

Design Investments in Small Wood Manufacturing Companies

*- Problems and Possibilities of Using
Design Expertise in Product Development*



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LICENTIATE THESIS

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Abstract

Previous research has shown that effective use of design by small companies can contribute positively to business performance and competitiveness. The Swedish wood manufacturing industry is facing intensified global competition. In many, especially smaller, companies the struggle for their survival involves an imperative to find new ways of development in order to increase profit. Design and product development are traditionally given low priority in many companies, but design investments are now seen as an important opportunity to create competitive advantages for small wood manufacturing companies. Until today, however, very little research has been published addressing product development and design in small wood manufacturing companies. The main purpose of this research was to document how small wood manufacturing companies invest in design and use professional design skills in product development. More specifically the objectives were:

- to examine how the product development process of a design project is carried out
- to identify success factors and problems occurring during the project process
- to compare company managers' and design consultants' perspectives on how they view the problems and opportunities of a design project.

The results are presented in three papers based on two multiple case studies of small wood manufacturing companies in Sweden. In the first study, presented in paper A, data was collected from nine wood manufacturing companies located in the county of Norrbotten. Papers B and C were based on the second study, which comprised four small wood manufacturing companies, located in the counties of Norrbotten and Småland, together with their associated design consultants. Data collection methods in both studies involved mainly semi-structured interviews complemented by questionnaires, an approach chosen to achieve both broad and deep understanding of each studied case.

The results indicate that using design experts in product development can be of importance for creating a competitive edge for small manufacturers if used efficiently. Design investments cannot be considered a guarantee for success, however, and it should be clear that small wood manufacturers, also ones of similar size and structure, face different needs for design and possess different competence to manage design effectively.

Product development processes were seen to depend widely on the existing conditions and hence vary from project to project. No formalized methods were used in the studied design projects and processes were managed more or less on an ad hoc basis. Limited resources concerning finances, personnel and design competence, together with a lack of planning and process structure, were seen to affect the project outcome negatively, whereas previous design experience, management by the designer when a company lacked experience, external financing, and a good relationship and tight communication between the company and the designer were identified as success factors.

Differences in project perspective, experience level, and starting points cause managers and designers to take different views on problems and opportunities occurring in a design project and therefore cause communication difficulties and affect project cooperation negatively. It seems that to get these perspectives to meet is a large challenge to achieve successful cooperation.

Preface

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Thesis

This licentiate thesis is based on the work reported in the following three papers:

Paper A:

Ekberg K (2004): *The importance of industrial design in small wood manufacturing companies*. Proceedings at Future Ground Design Conference, Monash Australia 2004, 17-21 Nov.

Paper B:

Ekberg K (2005): *Product development through design expertise – a multiple case study of design investments in small wood manufacturing companies*. Proceedings at VIII Nordic-Scottish Conference on Rural and Regional Development, Akureyri Iceland, 22-25 Sep 2005

Paper C:

Ekberg K (2005): *Diverse perspectives: A comparative study of managers' and design consultants' views on design projects in small wood manufacturing companies*

To be submitted

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1 Introduction

Industrial design has been identified by the Swedish Government as a key area for Swedish industry and especially for the small business sector. The Government has given the Swedish Agency for Innovation Systems, VINNOVA, the assignment to promote sustainable growth by developing effective innovation systems and funding problem-oriented research. In their vision for 2010, wood manufacturing is pointed out as a highly prioritized area with potential for economic growth.

Research has shown that effective use of design by small companies can contribute positively to business performance and competitiveness (Walsh et al 1992). According to Bruce and Potter (1995), investments in professional design expertise at product or project level involve relatively low risks and can yield substantial rewards by opening up markets and enhancing profitability. The Swedish wood manufacturing industry is facing intensified global competition. In many, especially smaller, companies the struggle for their survival involves an imperative to find new ways of development to increase profit. Design and product development are traditionally given low priority in many companies (Brege et al 2004), but design investments are now increasingly being seen as an important opportunity to create competitive advantage for small wood manufacturing companies.

Until today, however, very little research has been published addressing product development and design in small wood manufacturing companies. Most of the literature that can be found concerns large companies and is often focused specifically on the furniture industry (see for example Bumgardner et al 2001 Ratnasingam 2003). One exception is a study reported by Hovgaard et al (2004), which looked at innovativeness in 17 small forest products firms. Hovgaard found that the respondents did not engage in consistent, structured processes for product development and that product design was often determined by available production equipment and material costs. Moreover, they found that small companies need assistance in defining the scope of their business and innovation capabilities to enable increased development. The study by Hovgaard et al points to increasing interest in and need for more research in this area. The purpose of this thesis was to explore how small wood manufacturing companies invest in design and use design experts in their product development.

1.1 What is design?

Design includes a large number of activities and has a wide area of application. Confusion exists about what the term “design” actually means and refers to. Over the years design has been defined in numerous ways, and it is hard to find a universally accepted definition (Cooper et al 1995, Svengren 1995). Most definitions of design share three attributes, however. First, the word design refers to a process. Second, the process is goal-oriented. Third, the goal of design is solving problems, meeting needs, improving situations, or creating something new or useful (Friedman 2003). According to Walsh et al (1992), design is the activity that transforms a set of product requirements into a configuration of material, elements and components (see Walsh et al 1992). Design as an activity or process can be applied to several different fields within a company. Gorb et al (1987) identified four key fields where design can contribute to a company’s activities:

- *Product design*-concerns the conceiving, styling, ergonomic, structure, function and economic manufacture of products.
- *Environmental design*-includes architecture, interiors and landscape design.

- *Information design*- concerns design of communicative information, such as packaging and graphic design.
- *Corporate identity design*- integrates product, environmental and information design into total company image.

Product design is often defined as including both engineering design and industrial (aesthetic) design. However, there exists an important distinction between these two. Pahl et al (1996) describe engineering design as “applying scientific and engineering knowledge to the solution of technical problems and optimising the solution within the requirements and constraints set by material, technological, economic, legal, environmental and human-related considerations”. A definition of industrial design was posed by Monö (1976): “Working with design means giving form to mainly serially manufactured utility products to adjust them to man and her environment, i.e. to form and coordinate technical, economic, ergonomic, social and aesthetic factors in a system, with the main purpose of improving and strengthening a true perception of the actual, total value to the user and of increasing the profitability for manufacturers and marketers.” Monö’s definition might be considered complicated and somewhat out of date, but it clearly displays the multitude of elements included in industrial design work.

This thesis concerns design as an activity or process in the context of product development. Since the focus lies on development of industrially manufactured products, the terms design, product design and industrial design are used interchangeably throughout this thesis.

When a company contemplates design and development activities, three options are available according to von Stamm (1998): developing the design in-house, employing an external designer or design consultancy to develop the design, or using a combination of the two. Since small companies seldom have design expertise in-house, or even house a development department (Larsson 2001), they mostly come to rely on the use of external consultants. The fact that an organisation does not have these skills in-house does not necessarily mean that it does not undertake design work. A study by Walsh et al (1992) found that design activities would often be undertaken by someone without any particular design-related qualification. This is of course the case also in small wood manufacturing companies, but is not brought up for discussion in this thesis. The term “design investments” is used here in conjunction with the reasoning above, about a service bought from external design expertise, and applied in product development, most commonly in the form of a design project.

1.2 The effects of design

In times of fast growing markets, the range of products available is constantly growing, and the competition for customers’ attention is continuously increasing. Large demands are put on new products; they should be functional, easy to manufacture, and last but not least appealing aesthetically, something that points to design as an important tool for creating competitive advantage. As mentioned earlier, the Swedish Government has identified design as a key area for Swedish industry and especially for the small business sector. But is this a true assumption?

Numerous studies, reports and commentators have identified the crucial role that design can play in improving the competitiveness of firms (see for example Gemser et al 2001, Roy et al 1997, Design Council 2004), something that also applies to small companies (Walsh et al 1992, Bruce and Potter 1995). The definitions of how and what design contributes vary, how-

ever. Walsh et al (1992) observed that product design affects competitiveness through a number of factors:

- *Price* (affecting manufacturing costs and determining cost of use and maintenance)
- *Non-price quality* (affecting product performance, uniqueness, reliability, ease of use and durability)
- *Company image* (product presentation, display, packaging, promotion)
- *Delivery time* (affecting ease of development)
- *After sales service* (affecting ease of service and repair)

According to Svengren (1995), well planned design could increase the efficiency of product development, serve as a driving force for innovation, lead to more customer-adjusted products and make products easier to identify on the market. Even though these definitions point to a variety of positive effects, the benefits cannot outweigh the cost of design investment in every case (Gemser et al 2001). Accordingly, the specific benefits (or not) a company stands to see from an investment obviously vary from case to case and depend on the efficiency in the use of design.

To profit from a design investment, the process must be effectively managed (Bruce et al 1999). Design management is the planning and coordinating activity necessary to create, manufacture and launch a new product on the market (von Stamm 2004). According to Bruce and Morris (1995), the tasks and responsibility of design management include: selection and commissioning of design expertise, preparation of design briefs, and evaluation of design work and project management skills. These descriptions of design management are fairly simple and could be applied to design investments in small companies, but many definitions of design management in the literature are complicated (see Cooper et al 1995 for an illustrative example) and include tasks that go way beyond the resources of a small company. To avoid any misunderstanding, the term “design management” is used here according to von Stamm’s definition above.

1.3 The use of design in the Swedish wood manufacturing industry

The term “wood manufacturing” stands for the later stages of the value chain in the wood industry, and refers to the activities following on after the sawmill and initial refinement such as cutting, planing or fingerjointing. Wood manufacturing includes first and foremost development and production of finished components and systems in wood and carpentry. The definition of wood industry used in this thesis includes products from the following areas: carpentry (doors, windows, floors, interior decoration and kitchen), furniture (home furniture and public furniture) and wood components (strips, edge-glued panels, coffins, turned material, veneer and wooden boards). Wooden houses are often included in official definitions of wood manufacturing, but were due to largely differential market conditions excluded in this study.

Today, wood manufacturing constitutes a significant part of Swedish industry. The industry has nearly 35,000 employees and the annual turnover has been estimated at 48 billion SEK, of which furniture production accounts for about 20 billion SEK, and other wood manufacturing (including small houses, doors, windows, floors, kitchen, stairs, carpentry etc.) for 28 billion SEK (Brege et al 2004). Numerically the wood manufacturing industry is largely dominated by smaller companies. 84 percent of the companies have a turnover below 50 million SEK (Brege et al 2003). This percentage, however, only includes companies with more than 5 employees. Thus, if companies with 1-5 employees are added, the percentage will rise further.

With the exception of furniture manufacturers, design investments have traditionally been uncommon in the wood industry. Furniture design has, however, always taken an important position, and today Swedish furniture design is considered successful throughout the world. Despite great attention, unprofitability can be discerned among design furniture manufacturers. This is mostly not due to their ability to produce good design, but rather to a lacking ability to combine their competence in design with conducting business and handling production and/or relations with suppliers (Brege et al 2004).

By assignment from the Swedish Wood and Furniture Association (TMF), a study of growth and strategic development in Swedish wood manufacturing (excluding furniture) was carried out by Brege et al (2003). The study included 251 wood manufacturing companies with more than five employees and showed that design and branding in total (with the exception of furniture) has a hidden position in most branch segments. Exceptions were found in a few companies manufacturing kitchens and floors. As a part of the study, the companies were asked how much they spend on product development and design in relation to their turnover. These figures, on average for each branch segment, are found below in table 1.

Branch segment	Design & product development cost /turnover
Manufacturers of doors	2.6 %
Windows	3.8 %
Floor	2.3 %
Kitchen interiors	2.7 %
Stairs	1.8 %
Building components (small scale joinery of windows, stairs and floors through carpentry)	1.2 %
Interior Furnishings	3.2 %
Packaging	1.6 %
Glued laminated boards/gluelam	1.3 %
Mouldings and claddings	1.4 %
Other building components	2.0 %
Special products (matches, coffins, saunas, handicraft)	2.3 %

Table 1. Investments in design and product development in relation to turnover in branch segments in wood manufacturing (Adapted from Brege et al 2003)

These figures clearly indicate that up till now design has not been used to any great extent in wood manufacturing companies. In the report from TMF this is seen as a potential for large improvements, as a way of protecting companies against the increasing low-price competition (Brege et al 2003). Furthermore, the increasing environmental demands of today are seen as an important potential for wooden products. The hope is that environmentally conscious consumers will prioritise products made of wood over others (Brege et al 2004).

An analysis made by the Swedish Agency for Innovation Systems, VINNOVA, shows a large potential for development and hope for the future for Swedish wood manufacturing. Two weaknesses are, however, pointed out, which might affect the development and must be removed or evaded in order not to hamper the development: problems with changing from traditional values and structures and a generally low level of knowledge (Brege et al 2004).

1.4 Product development and design in small companies

Various definitions exist of what is referred to as small companies. One much used definition stems from the Bolton Report (Bolton 1971) defining small companies as being owner managed, financially independent and having a small market share. Another definition was made by the European Commission in 1996, dividing companies into micro- (0-9 employees), small- (10-50 employees) and medium- (51-249 employees) sized firms. In this study small is defined as a company with fewer than 50 employees, but no distinction between micro and small is made. Furthermore, the studied companies are all owner managed and financially independent. Although small companies differ a lot from each other, there are aspects that differentiate them from large companies. This is the reason why small companies often need to be treated differently and hence studied separately. Culture, influences, resources and ambition are critical differences according to Bridge et al (1998). The special circumstances that apply to small companies naturally affect their work with product development and design. The specific conditions relevant to this issue and their significance will be discussed further in the following subsections.

The impact of limited resources on small firms

Limited resources are often considered a barrier for small companies. This is particularly highlighted when it comes to activities such as product development and design. Design is a long-term investment demanding money, time and competence to pay off, assets that small companies are often short of. Comparing small companies to large ones, it is clear that small firms have less capital, net assets and reserves than larger firms have (Storey 1994), which naturally affects their ability to invest in new projects. Limited finances also enhance the importance of prioritizing in the right way, and small companies often worry about the cost of consulting a design expert, due to what they consider an insecure commercial outcome (Bruce et al 1999). In a study of innovation in small forest products firms, Hovgaard et al (2004) found that limited resources often prohibit small companies from implementing consistent, structured innovation practices. Managers find themselves in a day-to-day survival mode and struggle to plan product development strategically. It seems that limited resources force companies to prioritise acute problems over long-term investments such as product development and design.

Another potential resource problem for the small company lies in the limited number of staff. In large companies with many divisions the problem can be to find efficient ways of cooperating and letting everyone contribute their part to the product development. In small companies the situation is rather the opposite, since there is often only one person in the management role – the owner, who embraces all aspects of management (Rantakyro 2004). Because of the limited number of personnel, there is seldom a product development department (Larsson 2001) and the responsibility for product development is left with the manager alone. Research has shown that, to fully exploit the design expertise, the company needs to possess good management skills (Bruce et al 1999), something that creates a potential problem in this context. With the owner also being the manager, the firm becomes very dependent on the skills and experience of one individual. If the manager cannot find the time or does not possess the right skills, the integration of design might not succeed.

The importance of attitudes and design awareness

The literature includes many arguments in favour of the importance of attitudes towards design among company management and personnel in order to succeed with an investment. Von Stamm (1998) argues that the way design is perceived and valued in a company, i.e. the company's design consciousness, influences the way in which design is used and consequently

affects the outcome of an investment. With this focus Fairhead (1988) identified four different levels of design understanding: design seen as styling; design as being about better products; design as the interface between company and audiences; and design as being an integrated process (see figure 1). The same levels were later on used in a study of the use of design in Swedish companies (QNB 2004) in order to investigate the profit from design investments. The results showed that companies with a high design understanding had a more profitable development. This implies a potential difficulty since small companies often view a focus on design and development as a luxury that they can do without (von Stamm 1998). In the wood industry, strong traditional values and structures together with a generally low knowledge level (Brege et al 2004) might also be an obstacle to a high design consciousness in small wood manufacturing companies.



Figure 1. Levels of design understanding (adapted from Fairhead 1988)

Strategies mean better design?

Strategies, both on a company level and more specific development strategies, have been found beneficial in product development work and are considered an important tool for specifying the aim, focus and structure of a company's product development projects. The importance of using strategies is emphasized in several studies that point out that design is better used if it is incorporated in the company's business strategies and not only applied to product development (Blaich et al 1993, Brazier 2004). Small companies however often lack formal company strategies and innovation is generally spontaneous, sporadic, and related to solving current production problems (Rantakyro 2004). Without a defined strategy or long-term development plan, the aim of each development project must be decided separately and hence have a greater risk of failing because of a wrongly defined focus.

Does the context matter?

