



Handelshøyskolen BI

**Discussion Paper
8/2002**

Strategic Acting as Stagesetting: The Case of Industrial Design

Birgit H. Jevnaker

Abstract

Recent research in strategy, organization theory and industrial marketing is emphasizing the new complexities of gaining a dynamic resource-advantage that can reinvent and differentiate the industrial firm's offerings. This paper examines the dynamic capabilities contributed through industrial design and product innovation. An expanded understanding is needed to capture the specifics of industrial design expertise and its role in developing products as well as business organizations. Industrial design is an intensive transforming and mediating "technology" and the expertise is highly tacit, mobile, and relates to emergent realities of notyet-embodied knowledge. It tends to be embedded in dyads as well as multiple networks that construct new path-dependencies and can enact market, consumer and technological shifts in the business environment. The paper therefore extends the exploration of firm-specific dynamic capabilities to a relational-expressive level by focusing on the collaboration with (partly) independent design partners. Based on in-depth case studies of five Scandinavian firms and their allied industrial designers, a set of potential strategic gains is identified and these relates to four design-strategic processes, which are discussed. Finally, a new framework is presented that may capture how these dynamics between design and innovation actually is constituted and staged through a creative "relational constructing" within new design/business hybrids.

Introduction

This paper focuses on how relations with designers may enable imaginative rearrangements of business resources and activities, which may engage multiple stakeholders and *affect the way* business is being done. In a world of increased visibility, multiple converging media, and a range of new design specialists (Cotton and Oliver, 1992), we need to deepen our understanding of the development of design and its role in renewal and innovation processes. Interestingly, design and designers can be related to the "dynamic capabilities" perspective of how firms sense and seize business opportunities and renew their organizational capabilities (Teece, 1998). As recently pointed out by Tom Kelley (2000), general manager of Palo Alto based product design firm IDEO, industrial designers actually do corporate innovations and collaborate closely with firms, rather than merely supplying generic professional advice. Designers with rich innovation experience that I have had the opportunity to meet at mE0 and elsewhere tend to be both playful and disciplined, thus combining opposing traits as found by previous studies of creative individuals (Csikszentmihalyi, 1996). Yet sparse research exists on how designers work within and across industries and firms (Hargadon, 1998) as a visually projecting "in-between" expertise (Walton, 1992) and apparently contribute to novelty and originality (see Heskett, 1980).

Because industrial designers are often located outside firms or are boundary-spanners (Sparke, 1983, Bruce and Morris, 1998), we need to investigate dynamic design capabilities in connection to external or partly independent partners (the designer). This extension may provide insight into the creative "people" factor (Hart, 1995) as well as help to delineate the originating and organizing of innovation activities that currently are called for within new theory-building on managing industrial knowledge (see Nonaka and Teece, 2001). Despite the fact that a range of industrial products have been shaped successfully by designers since the 1930s (Heskett, 1980, Sparke, 1986), firms still tend to be "design-illiterate" (Kotler and Rath, 1984) and also trapped by product failures (see Cooper, 1997; March, 1999). In general, more specific investigations are needed (von Hippel, 1988) to capture how firms build resource advantages (Hunt, 2000). Guided by the knowledge-based strategy perspective (Nonaka and Teece, 2001) even more important is to understand how firms build the capabilities to do so. Here I address, in particular, how design relations can contribute to these objectives.

Thus, the purpose of this paper is to identify and examine how firms actually develop dynamic capabilities in product design through working with industrial designers. And what types of benefits¹ can be gained and replicated over time through this source of expertise. A set of benefits and processes of industrial design is presented drawing on my field study of design/business relations. Previous literature on design and product development is often stage-oriented (Lawson, 1990; Cooper, 1993), or tends to be object-focused (Walker, 1989; Dumas, 1993) - leaving complexities and interactions of the product design development and its relationships as a "black box". In order to examine industrial design relations, we need to open it up and I therefore give primacy to discussing the basic innovation processes that come into being - or are fundamentally impacted - through industrial design. Finally, I propose a tentative framework that may sensitize us to a more dynamic and expressive conceptualization of design developments that needs to be further explored. Since design and design relations are complex and research of design-in-business is at an early stage (Kristensen,

¹ The challenges and downsides of design/business relationships are delineated elsewhere (e.g. Dumas, 1993, Svengren, 1995; Jevnaker and Bruce, 1999; Jevnaker, 1999, 2001b).

1998), the paper first briefly introduces design and positions the research in current theories and debates.

Exploring Dynamic Capabilities and Design/Business Relations

MIT-professor Eric von Hippel (1988) found that innovation can emerge from multiple sources (e.g. lead users), and through field investigation he discovered an extensive informal trading of know-how through professional networks of engineers. Based on this he recommends further research on the attributes of this "distributed innovation process" rather than focusing simply on a focal firm. In contrast, the Berkeley economist David Teece (1998:72) highlights the significance of firm-related dynamic capabilities, also when knowledgebased services are utilized, but he comments that "it is relatively easy to define dynamic capabilities, quite another to explain how they are built". Pettigrew and Fenton (2000) in their recent book on innovating organization point to "new" subtle coordination mechanisms (that) stress the informal and social processes of organizations but remarks that "there is also a move away from defining organizations purely in distributional terms toward more relation notions". In this theoretical context, I propose that the experienced industrial designer and his/her relationship with business firms represents a compelling yet mostly unexplored source of innovation and competitive advantage (see also Svengren, 1995). Design can be conceived in a variety of ways, albeit most definitions miss significant aspects (Lawson, 1990; Gorb, 1990; Blaich, 1993; Dumas, 1993). Here I refer to design mainly as a creative and humancentered projecting expertise to configure and visualize something that did not exist before, at least not in exactly the same form (Walsh et al., 1992). In short, "design" (whether professional or amateurishly performed) can transform products - to the better or worse - and may have long-term use consequences (see Norman, 1988).

In line with historian John Heskett (1980) and more recent literature describing design through research (Dorst, 1997), I view design as a fundamental human capacity that is creativity-based and draws on both analytical and experiential-intuitive approaches. In fact, "one of the main difficulties and fascinations of designing is the need to embrace so many different kinds of thought and knowledge (Lawson, 1990:5). Multiple design disciplines exist (see Bruce and Cooper, 1997). *Industrial design* is a profession, rooted in humanistic-artistic, technology-based, cultural and marketing practices (cf. Heskett, 1980; Sparke, 1983, 1986). Put shortly, industrial designers conceive and "draw" future products or systems for industrial purposes in a rich variety of ways - and now often "digitize" or assist in building prototypes and associated documentation (see Jevnaker, 1996 for more elaboration). Nevertheless, designers need to convince their industrial partners of the potential design-related benefits, which can be challenging (Blaich, 1993). Thus the new product models or redesigns to be presented need to be perceived as promising and feasible including being manufacturable and marketable, which typically include complex tradeoffs and concerns (Heskett, 1980), as regards e.g. novelty and usability (see e.g. Svengren, 1995; 1998).

