actual choice based on measurable parameters. The clients often also consider their own experiences with the building system, using their own stock as a knowledge base (Engström and Levander, 2010).

Value

Both Lumi and Noin offer value to their clients, but the nuances of value differs between them. Lumi offers a turnkey deal taking full responsibility for the entire building process form conception to realisation. This might seem as a very appealing offer, but building clients are generally used to having great insight and many opportunities for changes during a building project (Engström and Levander 2010). Therefore, the specialised offer can with some clients create uncertainty and equivocality due to its novelty (ibid). The clients that are returning clients to Lumi perceive great value in the wholesale process and furthermore a good economical value due to a lower price.

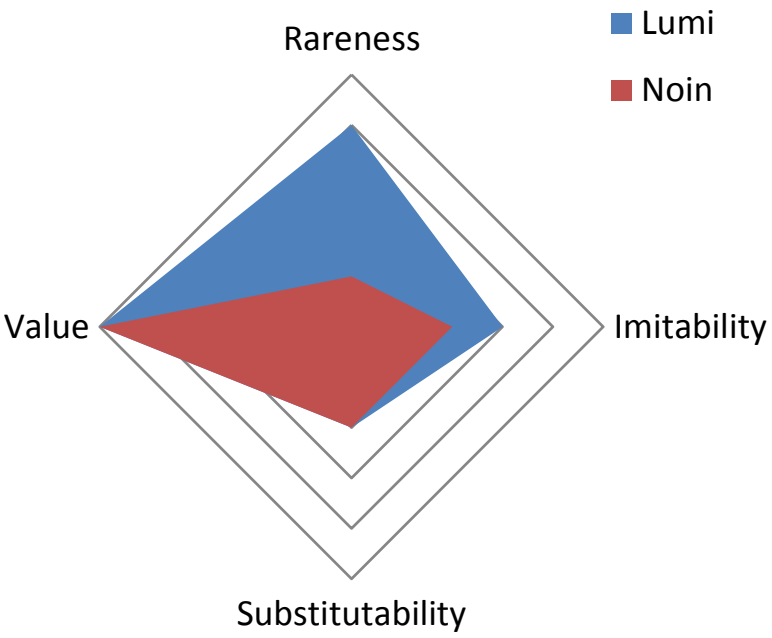
Noin on the other hand relies on the experience in production and the size of the company, providing a good security against situations where something unexpected happens. By Noin's possession of broad competence, they neutralise the threats or risks perceived by the client, being able to answer any question or any uncertainty the client might have. Noin's business model is more traditional to the construction trade, using general and design-build contracts as their main means to run projects.

CONCLUSIONS

The properties of a strategic asset were used to analyse the building systems of two different building companies, Lumi and Noin, figure 1. (Note that figure 1 is merely a graphical representation of the reasoning in the case analysis and not a quantified fact.) Lumi is a specialised contractor working with industrialised production of modules in an integrated building process with wholesale responsibility. Noin is a more traditional contractor currently organising their technical and organisation knowledge in technical platforms according to industrialised principles without taking the risk of owning their production facilities themselves. The specialised organisation and business model that support Lumi's building system identify their building system as a strategic asset. Their resources are directly aligned to support their strategy, which was identified as a factor increasing firm performance by Edelman et al. (2005). Lumi's building system, seen as a strategic asset, supports all the basic capabilities in an SME; innovation, production and market management (Rangone 1999). Lumi's building system is not only rare, but also difficult to imitate, and creates great value for the client. When it comes to substitutability, alternatives do exist and Noin presents one of

them. Noin's building system is not so clearly a strategic asset when looking at technology. The building system is not rare, it is possible to imitate, and a variety of substitutes exist. The value that Noin delivers to the client lies in their strong organisation and experienced personnel, which eliminates threats in the form of risks for the client. Strategic human resource management is shown to be part of Noin's strategic asset (Wright et al. 2001).

Figure 1: The four characteristics of a strategic asset for Noin and Lumi.



To further strengthen their human resources as a strategic asset, Ndofor and Levitas (2004) propose methods to communicate competence without disclosing the actual knowledge. The strategy for Lumi should be to nurture their uniqueness and work on communicating their building system to the client, while Noin should continue to exploit their human resources, but also focus on increasing their rareness in order to increase their competitive advantage. A proposal for Noin could be to expand their cooperative capabilities (Tyler 2001), which complement their technological competence, and become unique through process rather than product development.

Based on the comparative case study presented, a broader study is planned to further elaborate on the properties of a strategic asset in construction. The organisation of the companies could affect the maintenance of a building system to a greater extent than detected here. It could be interesting to match the identified strengths in this study against the communicated strengths by the companies to detect if their assets are exploited on the market. The strategies for manufacturing suggested by Winch (2003) could also provide basis for a deeper analysis of the strategic asset characterisation depending on the production strategy chosen.

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