There are a number of external factors that are out of control of a company and that can affect the success or otherwise of a new product. Cooper et al (1995) define these as: the economic climate, the market, environmental issues and factors intrinsic to the industry. The economic climate affects the ability of the consumer to buy the developed product. The market in which a company acts and the competition on that market provide the prerequisites for succeeding in launching and establishing new products. Due to their limited size, small firms can very seldom "set the rules of the game" on the markets where they operate. Their bargaining power is smaller compared to that of larger corporations, and their financial back-up for creating a market demand through massive investments in marketing is more limited. Environmental issues, including environmental legislation, are today important issues for the acceptance of a product in the market and also work as a determinant of costs for design marketing and manufacture. Product success factors operate in many cases over a number of industrial sectors, but

some features of new product development are intrinsic to a specific industrial sector and must be taken into account. In the wood manufacturing industry this might mean that it is easier to find market opportunities for design of product categories where design is limited today. Finally, the outcome of a design project may also be influenced by a company's geographical location, which affects its access to customers, material and trained personnel, freight-costs and possible cooperation with other local companies.

Using the right external designer

The resources and skills of the external designer have a major influence on project outcome, since the quality of the design work is an important success factor (Bruce and Potter 1995). The acquisition of design skills that are appropriate for the creation and implementation of new products may however be risky. Not surprisingly, many small companies consider it too expensive to consult designers and consider it difficult to find the designer that is just right for their company (von Stamm 1998). Today there is a large choice of design suppliers available on the market and both high quality and poor quality design suppliers exist side by side. Often the price rises with increasing experience and reputation, which limits the range of choices for the small company. What skills a designer should possess has often been debated in the literature. NEDO (1993) identified a number of competencies a designer should ideally combine (see table 2).

Design Competencies

- Objective creativity
- Technical
- Colour and Conceptual Design

Business Orientation Competencies

- Organisational, planning
- Problem solving
- Commercial skills

Driving the Process Competencies

- Commitment, enthusiasm, self-confidence
- Results orientation
- Team orientation

Perspective and Framework Competencies

- Gathering and using information
- Strategic thinking
- Consumer/customer focus

Interpersonal Competencies

- Builds relationships
 - Presentational skills
 - Flexible
-

Table 2. Competency model for designers (adapted from NEDO 1993)

The selection of design skills is naturally dependent on the specific assignment, and to find the right designer, the design buyer needs knowledge to evaluate and decide what expertise is appropriate, something that can be very complicated for the small company (Bruce et al 1999).

The development process as a key to successful design projects

The issues discussed in the sections above all describe input factors to a design project. These factors together create the base for what is the centre of a design project, namely the product development process. The product development process involves all the activities and decisions from idea generation to product commercialisation and the efficient execution of this

process is often considered the greatest success factor of design projects (see for example Hart 1995). From the literature three factors can be seen to be of major importance for the efficiency of the product development process: the activities involved and their performance, the organisation and management of these activities, and finally the communication and relationship between the company and the external designer.

Different activities have been highlighted as being the most critical in the literature. Bruce et al (1999) point out sourcing (as discussed above), briefing, and evaluation to be of utmost importance. Well performed briefing is essential to enable the designer to get a true picture of the company's needs and resources, and should provide answers to the questions who, what, why, where and when. According to Cooper et al (1995) a design brief should contain the following information: background of the company, the design problem, design specification and product attributes, consumer and market information, costs and budgets, and time-scales. Some of this information might not be clearly comprehensible to the small firm and it is no surprise that briefing is often bypassed by small companies (Bruce et al 1999). However, unless the designer finds another way to retain this information, this might induce development problems. Finally, evaluation of a finished project is important for governing future learning and improving future projects, but according to Rantakyrö (2004), evaluation and documentation are activities that are easily overlooked by the small company.

The management and organisation of the activities in the project process and the people involved are often considered critical for reaching a successful design outcome. To enable a structured and well-performed product development process, companies are often recommended to follow a structured process model (see for example Ulrich and Eppinger 2000 or Bruce et al 1999). Small companies tend, however, to have limited knowledge and experience of working with established development methods, and product development is therefore performed without following any consistent, structured processes (Rantakyrö 2004, Hovgaard 2004). As mentioned earlier, studies have shown that companies need good management skills to fully exploit the use of design experts, something that can be difficult to achieve for the small company. This exemplifies the common view that project management is a responsibility solely for the company. But according to Brazier (2004), the failure of design projects in small companies can often be ascribed to management shortcomings both on the part of the business and on the part of the designer.

The relationship between the commissioning company and the design consultant is often of a personal nature and is affected by personal chemistry, mutual trust and respect and understanding each other's language (Bruce et al 1993). To succeed in a design project it is vital that the designer captures and is able to express the company's spirit and identity. Good personal chemistry allows the designer to fully grasp what the client really wants and to see the more invisible core competencies and resources relative to customers and competitors (Bruce and Morris 1995). Mutual trust and respect allow both parties to recognise the other's abilities and enable specialist opinions and knowledge to be passed between company and designer, which is crucial for attaining effective design solutions (Bruce et al 1993). Since the designer must be able to interpret the needs and concerns of the client in order to create an appropriate design, it is important that the company and designer understand each other's language. To create a well working relationship is however not so easy. According to Jevnaker (1999), a great dilemma of the design/business relationship is that it is diffuse, uncertain and asymmetric due to knowledge gaps concerning the other part's competence field and diverse perspectives on design, its use and strategic importance. The discussion above reveals that small companies and in particular small wood manufacturers in general display a narrow view of

design and little knowledge of the field, something that would hence complicate communication. Overcoming these relational problems often takes time and can be hard to achieve when engaging an external designer for a one-off purchase (Jevnaker 1999). However, a long-term relationship with one designer may be a way of overcoming these problems and building up well working cooperation (Bruce et al 1993).

2 Research objectives

Due to the lack of research **in** the area, the overall purpose of this research was to describe and analyse how small wood manufacturing companies invest in design and use professional design skills in product development. More specifically the objectives of the research were:

1. To examine how the product development process of a design project involving a design consultant is carried out.
2. To investigate problems occurring during the process and identify success factors.
3. To compare perspectives of company management and design consultants, to see whether they share a common view or display different experiences of the process, problems and opportunities.

The research presented in this thesis is based on the work presented in three appended papers. Paper A deals with the main objective, but also touches on objectives 1 and 2. Paper B elaborates objectives 1 and 2, and paper C objective 3.

3 Research methodology

The findings presented in the three papers appended to this thesis are based on two multiple case studies of small wood manufacturing companies in Sweden. Table 3 depicts the relationship between the three papers, the two studies and the research objectives. Paper A focuses on the overall research objective and draws upon the results of the first case study. Paper B focuses on the first and second specific research objectives, paper C on the third specific objective and both paper B and paper C are based on the results from the second case study. This chapter describes the research process and methodology used during the two case studies, starting with a short discussion of the chosen research approach.

Study	Paper	Research purpose
Study I: empirical study of nine companies in Eastern Norrbotten	A	Overall purpose: To document how small wood manufacturing companies invest in design and use professional design skills in product development
Study II: empirical study of four companies in Eastern Norrbotten and Småland	B	Objectives 1+2: To examine how the product development process of a design project involving a design consultant is carried out. To investigate problems occurring during the process and identify success factors.
	C	Objective 3: To compare perspectives of company management and design consultants, to see whether they share a common view or display different experiences of the process, problems and opportunities

Table 3. Relation between appended papers, research objectives and studies

3.1 Research approach

The purpose of research is to generate knowledge. This knowledge is gained through reading, discussing and investigating. The result is dependent on the strategy and methods used in the research process, which hence should be carefully considered by the researcher. According to Yin (1994), three conditions should influence the choice of research strategy:

- Type of research question.
- Extent of control over behavioural events.
- Degree of focus on contemporary events as opposed to historical events.

With little research available in the field of interest of this study, the main purpose of this study was to explore and describe the phenomenon of design investments and the process involved in a design project, in the context of the small wood manufacturing company. Case studies are often used when there is a need to develop a deeper understanding of a complex phenomenon. A case study approach is especially useful when the boundaries between a phenomenon and its context are not clearly evident (Yin 1994), and when the focus is on the process rather than the result (Merriam 1998). A case study can be used for exploratory, descriptive or explanatory purposes, and this research strategy is preferred when investigating a contemporary phenomenon in a real life context and when the purpose is to search for answers to how- and why-questions (Yin 1994). Based on the reasoning above, the case study methodology was considered to be an appropriate research strategy both to fit the overall purpose of the thesis and to find answers to the questions incorporated in the stated research objectives.

Case study research is also suitable for the abductive approach that was used in this study. Abduction is often described as a combination of two research approaches: induction and deduction. Induction may be described as going from the particular to the general and has its starting point in empirical observations. Deduction then goes from general to particular and begins with an explicit theory or model that is empirically tested. Abduction departs from empirical facts, like induction, but does not avoid using theoretical frameworks. The empirical work can be combined with connected theories to create greater understanding (Alvesson & Sköldbberg 1994).

A case study can be performed both as a single-case and a multiple-case study. The single case approach is suitable when the case represents a critical test of existing theory, when it is unique or rare, or when it has a revealing purpose (Yin 1994). A multiple case study, on the other hand, makes it possible to create a general explanation that fits each of the individual cases in the study, even though cases vary according to different characteristics. Considering the small amount of prior research available in this area and the wish to compare conditions, the choice was made to use multiple case studies. This provided an opportunity to point to common patterns and factors, as well as contradictions. The use of multiple cases demands that every case is selected with care, and therefore a strategic selection of cases to suit the purpose of the research was applied.

This research was based mainly on the use of qualitative methods for several reasons. Firstly the research questions were concerned with how- and why-questions. Secondly this approach was best suited to explore and describe the situation as experienced from the individual's perspective, which was the main interest in both case studies.

When conducting a case study, it is possible to choose among a number of different data collection methods, including using documentation, archival records, questionnaires, interviews, observations and physical artefacts (Yin 1994). In the two case studies semi-structured interviews were used as the main data collection device, complemented by questionnaires, and in study II also by collection of additional documentary material such as written documents on company strategy and history. According to Westlander (2000), the semi-structured interview aims at investigating the individual's own view of the conditions in each subject area, while a questionnaire can be used to assess and compare responses to a number of questions. The combination of these two methods was considered beneficial, as it enabled a both deep and broad understanding of the studied phenomena.

3.2 The research process

This research was initiated and driven as a part of a regional research project aimed at finding new sources for development of the local wood industry in Eastern Norrbotten¹, something that initially brought about a very wide focus on how design might be used to create competitive advantages in small wood manufacturing companies. After an initial literature survey, this was narrowed down considerably to meet the aim of the research objectives stated in this thesis. Based on the limited amount of research available, it was decided that the first case study should be performed as an exploratory pilot study to enable more insight into the area and confirm the choice of research questions.

¹ The region of Eastern Norrbotten consists of four Swedish municipalities: Kalix, Haparanda, Övertorneå and Övertorneå.

The aim of study I (paper A) was therefore to examine how design and product development in general are used and for what purpose as well as to identify attitudes and beliefs about the importance and need for design. Due to the aim of the larger research project, the population of interest in this pilot study consisted of small wood manufacturing companies in the region of Eastern Norrbotten. In total 35 companies in the region fitting the used definition of small wood manufacturing companies were approached, and out of these, nine companies were selected to participate in the study. These ranged from 1-17 employees, with medium to high degree of processing and design experience varying from none to performing continuous design investments. The selection was made with the help of design experts and trade associations with a good insight into local industry, in order to give a realistic picture of the heterogeneous conditions and needs that exist for small-sized companies working in the industry and to enable comparisons of conditions.

Data collection was made using a questionnaire followed by semi-structured interviews (the questionnaire with added interview questions can be found in appendix 1). The questionnaire covered company structure, company history, market competition, sales and marketing, customer relations, production, products and product development processes. Before use, the questionnaire was tested and evaluated twice, using a test group of laymen and industrial designers, and a final test with one manufacturer. The interviews with senior managers were made on location in the companies, using an interview guide constructed on the basis of the collected questionnaires. Each interview lasted between one and three hours, interview notes were taken and transcribed afterwards and the transcripts were sent back to the respondents for revision. The data analysis started with a first review of all the material being made and the most significant results being marked. Then there followed a more systematic analysis and reduction of the complete material. In this analysis the respondents were divided into three groups (companies that manufacture products of their own development, companies that manufacture products on customer order, and companies that manufacture components on customer order) and analyzed by category. Finally the preliminary results were presented in a group meeting for all companies to provide an opportunity for feedback and discussion.

The findings in the first study indicated low design competence and problems with design project management. This confirmed the choice of research objectives, namely that it would be useful to further investigate how small wood manufacturers use professional design skills in product development projects. The second study (II) followed the aim of papers B and C, namely to examine how the design project process is carried out, and identify problems and success factors occurring in the process (paper B) and compare perspectives on a design project, as seen from company management and design consultants (paper C). Four small Swedish wood manufacturing companies and their associated designers participated in the study. In this study help with selection was also received from design experts and trade associations with insight into the industry. The four companies ranged from beginners to highly experienced design buyers and had all successfully carried out a product development project consulting a professional designer during the last three years. As became apparent during the selection process, very few companies throughout Sweden that fitted the used description of small wood manufacturing companies had in fact invested in design expertise for a development project within this timeframe. Two of the companies included in study I were however found suitable and were selected to participate together with two companies in the south of Sweden.

The data collection of study II involved preparation of an interview guide, semi-structured interviews with company managing directors and design consultants, complemented by a

questionnaire and collection of additional documentary material such as written documents on company strategy and history. The very first stage of the study was, however, devoted to putting together a conceptual framework using the current best practice literature of design, new product development and design management. This framework was used for several purposes. The first was to identify key factors affecting design project outcomes. These key factors were used to formulate a number of propositions used to compare perspectives in paper C, and to construct the questionnaire. The framework was also used to define a theoretical process model used for comparison during the interviews. The interview schedule involved three stages. The first stage included collection of background information about the company (company resources, company history, company strategies and product development approach) and the designer (education, experience and development approach). The main part was dedicated to letting each respondent describe the product development process of a chosen project from start to finish, pointing out important steps, problems and opportunities experienced. Finally the theoretical process model was shown to the respondents, who were asked to comment on similarities with and differences from the described process. The questionnaire, filled out on location, contained 38 statements to be judged on a five-point scale (the questionnaire is found in appendix 2). Contrary to the process description previously addressed, the statements were not focused on specific projects but rather aimed at depicting the respondents' overall design project experience. The respondents were asked to take this into account and were also given the opportunity to comment on the wider perspective. All interviews were tape-recorded, additional notes were taken and each interview lasted between 1.5 and 3 hours. The tape recordings and interview notes were transcribed and combined with the additional material to form interview reports.

The analysing strategy used in the second study follows the methodology suggested in Miles and Huberman (1994), where each single case is analysed in depth using matrices and displays, and then stacked in a meta-matrix for cross-case comparisons. After a first read-through review, the complete material was coded and categorised and interview reports returned to the respondents and checked for accuracy. The following analysis differed somewhat between the two papers due to the variation in focus. For paper B, the interview material from each company manager and design consultant was combined into four cases and analysed separately. A cross-case analysis was done by summarizing the four cases in a matrix, comparing key issues and evaluating the results against existing theory. In the procedure used for paper C, a comparison matrix was used to identify differences and similarities between companies and designers concerning key factors both in each project case, and between companies and designers as groups. The results were compared with the answers from the questionnaire to answer the stated propositions and evaluated against existing theory.

3.3 Validity and reliability

A potential problem found in the case study methodology is to secure validity and reliability. Reliability concerns the ability to reproduce a study, in other words if the data collection procedures can be repeated with the same result. To ensure reliability it is important to display a clear structure of data collection and analysis. The author attempted to follow these instructions by documenting each feature carefully and displaying this in a clear and structured way throughout the study.

Validity has to do with trustworthiness, and questions the empirical evidence and the interpretation of evidence. There are different types of validity and different techniques for eliminating validity threats. According to Yin (1994), these types are: construct validity, internal va-

lidity and external validity. *Internal validity* has to do with whether the findings make sense and whether the conclusions are transferable or valid in the studied group or context. *External validity* concerns whether conclusions are transferable to other contexts or valid for other populations, or situations. *Construct validity* is related to data collection and to establishing correct operational methods for the phenomenon being studied. Internal and external validity were addressed in this study by using structured accepted methods for data analysis and using theory as a support in the study design. To increase construct validity, the author attempted to use methodological triangulation as far as possible (for further discussion of triangulation methods see Yin 1994 and Miles and Huberman 1994). Triangulation was applied at three levels by using multiple types of data (qualitative and quantitative), multiple data collection techniques (interviews, questionnaires and secondary data) and applying multiple methodological approaches (open-ended as well as structured questions).

4 Overall results

The results from paper A point to a great diversity concerning the use of design in small wood manufacturing companies. The three companies that manufactured products of their own development had all invested in design for product development and found that it was of vital importance for business success and considered it a future necessity. Even though these firms showed high design awareness, a number of problems concerning effective use of design were identified. Examples of this were a lack of efficient project management, a shortage of clear strategies or long-term goals, and difficulties with budgeting. Among the eight other companies who had not invested in design (manufacturers of products or components on customer order), no need for design was identified and the potential profit from an investment was questioned. These companies displayed low design awareness, however, and saw design merely as an aesthetic add-on. In general limited resources were of major importance, and issues such as costs, time and knowledge were seen to greatly affect the companies' product development and use of design and made companies wary of the potential outcome of design investments.