It is never easy to break new grounds. Extending theorizing by Teece (1998), Henderson and Clark (1990), Håkansson and Waluszewski (1999), Eisenhardt and Martin (2000) and Galunic and Eisenhardt (forthcoming), this is examining architectural innovation (Henderson and Clark, 1990) at the relational and expressive levels. This concerns *reconfiguring capacities* and the dynamic aspect of value creation within the business of relationships (see also Normann and Ramirez, 1998), which depends on the actors concerned, their ability to connect (Ford et. al., 1998), work together or enable a value-creating practice that cannot be fully

anticipated. Yet people can be inspired or creatively coordinated to perform well by recombining existing resources with subtle new ones, developing new possibilities for firms (Kogut and Zander, 1992; Leonard(-Barton), 1991, 1995). The position of allied designers "at a distance" (Aldersey-Williams, 1996; Bruce and Jevnaker, 1998) of firms² offers an interesting entry point from which to understand not merely what dynamic capabilities of firms are (Eisenhardt and Martin, 2000) but how they are constituted and enabled. While innovation may take place in established social structures, it is at the interfaces and "limens" (threshold positions) that they most frequently occur (Garsten, 1999). During my fieldwork practitioners gave telling examples how collaboration with industrial designers had created new product and service architecture that could meet more sophisticated needs and entice even the pragmatic industrial buyer³. Yet design tends to remain underspecified and diffuse in its conceptualization within management (see also Gorb, 1990; Dumas, 1993; Svengren, 1995, 1998). This is an area in which we need more insight to cope with innovation pressure, daily adaptations and renewal efforts as well as the relative inertia in resources, technologies, markets, economic relationships.

The point of departure in the paper is also the unsystematic but triggering observation that firms tend to lack *expressive coordination* of their resources and activities. Previous literature illustrates how firms have problems with making their mission visible (Olins, 1989) or failing to build unique products (Cooper, 1993) or other attraction forces, which can be developed through imagery relationships (Hedberg et al., 1997). Organization theorist Mary Jo Hatch (1997:192) notes that "probably the greatest challenge in managing network relationships is developing and maintaining an organizational identity and sense of purpose in the face of geographical diversity and loosely coupled interests and activities".

Ample evidence suggests a lack of coordination between the firm's and its partners various input-related activities and their output-related marketing, communication and customer relations. On one hand, there is a rich supply of specialized resources in factor markets and networks that the firm and its collaborative partners seek to mobilize and combine in new or more efficient ways. On the other hand, products, services, messages and brand promises are offered in product markets and networks through a plethora of marketing and customer-focused activities. Networking processes hold or fail to hold the arrangement of associated elements in place, as pointed out by Ford et al. (1998).

The missing links accord to what the network sociologist Burt (1992) calls "structural holes", which can offer opportunities for entrepreneurial linking. A production facilitator, a broker or otherwise connecting body can create value by fostering enriched activity-links, which again may affect resource-ties and actor bonds - to use the terminology developed by the Industrial Marketing and Purchasing (INIP) group in research on business relationships. How can some form of unifying attraction or common engagement be created? One major conclusion in

² Firms tend to have biased information of e.g. user needs (see von Hippel, 1988) and master only parts of the innovation process (Ridd et al., 1997).

³ One example is the telecommunication company NERA's experience when exhibiting the company's redesigned satellite transceivers on a fair in Germany; the product had major new technology embodied but what was evoking a triggering interest was the smart new design, which also had significant installation benefits providing a snap on solution inspired by the designer Emil Abry's long-term work for Rottefella (source: conversations with both industrial designer and former CEO of Nera, Spring 1996).

previous research on business relations is "that the way a company creates economic value is to a large extent dependent on its relationships" (Ford et al., 1998:261).

Yet the potential *strategic acting* within the frames of business relationships as those between designers and their clients is not sufficiently delineated. Design firms as "knowledgebrokers" between various client industries are already identified in recent research (Hargadon, 1998) but the *design-expressive* constructing initiatives were not fully explored. Interestingly, design-business relationships can be recognized as a strategic opportunity to conceive, shape and link as well as advance and embed business activities in multiple media and matter. It represents a compelling case for understanding staging of business performance. Creating an engaging design-arrangement that is tailored to the particular setting is complex (Olins, 1989), typically non-routine although previous "types" can be drawn on (Schon, 1988), and it often involves strategic and conceptually intricate matters affecting the firm's core product thinking (Svengren, 1995, 1998). Design is a creativity-based field of expertise that reconfigure present and future performances, it affects costs (reduce as well as increase) and create values for firms (e.g. build a brand icon).

Despite the recent interest in relations between different economic subjects, few have focused on design relations as a way of reinventing and expressing business. Previous network research focuses on issues such as trust and relational norms, investments, adaptations and learning (see Pettigrew and Fenton, 2000, Ford et al., 1998). The creative combination and synchronization of the creativity-based and expressive side of business are seldom sufficiently delineated. This is a mixed-motive situation. The current exchange process between for example new technology-providers and marketing people is not only about cooperation. It involves working with other specialists, managers, supplying companies, but it also involves working *against* them, *through* them and often *in spite* of them, David Ford and co-authors (1998) claim. It is found to be beneficial to create trust-based interconnectivity among various nets of activities to build up a longer-term productive relationship. Yet this is no guarantee for creating a synergistic interplay. Creative time/place for experimentation and voicing tensions are crucial as well. How this actually happens and can be understood needs to be taken out of the shadow of the mystery of creative relationships or secret interactions behind the scenes.