The results from paper B displayed four development processes differing largely as a consequence of existing conditions. Limited resources, both financial and human, were seen to have a large impact on the studied projects. In two cases external financing provided an opportunity to start and implement the project. The limited number of staff allowed no personnel to work specifically on the project, slowing down the process when other ongoing production required full use of the companies' time resources. The competence to handle design projects varied. Previous design experience on the part of the company was seen to simplify project management and the companies with large design experience took on all the project management, while the less experienced ones were helped by the designer taking on a more leading role. None of the studied projects used any formalized methods during the development process. Instead the process was managed more or less on an ad hoc basis, using no plan or time-schedule. The stepwise development procedures of the four projects differed somewhat in their organisation and order, but many activities could be identified across all projects. The largest difference between the studied projects was found in the amount of involvement from the designer, which varied from merely fine adjustment of product concepts to participation in all development decisions. Time pressure, caused partly by lack of planning and process structure, was found to have a large effect on the process, causing fast forwarding of the final process steps. In contrast to what is often described in theoretical models, none of the project processes saw any end with product launch, but rather entered a new stage of continuous development and improvements until a new model was launched. A good relationship and tight communication between the company and the designer was seen to be of major importance for the four projects. A long-term relationship was one way to achieve good working cooperation. Another contributing factor was the use of a royalty contract, which created a joint interest in the product success and created informal communication also when using a new designer.

The results from paper C indicate differences in perspectives both between and within the groups of managers and designers. Communication and a well working relationship were the factors valued highest by both company managers and designers to reach a successful project result. Moreover, positive attitudes and long-term relationships were considered success factors by all, whereas companies' limited competence to handle design projects was seen as a potential problem source. Concerning financial resources, company strategies, contextual factors as well as the competence and role of external design consultants, the two groups dis-

played varying opinions both within and between groups. However, even though differences were found within the groups, the results imply larger differences in perspectives between the two groups that negatively affect project cooperation. The results moreover indicate that the identified differences are dependent on different project perspectives, experience levels and starting points. Different *project perspectives* are caused by company managers seeing the design project from a wide business perspective, whereas the designers' perspective is narrower and focused on the product or product line. Different *experience levels* come about as designers, because of their occupation, have a greater collected experience of design and design projects than company managers that only now and then involve themselves in a design project. Managers and designers also enter projects with different *starting points*. Managers responsible for all company activities have to prioritise among investments and tend to have a strong focus on ensuring effective use of available resources and production facilities. The designer, on the other hand, has a stronger market focus, seeking to satisfy customer preferences. The results also indicate that a long-term relationship between company and designer is a possible way to overcome these differences, since less reconciliation and debate were needed in the projects based on long-term relationships.

5 Discussion

This research concerns the use of design in small wood manufacturing companies. The restriction to wooden products was given by the project initiation, but it might of course be questioned where the difference lies in relation to other industries. Prior research focused on design investments in small companies makes no difference among different industries, nor among different design categories, such as product and graphic design (see for example Bruce et al 1999). It is the present author's opinion that the restriction made in this study has been valuable for several reasons. Firstly, it is interesting from a political perspective to investigate the circumstances of a specific industry sector, since different sectors operate rather independently and under different conditions, to enable problems to be addressed on a branch level through packages of measures. Secondly, different industries are governed by specific features such as culture and attitudes (see Brege et al 2004 for a discussion of these aspects in the context of the wood industry), which can be addressed better if studied separately. Thirdly, the specific material conditions that apply to wood manufacturing influence product design considerably and create developmental problems and opportunities not applicable to other industries.

Wood manufacturing (see the definition stated in chapter 1.3) comprises a large number of products, which naturally display a variation in their need for design. Paper A discusses the differences in the need for design between companies manufacturing their own products and those who manufacture on customer order. No further distinction between product types is however made in the analysis. As the purpose was to explore the use of design in the wood manufacturing industry as a whole, this approach was considered beneficial. However, for future investigations it could be interesting to study different product categories separately to enable comparisons.

The three papers investigated design investments in small wood manufacturing companies from different angles. Paper A looked at the overall use of design among nine wood manufacturers and included companies that both had invested in design and those that had not. Paper B and C investigated the process, identified problems and opportunities and compared perspectives on these among managers and designers. Both these papers draw upon the same multiple case study where respondents were chosen due to their successful design invest-

ments. The chosen approach was well suited to the purpose of the research, but a few methodological problems that should be considered appeared along the way. In paper A widely spread product categories caused minor problems with comparisons and analyses. The large variety of cases was chosen deliberately, as it was considered valuable to give a picture of all the different conditions existing in wood manufacturing. A potential problem experienced in paper B was that, due to design investments in small wood manufacturing companies often being a non-regular routine activity, several respondents described a process that had been performed some time ago. In some cases the respondents found it hard to recall details like timing. Overall this did not however influence the questions in focus and was therefore considered to be of insignificant importance. The variety in company size made a comparison between cases more complicated, since problems that appear in design projects are partly dependent on size. To enable the comparison of perspectives in paper C, the respondents were asked to judge independently a number of statements regarding both designers and managers. It might be argued that the company of course knows more about their own situation and vice versa and that the opinions from the other group is a mere estimate. The respondents found no trouble with the assignment, but it should be pointed out that the method used might have affected the results.

The results of all three papers point to great diversification concerning the use of design among small wood manufacturing companies. In paper A the nine studied companies displayed large differences with respect to awareness, experienced need for design, and competence to manage design effectively. Companies that had not invested in design (manufacturers of products or components on customer order) did not see any need for design and questioned the benefits from an investment. It may however be argued that the companies in these groups had very little knowledge of design in any other aspect than styling and shape. With little knowledge of what design comprises and of potential benefits from its use, it is no surprise that no need to invest is perceived. The effect of limited resources often documented in previous research (see for example Storey et al 1994) was confirmed in the studied companies and it appeared that companies with limited resources tend to prioritize acute problems rather than long-term activities such as product development and design.

The results of paper B indicate that the product development process differs largely among design projects depending on the existing conditions. The problems and success factors that were experienced during the development process also varied according to these conditions. In total, however, even though many smaller problems appeared during the development process in all projects, they were all solved relatively easily, and no problems large enough to jeopardise the project's success could be identified. This points to high design awareness and an ability to adapt to new conditions in all four companies, something that stands in clear contrast to the common perception that wood manufacturers would be hindered in their development work by traditional values and a low competence level (Brege et al 2004). Previous studies have shown that small companies often tend to have limited knowledge and experience of working with established development methods and that product development is therefore performed without following any consistent, structured processes (Rantakyrö 2004, Hovgaard 2004). This is confirmed by the results of paper B where the greatest implication of how to increase efficiency in all four projects refers to a lack of planning and structure throughout the processes, which caused time pressure and induced production problems. This supports the practical use of the suggested design project model (found in paper B), to find more structure for future design projects. The model could be seen as a good representation of a best practice model, and be used as a basis for a customized design project plan.

The results of paper C confirmed the findings of Jevnaker (1998) that designers and managers face communication problems because of differences in perspectives, and moreover that a large part of success of a design project's outcome lies in getting these perspectives to meet. The results also indicated, however, a variation of opinions in the groups of managers and designers. This variation may be due to a difference in experience in the separate cases, but might also be caused by more individual preferences that are difficult to depict. With this limited sample it is hard to tell whether this might also have caused differences between the groups that make the assumption of different perspectives less significant. What strengthens the implication of diverse perspectives is that, even though all respondents valued communication and working relationships highly to reach a successful result, all projects (including the long-term relationships) experienced problems with communication in one way or another. The benefits from long-term relationships between company and designer indicated in the study confirms the findings of Bruce et al (1993), that a long-term relationship is one way of creating shared understanding and achieving a better working communication. With the sample in this study being limited in size, it is however risky to draw any general conclusions. To confirm these findings and find possible proposals for a solution, more empirical research is needed.

The results from papers B and C together demonstrate the learning process that is involved in every design investment (for a closer discussion see Bruce and Potter 1995). Both company managers and designers illustrated how they used knowledge gained in prior projects to create better cooperation in the next. It is clear that for both parties greater experience simplifies the cooperation and increases the efficiency of project work. A way to deal with varying experience levels was displayed in paper B, where companies with large design experience took on all the project management, while the less experienced ones were helped by the designer taking on a more leading role. This stands in contrast to the common view in the literature that project management is the responsibility of the company and a necessity for success (Bruce et al 1999), but was seen to work well in the study and thus confirms Brazier's findings (2004).

Today there is an extensive focus on design as an almost guaranteed success factor. Government authorities promote the use of design in small companies and research points to benefits from investments (see Walsh et al 1995 or Bruce and Potter 1995). The results presented here do indicate that small wood manufacturers can benefit from design investments, if used efficiently. However, the need for and competence to handle design vary to a great extent among different companies, which should be taken into account when considering an investment. It appears that the prerequisites for investing lie in the company's and designer's joint resources and competence, which must be the starting point for the planning and execution of a design project. With the right starting point, the key to succeeding with a design project lies in the efficiency of the joint development process and the relationship between company and designer.

6 Conclusions

The main purpose of this research was to study how small wood manufacturers invest in design and use design expertise in their product development. More specifically the objectives were to examine how the design project process is carried out, to identify problems and success factors occurring in the process and to compare the perspectives on design projects as seen from company management and design consultants. The conclusions of this thesis may be summarised as follows:

- Using design experts in product development can be of importance for creating a competitive edge for small manufacturers if used efficiently. However, design investments are no guarantee for success and it should be clear that small wood manufacturers, even ones of similar size and structure, face different needs for design and possess different competence to manage design effectively. To be able to decide how and to what extent design can be beneficial to a specific manufacturer, the whole situation of a specific company must be taken into consideration.
- Product development processes are greatly dependent on the existing conditions and hence vary from project to project concerning organisation and management, performed activities, and ways of communication. The common denominator found was that no formalized methods were used during the studied design projects to structure the processes, which were managed more or less on an ad hoc basis. Limited resources concerning finances, personnel and design competence, together with a lack of planning and process structure, were seen to affect the project outcome negatively, whereas previous design experience, management by the designer when a company lacked experience, external financing, and a good relationship and tight communication between the company and the designer were identified as success factors
- Differences in project perspective, experience level, and starting points cause managers and designers to take different views on problems and opportunities occurring in a design project and therefore cause communication difficulties and affect project cooperation negatively. It seems that to get these perspectives to meet is a great challenge to achieve successful cooperation.

7 Implications of the results

There are clear opportunities to assist small wood manufacturing companies in reaching more effective use of design. A better understanding of the need for design in small wood manufacturing companies and factors that influence the outcome of design investments could be applied to create better-suited design investments. Hopefully, this thesis is one step towards greater interest in and understanding of design in small wood manufacturing companies. Below there is an attempt to formulate some implications that may be drawn from this research, addressing both practice and theory.

7.1 Implications for practice

The results imply several opportunities to assist small wood manufacturing companies in implementing a more effective use of design. Measures can be directed either to influencing the prerequisites (company resources and competence) or to increasing the effectiveness of the project process itself. The first option could include providing financial economic support or education to increase the knowledge of design and project management and raise design awareness. To increase efficiency in the process could mean a designer taking on part of the management if the company is inexperienced, but also providing design project models adjusted to the small company, and to develop methods to facilitate communication between designers and managers and enable both parties to see each other's perspective.

Moreover, the results imply that low design awareness among non-investors poses a problem with discovering potential needs. There exists a need to enhance design awareness in the industry in order to enable companies to make more fact-based evaluations of the need for and potential benefits of design.

7.2 Implications for future research

This research was conducted with a limited sample of small wood manufacturing companies in Sweden. The sample was strategically chosen and therefore inferences drawn about the larger population of small wood manufacturers in Sweden or elsewhere are only tentative. To confirm the findings of this study more empirical research is needed.

For further studies it would be recommended to confirm and further examine the differences in perspectives found in paper C, and to find implications of how their negative effects on communication could be reduced. Moreover, it would be interesting to focus on further examining and finding methods for facilitating project management and communication. Another aspect of interest is the role of the designer in these circumstances, and a possible continuation would be to investigate what competencies are best suited to help the small company, and how design projects in small companies are best addressed by designers.

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Appendix

Appendix 1: Questionnaire to company managers (with added interview questions in *Italic*)

Company

Name, Address, phone, fax, e-mail, homepage

Owner/manager

Field of operation, business idea

Products

Turnover

Number of employees and positions

Company history

Competitors

1. What is your appreciation of the total market in your branch today?

- | | |
|-------------------------------------|-------------------------------------|
| In Sweden | Abroad |
| <input type="checkbox"/> decreasing | <input type="checkbox"/> decreasing |
| <input type="checkbox"/> unchanged | <input type="checkbox"/> unchanged |
| <input type="checkbox"/> expanding | <input type="checkbox"/> expanding |

2. Is your company a market leader in any field?

- yes, which: _____
- no

3. What is your plan for the future?

- expand business activities
- maintain the same activity level
- reduce business activities

Do you have any business goal? Which?

Below follows a number of statements. For each statement choose your standpoint.

- | | Strongly agree | agree | disagree | Strongly disagree |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 4. We are winning market shares from our competitors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>If so-why?</i> | | | | |
| 5. We are losing market shares to our competitors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>If so-why?</i> | | | | |
| 6. We know our competitors strengths and weaknesses well | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Who are your competitors?
Which are their strengths and weaknesses?</i> | | | | |
| 7. We know what separates our products from competitors' products | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>What?
How do you know?</i> | | | | |
| 8. We have better delivery guarantees than our competitors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Why / how?</i> | | | | |
| 9. We have better service guarantees than our competitors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Why / how?</i> | | | | |

Sales/Market

10. Approximately how much of your turnover 2002 came from:

- Products of own development ___%
- subcontracting ___%
- manufacturing against order ___%
- other _____ ___%

Below follows a number of statements. For each statement choose your standpoint.

	Strongly agree	agree	disagree	Strongly disagree
11. We keep a budget for marketing and sales	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
12. We communicate well with our market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Ways of communication?</i>				
13. We have the best sales channels in relation to our assortment and focus group	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Which sales channels are you using?</i>				
14. Our price setting is based on our own calculations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Our price setting is based on competitors prices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our price setting is based on strategic reasons (for example image)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. We use our products strengths as sales argument	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
17. There is a clear connection between products, graphic material and packaging when the company is exposed in different situations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Exemplify?</i>				
18. Our sales arguments are reflected in the product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				

Production

19. What does your production consist of (and to which extent)?

- Development of own products _____ %
- Development of own components _____ %
- Assembly of bought components _____ %
- other _____ %

Below follows a number of statements. For each statement choose your standpoint.

	Strongly agree	agree	disagree	Strongly disagree
20. We do product calculations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. We examine whether it is cheaper to buy the service from a supplier then manufacture in our own production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. We are attentive to possibilities to increase efficiency in production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Exemplify?</i>				
23. We are attentive to the possibility of using standardized components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. We investigate the possibility to use new materials in our production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. We are effected by environmental demands on recycling and destruction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
26. We put require suppliers and consultants to follow environmental demands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Which?</i>				
27. We have routines to secure quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Do you apply environmental/quality certification?</i>				

Customers/Users

Below follows a number of statements. For each statement choose your standpoint.

	Strongly agree	agree	disagree	Strongly disagree
28. We have good knowledge of our customer clientele	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Describe your customers? Would you like to change customer focus?</i>				
29. We have good knowledge of our users	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Describe your users?</i>				
30. Customers and users are the same as	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Our focus group understand the products function and quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>What do/don't they understand? How do you know?</i>				
32. We know why customers choose our products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. We know what customers prefer if they don't choose our product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Our customers demand environmentally friendly products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Changed product appearance would revise customers opinions of the product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
36. Changed product function would revise customers opinions of the product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
37. Changed price would revise customers opinions of the product	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				

Products

Below follows a number of statements. For each statement choose your standpoint.

	Strongly agree	agree	disagree	Strongly disagree
38. When our products are seen on the market customers associate them with our company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How/ how do you know?</i>				
39. Our product solutions are copied by competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. We copy product solutions from competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Our products suit existing demands and trends of today	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How?</i>				
42. Our product quality is the right in relation to the price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. We know what image our products display	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How do you know? Is it the image you wish to display/ does it reflect your company?</i>				
44. There is a clear connection between our products when seen together	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Describe how?</i>				
45. We consider our assortment to be satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. We have unprofitable products among our assortment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>How many? Are the necessary? Which is your most lucrative product?</i>				
47. Environmental aspects are an important part of our product image	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Product development

48. What is the most correct description of your product development?
- no own product development
 - sporadic product development
 - continues product development
 - other _____
- Describe your product development?*

49. Do you consult experts of any kind?
- designer
 - engineer
 - other _____
- For what purpose?
How did it work? Are you satisfied?*

50. How often do you develop a new product? _____
- How is this organised?*

51. What is the reason for new product development?
- Company need (for ex. to fill production)
 - Market demands
 - other _____

52. What is the greatest barrier to develop new products? (multiple choices allowed)
- costs
 - knowledge
 - time constraints
 - see no need
 - other _____
 - see no barriers

Below follows a number of statements. For each statement choose your standpoint.

- | | Strongly agree | agree | disagree | Strongly disagree |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 53. We keep a budget for product development | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 54. We have someone with responsibility for product development
<i>Who?</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 55. We work with product improvements on the existing product range

<i>How do you know if and which improvements are needed and how it should be solved?</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 56. We systematically use external information and market surveys | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57. We use modern computer visualisation, rapid prototyping or other equipment for development

<i>What/for what reason?</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. We feel insecure concerning product development

<i>What makes you feel insecure/secure?</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 59. We prioritize design investments in development work

<i>What is prioritized?</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 60. Describe shortly what you consider good design is? | | | | |

Appendix 2: Questionnaire to company managers and design consultants

Below there follows a number of statements about small wood manufacturers (SWMs) and design investments. For each statement choose your opinion. The categories are:

Strongly disagree 1	Disagree 2	Neutral – have no opinion 3	Agree 4	Strongly agree 5
-------------------------------	----------------------	---------------------------------------	-------------------	----------------------------

- | | 1 | 2 | 3 | 4 | 5 |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1) The limited resources available to small wood manufacturing companies imply dysfunctional barriers to design investments | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2) To engage a design expert is a risky investment for SWMs as the outcome cannot be predicted..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3) SWMs have limited resources for collecting and evaluating information (mapping), which can result in the implementation of projects with the wrong focus or bad potential | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4) It is difficult for SWMs to possess knowledge and competence in all areas needed to efficiently manage a development project..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5) It is difficult for SWMs to assess what design competence suits a specific project | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6) It is difficult for SWMs to know where to search to find the right consultant..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7) A design project functions well when the management is convinced of the project's success..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8) A design project functions well when all personnel see the benefits from the design investment..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9) Design is about styling and shape..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10) Design is about better products..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11) Design works on the borderline between company and customers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12) Design should be integrated in the whole process from idea to finished product | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13) Design should be a component in a company's business concept..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14) Design should be a way to separate the company's products from the competitors and thereby win orders on the market..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

- 15) Design investments in SWMs are seldom based on formal strategies or long-term plans
- 16) Design investments in SWMs tend to be short-sighted solutions to acute problems.....
- 17) The outcome of a design project is highly dependent on external factors (such as market factors and economic climate) that SWMs have little influence on.....
- 18) In business areas subjected to fast changes, design is an important tool for creating competitive advantages.....
- 19) When engaging a consultant for a product development project in SWMs, it is important that the design consultant is used to working with small companies.....
- 20) When engaging a consultant for a product development project in SWMs, it is important that the design consultant has a good knowledge of wood materials (characteristics, areas of use, production methods).....
- 21) When engaging a consultant for a product development project in SWMs, it is important that the design consultant is well acquainted with the wood industry.....
- 22) When engaging a consultant for a product development project in SWMs, it is important that the design consultant has competence in project management.....
- 23) When engaging a consultant for a product development project in SWMs, it is important that the design consultant is versatile and has a wide experience.....
- 24) The limited access to designers makes it difficult for SWMs to find the right consultant (with the right knowledge, cost and personal chemistry).....
- 25) Poor management on the part of the company is an important reason for decreased efficiency of design projects in SWMs
- 26) Poor management on the part of the designer is an important reason for decreased efficiency of design projects in SWMs
- 27) The work process in a design investment varies from project to project.....
- 28) The lack of tight and continuous design investments makes it difficult for SWMs to develop the experience and certainty that create efficiency in the product development process.....
- 29) As time and money are often limited in SWMs, the design process must often be simplified and shortened

- 30) In design projects engaging a design consultant, SWMs often experience problems with transferring the design proposal to industrial production.....
- 31) SWMs and their design consultant tend not to evaluate design projects and thereby miss learning for the following project.....
- 32) SWMs and their engaged designer are often unfamiliar with the knowledge field and expertise of the other party.....
- 33) SWMs and their engaged designer often have different perspectives on design, its meaning, extent and purpose of use.....
- 34) When engaging external design expertise for a separate product development project, it is difficult to achieve the openness and respect that is necessary for well-functioning cooperation.....
- 35) Effective and regular information exchange between company and consultant is necessary to succeed with a design project
- 36) Through repeated design investments and a long-term relationship with one consultant, communication and management problems can be overcome and contribute to developing more effective design solutions ...
- 37) The cooperation with an external design consultant is simplified by the MD of an SWM often being able to can take fast decisions on her/his own, concerning for instance design matters.....
- 38) The right personal chemistry between the company and the design consultant is important for the success of a project.....

Paper A

The importance of industrial design for small wood manufacturing companies - an analysis from the manufacturers' perspective

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Abstract

Although industrial design use in small companies has been discussed more frequently in the literature in the past few years, very little research has been specifically done on the wood industry. This article presents a study of design use in small wood manufacturing companies in the northeast region of Sweden. Qualitative empirical data was collected from nine wood manufacturing companies using a structured questionnaire combined with a series of semi-structured interviews. The results indicate that industrial design is important for increasing competitiveness in small wood manufacturing companies. The firms that had invested in design found that it was of vital importance for business success. The general knowledge of design and commercial outcome of investments were, however, limited, and in several cases project management was experienced as difficult to cope with. Thus there is a need for enhancing design awareness and providing training in design management.

1 Introduction

Research has shown that effective use of design by small companies can contribute positively to business performance and competitiveness (Walsh et al. 1992). According to Svengren (1995), well planned design could increase the efficiency of product development, serve as a driving force for innovation, lead to more customer-adjusted products and make products easier to identify on the market.

However, studies have also shown that, even though many small companies have a range of business needs for design, their awareness of and competence to manage design effectively vary considerably (Bruce 1999).

Industrial design has been identified by the Swedish Government as a key area for Swedish industry and especially for the small business sector. The Government has given the Swedish Agency for Innovation Systems, VINNOVA, the assignment to promote sustainable growth by developing effective innovation systems and funding problem-oriented research. In their vision for 2010, wood manufacturing is pointed out as a highly prioritized area with potential for economic growth. The present article reports the results of a study of design use

in small wood manufacturing companies¹ in the northeast region of Sweden. The study is a part of a regional project aimed at finding new resources for development of the local wood industry.

1.1 Small businesses and product development

Small companies² differ from larger ones in many ways. Small companies tend to be managed by the owner, who is responsible for both the company and all employees (Larsson, 2001). Another big difference may be found with regard to both financial and human resources. Storey (1994) shows that larger firms have more capital, net assets and reserves than smaller firms have. The small company does not have the same ability to invest in new projects and seldom has a development department due to lack of staff. As for product development, the small company often tends to have limited knowledge and experience of working with established development methods (Rantakyrö, Larson 1996). Problems are instead solved as they occur (Larsson 2001).

Previous research has shown that many small companies are wary of the cost of employing a professional designer and are unsure about the commercial outcome of design investments (Bruce 1999). According to von Stamm (1998), companies are faced with two questions when contemplating design and development activities. The first is whether or not to develop designs in-house, or use external designers or a combination of the two. The second is how to structure and manage the relationship to make it work. In answering the first question most small companies must rely on external consultants. The second question indicates something that is a critical issue for many small companies. With the owner also being the manager, a potential problem may arise, as the firm may become too dependent on the skills and experience of one individual. If the manager cannot find the time or does not possess the right skills, the integration of design might not succeed.

Product development and design use in small companies have been a subject of discussion appearing more often in the literature than before in the past few years. Despite this, very little has been published about product development in small wood manufacturing companies. Most literature that can be found concerns large companies and is often focused specifically on the furniture industry (see for example Bumgardner et al 2001). One exception is a study reported by Hovgaard et al. (2004), which looked at innovativeness in 17 small forest

¹ By wood manufacturing is meant here the later stages of processing, with products from these areas: carpentry (doors, windows, floors, interior decoration and kitchen), furniture (home furniture and public furniture) and wood components (strips, edge glued panels, coffins, turned material, veneer and wooden boards). Wooden houses are not included due to largely differential market conditions.

² Various definitions exist of what is referred to as small companies. In a definition from the European Committee in 1996, companies are divided into micro (0-9 employees), small (10-50 employees) and medium (51-249 employees). According to the EU definitions the sample in this study are all micro or small firms, with fewer than 20 employees.

products firms. They found that the respondents did not undertake consistent, structured processes for product development and that product design is often determined by available production equipment and material costs.

2 Method

Because little research has been done on the use of industrial design in wood manufacturing companies, the study approach was exploratory in nature. This study sought to create a picture of the current use of and need for design for small manufacturers in the northeast region of Sweden. Specifically it sought to:

- understand how design and product development in general are used and for what purpose
- identify beliefs about the importance and need for design
- find ways of using design more effectively

2.1 Sampling

The population of interest in this study consisted of small wood manufacturing companies in the northeast region of Sweden³. The region may be described as relatively sparsely populated, with a manufacturing industry largely dominated by small companies. The tradition of wood manufacturing goes far back in history and has always been considered an important regional income source. Today there are approximately 35 companies in the region fitting the used definition of small wood manufacturing companies.

With the help of design experts and trade associations with a good insight into local industry, nine companies⁴ were selected to participate in the study. These ranged from 1-17 employees, with medium to high degree of processing and design investments varying from none to continuous. Details of the sample may be found in Table 1. The selection was made in order to give a realistic picture of the heterogeneous conditions and needs that exist for small-sized companies working in the industry and to enable comparisons of conditions.

2.2 Data collection

Data collection was made using a structured questionnaire combined with semi-structured interviews. This procedure made it possible to collect a large number of facts through the questionnaire, allowing the interviews to focus on questions central to each company.

The questionnaire contained 60 questions and covered: company structure, company history, market competition, sales and marketing, customer relations, production, products and product development processes. Before use, the

³ The region consists of four Swedish municipalities: Kalix, Haparanda, Övertorneå and Övertorneå.

⁴ Originally the sample consisted of 10 companies, but one company went bankrupt during the study and was therefore eliminated.

questionnaire was tested and evaluated twice, using a test group of laymen and industrial designers, and a final test with one manufacturer.

Interviews with senior managers were made on location in the companies, using an interview guide constructed on the basis of the collected questionnaires. Each interview lasted between one and three hours, during which the respondents were asked leading questions, but also given the opportunity and encouragement to expand on themes.

During the interview notes were taken by the researcher and transcribed afterwards. To correct possible misinterpretations, all transcripts were sent back to the respondents for revision.

	Company A	Company B	Company C	Company D	Company E	Company F	Company G	Company H	Company I
Products	Housing components	Furniture for public and home use	Park equipment	Carpentry	Carpentry	Packaging	Packaging	Furniture components (some assembly)	Building components
Size (no. of employees)	7	16 1/2	8	1	1	1	11	7	4
Annual turnover (€)	370,000	1,750,000	875,000	Not stated	Not stated	Not stated	1,950,000-2,200,000	900,000	355,000
Product development	Continuous	Continuous	Sporadic	Sporadic, on demand	Sporadic, on demand	Sporadic	Continuou s	Sporadic	Sporadic
Professional design use	Architect	Industrial designer	Industrial designer	None	None	None	None	None	None
Analysis group	1	1	1	2	2	3	3	3	3

Table 1 Sample description

2.3 Data analysis

After transcription and accuracy check, a first review of all the material was made and the most significant results marked. Then there followed a more systematic analysis and reduction of the complete material. In this analysis the respondents were divided into three groups and analyzed by category. The grouping was done according to the following criteria:

Group 1 – manufacture products of their own development. Company A-C

Group 2 - manufacture products on customer order. Company D and E

Group 3 - manufacture components on customer order. Company F-I

A company belonging to several groups was placed in the group that best fitted its main operations.

Finally the preliminary results were presented in a group meeting for all companies to provide an opportunity for feedback and discussion.

3 Results

The results are presented for each group separately.

3.1 Group 1

The first group shows a fairly integrated view of industrial design. Among the three there is a common understanding that design investments contribute to more competitive products and may be used strategically as a sales argument.

In all three companies the managers are responsible for product development, but otherwise the processes differ to a great extent. All three companies had used external professional designers, in two cases industrial designers, in the third an architect. They all agree that this has been of vital importance for their success and considered it a future necessity. A few problems could however be identified.

It was considered vitally important to find the right designer to do the work, but the process of sourcing was experienced as difficult. Two respondents experienced the uncertain commercial outcome of future design investments as a major problem. In both cases large investments in a new product range had been made successfully a few years earlier, and since then only small updates and product improvements had been performed in-house. At the time of the study the respondents recognized that they were in great need of new large investments to update the product assortment. With no money reserved, this would put a great strain on the companies' economy, which makes it tempting to solve more acute problems. In one case this caused the company to look for other less costly opportunities that would yield safe results in the immediate future. The problems experienced were seen to be connected to a lack of strategy and budget for development.

Two of the three respondents state that they feel confident about managing the total product development process and claim that their long experience enables them to cope with most situations. One company states that they feel insecure and mentions the uncertain outcome of investments as the major reason.

Resources are an important issue, where costs and lack of time are given as the main reasons by all three for not engaging in new product development.

3.2 Group 2

In this group the view on industrial design is less integrated and primarily geared to form and aesthetics. Design is neither prioritized in development work, nor used extensively for strategic reasons.

The issue of product development is somewhat different in this group. All product development is customer driven and done on request. Both companies have an assortment of products that is used for demonstration, but also produce other products on demand. Product design is decided on together with the customer, but to some extent the companies are given free hands. The customer driven development means a wide assortment of products without a distinct company profile. In both cases the variation in work activity was seen as a positive aspect.

Neither of the respondents had used any professional designer and sees little potential benefit from it in the future.

Both respondents stated that they felt relatively confident about managing product development processes and pointed to long experience and training. There was greater insecurity in other areas concerned with administration.

Resources are an important issue also in this group and the largest obstacles to new product development are considered to be cost and lack of time.

3.3 Group 3

Among the last group the differentiation might appear to be larger, but several common aspects may be found. In this group industrial design is defined as merely form and aesthetics and not generally prioritized.

Product development mostly consists of correcting drawings or adjusting models according to order. No budget exists in any company and product development is only done sporadically on demand. Apart from one company, which aimed to increase in-house product development, there was little interest in manufacturing their own products. The confidence about managing product development processes varied widely from high to little.

None of the respondents had used any external designer and no benefit from employing a professional was evident.

Resources are again of great importance, and the most important reasons for not investing in new product development were considered to be cost, and lack of time and knowledge. Acute problems must often be prioritized to ensure day-to-day survival. The exception is one company manufacturing components that tries to increase the production of assembled furniture to increase their profit.

4 Discussion

The results found in this study yield a picture of the great diversification that characterizes design use in small wood manufacturing companies. Great differences were found among the respondents with respect to awareness, experienced design need, and competence to manage design effectively.

The companies in group one are the ones that express the greatest needs for design and stand to see the most benefit from design investments. The recognition of industrial design as a necessary competitive investment among these companies also indicates a high awareness of the commercial effect design investments can have on their business performance.

The benefits cannot outweigh the cost of design investment in every case (Gemser 2000). To what extent the other two groups can benefit from industrial design use is hard to predict. The companies in the second group may not have used professional designers, but in some sense act as designers themselves. The third group shows no explicit need for design, but with growing market competition it might be a possible way to gain profit. Even though both the need for and the profit from design were questioned in these groups, it should be considered that the knowledge and awareness of design effects are very limited, making it hard to discover potential needs.

In all groups the competence for design management is relatively small. With the exception of one company in the first group, all respondents experienced problems running development projects. A majority of the respondents show uncertainty about design investments, and product development in general is performed sporadically without budgeting. In several cases it appears that the lack of a clear strategy or development plan could be the reason. In this situation the importance of the manager's ability to control and make the right decisions is vital for the outcome of a possible investment. An issue of concern in this context is that several companies showed inconsistencies in the description of development work, indicating limited awareness of their own management abilities.

The issue of resources often discussed in earlier research is shown to be of major importance also in this study. Broader issues such as costs, time and knowledge in the companies greatly affect the use of design. It appears that companies with limited resources tend to prioritize acute problems rather than long-term activities such as product development and design. In many cases the greatest challenge to effective design use seems to come down to the will to change and adapt to new processes.

5 Conclusions

To sum up the discussion a few important conclusions may be drawn:

- Industrial design can be of importance for small manufacturers to create a competitive edge.

However, it needs to be pointed out that small wood manufacturers, even ones of similar size and structure, face different needs for design and possess different competence to manage design effectively. To be able to decide how and to what

extent industrial design can be beneficial for manufacturers, companies must be studied in their surrounding context.