The paper adopts the "backstage/frontstage" distinction for this purpose, based on induction from observed ways of interacting and organizing design experiences found in my field-research and also inspired by the Chicago-based sociologist and eminent field-researcher Erving Goffmann (1959). Sorting out what design-work can be shown and what should be kept secret "backstage" is a distinction actually in use and heeded more generally in design milieus but is often more or less taken for granted, which resonates with Goffman's original conceptualization (1959), although applied in a different setting. Adopting such a lens helps to clarify how designers work with business firms dealing with the dilemma of how, when and where to express and expose what of the design models and product innovation material to the firm's multiple stakeholders. In light of the intricacies of extensive informal trading of know-how (von Hippel, 1988), this seemed important and I repeatedly observed various ways of staging design with finesse as to client and shared interests (see also Jevnaker, 2000b). A framework for expressive coordination or "stagesetting" of actors' resources and activities is then developed using the theatrical metaphor to link recent resource-based (Barney, 1997; Teece, 1998) and activity-based perspectives (see Leonard, 1995; Nardi, 1996). Any drama or stagesetting will not do, it needs relevance and leverage; i.e., to be capable of advancing the actual business and its stakeholders to a point where a distinct but also moving performance

of offerings can be enjoyed. My aim here is to identify and delineate how this dynamic capability is constituted through design/business relations.

Method and Material

This paper is based on in-depth research from working relationships between designers and business firms. As Starbuck (1993) recommends, the paper draws mainly on the study of "outliers" to gain new insight, i.e. firms and allied designers that have excelled in product design. It is not focused as a success story, both failures and successes were retold or could be observed in the exemplary cases (Jevnaker, 1995). It draws on several primary data sets; first and foremost, an in-depth study of five Scandinavian small and medium-sized product companies that have pursued a qualified product design approach with industrial design consultants over time and more than one project (see appendix table 1, and Jevnaker, 1995a,b, 2000b). The respective four design consultants working with these companies were also researched (one of the design experts, Peter Opsvik, worked for 2 of the furniture-making firms investigated, HÅG and Stokke). The material also include a recent follow-up study of HÅG H05, which is an innovative new office-chair line designed by Peter Opsvik and his design firm in collaboration with HÅG. The particular stagesetting theme elaborated in this paper emerged from this context.

Second, a focus group and pilot studies were conducted initially in order to identify the most critical issues between designers and firms (see Jevnaker, 1996). The first overall intent was to identify and understand "what happens and how"; i.e. how a capability for design advance of firms occurred in practice. The focus on design/business relationships and search for other potentially enabling conditions were sharpened in the in-depth company study since the initial focus group pointed to the critical importance of a *dynamic collaboration* among designers and business firms behind the design-related outcomes (see Jevnaker, 1996)⁴. A long-term approach was beneficial to ensure enhanced transparency of otherwise secret design development processes in the companies studied. In particular at HÅG, I had the opportunity to look more closely at design development within a broader innovation process which included the company's basic assumptions, primary corporate strategy and expressive strategies (Gagliardi, 1986; Hatch, 1997: 359ff.). Genuine relational data were collected from all five manufacturing companies (several informants) and their design partners, which provided insight and nuance.

The regional and medium-size characteristics may also represent limitations of the findings (though some of the firms have shown a considerable growth - beyond the SME-level). Thus effort was taken to expand the research base, complementary material were collected from both local design consultancies (Oslo, Bergen) and additional international design consultancies most notably Fitch and IDEO to gain a broader understanding (see appendix table 2). Moreover, the present study also draw on collaborative research into product design cases in Nordic, European, American and cross-national settings allowing the search for similar patterns and contrasts (Yin, 1984/89) to the five Norwegian companies as well as

⁴ The author, through repeat interviews and observations collected the data, mainly from 1991-95. One of the companies, HÅG, was followed-up recently (1999-2001) through observation of launching events, exhibitions, and presentations to various audiences, including repeat conversations with project managers, the key designer, and involved corporate staff; visits to the company, written company material, and press clippings. New as well as repeat conversations were also made with development managers and staff at TOMRA (reverse vending machines for drinking containers).

more conceptual discussions (see Bruce and Jevnaker, 1998). Both within-case analyses and cross-case analyses were conducted through an iterative, multiple case logic (see Jevnaker, 1991, 1993, 1995, 1998, 2000a,b, 2001; Jevnaker and Bruce, 1999). The research base is more fully explicated elsewhere (see Jevnaker, 1996, 2000).

Strategic Gains Identified

Design is interdisciplinary, often tacit and complex. How do firms gain a dynamic capability in this creativity-based and not-well-understood field through their design-supply relations? Based on the five Norwegian design/business cases, I found seven elements each of which made a distinct contribution to the firms' product innovation and commercialization processes, but to a varying degree. Some design/business relationships exploited only a few elements; others made design relevant to ever-larger audiences so that design became suffused in the firm's task environment. The findings are elaborated more fully elsewhere (see Jevnaker, 1991, 1993, 1995a,b, 1996, 1998, 1999, 2000a,b) so I will briefly summarize the seven elements in the following section.

Dynamic Capability Gains

Contrary to seeing design as a "creative flair" to be bought late in the value chain, all the five cases told a story of rich path-dependence, diverse skills and intensive interaction around new possible paths concretized through new product designs. Design in these companies often started "small" but over time designers became strategic in conceiving, assembling and making sense of the new or redesigned products. As in core product-innovation projects when new crossroads of such paths are created (Håkansson and Waluszewski, 1999), there were possibilities to find new combinations. Designing emerged as both separate and joint collaborative construction encompassing multiple stages of the product creation process, some of which revealed a high intensity of interaction. The parties typically needed to actually work together intensely in periods to make design tailor-made and valuable to the particular firms, their settings and stakeholders. The gained elements found in these interactive processes are summarized in table 1 and elaborated below.

Table 1 Dynamic Capability Gains of Design Relations Identified from Five Norwegian-Scandinavian Product-based Firms

Component Capability Gains of Design	Characteristic design processes
Reconfiguring and Mediation Gains	<i>Visualizing and reassembly.</i>
Opportunity Foresight Gains	<i>Empathic designing for users and imagining user futures</i>
Creative Integrity Gains	<i>Providing new ideas and alternative paths while also mobilizing knowledge of existing or previous paths.</i>
Scope Gains	<i>Enhancing an attractive coherence of product character, product support, marketing-communication and stakeholder networking through visual coordination</i>
Knowledge Expressive Gains	<i>Making sense of new designs through creative dialogues, analogies, storytelling, use of signs and symbols.</i>
Replicate Dynamic Innovation Gains	<i>Staging replicate dynamics of resources and activities.</i>
Credible Reputation Gains	<i>Fostering and assembling reputational asset awards, media coverage, design- signatures etc.).</i>

Reconfiguring-and-Mediation Gains - Designers were used in all five cases to come up with new ideas and reconfigure existing concepts. The reinvented or reconfigured concepts were made visible and observable mainly through prototypes (3D and digital) together with associated sketches, renderings, instructive and explaining comments on drawings, etc. Interviews with development and management teams repeatedly told the same kind of story: The mediation by design created "shared space" (Schrage, 2000, see also Weick, 1979) for constructive probe-and-learn by which development teams *gain visible experience of what they are constructing*. To see how a new-product model functions, for example, fosters further scrutinize-and-improve activities between designers and their collaborators from technology, marketing, project management, corporate directors, and other stakeholders. In short, it helped illuminate experimentation as well as implementation.