- The general knowledge of design and the commercial outcome of design investments are limited. Thus there exists a need to enhance design awareness among small wood manufacturing companies.
- There is a need for training in design and project management. Even though external design services are used, more knowledge is needed to be able to run the project smoothly.

There are clear opportunities to assist small wood manufacturing companies in design use. An increased understanding of the design need in small wood manufacturing companies can be applied to better-suited design investments. The information gained in this study can help to guide third-party efforts aimed at effective use of design in wood manufacturing companies, and can aid producers in finding possible approaches to increasing their use of design.

5.1 Limitations

This research was conducted with a sample of wood manufacturing companies in the northeast of Sweden. The conditions specific to this region might not apply in other cases; therefore inferences drawn about the larger population of small wood manufacturing companies within and outside this region should be made with caution.

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Paper B

Product development through design expertise – a multiple case study of design investments in small wood manufacturing companies

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Abstract

Up to today very little has been documented on how small wood manufacturing companies invest in design expertise to develop new products. This paper draws on the results from a multiple case study examining the ways in which small wood manufacturing companies use professional design skills in product development projects. Four design projects were studied focusing on the development process, problems experienced and success factors. The four cases illustrate how development processes differ largely among design projects depending on the existing conditions. Unstructured processes and limited resources were identified as problems, whereas a good relationship and tight communication between company and designer contributed to project success.

1 Introduction

Research has shown that effective design use by small companies can contribute positively to business performance and competitiveness (Walsh et al 1992). According to Bruce and Potter (1995), investments in professional design expertise at product or project level involves relatively low risks and can yield substantial rewards by opening up markets and enhancing profitability. In the Swedish wood manufacturing¹ industry, design and product development are given low priority in many companies (Brege et al 2004). With the industry facing intensified competition from the growing market, the imperative to find new ways of development increases and design investments are now seen as an important opportunity to create competitive advantages for small wood manufacturing companies. Up till today, very little has been published concerning product development and design in small wood manufacturing companies (Ekberg 2004). The research reported in this paper explores the use of design expertise in small wood manufacturing companies by exemplifying four design projects and identifying occurring problems and opportunities in the development process. A design project model is presented, suggesting a stepwise procedure suited for the small company consulting an external designer.

1.1 *Small companies and design*

Various definitions exist of what is referred to as small companies. One much used definition stems from the Bolton Report (Bolton 1971) defining small companies as being owner managed, financially independent and having a small market share. Another definition comes from the European Commission in 1996, dividing companies into micro- (0-9 employees), small- (10-50 employees) and medium- (51-249 employees) sized firms. The sample in this study falls within the EU definition of micro and small companies. They are all owner managed and financially independent.

¹ Wood manufacturing is defined as being the later stages of wood processing, including development and manufacturing of finished components, wood systems, carpentry and furniture.

The success of a design project is dependent on several factors. Cooper et al (1995) identifies the new product performance to be dependent on the product development process and its organisation, product strategy, company culture and senior management commitment. Hart (1995) points out the following critical factors: The product development process, its management, information handling, strategies, people involved and organisational structure. On a project level these factors can easily be divided into two groups:

- *input factors*, including everything that constitutes the basis for the project, such as company strategies, resources, people, knowledge and external factors
- *process factors*, including organisation and management of the development process, process activities and project communication

Below follows a closer discussion of these factors within the context of the small company.

Input factors

Limited resources are often considered a barrier in small companies' product development. Available finances affect the ability to invest and with a limited number of employees, the small company seldom has a product development department (Larsson 2001). The company's knowledge and competence to handle design and design projects are considered very important for the outcome of an investment, and to fully exploit the design expertise the company needs to possess good management skills (Bruce et al 1999). With the owner also being the manager, the firm becomes very dependent on the skills and experience of one individual. If the manager cannot find the time and does not possess the right skills to utilise the design professional's skills adequately, the design project might not succeed.

New product strategies as part of company strategy may be an important tool for specifying the aim, focus and structure of the company's product development projects (see Cooper et al 1995). Several studies also point out that design is better used if it is incorporated in the business strategies and is not only applied in product development (Blaich et al 1993, Brazier 2004). Small companies however often lack formal company strategies (Brazier 2004), and tend to plan and act in the short term (Rantakyro 2004).

The resources and skills of the external designer have a major influence on project outcome, and the quality of the design work is an important success factor (Bruce and Potter 1995). For example, a small company with little experience of running design projects could profit from using a designer with management competence (Brazier 2004). However, to find the right designer, the design buyer needs knowledge to decide and evaluate what expertise is appropriate, something that can be complicated for the small company (Bruce et al 1999). According to von Stamm (1998), many small companies consider it to expensive to consult designers and experience it hard to find the designer that is just right for their company.

Process factors

The efficient execution of the product development process (involving all the activities and decisions from idea generation to product commercialisation) has been shown to be critical to design project outcome (Hart et al 1995). The literature includes many descriptive models of the product development process in large companies (see for example Ulrich and Eppinger, 2000), but design project models that suit the small company are rare. One exception is a design management model for small businesses presented by Bruce et al (1999). This model highlights three process activities of special importance for the project result, namely sourcing of the designer, briefing the designer and project evaluation.

The management and organisation of the project process and the people involved are also critical for project success (see for example Bruce and Potter 1995). Usually this is seen as a responsibility solely for the company, but according to Brazier (2004) the failure of design projects in small companies can often be ascribed to management shortcomings both on the part of the business and on the part of the designer.

The process and the project outcome are highly dependent on the relationship and communication between designer and company (Jevnaker 1999, Bruce and Morris 1995). Mutual understanding, respect, trust, openness and matching personal chemistry are all described as success factors for a working project communication (Bruce et al 1998, Jevnaker 1999). Jevnaker also points to a number of relational problems that often occur in a design project, such as different perspectives on design, asymmetric expertise and partial perceptions. Overcoming these problems often takes time and can be hard to achieve when engaging an external designer for the first time (Jevnaker 1998). Long-term cooperation with one designer can be a way to overcome the problems and build up a design competence (Bruce et al 1998).

Suggested model for design projects

The literature review above has pointed out the importance of a well-performed development process for the success of a design project. From this a model for the design project process was developed by the author, see Figure 1, showing a suggested sequence of steps for successfully completing a project with an external designer. The model takes into account the special circumstances surrounding a small company and can be used for beginners as well as experienced design buyers. The model was used as a basis for data collection and also serves as a framework for data analyses. This paper will not however use the model for detailed comparison but rather discuss the process in general terms using the following categorisation:

- Input factors (represented in the model by company and designer)
- Process factors (representing process organisation, and the stepwise procedure and communication between company and designer)
- Success factors and problems experienced during the process

2 Methodology

Due to the lack of research within the area, the main aim of this study was to document how small wood manufacturing companies use professional design skills in product development projects. More specifically it sought to answer the following questions:

- How is the product development process involving a design consultant carried out?
- What problems may occur during the process and what success factors can be identified?

The first stage of the study was devoted to putting together a conceptual framework using the current best practise literature of design, new product development and design management. The framework is presented here as a suggested model for design projects. The second stage consisted of qualitative research in the form of a multiple case study. The methodology used in the case study draws upon the case study research tradition (Yin 1994, Miles & Huberman 1994) and is outlined below.

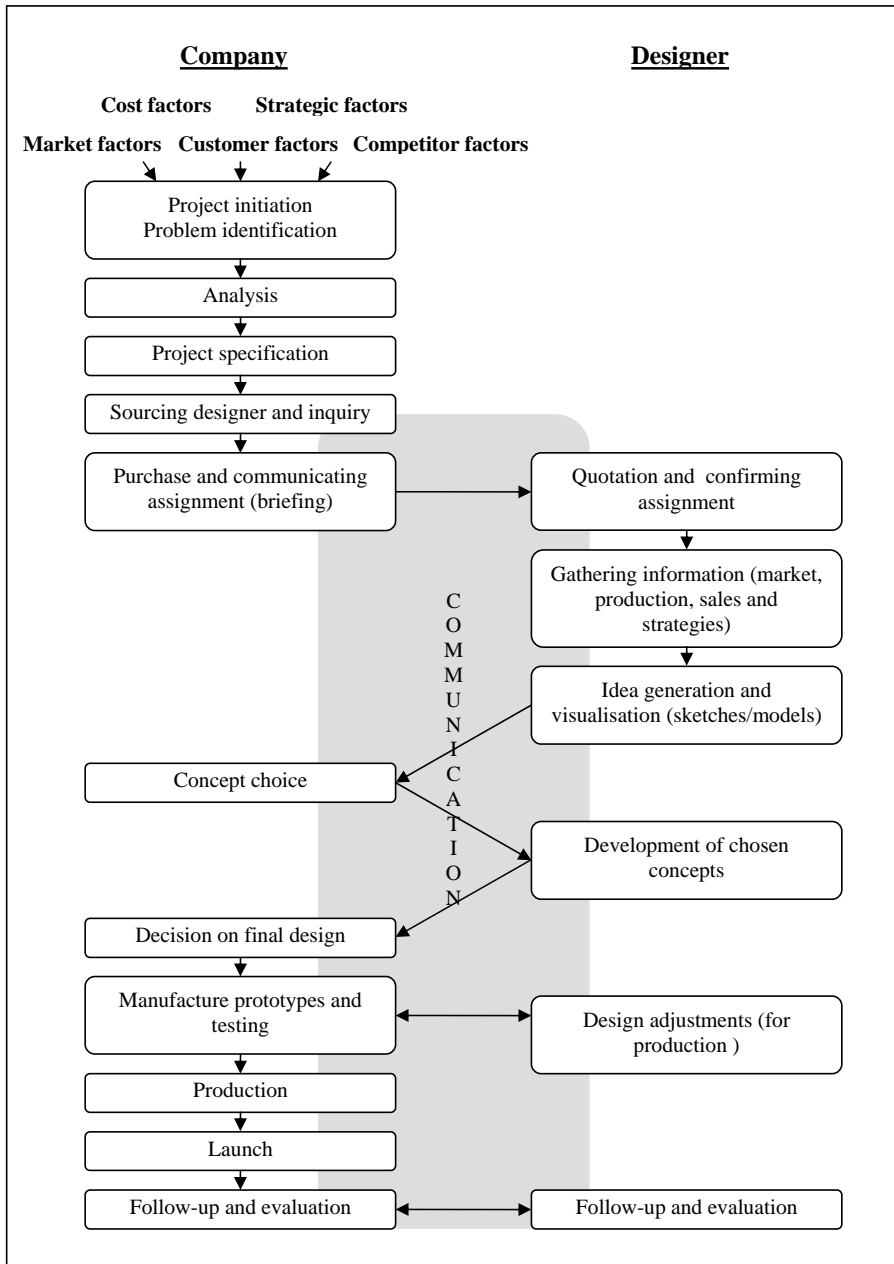


Figure 1 Suggested model for the design project process

2.1 Sampling

Four small Swedish wood manufacturing companies and their associated designer participated in the study. Details of the sample can be found in table 1. The four companies were selected

with the help of design experts and trade associations with insight into the industry and the selection was made on the basis of the following three criteria:

- The companies should have fewer than 50 employees.
- The companies should range from beginners to highly experienced design buyers.
- The companies should have successfully carried out a product development project consulting design expertise during the last three years.

Table 1 The case studies, their background location in Sweden, design consultant and development project

Case study	Background	Location in Sweden	Design consultant and work location	Development project studied
Company A	34 employees €4,5m turnover	Småland	Interior/Product designer Malmö	New door collection
Company B	40 employees €6,1m turnover	Småland	Interior/Product designer Stockholm	New collection of indoors stairs
Company C	8 employees €0,5-0,6m turnover	MD in Stockholm Production in Norrbotten	Architect Stockholm	New safety door
Company D	17 employees €1,5m turnover	Norrbotten	Product designer Stockholm	Renewal of existing library collection

2.2 Data collection and analysis

The data collection involved preparation of an interview schedule, semi-structured interviews with company managing directors (MDs) and design consultants, and collection of additional documentary material such as written documents on company strategy and history. The interview was divided into three stages. The first stage involved collecting background information on company resources, company history, company strategies and product development approach as well as designer education, experience and development approach. In the second stage both MDs and design consultants were asked to describe their experience of the product development process of the chosen project from start to finish. The respondents were asked to point out any important steps and decisions taken during the process and encouraged to describe the meaning and thinking behind each choice. Finally the process model from Figure 1 was shown to the respondents, who were asked to comment on similarities with and differences from the described process. During the interviews the ambition was to cover all issues in the interview schedule and the respondents were allowed to expand themes, but backtracked when so was needed. All interviews were tape-recorded, additional notes were taken and each interview lasted between 1.5 and 3 hours. The tape recordings and interview notes were transcribed and combined with the additional material to form interview reports. After a first read-through review, the complete material was coded and categorised and interview reports returned to the respondents and checked for accuracy. Interview material from each company director and the associated designer was combined into four cases and analysed separately. Finally there followed a cross-case analysis with summarizing the cases in a matrix, comparing key issues across cases and evaluating against existing theory.

3 Case summaries

In the following subsections each case will be described, and in the following section the cross-case patterns and similarities with and differences from the literature will be considered.

3.1 Project A: development of a new door collection

Company A started in 1935 as a local carpentry. After one shift of ownership the present owner, a family-owned holding corporation, bought the company in 1992. Today the company has 34 employees divided on sales and marketing, administration and production. Company A designs, markets and manufactures wooden doors of what they describe as a premium brand in aesthetics, construction and material. For 40 years design has been a central part of the company's strategies for developing a strong brand name, and external designers are consulted for all new product developments, both for longer term and single projects. The responsibility and initiative for new product development lies with the company MD, but decisions are shared between the MD and the production manager.

The external designer has a degree in interior design from 1993 complemented with art education and runs a design consultancy with three employees taking on assignments in the fields of product design, interior design, house architecture and small artwork. Clients are companies of all sizes and wood is a frequently occurring work material.

3.1.1 Product development process

Company A was facing unprofitability and a trademark survey showed lost lead over competitors. Countermeasures were discussed, and in August 2004 a decision to engage a new designer was taken. Several options were considered before the choice fell on the project designer. A meeting was set up to discuss product market, current trends, company strategies and production opportunities, and a financial contract was drawn up assigning the designer product royalty with a small payment in advance. The decision fell on developing three new product lines. No restriction regarding shape was given, but the designer was encouraged to follow production standards and allow for product combinations. The new project was launched by introducing the new designer on the company web site, and the designer started the development with information gathering, including two company visits to study production and construction possibilities more closely. After idea generation and sketching, a number of concepts were presented to the company and jointly evaluated, and two series were chosen to go on to production. The company manufactured product tests of key elements that were reviewed by the designer, and after an intense dialogue and reconciliation of ideas, acceptance was given by the designer and a decision on design and production was taken. CAD-drawings were made by the company, full-sized prototypes manufactured and a search for potential suppliers started. The finished prototypes were reviewed by the designer for a final test of proportions and a decision was taken to make minor adjustments before starting final production. The prototypes were photographed for graphic illustration and launched at two following trade fairs in early 2005. After the launch, further development continued, with production adjustments, fine-tuning of components and building relations with suppliers. At the time of the interviews, the company and the designer were working on a further launch, using joint exhibitions, price offers and public relations.

Both company A and the designer experienced well working communication during the process, and a good personal chemistry provided for mutual understanding. A continuous dialogue was held concerning all significant issues, but work was done relatively independently. Due to time pressure before launch, some decisions were taken without involvement from the designer, something that the company experienced as negative.

Problems experienced

- Lack of a project plan and simultaneously ongoing projects with other designers created great time pressure before the launch, causing decisions to be taken without the designer, and delaying final tests and specification until after production and launch of prototypes.
- Difficulties finding component suppliers with the right production capabilities and price.

Success factors

- Company A has great experience of design projects and clear strategies.
- The designer is a well-established name and participated actively during the launch.
- Involvement of all personnel in the development facilitated a smoother process.
- Humility from both parties, listening and seeing the other's perspective.
- Shared interest in product success and
- Finding the project work enjoyable and rewarding.

3.2 Project B: development of a new collection of indoor stairs

Company B started in 1983 as a split-off from a local house factory. After two changes of ownerships and a relocation of the production facilities, it is now owned by three partners. One of these is the present MD, who joined the company in 2001. 40 employees are divided on sales and marketing, administration and production. Company B develops, markets, manufactures and assembles a large assortment of wooden stairs for all kinds of houses. Traditionally it has a production focus, but is now aiming to become market leaders through increased branding. Company B has no prior experience of design projects and the design investments are seen as a test to strengthen the brand by raising the product status, but will remain a sidetrack to the main product line. The company MD and the production manager (who also is a partner) share unspoken responsibility for decision-making and product development.

The external designer has a degree in product design from 1999 and has since then shared a company with her father, who has experience of small company management and wooden construction. Assignments lay in the area of product and interior design where wood is a frequently occurring work material.

3.2.1 Product development process

The project was initiated in the winter of 2003/2004 when company B was offered financial aid for a design investment by a local trade organisation. Company B, which recently had made a market survey and was discussing the use of design, accepted the offer and a project strategy was developed. The organisation came with suggestions and contacted four designers. Two candidates were booked for interviews, which involved presentation of company and designer and a discussion of company vision, production facilities and target market. The designers were given a few weeks to freely sketch ideas, (the only restriction being to enable in-house production) and came back to present the result. A decision was made and a contract was written assigning the designer product royalty plus an additional sketching fee. The choice of designer was made on the basis of the presented ideas and because the designer and her firm associate both were known from the region. A discussion about the ideas was held and a concept choice made. The designer was then given a few weeks more to refine the designs, produce plans and assign production method. Prototypes were manufactured in the factory, with the designer participating in modification of drawings together with production and construction personnel. An intense dialogue and reconciliation

of ideas resulted in a number of smaller adjustments. Around this time a decision was taken to launch the new collection at a furniture fair in February and this speeded up the process. Prototypes were tested and found satisfactory. Exhibition prototypes were manufactured and photographed for graphic material and preparations for press release and the fair were made. The launch gained a lot of publicity in the press. After the launch there followed marketing and sales through press releases and Internet presentations and exhibitions, in which the designer occasionally participated. An evaluation against budget was found satisfying and the collection is now under continuous development together with the designer to develop new models and complementary products.

Mutual understanding and interest in the success of the product contributed to well working communication between the company and the designer. The designer was involved in all decisions and a continuous dialogue was held concerning all development issues, larger and smaller, and lot of reconciliation was needed to reach a satisfactory result on both parts. The company received more help than is customary in similar projects, also with things lying outside the budget, such as construction drawings.

Problems experienced

- High activity in production and no personnel assigned to the project caused time pressure before the launch, which resulted in fast forwarding of the final process steps.
- Due to the new products the company had to depart from its product safety strategies.
- Insufficient production adjustments made the new design ill suited for the normal factory logistics and led to demanding manual work.

Success factors

- Well thought-out project before start (partly helped by the external organisation).
- Great enthusiasm and large participation from the company.
- A good first idea and a quick decision on the final collection saved much development time.
- Good communication, mutual understanding and interest in the product.
- The designer could provide extra help due to available competence from design associate.
- Large publicity was positive for the launch.
- Involving and informing all personnel during the development smoothed the process.
- Both parties finding the project work interesting and fun.

3.3 Project C: development of a new safety door

Company C was started in 1997 by the present MD. After a bankruptcy it was restarted in 2002 with the help of private capital investors. The company MD responsible for product development and marketing lives in Stockholm. The production facilities located in Norrbotten have seven employees running administration, calculation and production. Company C develops, markets and manufactures façade products out of northern Swedish pine, intended for a high price segment of house building and architecture. Quality and design are leading words and considered vitally important for profiling the product concept. The MD is the inventor behind the product concept and manages all product development. Architects are brought into the development to adjust product concepts in order to perfect function and aesthetics and to supply complete drawings. Since the first start the company has consulted

several architects and has since ten years developed cooperation with the architect for the described project.

The external designer has a degree in architecture from 1978 and has since 1997 run an architectural agency, today employing six people and focusing on building construction and specialist development projects in wood construction. The designer has extensive knowledge and experience of working with wood as a building material and his projects frequently involve working with small companies as suppliers for special projects.

3.3.1 Product development process

Company C has since the start aimed to develop a complete assortment of façade products. An earlier trial production of doors drawn by the same architect turned out unsuccessful and was put on ice. In the spring of 2003 a capital investor owning a door from the trial production contacted the company MD, pushing to initiate the door development again. A meeting with the investor specified problems and required improvements, and the MD started thinking and sketching to find a solution. The architect was contacted, sketches discussed and an oral agreement made that the architect would contribute with opinions on aesthetics and design details and supply CAD-drawings. No contract was written, but the agreement included future payment after finished development. As the architect saw a great interest in the product being developed and considered it a future investment, this was considered no problem. An employee at the architect agency worked on the drawings for approximately 1.5 months, during which the company MD was involved in a dialogue when needed. Complete drawings were delivered to the MD for further development. Following the drawings the company put together a prototype by hand, which was presented at a trade fair in the spring of 2004. However, the MD was dissatisfied with some components and the prototype was put to test in the MDs private house during the winter before deciding to go on with production. To be able to proceed, the company applied for and received financial support from a local design project. Further development and design of construction was done in cooperation with component suppliers, and resulted in a few new component solutions. The finished concept was run by a few architects and after positive response a decision was taken to make new prototypes. The prototypes (variations of the same concept) were manufactured outside the company by personnel from the financing project and launched at two trade exhibitions in March 2005. The launch was well received and orders requested. At the time of the interview there remained minor modifications, preparations for production, a possible contract with suppliers and production of a first trial series.

The relationship between the designer and the company MD is based on a mutual interest in the development of new products and an exchange of favours. The communication is of an informal kind and works well for both actors. All communication was controlled by the MD and the designer was more or less used as a discussion partner. The designer sees the consultation work as a long-term investment and thinks that in the future, when the company solidity has increased, the cooperation can be raised to another level, more like the traditional company/consultant relationship.

Problems experienced

- Limited financial resources generated no financial compensation for the designer and finding external financing demanded time from the design project.
- Time pressure before the launch caused fast forwarding of process steps.
- Limited contact during further development stages.

Success factors

- Financial support enabled final development and prototype production.
- Good working cooperation between company and designer and the designer finding the work interesting and fun enabled consultation without contracted payment.
- The company MD is a real enthusiast and knows his production well.

3.4 Project D: Renewal of existing library collection

Company D started in the 1920s as a local carpentry and has since the start been family managed. The present MD took over ownership in 1987 and today 17 employees are divided on administration, production preparation and purchase and production, and one external salesperson is employed. Company C works with three product fields: home furnishing and interior design carpentry, where they act as suppliers, and library furniture. The company is mainly a manufacturing unit, but owns the library collection and has handled all its product development and marketing for some years. For this purpose, design and more primarily function are seen as vital, and designers are consulted to add competence and an eye for design, collect market opinions and gain the advantages that come with a well-known name. Since the library collection was developed 10 years ago by the two designers in the studied project, these have been connected to the company and regularly consulted. Several other designers have also been involved in smaller parts of the collection and the other product fields. Management and responsibility for product development lie with the MD.

The external designer (D1) holds a university degree in interior architecture and furniture design from 1985, complemented with a wood education, and has since 1987 run his own design consultancy. Assignments mainly lie in the field of product design, but occasionally include some projects on the borderline to industrial design. Wood is the most frequently used work material, the projects are usually small, and long-term cooperation is allowed only for a few clients. The second designer (D2) involved in the project² works mainly with large interior design projects and has collaborated with the first designer (D1) for many years. Both designers work for product royalty and additional payment for extra assignment outside product development.

3.4.1 Product development process

Company D and the two external designers had been discussing a renewal of the library collection when designer D1 started working with an interior design project for a new library. The company's older library collection did not fit in with the new concept and the company was asked to participate in developing a new collection suited for the new library. Company D decided to participate in the project, but also saw an opportunity to use the developed product as a complement to the existing collection. Designer D1 worked on drawings while using company D to discuss ideas and add technical competence. Company D tested and calculated costs and an intense dialogue took place before complete drawings were received and prototypes manufactured. During the project work a discussion was held about the possibilities of standardisation of the new model. Due to health problems, designer D1 backed out and designer D2, who had been kept informed by D1 about the development, started the work with adjustments for the collection and its industrialisation. The prototype manufactured

² In this project two designers were involved, but as the designer D1 involved in the project's beginning could not participate due to health problems, the case report only reflects his involvement as seen from the other participants' point of view.

for the library project was used for mapping positive and negative aspects before further development, and complementary products were developed. During this work a continuous dialogue was held with the company, and after adjustments were completed, a new prototype was manufactured and launched at a trade fair. The new model was received well and a decision was taken to continue with the model as part of the standard collection. A few modifications were made before the model was launched at another exhibition together with graphic material made by the designer. The library project underwent public purchasing, but due to unfortunate circumstances, company D lost the project to a competitor. This was a large drawback for the company that was reversed when the full-scale model produced by the competitor could be evaluated as a final test and used to develop their own model yet another step. At the next trade fair the model was presented using the advantage that the library project now could be used as a reference for sales. At the time of the interview the collection was still under development and continuously complemented with side products in order to achieve customer satisfaction.

The long relationship between the company MD and designers brings about good knowledge and respect for each other. The relationship is personal and informal and both the interviewed designer D2 and company D feel they can rely on the other's competence. For instance, the designer knows and adjusts well to the company's needs and a relatively small work effort is needed before leaving over final adjustments to the company. The cooperation with two designers gives different perspectives to the development (D1 being more visionary in style and D2 more concrete), and is seen as positive by the company. The product is seen as a mutual investment and interest.

Problems experienced

- Time pressure before launching caused fast production adjustments that might not always be the most cost effective solution.
- The large geographical distance between company and designers is experienced as making communication somewhat slow and complicated.
- A week connection between the designers' work and the company's production adjustments.
- Limited financial resources and marketing competence are negative for the launch.
- The insecurity of long-term investments for external projects makes product development hard to plan and budget.

Success factors

- The perspectives of two designers yield a well thought-out product.
- The cost-free consultation of the royalty contract gives a personal and informal relationship where no questions are left unanswered.
- The long-term relationship makes it possible for both parties to work efficiently, involving an overall good personal relationship, tight communication and mutual understanding

4 Analysis

The case summaries found above detail the activities, problems and opportunities of design projects in four small wood manufacturing firms. In the following section the four cases will be analysed and discussed according to influencing factors. A summary of the most important aspects of the four cases can be found in table 2.

Project input

Limited resources are often pinpointed as a barrier to small companies' product development. This has also been identified in the studied cases. Companies C and D both experienced limited finances as a significant problem. This is very evident in the case of company C, where despite the designer agreeing to have no contract of payment, more external funding had to be found to finance part of the project, something that took both effort and time from the MD's busy schedule. Company B experienced no financial problems, but might not have entered the project, if it had not been for an offer of partial external financing. Financial support lowers the risk-taking, as many small companies are wary of the cost and unsure about the commercial outcome of design investments (Bruce et al 1999).

Table 2 Comparison summary of the four cases

	Project A	Project B	Project C	Project D
Project input	Large design experience New consultant	No design experience New consultant Financial support	Moderate design experience Known consultant Financial support	Moderate design experience 2 known consultants
Process	Internal initiative. No specification. Early project launch. Company & designer rather independent process activities. Involvement of all personnel. Speeded process forcing decisions without designer. Launch with designer. Continued development Joint decisions by MD, PM & designer	External initiative. No specification. Much work by the designer. Involvement of all personnel. Speeded process in final steps. Free publicity helped launch. Continued development Joined decisions by MD, PM & designer	Internal initiative Internal development up to product concept, designer involved only in fine-tuning. Further development, prototype testing and launch by company. MD responsible for all decisions	External initiative Specification from external project. Simultaneous development for external project and for their own collection. Exchange of designer during process. Several rounds of prototyping, testing and launch. Continued development Joined decisions by MD & designers
Communication	Continuous dialogue when relevant	Intensive dialogue about all matters	Dialogue on the MD's request	Continuous dialogue, very informal
Problems	-Time pressure -Decisions without designer -Tests and change after launch -Difficult finding suppliers	-Time pressure -Final stages speeded -Limited production adjustment -Not following safety strategies	-Time pressure -Limited finances -Bad contact during final development stages	-Time pressure -Distance to designer -Limited finances -Lacking competence in marketing/sales -Gap in production adjustments -Insecure investment
Success factors	-Design experience and clear strategies -Established designer active during launch -Involving all personnel -Good relationship -Interesting and fun	-Thought through project strategy -Fast decisions -Extra help -Enthusiasm -Involving all personnel -Free publicity -Interesting and fun	-MD experienced and knows his production -Financial support & free consultation -Profitable cooperation for both company & designer	-Trust & respect -Tight communication -2 designers giving complementary perspectives

None of the companies in the study have any development department and appointed any staff to handle the design project (compare Larsson 2001). In all cases the company MD has the main responsibility for product development, but in companies A and B most decisions were

taken in cooperation with the production manager. The competence in design management differed largely among the companies. In company A the long experience of working with design projects was seen as a success factor by the designer and enabled easy cooperation and relatively independent work for both parties. Company B with no prior design experience was greatly assisted by the initiating organisation participating in formulating the project plan and sourcing. The designer also took on part of the management and somewhat steered the company through the project by participating in all decisions, large or small. The lack of experience on the company's part was seen to be compensated by great enthusiasm and engagement. In project D, where the MD had moderate design experience, the company and designer took equal responsibility for carrying the project forward. In company C the MD had moderate design experience, but wanted full control and managed the process through all process activities. Together the four cases could be seen as an example of a learning process, where inexperienced design buyers need the designer to steer the project, while the more experienced company can take over full management.

All companies in the study have more or less defined company strategies for managing product development. Company A has worked most explicitly with this and has formulated strategies for use both in marketing and in product development as a basis for product specification. Their strong marketing strategies can be noticed in the launch of the designer directly after project start, something that they were alone to do.

All designers involved in the four cases have experience of working with small companies and with wood as product material. In contrast to previous findings (von Stamm 1998), the two companies with new designers experienced sourcing easy and all four companies were satisfied with the designer's competence. Companies A and D also pointed out the importance of the designer having an established name in the product market, to give the consumer the right feeling and to contribute good marketing channels.

Project process

The four studied projects display unique and very different processes. The statement that small companies often do not follow any formalized process model (Larsson 2001) is supported by the four cases, where all processes are managed more or less on an ad hoc basis without any existing plan or time schedule. The suggested model in figure 1 could not be used in detail to describe any of the projects in the study. The largest resemblance to the suggested model can be found in projects A and B, where it also was pointed out during the interviews that the model was a good description of at least how it "should" be done. Most of the suggested activities can be found in each of the four projects, but in projects C and D the processes differ in the organisation and division of work between the company and designer. In project D the process organisation was largely affected by the external initiation and product specification that steered the development in the first project phase, giving the company little room for their own demands. The exchange of designer and change of direction towards their own development made the project resemble a normal project more, but the external project influenced the whole process. Project C is clearly different from the others in that the entire process is controlled by the MD, who develops the product almost entirely on his own and consults a designer only to do the fine-tuning to get the right "architecturally designed" feeling and to produce drawings that the company does not have the competence or equipment to make themselves.

In none of the projects was any written specification used to brief the designer, and neither company A nor company B provided any design limitations. The designers used their

information retrieval from the company to give direction and limitations for the product development, and the clear strategies and a well thought-out project could be seen as a substitute for specification. In project C no specification was needed for the designer, as the concept was ready, but the MD produced his own specification during his concept formation. In company D, as mentioned, the specification came from the external initiation, but it would have looked substantially different if the company had initiated the project themselves.

The management's attitude towards design and how much design is embedded in an organization's thinking and culture are of great importance (von Stamm 1998). In all companies attitude problems among personnel were seen as a problem that might affect the process negatively. In projects A and B the management worked a lot with involving all personnel in the development process, something that was seen to raise the employees' design awareness and increase the engagement in all development steps.

The product adjustments for production were seen to cause problems in projects A, B and D. In project A, some components were hard to find suppliers for, and in company B the product could not be produced in the company's normal production logistics. What this is due to is hard to pinpoint, but the work of the designer is of course a potential source to blame, as well as the lack of specification by the company. In Project D the company experienced a gap between the designer's work and production, something that demanded considerable extra work on the company's part with production adjustments. With limited time, the company was forced to manufacture the product using a "quick solution" that might be more expensive and not possible to change after presentation of the product.

Time pressure was experienced as a large problem in all four projects, causing the final development steps to be fast-forwarded and ill structured. The time pressure is triggered by the need to launch the new product at the yearly trade exhibitions, but was raised by not having any personnel assigned to the project. If the normal production is fully booked, this easily takes focus and time away from the design project. However, as pointed out by project A, a project plan with a time schedule could be an easy solution to the problem.

In all projects the first launch and presentation of the project are made before the product goes to production and production adjustments are made. This is partly due to the time pressure discussed above, but the presentation is also seen as a good test of the product, and if the product is badly received, money can be saved by changing the concept or dropping the project. However, the early presentation can also have negative effects, as it is hard to make any visible changes after showing the product. The importance of the designer being active during the launch is highlighted in projects A and B. The designer's interest in product success that comes with the royalty contract could be a good chance for the small company to share the cost of an expensive marketing operation.

Evaluation was made continually as a part of the development process in all four cases, but not as a formal activity. The continuous development makes it hard to see an end to the project and to find the moment to make the evaluation. However, as project A points out, project documentation and evaluation could be useful for future learning.

The importance of a good relationship is highlighted in all four projects and tight communication, personal chemistry and mutual understanding are all mentioned as success factors. The royalty contract means no additional cost for communication time, and is seen as a good way to make communication informal and smooth. Working with no financial contract

as in project C gives little reason for tight communication, however, and could not be seen as viable in the long run. A long-term relationship between company and designer as in projects C and D is seen to create trust and respect that are important in communication. A potential problem, however, is that it becomes easy to take the other part for granted. This could be the case in project D, where the company's competence to handle all production assessments on its own might be overrated by the designer.