Opportunity Foresight Gains - In all the five cases, but to a different degree, designers also provided new, alternative thinking about products and their uses, which opened up new markets, new customer relationships, or set new standards in existing ones (see Jevnaker, 1995). For example, the independent design group, "Balans", explored an alternative sitting concept that eventually put dynamic ergonomics on the agenda within the Nordic furniture industry and beyond (see Jevnaker, 1993, 1995a,b). Designer Peter Opsvik and his collaborators were especially significant in transforming this ergonomic-design experimentation into a more coherent innovative product/user philosophy that could be realized in office furniture and children's chairs and expressed to customers and dealers in a way that opened up new opportunities for the respective collaborating firms.

Creative Integrity Gains - Designers in these firms proposed ideas that did not all end at the ideation stage, which often happens in product innovation or corporate creativity processes (Robinson and Stern, 1997). Rather, ideas were adopted, projected, edited, tested, transformed or modified, improved and refined within both a close and also a wider network of product design and development relationships. Put shortly, design was dynamically integrated. New-product designs were also made commercially viable through close collaboration with the producer's respective marketing networks. For example, Stokke with the new-design models

and their special philosophy has been able to establish and mobilize support from an international network of committed dealers, such as in Germany and the Netherlands. Interestingly, designers were seldom fully integrated in the sense of being entirely absorbed as a creative source. Most of them enjoyed the freedom to work for other firms and even, in one case, partly a rival. This seemed to help build the designers' character, the fact is that they could probe-and-learn within a wider arena and most of them took a stance for a wider cause (than design or profit), e.g. heeding the user's interests. Creative dialectics were common and a multiplicity of concerns rubbed against each other in these firms' innovation processes (*see* Jevnaker, 1995) which is regarded as significant for taking advantage of diverse skills in innovation (Leonard, 1995). To work towards a best possible product integrity was a particular concern for designers while engineers were worried about technical feasibility, costs, and other concerns. It is therefore worth to note that unwritten rules and other subtle processual mechanisms gave designers a certain veto or last word to help them avoid unproductive compromise. This enabled a dual heedful (Weick, 2001) but dynamic process to integrate design within the corporate networks without losing the creative intentions and efforts; we main coin this a "creative integrity gain".

Scope Gains - In some of the firms, efforts were taken to enhance the basic new or reconfigured products with appropriate package, marketing material, internal and external communication, and identity-building visual profiles. Linkages in breath were also made with external experts, suppliers, dealers, customers, investors and other stakeholders that in some cases eventually enacted a dynamic community for co-creating and appreciating those innovative efforts that could lead to value in a broad sense; i.e. both commercial and well-being. The "packaged" products and broadened design thinking could foster and enrich many relationships, also internationally. These scope gains helped leverage the new products to deliver value within the firms' target markets, albeit liabilities of newness were also observed. Thus a certain stamina and replication efforts were needed over time to accumulate the desirable scope.

Knowledge Expressive Gains - When providing new design ideas and models, some of the design teams took great effort in finding the right arguments (in Greek: *inventio*) and formulating them (*elucito*) in an appropriate "true" persuasive way which could make sense. The designers, inventors, and creative managers adopted metaphoric analogies such as sitting "in balance" as a small child, as a horse-rider, or like women do when making food in primitive cultures. This verbal-expressive ordering typically followed the visual-expressive one and were part of a design-related sensemaking (cf. Weick, 2001) far beyond a top-down image-building; e.g. the key terms "Balans" and "Movement and Variation" were not preplanned or intended *a priori*. Rather the vital words emerged while refining and talking vividly around prototypes and problematic product-human interfaces (*see* Jevnaker, 1993, 1995, 2000a,b).

Replicate Innovation Gains - Several factors influenced innovation processes in these firms, as pointed out in the previous literature (Burgelman and Sayles, 1987; Tidd et al., 1997/2001). Yet designers and design processes were significant in mobilizing, recombining and transforming manifold resources and activities into a smaller number of critical ones that could express an attractive competent approach that made sense to stakeholders. As also found by Karl Weick (2001:68) initial small steps can become "stabilized into repetitive sequences that then become a new emergent structure" such as at Tomra, who, on the

designer's initiative, adopted a modularity principle as a design rule, which has facilitated an innovation platform with reduced uncertainty.

Credible Reputation Gains - All the five firms and their designers were granted several design awards in Norway and/or internationally for their new or reconfigured products embodying new knowledge and meaning about the product's user benefits and attractiveness (see Jevnaker, 1995). Supporting processes by managers, designers or other ambassadors even in a larger network of for example physiotherapists probably also helped to build this credible reputation. Numerous articles in the national and international press covered the Balans group and their designs for HAG and Stokke. And designer Peter Opsvik's follow-up product-creations have been awarded repeatedly and are also exhibited internationally. He is one of the very few Norwegian designers that have become known in the international design context. The Dutch design group npk and its work for Hamax also received several awards and attention internationally.

Briefly summarizing this section, I have stated that dynamic capability in design consists of a set of processual elements ranging from mediation/reconfiguring of resources and activities to evoking reputation and a corporate credibility. These elements were all potentially strategic since they honed an often overlooked user need, created unique offerings, expressed innovative architecture and fostered beneficial reputation (Kay, 1996; Teece, 1998; Barney, 1997). In accordance with criteria for strategic capabilities within evolutionary economics and the resource-based theory, the design/business relationships also encompassed difficult to replicate expertise (Teece, 1998), it was often an intricate blend caused by the *joint activities* within relationships (Ford et al. 1998). It was thus difficult to judge which party contributed what in the design development process but every manager interviewed acknowledged the significant inputs from, and constructive interplay with, designers.