5 Concluding remarks

In this study the use of design expertise in small wood manufacturing companies' product development is explored. The detailed case studies of four design projects illustrate how the development process differs largely between projects depending on the existing conditions.

Limited resources, both financial and human, were seen to have a large impact on the studied projects. In two cases external financing gave the opportunity to start and implement the project. The limited number of staff allowed no personnel to work specifically on the project, slowing down the process when other production demanded all the time. The competence to handle design projects varied, but was not considered a large problem. The companies with large design experience took on all the project management, while the less experienced ones were helped by the designer taking on a more leading role. This stands in contrast to the common view in the literature that project management is the responsibility of the company and a necessity for success (Bruce et al 1999), but was seen to work well in the study.

No formalized methods were used during the development process, confirming the results of Larsson (2001). Instead the process was managed more or less on an ad hoc basis, using no plan or time-schedule. The stepwise development procedure of the four projects differed somewhat in the organisation and order, but most activities in the suggested model in figure 1, could be identified in all projects. The largest difference was found in the amount of involvement from the designer's side, which varied from merely fine-adjusting ready concepts to participating in all development decisions. Time pressure was found to have a large effect on the process, causing fast forwarding of the final process steps. None of the projects saw any end with the product launch, but rather entered a new stage of continuous development and improvements until a new model is launched. Even though many smaller problems appeared during the development process in all projects, they were solved relatively easily, and no problems large enough to jeopardise the projects success could be identified.

In line with the findings of Bruce et al (1993), a good relationship and tight communication between the company and the designer was seen to be of major importance for the four projects. A long-term relationship was one way to achieve this, and another contributing factor was the royalty contract, which created a joint interest in product success and created informal communication also when using a new designer. The common perception that wood manufacturers would be hindered in their development work by traditional values and a low competence level (Brege et al 2004) is not supported by the study. On the contrary, the four cases show a high design awareness and ability to adapt to new conditions.

The findings of the case study indicate that a project plan would be the solution to many of the problems occurring in the studied projects. This supports the practical use of the suggested design project model in figure 1. The model, even though not perfectly agreeing with the described processes, could still be seen as a good representation of a best practice model, and could be used as basis for a customized design project plan.

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Paper C

Diverse perspectives: A comparative study of managers' and design consultants' views on design projects in small wood manufacturing companies

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Abstract

Many factors influence the successful outcome of design projects in small companies, where different perspectives between the firm's management and external design experts represent one such factor. By employing a multiple case study of design projects in small wood manufacturing companies, this paper explores the different perspectives of company managers and external design consultants to compare how problems and possibilities involved in a design project are experienced. The results reveal that communication and a well working relationship were valued highest by both parties to reach a successful result, but also that differences in perspectives negatively affect project cooperation. The results moreover indicate that identified differences are dependent on different project perspectives, experience levels and starting points.

1 Introduction

Research has shown that effective design use by small companies can contribute positively to business performance and competitiveness (Walsh et al 1992). According to Bruce et al (1995), investments in professional design expertise at product or project level involve relatively low risks and can yield substantial rewards by opening up markets and enhancing profitability. Even though the risks involved might be low, the company making the investment is eager to profit from the outcome. Numerous studies have examined why new products succeed, and why others fail (for a review of these studies, see Montoya-Weiss 1994 and Johnes et al 1988). One factor found to be vital for the outcome of a design project is the relationship and communication between the commissioning company and the external design consultant (see for example Bruce et al 1993). But to achieve a good relationship and working communication is not always so easy. According to Jevnaker (1999), a great dilemma of the design/business relationship is that it is diffuse, uncertain and asymmetric due to gaps of knowledge and diverse perspectives between the firm's management and the design experts.

The research reported on in this paper investigates and compares the perspectives of companies and design consultants using a multiple case study of design projects in small wood manufacturing companies. A conceptual framework is presented and tested, suggesting a number of key factors influencing the project outcome in small companies.

1.1 Design in small wood manufacturing companies

The Swedish wood manufacturing¹ industry is facing intensified global competition. In many, especially smaller, companies the struggle for their survival involves an imperative to find new ways of development to increase profit. Design and product development are traditionally given low priority in many companies (Brege et al 2004), but design investments

¹ Wood manufacturing is defined as being the later stages of wood processing, including development and manufacturing of finished components, wood systems, carpentry and furniture.

are now seen as an important opportunity to create competitive advantages for small wood manufacturing companies. Until today, however, very little research has been published addressing product development and design in small wood manufacturing companies (Ekberg 2004).

The present study is part of a larger research project that aims at developing a better understanding of design investments in small wood manufacturing companies, and examines the problems with and opportunities for investing in design expertise for product development projects. The focus here lies specifically on comparing the different perspectives of company management and design consultants, to see whether they share a common view or have different experiences of the process, problems and opportunities related to product development and design investment projects and to explore possible implications.

2 Conceptual framework

To compare the views on problems and possibilities of design projects in small companies, we first have to define what factors influence the project outcome. To do so, a conceptual framework was first developed, which helped to identify the major variables and key factors explored in this paper. The conceptual framework presented here is a hypothesized model put together by the author on the basis of previous research as well as the best practice literature on design, design management, new product development and small business performance.

Many factors that impact new product outcomes have been identified in the literature. A majority of these studies focus on success factors at a project or product level, but according to Cooper et al (1995), this might mean missing important characteristics on a company level. Cooper states that to capture the complete picture, it is necessary to move to the firm level. This statement corresponds well with the aim of this research, of exploring all the problems and opportunities that a small company may experience in and around a design investment. The model below in Figure 1 displays the framework proposed in this study. The framework is mainly based on frameworks presented by Cooper et al (1995), Hart (1995), and Bruce et al (1999), and divides the factors influencing project outcome into two groups: input factors and process factors.

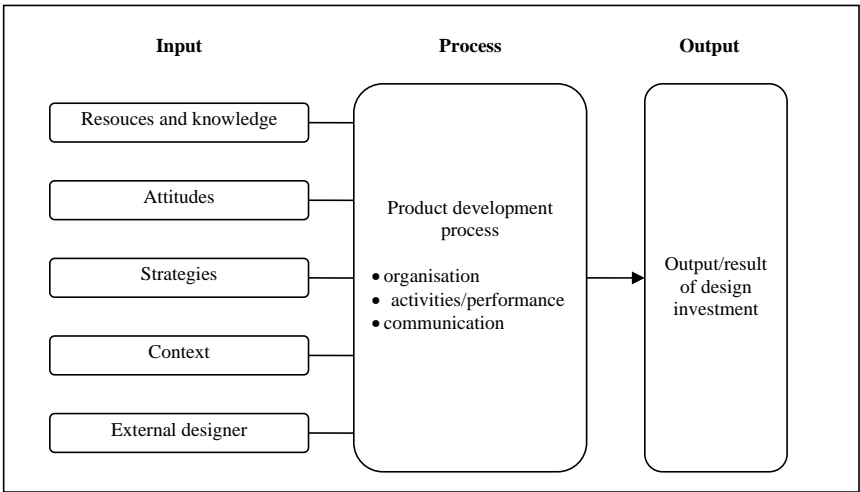


Figure 1. Conceptual framework for key factors influencing design project outcome

Below there follows a closer discussion of each key factor within the context of the small company. For each key factor the propositions used for comparison between perspectives are presented together with a theoretical background.

Resources and knowledge

Limited resources concerning both financial and human assets are often considered a barrier in small companies' product development. In comparison, small firms have less capital, net assets and reserves than larger firms have (Storey, 1994). Limited finances affect the ability to invest in new projects and enhance the importance of prioritizing in the right way. Earlier studies have shown that small wood manufacturing companies are wary of the cost of consulting a design expert because of the unsure commercial outcome (Ekberg 2004), something that is confirmed in a study by Gemser (2001) establishing that the benefits do not always outweigh the cost of a design investment. From this discussion we propose:

- 1) *The limited resources available to small wood manufacturing companies imply dysfunctional barriers for design investments.*

The company's knowledge and competence to manage design and design projects is vital to the project outcome, and to fully exploit the design expertise the company needs to possess good management skills (Bruce et al 1999). With a limited number of employees, the small company seldom has a product development department (Larsson 2001). With the owner also being the manager, the firm moreover becomes very dependent on the skills and experience of one individual. A study by the author of nine small wood manufacturers (Ekberg 2004) showed limited knowledge of design and lack of competence in project management. Thus we propose that:

- 2) *It is difficult for small wood manufacturers to possess knowledge and competence in all areas needed to efficiently manage a development project.*

Attitudes

How design is perceived and valued within the company, i.e. the company's design consciousness, influences the way in which design is used (von Stamm 1998) and consequently affects the outcome of an investment. Fairhead (1988) identified four different levels of understanding: design seen as styling; design as being about better products; design as the interface between company and audiences; and design as being an integrated process. In a study of design use in Swedish companies (QNB 2004), these levels were used to investigate the profit from design investments. The results showed that companies with a high design understanding had a more profitable development. However, the Swedish wood industry is by and large governed by traditional values and structures and companies in general display a low knowledge level (Brege et al 2004), something that might tell against a high design consciousness in this line of business. Whether design actually contributes to the success of a product and to a company's performance is critically influenced by the management's attitude toward it (Hart and Service 1989), but attitudes among the staff are also emphasized in several studies (see for example Larsson 2001). We propose:

- 3) *A design project functions well when the company management and/or personnel are convinced of the project's success and see the benefits from the design investment.*

Strategies

According to Hill (1993), it is important to let the goals and strategies of a company steer its product development and the methods used there. Several studies point out that design is

better used if it is incorporated into the business strategies and is not only applied in product development (Blaich et al 1993, Brazier 2004). However, small companies plan and act in the short term, and do not normally practise strategic management (Rantakyrö 2004), and product development in wood manufacturing companies is often performed sporadically, or as a spontaneous and reactive action to handle an acute problem (Ekberg 2004). We propose:

- 4) *Design investments in small wood manufacturing firms are seldom based on formal strategies or long-term plans.*

Contextual factors

According to Storey (1994), small companies are distinguished by a large degree of external insecurity, which restricts them from long-term planning. Due to their limited size, small firms can very seldom “set the rules of the game” on the markets where they operate. Their bargaining power is smaller compared to larger corporations, and their financial back-up for creating a market demand through massive investments in marketing are more limited. External factors thus have a great influence on new product development success (Cooper et al 1995). We therefore propose:

- 5) *The outcome of a design project is highly dependent on external factors (such as market factors and economic climate) that small companies have little influence on.*

External designer

Selection of appropriate design skills is a key factor affecting a successful project outcome. The resources and skills of the external designer have a major influence on project outcome, since the quality of the design work is an important success factor (Bruce et al 1995). To succeed in a design project it is important that the designer understands and grasps the firm’s strengths and weaknesses in relation to the opportunities and threats in a particular target area so as to make effective trade-offs (Sakakibara 1998). According to von Stamm (1998), many small companies consider it too expensive to consult designers and experience it difficult to find the designer that is just right for their company. Good and bad designers exist side by side and often the price rises with increased experience and reputation. To find the right designer, the design buyer needs knowledge in order to evaluate and decide what expertise is appropriate, but this may be complicated for the small company (Bruce et al 1999). We propose:

- 6) *It is difficult for small wood manufacturers to assess what design competence suits a specific project.*

Process organisation/management

If companies are to be effective in their use of professional designers, they need knowledge of design management (Bruce et al 1999). Studies have shown that small companies’ product development is performed sporadically on demand and without following any consistent, structured processes or methods (Ekberg 2004, Hovgaard 2004). In unsuccessful projects with professional designers, the lack of success can often be explained by poor management of design, both on the part of the business and on the part of the designer (Brazier 2004). We hence propose:

- 7) *Poor management on the part of the company is an important cause of decreased efficiency of design projects in small wood manufacturing companies.*
- 8) *Poor management on the part of the designer is an important cause of decreased efficiency of design projects in small wood manufacturing companies.*

Process activities

The efficient execution of the product development process, involving all the activities and decisions from idea generation to product commercialisation, has been shown to be critical for design project outcome (Hart et al 1995). Different activities have been highlighted as most critical in the literature. Bruce et al (1999) point out that sourcing (as discussed above), briefing, and evaluation are of utmost importance. Well-performed briefing is essential for enabling the designer to get a true picture of the company's needs and resources, something that is often neglected by a small company (Bruce et al 1999). Evaluation is important for governing future learning and improvement (Bruce et al 1999). According to Rantakyrö (2004), evaluation and documentation are activities that are easily overlooked by the small company. Another factor of importance here is that small companies often experience a loss of control of the development when working with an external designer, and find it difficult to successfully industrialise the externally designed product (von Stamm 1998). With limited finances and a restricted number of personnel, it may be hard to find the time and means for working through all steps in the product development processes, which often become unstructured and unplanned (Ekberg 2004, Hovgaard 2004). We propose:

- 9) *As time and money are often limited in small wood manufacturing companies, the design process must often be simplified and shortened.*

Communication/relationship

According to Bruce et al (1993), the relationship between the company and the designer is the most significant factor influencing a project's outcome. Personal chemistry, tight communication, mutual respect and trust and openness are all considered success factors in creating well-working cooperation. It takes time, however, to build such relations, and they may not be required when an external designer is engaged to work on a one-off project (Bruce et al 1993). Long-term cooperation with one designer may be a way to overcome the problems and build up design competence (Bruce et al 1998). This is also verified by a study by von Stamm (1998), in which small companies stated that each project gave new knowledge of design management that helped to run the following project more smoothly. Communication difficulties between the parties are a major problem source that often causes cooperation difficulties (Jevnaker 1999). Jevnaker identified that this was partly due to asymmetrical knowledge, i.e. actors are not acquainted with the other party's competence field, and a company and its external designer have different perspectives on design, its use and strategic importance. Different perspectives make it difficult for the designers to grasp what the client really wants, while the company management may not capture what the designers actually need to know (Sakakibara 1998). The Swedish wood industry is to a large extent governed by traditional values and structures and in general companies display a low knowledge level (Brege et al 2004), something that implies a narrow view of design and a limited knowledge of the field that hence might complicate communication. We propose:

- 10) *Effective and regular information exchange between company and consultant is necessary to succeed with a design project.*
- 11) *Repeated design investments and a long-term relationship with one consultant may solve communication and management problems and contribute to developing more effective design solutions.*

3 Methodology

A multiple case study design was used for collection of empirical data to explore the views of key actors in design projects in small wood manufacturing companies. Four small² Swedish wood manufacturing companies and their associated external designers participated in the study. The selection was made with the help of design experts and trade associations with insight into the industry. The four companies ranged from beginners to highly experienced design buyers and had all successfully carried out a product development project consulting professional designers during the last three years. Details of the selected cases can be found in Table 1. For a more detailed description of each case, see Ekberg (2005).

Case study	Background	Design project experience	Design consultant	Client/consultant relationship	Development project studied
Company A	34 employees €4,5m turnover	Large	Interior/ Product designer	New	New door collection
Company B	40 employees €6,1m turnover	None	Interior/ Product designer	New	New collection of indoors stairs
Company C	8 employees €0,5-0,6m turnover	Moderate	Architect	Long-term cooperation	New safety door
Company D	17 employees €1,5m turnover	Moderate	Product designer	Long-term cooperation	Renewal of existing library collection

Table 1. Background data on selected case study objects

3.1 Data collection and analysis

The case study method used in the research draws upon the case study research tradition (Yin 1994, Miles & Huberman 1994). Data was collected using semi-structured interviews with company managing directors (MD) and design consultants, in combination with a structured questionnaire. The interview agenda included collection of background information about both the company (company resources, company history, company strategies and product development approach) and their designer (education, experience and development approach). The main interest was, however, dedicated to letting each respondent give a description of the product development process of the chosen project from start to finish, pointing out all important steps, problems and opportunities experienced. A questionnaire, filled in on location, contained 38 theoretically derived statements focusing on the key factors of the conceptual framework, including the suggested propositions. These were judged on a five-point scale where 1 represented “strongly disagree” and 5 “strongly agree”. Contrary to the open-ended questions used to address a specific process, the statements were not focused on a specific projects but rather aimed at depicting the respondents’ overall design project experience. The respondents were asked to take this into account and were also given the opportunity to comment on the wider perspective.

All interviews were tape-recorded, additional notes were taken and each interview lasted between 1.5 and 3 hours. The tape recordings and interview notes were transcribed and

² Various definitions exist of what is referred to as small companies. In a definition from the European Commission in 1996, companies are divided into micro (0-9 employees), small (10-50 employees) and medium (51-249 employees). The sample in this study falls within the EU definition of micro and small companies. They are all owner-managed and financially independent.

combined with additional material to form interview reports. After a first read-through review, the complete material was coded and categorised and interview reports returned to the respondents and checked for accuracy. A comparison matrix was used to identify differences and similarities between companies and designers concerning key factors both within each project case and between companies and designers as groups. The results were compared with the answers from the questionnaire and evaluated against existing theory.

4 Findings

In the following subsections the findings are presented following the outline of the conceptual framework. For each key factor the problems and opportunities highlighted by company managers and designers are compared and exemplified. Where comments are included, the source is noted by a two-letter combination where the first MD/D stands for company manager/designer and the second note for the project name (see Table 1).

4.1 Resources and knowledge

Limited resources were to some extent considered an obstacle to product development by all respondents. Different aspects were however highlighted to a varying extent in the four projects. All four companies state that they consider carefully what their money is spent on: *"You should be aware that this costs a lot of money..."*(MDA); *"You have to be careful of your piggybank, it's limited"* (MDD). Companies A and B, having the largest turnover, put less importance, however, on finances than the two others. Among the designers, opinions on finances differed widely. Designers A and D rated it as being of low importance, pointing to the royalty contract³ as a solution because of the lower investment at project start for the company. Designers C and B, who both put more time into the project than they got compensation for, perceived a greater problem but saw it as a necessary future investment: *"You have to believe it repays in the long run"* (DB). Despite this variation, all parties experienced that projects would benefit from larger financial means in that more money could be put into each part of the development, for instance on prototype manufacturing or marketing efforts. Another resource problem was seen in the limited number of personnel, something that designers found to complicate the process: *"The problem lies to a large part in that they want a lot, but have no personnel allocated to working on the project. It makes it more muddled..."* (DB). For the companies this meant that time must be taken from other company tasks. Linked to this is also the problem both designers and MDs see in the limited competence to handle a design project efficiently that smaller companies possess. The four cases clearly show how the quality of management is connected to their prior experience, as learning increases with every design project. The designers considered great experience a success factor, whereas the opposite was seen to make it difficult to focus efforts on the right things: *"You learn to sort out where to put your energy in the long run"* (DB).

4.2 Attitudes

The management's opinion about and attitude to the investment were seen to drive both the focus of the product development and the commitment to the project. Designers consider it a success factor that companies are genuinely interested and committed, and believe that great enthusiasm somewhat compensates for lack of experience. As designer B explained: *"They have been incredibly enthusiastic and have really taken the time to finish what they started, but it is common that this doesn't happen. You want so much, but you have to persist the*

³ By the term royalty contract we here mean the written agreement between company and design consultant. A typical royalty contract grants the designer a smaller payment at project start, and after product launch a percentage of the product sales.

whole way. And I must say they really did..." (DB). All MDs stressed the importance of having a personal interest and of enjoying the work: *"It is ultimately about whether you are interested or not, if you find it fun. If you don't, it will fail"* (MDA). In company B, which engaged in a design project for the first time, some hesitation existed in parallel to the enthusiasm: *"When we are fully occupied in production, it feels a bit like an urgent but not very welcomed necessity that this also comes in and disturbs..."* (MDB). This opinion was reflected in the project's focus, which was stated to be a test parallel to the normal production. The MDs pointed out the importance of employees' attitudes, and how negative attitudes could affect the development work: *"Then you won't get their full attention... We need to get everyone to join in, the individual is important..."* (MDD). To continuously inform the personnel about the reason for investment and to update them on the progress were seen as an important mission for the company management.

4.3 Strategies

Concerning strategies, company Mds and designers view the situation somewhat differently, but opinions again vary within the groups. All designers agreed that manufacturers' design investments are seldom based on strategies, but rather become short-term solutions to acute problems. The company MDs' opinions on this matter varied, probably in relation to the importance managers ascribe to their own strategy work. All companies in the study use some sort of design strategies, but their extent differs widely. In company A, design is fully incorporated in the company's business strategies and applied in every new development project. Designer A experienced this as a great success factor in that they were certain and could easily show what the company wanted from the new project. In company B the design strategies encompassed only a specific product assortment and were, as mentioned above, restricted to being a sidetrack of the main production. This strategy was however seen as negative by the designer: *"If you go in and start with this and haven't worked with design earlier and are trying to niche the company, you should also take on the graphical part to achieve the same design of everything"* (DB). It was also seen that several designers consider companies to have a too narrow perspective focused on their own production possibilities, which would have to be widened to increase the benefits from design use. *"The incentive to invest in innovation, new tools and machines is so inadequate"* (DA).

4.4 Contextual factors

External factors were considered important for the project outcome by company A and designers A and B, while other respondents did not see any strong influence. However, all projects were seen to be affected by external factors, for example by receiving external financing that lowered the company's risk-taking (projects B and C), or by limited access to suppliers that induced problems in later development stages. An electrical shortcut due to a storm was also seen to affect project A by increasing time pressure. The external financing in project C was however the only contextual factor seen to greatly affect the project outcome. On a higher level, company D saw the hard competition in the market field as limiting the opportunities for successfully introducing a new product, and designer A expressed the problem of low export rate: *"Sweden is a disappearing small market..."* (DA).

4.5 External designer

Designers consider it difficult for companies to decide what design competence should be used in a specific project. The MDs of companies A and B agreed, but disagreed in companies C and D, a result that might be due to the fact that the on-going long-term cooperation with one or more designers diminishes the need to find new designers. The opinions of what are important competences for a designer varied both among and within the groups. Experience

of small businesses, wood material knowledge and a wide experience were highly rated by both groups, but acquaintance with the wood industry was rated higher by the designers than by the MDs. It is interesting to note that three MDs (A, B, D) rate designers' artistic capability higher than their competence to produce industrially adjusted solutions, even though problems with production adjustments were experienced in all these cases. Designers pointed out the importance of a design consultant being capable both at artistic work and having knowledge of the field and its market potentials, but also pointed out that this was very difficult for a company to analyse. All designers displayed an aim to include production and market factors in their work and saw a large responsibility in taking on a project for a small company. As one designer typically stated: *"It feels important if you do something for them that they put down money, energy and resources on, that it will generate increased sales for them so to say. So they won't become fewer thanks to my effort, but rather the opposite maybe..."* (DA).

4.6 Process organisation/management

In accordance with prior literature, the importance of well functioning management is highlighted by all case studies. All respondents agree that company management is vital for the project outcome and that poor management might affect the project negatively. According to all respondents except company C, the problem with performing effective management lies in the lack of experience discussed earlier. A contributing factor is however also that the work process varies from project to project. The opinions diverge when it comes to the designers' role in the management of the project. None of the companies value management by the designer as important, but three designers (A, B C) point to the opposite. The most apparent example is manager C, who keeps full control to make sure the result is to his satisfaction and is not left to someone else, *"then it might become solutions that I think sh..t, this isn't a direct hit..."* (MDC). On the opposite side, designer B, who took on a large part of the management of project B, stated that designers should exercise higher control *"to dare to step in and say that no, we won't just do it like this. But to step in and steer things and say what you think, about all parts"* (DB). All designers agree that their role is more significant in small companies than in large ones, something that was experienced as positive: *"The big advantage in working with small companies is to be involved in what actually happens, and not only fill a gap in a structure, which can be the case in a large company"* (DD). It is however unclear whether the managers experience any steering on the part of the designers, even when this was the case according to the designer. In project D, for example, both the MD and the designers pointed out themselves as being the one most pushing the development forward.

4.7 Process activities

When looking at the process descriptions it was clear that the two parties experience the development process from different perspectives. Not surprisingly, both parties emphasize the specific part of the development work they take the main responsibility for, which means that they also view problems and opportunities appearing during the process differently. The MDs can be seen to focus more on hands-on problems concerning available resources, such as production assessment, whereas the designers focus on what brings the product forward most successfully, such as applying the right marketing efforts. In a way it could be described as a tug-of-war where the designer tries to get the company to apply their suggestions and the company argues in favour of their standpoint: *"We had to give and take a bit in both directions. I think it's like a pretty well working marriage"* (MDB). One subject on which the MDs and the designers demonstrate different views is briefing. The companies appear afraid of constraining the designer in her/his work and rather leave the specification open for the designer: *"It is dangerous to cut the wings of designers in this situation, I mean, then in the*

end you could just sit and do it yourself. You have to, if you want to develop something that holds over time, maybe think in new ways..." (MDA) The designers, on the other hand, want to know more than the companies tell them to be able to create a satisfactory result: *"Preferably you want to know everything about the company, but as a designer you can't do more than you are allowed to or can create room for"* (DD). In all four projects it was evident that the process had to be simplified and shortened due to time and money constraints, resulting in a fast-forwarding of development steps and problems with production adjustment. Connected to this was that all project processes were highly unstructured and no evaluation was used. Both groups acknowledged that evaluation would be helpful to use to a larger extent, and that design projects would benefit from more structure and planning.

4.8 Communication/relationship

When comparing the views of company managers and designers, the most evident correspondence is that all respondents value tight communication as the most important factor behind a successful project outcome. This was also displayed in the four projects, where a lot of effort was put into creating a well working relationship. Mutual understanding, trust, respect and personal chemistry along with tight communication were all mentioned as success factors by both parties. When comparing the cases, project C displayed the lowest level of communication of the four projects, something that seems to derive from strong management by the MD. As the involved designer stated: *"He is rather good at thinking himself, and likes to do so..."* (DC). Limited communication in this project caused a small problem, however, when the MD had applied a solution to the final prototype that the designer had not intended.

A significant prerequisite for reaching a functional relationship was seen by both parties to lie in creating a common interest in the project. In this respect, the royalty contract was seen as an impeccable solution. *"As in any other relationship you need to create a hold on each other. Contrary to a love relation this is a harder link, or even more cunning, because both want to get the most out of the project. And that includes the contract part also. At the same time I shouldn't get so much payment on the basis that I feel satisfied and don't care whether or not this will be produced"* (DA). The use of a royalty contract created a joint interest in the product success, but also induced an informal and relaxed communication into a new cooperation.

Another way to reach a good relationship agreed by all respondents is to engage in a long-term relationship. As designer A explains: *"I believe in cooperation over a long, long time. I think that as a designer you are never finished with it. And even more so when it comes to smaller companies like these"* (DA). In project D this could be seen to give great benefits by creating trust and respect for each other's work and capabilities. When both parties know each other well the work effort can be limited and *"you can do the right things with as little work as possible"* (DD), or as the manager stated: *"He knows fairly well what we want and don't want. It is an advantage when you have been in it so long"* (MDD). Even though the importance of communication was acknowledged, it was not considered simple to reach a working relationship, much due to different perspectives. Here designers appear to have a wider view of design, and see a more multifaceted use for design than managers, which created problems with expectations and in several cases demanded reconciliation on both parts. In projects based on first-time cooperation, designers saw unfamiliarity with the knowledge and expertise of the other party as another problem source. *"As a rule these small companies are totally uninformed, at least from the beginning. Many times they have no idea of what to expect from a designer. I think the wisest thing you could do is to create your own*

world together, where you create a shared frame of reference. From that you reason, define the project, make alterations and continue building...” (DD).

5 Discussion and conclusions

When comparing the views of designers and companies it seems that opinions differ both among and within the groups. A summary of the findings referring to each of the propositions⁴ is found in Table 2 below.

Proposition	Company MDs	Designers
1. The limited resources available to small wood manufacturing companies imply dysfunctional barriers to design investments	Partly confirmed	Not confirmed*
2. It is difficult for SWMs to possess knowledge, experience and competence in all areas needed to efficiently manage a development project	Partly confirmed	Confirmed
3. A design project functions well when the management and/or employees are convinced of the project’s success and see the benefits from the design investment	Confirmed	Partly confirmed
4. Design investments in SWMs are seldom based on formal strategies or long-term plans	Not confirmed*	Confirmed
5. The outcome of a design project is highly dependent on external factors (such as market factors and economic climate) that SWMs have little influence on	Not confirmed*	Not confirmed*
6. It is difficult for SWMs to assess what design competence suits a specific project	Not confirmed	Confirmed
7. Poor management on the part of the company is an important reason for decreased efficiency of design projects in SWMs	Partly confirmed	Partly confirmed
8. Poor management on the part of the designer is an important reason for decreased efficiency of design projects in SWMs	Not confirmed	Confirmed
9. As time and money are often limited in SWMs, the design process must often be simplified and shortened	Partly confirmed*	Partly confirmed*
10. Effective and regular information exchange between company and consultant is necessary to succeed with a design project	Not confirmed	Not confirmed*
11. Through repeated design investments and a long-term relationship with one consultant, communication and management problems can be overcome and contribute to developing more effective design solutions	Confirmed	Confirmed

Table 2. Summary of conclusions based on the study’s stated propositions (* indicates that diverse opinions existed within the group)

As can be seen in Table 2, both company MDs and designers confirm propositions number 2, 3 and 11. This that the problem and/or possibility indeed influence the design project as previously seen from the existing theory. Propositions 1, 4, 5 and 10 were judged as not confirmed in the groups marked with *, since opinions varied largely within the group. For proposition 9, only one respondent in each group was found to disagree, and this was thus

⁴ The confirmation or not of the eleven propositions has been judged according to the findings from the interviews, in combination with results from a number of questionnaire statements. The questionnaire answers to these statements may be found in appendix A.

judged as partly confirmed in both groups. The variation within the groups concerning these propositions may be due to a difference in experience in the separate cases, but also to more individual preferences that are more difficult to depict. Propositions 6 and 8 illustrate a more clear distinction between opinions in the two groups. The difference in opinions between designers and managers that these propositions exemplify, but that also exist to a certain extent in propositions 1 and 4, may partly be explained by differences of experience that might either partly have to do with the specific subject. It could for instance be argued that the company of course knows more about their own situation, and that the opinions from external consultants are mere estimates. However, it also points to a larger difference of viewpoints between the two groups, something that is supported by the fact that the studied projects displayed a number of communication problems, admittedly too small to jeopardise the project outcome, but large enough to complicate the situation. Looking closer at the results and comparing with the theory presented in the conceptual framework, it may be concluded that this difference in views is due to three factors: project perspective, experience level and starting point.

Confirming the results of Jevnaker (1999), it was seen here that company managers and design consultants come into a project with different perspectives. Managers take on a wider business perspective, whereas the designers' perspective is narrower and focused on the product. Even when managers and designers have developed close cooperation, as in project D in this study, it is difficult for the designer to reach the same insight into a company's more intrinsic values and problems.

Another important difference lies in the prior experience of design and design projects. Designers, working in the area every day and often having several projects going on at the same time, undeniably have a greater collected experience of design and design projects than company managers that now and then involve in a design project. It is in this key factor we find the largest variation among company managers (compare company A and B), and it appears as if an increased level of design project experience within a company simplifies the company-consultant relationship by allowing a more shared view already at project start.

When comparing the two groups, it appears that company managers and design consultants engage in a project with different starting points. In companies with limited finances, managers have to prioritise among investments and therefore tend to have a strong resource-based focus to secure effective use of available resources and production facilities, whereas designers have more of a market-oriented focus, seeking to satisfy customer preferences, thereby creating value for the company. From this perspective, the relation between a (normally) resource-oriented small business manager and a (normally) market-oriented hired consultant may serve as a functional and for the smaller firm very valuable alliance for the further development of the company.

To get the perspectives of managers and design consultants to meet is the largest challenge to achieve successful cooperation (Jevnaker 1999). According to Bruce et al (1998), a long-term relationship between a company and a designer is one way of creating shared understanding and achieving better working communication. This is confirmed by the study, where less reconciliation and debate were needed in the projects based on long-term relationships. Nevertheless, all projects (including those based on long-term cooperation) displayed communication problems to some extent.

The discussion above indicates that differences in project perspective, experience level, and starting points give managers and designers diverse views on problems and opportunities occurring in a design project and therefore causing communication difficulties. With the sample in this study being limited in size, it is however risky to draw any general conclusions. To confirm these findings and find possible implications towards a solution, more empirical research is needed.

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Appendix 1

Table of judged propositions

The categories were:

- 1 - Strongly disagree
- 2 – Disagree
- 3 - Neutral – can not take a stand
- 4 – Agree
- 5 - Strongly agree

Proposition	Company A	Company B	Company C	Company D	Designer A	Designer B	Designer C	Designer D
1	3	4	5	5	2	4	5	2
2	4,5	5	3	4	4,5	4,5	5	4
3	5	5	4,5	4,5	4,5	5	4	3
4	2	5	2	4	5	4	4	4
5	4	2	2	2	5	4	2	2
6	4	4	2	2	5	4	4	4
7	3	5	4	4	5	5	4	3
8	3	2	2	2	5	5	4	3
9	4	2	4	5	4	5	5	2
10	2	5	2	2	5	5	4	4
11	3	2	2	2	5	4	4	3

* The sum presented in this row is the mean from the answers to two statements posed to the respondents. Proposition 2 was judged on the following two statements:

- It is difficult for SWMs to possess knowledge and competence in all areas needed to efficiently manage a development project.
- The lack of tight and continuous design investments makes it difficult for SWMs to develop the experience and certainty that create efficiency in the product development process

Proposition 3 was judged on the following two statements:

- A design project functions well when the management is convinced of the project's success.
- A design project functions well when all personnel see the benefits from the design investment.