All the above elements were gained within industrial design relations but were achieved to a different degree. Yet all lead to at least temporarily strategic advantages for the firms involved, according to management (see Jevnaker, 1995). Similar impacts of design innovation within the product development process were also found by Gemser (2001) investigating a Dutch sample of manufacturing firms in two industries (home furniture and precision instruments). Taken together the seven elements constitute a partly visible partly "hidden treasure" contributing beyond the form of new product offerings. By "hidden treasure" it is not referred to something mystical, rather, it is an analogy that illuminates how highly valuable experiences, intangible design assets, path-dependent insights and creative contacts and alliances were cumulating in the shadow of the firms' product and business development processes. This is more fully elaborated elsewhere (Jevnaker, 1993, 1995, 1996).

Discussion

At first glance, the design developments unfolding in the five firms' design relationships might seem full of particularities. Yet I argue that design in these firm settings is contextually embedded creations and interactions that have some commonalities. Here I want to discuss four *design-strategic processes* that seemed significant: First, design is not simply adding a new "design" of a product, rather it tend to inquire into a whole range of issues, which complements the traditional research efforts or marketing of firms. Second, design is making ideas, new product-concepts and values visible and tangible even for virtual teams (Sakakibara, 1998). It is a process that not merely reconfigures new products, it can help build

iconic totems (Dumas, 1994) - something to flock around, speak about, and cultivate. Third, design affects the capability to replicate innovation processes through staging them in interactive doings, constructing rituals, memorable experiences and events that can foster inquiry, progress and performance. And, finally, designmaking can invite enriched perspectives of what the firm and its network has to offer. Through repeat observation I learned how a design-enriched expressive interaction can help firms build at least some sensory integrity reaching beyond fragmented resources and activities. This is an expressive engagement to enact, improvise and make sense (Weick, 2001) of what is being (or has been) developed, and at best, it weaves resources and activities into a unifying theme. Each process is delineated below based on analyses of the accounts of the experiences in the five Norwegian firms.

Empathic Field Inquiries

In line with previous literature (e.g. Lawson, 1990) I consistently found that a fundamental part of industrial design is explorative work enacting specific issues as well as inquiring about a range of potential other ones that might become significant at later stages. The group of industrial designers interviewed evidently tried to get as much insight as possible from first-hand observation of the present challenges and nitty-gritty of the clients' technologies. For example the Dutch designers from the design firm npk personally visited factories, sub-suppliers, distribution networks, customer sites, expert contacts, product regulatory offices, etc. (see Jevnaker, 1995). The focus group revealed that designers often felt they got too little knowledge from their clients, which could help them navigate and frame this design exploration (Jevnaker, 1996). Thus designers felt they sometimes had a quite tough job teasing out what might be significant clues for promising development directions. However, the industrial designers interviewed in the five manufacturing firms took part in both marketing and client-based information and perhaps more importantly, most of them were included proactively in a multiplicity of the firm's network contacts and were able to observe and interact with customers, dealers, suppliers and other partners/contacts. Some of these designers also looked beyond the client firm's domestic site and traveled to observe specific issues e.g. product/user interactions in a variety of real-user settings. In general, most designers tend to be outward looking into multiple cultures in order to find inspiration or capture deeper trends, meet other experts, etc.

This broad picture of design-related "field expeditions" or "empathic design" (Leonard, 1995) also emerged in the present study. It is no surprise that designers typically tend to want "the big picture" as well as zooming in on details, since "the devil (of beauty/ugliness, pleasure/discomfort, etc.) is in the details". What is more striking is how the most humancentered designers like Peter Opsvik and his collaborators are also continuously investigating less-articulate use situations even searching for latent problems as well as the presence of subtle dynamics with products in use. This is recently called "immersion ethnographies" within design and design research (see e.g. Deasy, 2001, Jevnaker, forthcoming). In line with Dorothy Leonard (1991, 1995), I found that designers can "learn from the market" even tapping not articulated user needs. Further, I also found that designers not simply learn but also improvise and create new and compelling use situations - for the better or worse. The broad sensuous scanning, which build practical wisdom (Chia, 2001), as well as the holistic-seeking creative immersion to come up with synthetic, reinterpreted solutions are important to notice (see also Lawson, 1990, Kristensen, 1998). These empathic processes of design, which tended to become more fully grasped over time by collaborating managers (Jevnaker, 1995a,

1996), albeit not always so (Svengren, 1995), may contribute to the critical sensing and reconfiguring aspects of dynamic capabilities as proposed by Teece (1998).

Design-Mediating Transforming Experience

The most salient process provided by design and designers is to visualize or mediate the new product ideas in a concrete live way, which people in projects and networks can relate to and be inspired by. In the five companies, this design-mediation and prototyping repeatedly provided rich experience and encounters that fostered and focused dialogue among specialists that tend to pursue diverse concerns in the development (see also Leonard, 1995). The interviews suggest that they do not necessarily share knowledge or perspective, rather a "shared space" (Schrage, 2000) and, I would propose, shared moments of experience and "thick description" (see Geertz, 1973) including *concrete visuals of what is being developed*. We should notice that this design-enhanced experience generates alternative thinking and suggestions that tend to open up for new and improved solutions. The design-related suggestions were both rooted in analytical skills and more intuitive improvising ones constructed by a creative but skilled collaborative interplay (see also Kao, 1996; Kreiner and Sev6n, 1998). This is significant for innovation processes that are often influenced by partial perspectives and ad hoc processes (Tidd et al. 1997/2001) that can be strongly affected by dominant groups' orientation towards own competencies or "signature skills" (Leonard, 1995).

Moreover, design is not merely "connecting" resources and activities or constituting them in the form of ideas or mental representations on an abstract level. Rather, design redefines and shapes the things to come *in a concrete live way that people can engage in*. Design-mediated activities thus help originate, recombine, correct and apply something new through providing concrete images of what may come into being. All informants recognized the value of designers' visualizing and especially the three-dimensional modeling. It helps development teams and strategy groups of managers exploring, experimenting and explicating different opinions and both diverging and converging on the problematic issues that typically arise. These issues cannot be fully specified beforehand and can easily evoke emotional stress among groups with different signature skills (Leonard, 1995).

How to interpret the repeat design-efforts of sketching, drawing, rendering, digital models, real prototyping and a plethora of other visual illustrations, which industrial designers typically immerse in? Why this richness, why not use merely a few illustrations - that perhaps may "sell" and convince more? Based on the interviews and observations, it is indicated that these designerly activities gradually and literally help build product innovation over both time and space. Yet the material suggests that there is much more than mere maturation unfolding, there is more dynamics going on. Some models are deserted or rejected, other changed, or improved ones become realized.

Design was not a quick fix in these medium or high technology-based firms, innovation capabilities and design relations were built through decades (see Jevnaker, 1995). It is strongly indicated from the data that industrial design is not merely (expertise) inputs or ready-made "designs" or outputs. It is also a range of projecting activities in a creative and interactive process embedded in relationships and cooperation among diverse specialists. The design-making and specific innovation processes (see elaboration in Jevnaker, 2001) constitute a dynamics which tends to transform, or at least affect what is being intended and shaped. In line with seemingly disparate literature from innovation and knowledge perspectives (Leonard, 1995) and developmental perspectives within cultural psychology and

educational pedagogy (see e.g. Bruner, 1986; Vygotsky, 1934/Kozulin, 2000) - this points to the meaningful "activity" view as a useful lens:

"Activity theory proposes a strong notion on mediation - all human experience is shaped by the tools and sign systems we use" (Nardi, 1996: 10)

Design activities can help to expand - and also iterate - between mediating in a world of ideas and mediating in a world of things-and-interactions that people in companies and within a wider network can also engage in and be inspired by, which may foster enhanced value creation. This is strategically significant since business need to respond with "dynamic capabilities" to the ever more complex interactions among humans and things in both real and virtual realities, according to Teece and Pisano (1998). In accordance with previous literature (e.g. Heskett, 1980; Blaich, 1993; Bruce and Morris, 1998), industrial design typically generates prototypes that transform ideas into something more tangible, which can be more fully related to, conceptualized, inspected, tested and evaluated. Design models were also proactively used to inaugurate and engage people within industrial market relations, such as within HÅG's and Tomra's international networks. The mediated new-product models became a kind of dynamo for "strategizing" change and renewal in the firm, which expands on the recent interest for entrepreneurial interactions (see Teece, 1998; Nyegaard, 2001). To understand this, we need to explicate the next process of staging innovation through a tailor-made qualified design process.

Replicate Dynamic Innovation Staging

The designers were involved in different ways in these firms' product design processes (as e.g. in-house consultant, external network partner, out-house insider). Yet all of them struggled for an overall synthetic approach to create a desirable product integrity, which seems to be a common value within industrial design (Dorst, 1997). Interestingly, the designers sought to mobilize and systematically process or "stage" the design development and their collaboration with managers, engineers, key developers and other parties in ways that could take care of the on-going construction of this product integrity value. These design developments were organized through both joint and more separate activities⁵.

The industrial designers in these cases were catering to both sides of innovation: new product ideas and new-product realization including commercialization. At best, this provided a particular rhythm that helped making progress. On one hand, designers with collaborators were engaged in product/user exploration and experimenting with reconfiguring and reintegrating the product architecture, materials, technology, etc. to create new opportunities. On the other hand, designers worked intensively with co-developers to realize the new product ideas or concepts and solve emergent problems. What otherwise are often seen as very separate or rival processes involving delicate trade-offs - as the classical one between exploration vs. exploitation (March, 1991/99) - here appeared to be two-sided ("dual") or interdependent and complementary forces, as also suggested as common for innovating organizations by Pettigrew and co-authors (2000). James March (1999: 5) in a recent introduction contends that both exploration and exploitation are needed for adaptation: "Exploration cannot realize its occasional gains without exploitation of discoveries."

⁵ Several, often iterative, micro-procedural processes were identifiable as affecting the new-product development progress and can be summarized under headings such as action-impulse and direction-setting, design exploration and analyses, imaginative conceptualization, visualizing and prototyping, narrating and making sensual sense, testing and validating, and delivering and following-up (see Jevnaker, 2001).

Interestingly, in the present study more than "occasional gains" could be identified. Designers and some of their collaborators seemed to contribute to a "Janusian" creative capability tending to both refinements of existing competencies/technologies *and* experimentation with new alternatives.

In contrast to the stereotyped image of designer as hero or a self-oriented persona (Walker, 1989; Dumas, 1993), the designers in the present study exploited a blend of collaborative work and more autonomous thinking. These designers listened to briefs of what was to be achieved (Cooper and Press, 1995), but they also took action that moved beyond the brief and eventually affected product strategy. What could enable this strategic acting? "Involvement" was the key word; explained one of Tomra's founders to the author and this resonates with the observed rich interaction. In line with Kreiner and Sevón (1998:9), strategy in innovation projects "is not something fixed and a priori given. Rather, such projects constitute a scene" for constructive collaboration. Indeed, as these organization scholars point out and my informants also confirmed, collaboration needs common construction. As one projectmanager from the furniture industry association explained (Jevnaker, 1996):

"The (collaborating) parties need to really labor (work) together."

Interviews with both designers and firm managers made clear that collaboration was a significant part of designer's constructive work and vice versa: Design-projecting became fundamental within new-product collaboration, and it was embedded in rich dialogues around opportunities, directions, concepts, testing, meanings, etc. Designers (and their clients) tended to structure these complexities by a variety of initiatives such as presentations with visual models at certain milestones, and intense interaction in particular periods, which provide shared space/time for more dynamic developments. Tom Kelley (2000) from IDEO outlines how beneficial it is to "squeeze in a ten-minute meeting at the end of the (first) week (within a one-month challenge. Moving design-presentations to an early stage (not the last deadline) give directing inputs, constructive or even useful critical comments before design alternatives are too refined and fixed:

"Even in the unlikely position that she (the boss) hates all five of your ideas, you're going to learn a lot as she tells you what's wrong with them, and you've now got three weeks to make the sixth one really sing" (p. 295).

The micro-processes fueled by design were dynamic in the sense that new-product progress did not necessarily evolve and "mature" gradually, what one party initiated could lead to new constructive responses. It was a human interaction among many specialists engaged in development efforts, which was recognized as critical to create and build credibility for new products within a larger network of stakeholders. Seemingly minor errors late in the new-product creation could disrupt the effective implementation and lead to costly iterations. Designers and firms all told stories about contextual change or overoptimistic enactment of market needs that could involve major upheavals. For example, both Tomra and Stokke underestimated the problems of introducing new products into the U.S. market. Hence designers and their collaborators sought to reduce uncertainties and ambiguities by staging innovation efforts in line with a multiplicity of concerns rooted in technology, business and market needs as well as particular interests catered to from the design side and this was, no doubt, a complex process.

The integration of designers to work collaboratively with R&D-people and product development-teams was typically not always easy. Industrial design is still a rare and partly unfamiliar expertise for most people, and small numbers of designers at the corporate or network levels make creative integration a challenge since industrial designers need to actually collaborate and work with more-dominant professional groups within product and business development (Blaich, 1993). In the companies investigated, designers were one or two professionals among several often highly skilled engineers, business managers and marketers, etc. As often is the case in manufacturing industry designers did not enjoy a fully ascribed status position in these companies. *Design had to establish its relevance to both the close collaborators and a wider network*, as also noted by Robert Blaich (1993), the former design director of Philips and Herman Miller. However, I found that the designer's dual posture as a somewhat distant or partly autonomous contributor, together with being engaged as a close partner within the product creation process, also had its advantages. Designers could be allowed to think "out of the box" of their client company, do experimental work for independent reasons, and even work for others.

Interestingly, I found that designers tended to accumulate a rich memory of previous experiments and they also proactively introduced steps that could partly enable partly restrict new designs such as modularization. This staging helped to replicate product innovation processes at Tomra, a high-tech firm that invest continuously in advancing its innovation processes in order to make profitable innovations for immature markets, which is highly challenging.

In these cases, design ideas also met skepticism and friction. Creative tensions are not new but its value may need to be rediscovered: In the Norwegian cases the fresh thinkers were invited into (at least major parts of) the strategic processes of product innovation, rather than locked out from the product strategy formation and core concept developments as found by Svengren (1995, 1998) in the case of Ericsson mobile phones-development. Passing your ideas against a locked door is very different from a creative passing-ball game among interested humans. As explained by designer Peter Opsvik, "we may have contact every day when it is at its most intense" (stage of design and development). The detailed descriptions elaborated elsewhere (Jevnaker, 1995) revealed that the decisions that arose during product innovation were the cumulative result of a range of interacting influences including creative friction within design/business relationships. In line with the management pioneer Mary Parker Follett, we may appreciate how the decisions "will be a moment pregnant with much experience, with many emotions, with many interests" (Follett, 1949/1995:150).

Design-Expressive Interacting

Designers in the present study all tried to create some form of "metaproduct" (Linn, 1993) - a character or product integrity, aesthetic look, and meaningful identity - beyond the functional requirements of the product. As already pointed out, designers consistently brought forward real models and expressive ideas, something to engage in, touch and use rather than business as abstract ideas or "a dead economic machine", as one reflective former CEO (from another design-based firm) put it. For example at HAG and Stokke, the talent-rich design/business actors were able to capture and mediate diverse knowledge-inputs and reinterpret what the firm and its partners had to offer. This came into shape over time. Design was not merely visual; a striking feature was a lot of talk around design models and lively discussions about how to best design for product-user interactions. In particular in the furniture-cases, this discourse was expanded literally to multiple stakeholders such as dealers, networks of

expertise (such as physiotherapists), and even a broader, international audience, e.g. through Opsvik's presentations to European dealers and his texts in relation to exhibitions in art and design museums.

Identifying that "design talks" is nothing new (Gorb, 1988). Yet designing-as-talk is partly a kind of white spot in the practice (see Jevnaker, 1993) but accords to recent ethnographic research in other fields of expertise (Orr, 1996). Industrial designers are, with some right, seen as a silent profession (Sparke, 1983) and often working in the shadows of product and business development. It is therefore interesting, albeit not new, to note the presence of intense expressive efforts and creative conversations around new models or prototypes. In the furniture cases repeat multiple evidence indicates that this rich expressive work helped building up high-end wisdom (cf. Kriger, 2000) and a corporate ethos or character. I also repeatedly noticed vital efforts to inaugurate significant others in the core ideas behind new-designs. These "significant others" were both close co-developers and company managers as well as more loose ties such as e.g. interaction design engineers or physiotherapy students (see Jevnaker, 1993, 1995, 1998, 2000a,b, 2001). Although it was most striking in the furniture design cases, use of design-expressive language, symbols, and events within interactive development could be traced both at Hamax, Tomra and at Grorud.

This character-building as part of product-innovation suggests a potential for design as "totem-building" (Dumas, 1994), that is a symbolic process which can help people to really engage in constructing their own context and "point to something meaningful" they have constructed (see Stacey et al., 2000: 177). As indicated by the work by Peter Opsvik and his co-developers, the symbolic construction of a dynamic ergonomic philosophy came into being during several decades of continuous renewal and innovation. Cooperation in the medium of symbols can be crucial, as stressed by the anthropologist G. Mead (see Stacey, 2000: 177). In particular so since hard work to develop innovations typically is needed over time and from many layers of organizations and their networks, as the five cases observed illustrate (cf. also Lazonick, after Carstensen, 1996). However, the engaging symbolic side of design should not be used to mystify the way people are engaged. In line with Stacey and coauthors' (2000) critical warning I found that the designers and the management teams did not necessarily share a clear-cut goal or perspective, although certain directions were seen as useful for a start. What is important, explained one of the industrial designers, is:

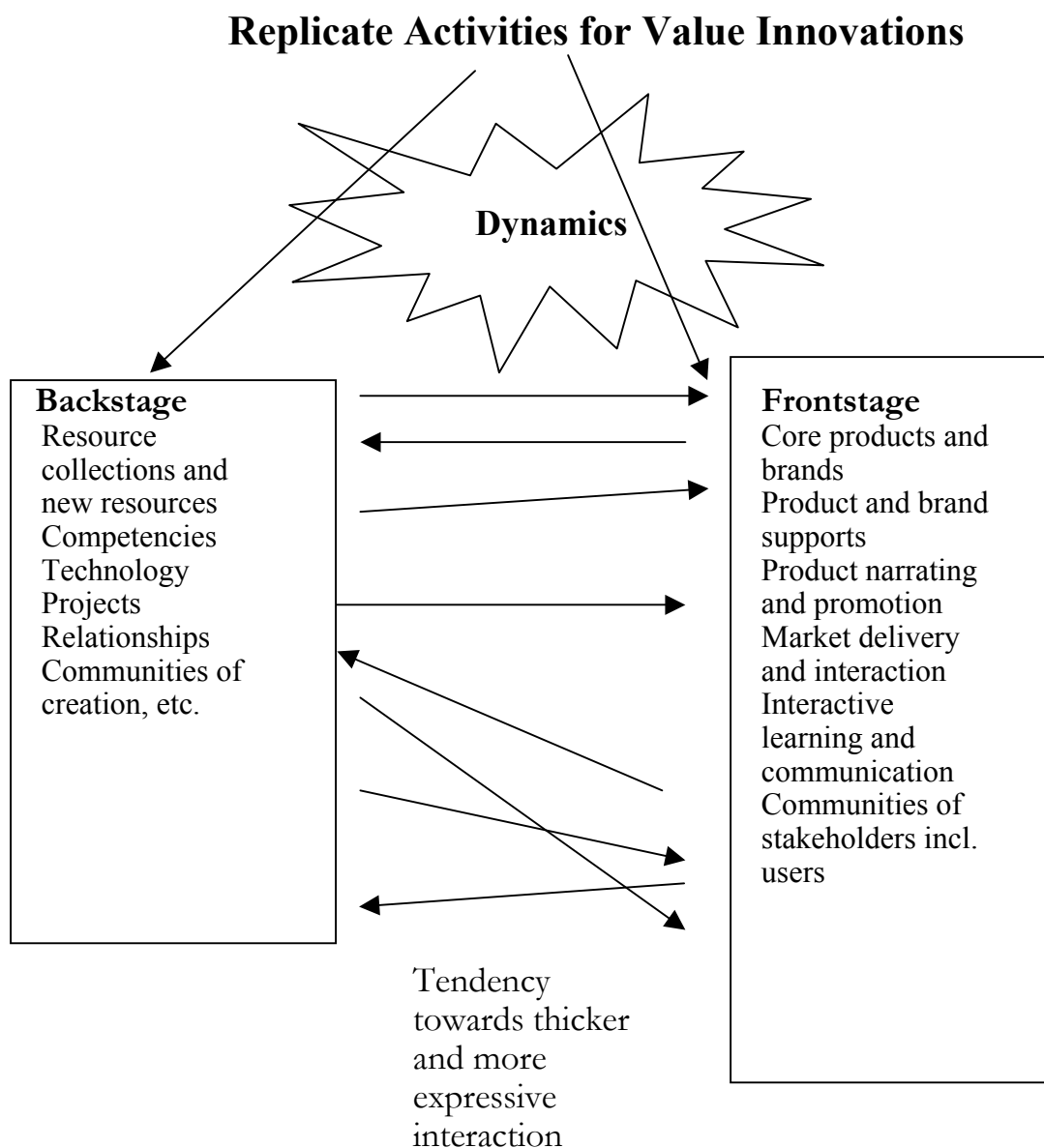
"The whole point here is that there is a group of people who has a different point of departure, that is, each perceives the product and product development from different angles. And because one accepts that one has (this)... and acknowledges that one has different approaches, then one uses all these, and can achieve a good product" (Jevnaker, 1996: 255).

Yet there was more to it than having merely diverse perspectives. Design might influence or indeed drive and shape sensemaking of product innovations through enacting particular images whilst improvising user situations. Also, this knowledge expressive micro-process brought forward a rich repertoire of insightful analogies, slogans, contextual terms, stories and way of reasoning that emerged as more or less deeply embedded in the design/business relationships and their respective networks. It became embodied in the products as well as the strategists, too, which were significant for corporate philosophy (see Jevnaker, 2000a). It is indicated that this micro rhetoric practice also eventually influenced industry standards within the office furniture business, which suggests that it is difficult to preserve expressive design as "owning words or images" (Larsen, 2000), but that is another story.

Toward an Understanding of the Dynamics of Design

The commonalities summarized above provide a start to an understanding of the dynamics of design in industrial settings and international markets. Designers and industrial agents can act strategically without being fully ascribed a strategic role. In order to understand this, I suggest a strategic stagesetting framework that may portray how dynamic capabilities seem to be expressively interacted by design (see figure 1).

Fig. 1:



Staging of Advancement Activities

Two distinctions can be put forward relating to staging of industrial design for business firms. First, design processes need to be conceived beyond the normative stage/gate models (Cooper, 1993) in order to capture the creative activities and interaction. The various aspects

of design processes (e.g. field explorations, prototyping/design icons, procedures, and communicative symbols) are seen as crucial in all firms investigated but can be staged somewhat differently. Second, the contextual and spatial specifics are important in design developments, which also influence how design action unfolds within and across any perceived stages or "gates". For example, in most of the firms investigated an integrated product development process is officially in place where technology, design and marketing work together. Yet the staging and "gating" can vary in practice. R&D efforts may come in first and frame specific problems, such as bottle-recognition, which is critical at TOMRA. In other companies or situations, the designers' inputs may set the agenda early up-front. In either case, prototyping has emerged as a significant practice suffusing multiple stages within product innovation. For example at the furniture-maker, Stokke, it is an unwritten rule to let the designer first try out his (accepted) ideas in three dimensions before other critical inputs are included (Jevnaker, 1995:296). This was not always so. Over time professional design has become a crucial part of the innovation process moving new ideas forward through visualization and models that reconfigure and combine components, functions, materials, and interfaces in new ways.

Among the many places for design, two types of contexts emerged as highly relevant for designmaking and its realization. In line with the sociologist Erving Goffmann (1974), it is possible to identify some implicit routines or capacities that seem to frame the design-related activities and interactions that flourish. Among these routines we may distinguish between the design efforts and interplay that happen externally, and the activities that occurs more hidden. Most designmaking occurs literally "backstage" - in the design studio, workshop and within the corporate secret spaces (product development department, boardroom, executive meetings, steering groups, etc.). Like in the theatre, in the soccer field, or in the publishing houses this distinction apparently helps to creating a well-prepared and potentially attractive expression and stagesetting of product design. Yet it does not matter what efforts are invested backstage if it is not able to being exposed to, and appreciated by, the firm's stakeholders and networks, as one of the industrial designers explained to this author. Hence this dual organizing emerged as a compelling theme worthy of further exploration.

A caveat is in place as also proposed elsewhere (Jevnaker, 2001 a). The stagesetting metaphor should not be taken too far as there are also possible differences: industrial design can be more "democratic" or team-based and performances more long lasting than normally associated by theatre terms. Designer Peter Opsvik often stressed the long-term values. Following Goffmann (1974), we may still appreciate the situational context or "framing" of experience as seen from this backstage/frontstage metaphor. Based on the cases researched, it is not surprising that designmaking tends to be structured according to certain interaction rituals and territoriality. What then do actually happen within the various arenas, which can be valuable for innovation and its commercialization?

Designmaking Backstage

Most of the design-related activities outlined in previous sections and elsewhere (see Jevnaker, 2001) are performed backstage such as the first insights and direction for further search, briefing, concept-creation, prototyping, testing, and follow-up work. Much work not visible for the public is unfolding in the design studio, in the corporate product development premises and related workshops, and in other work or meeting space. In fact, the word "backstage" is also sometimes used (e.g. in fashion design) and a clear demarcation can typically be found in most design consultancies and product development departments: work-

in-progress and not-yet-launched entities are carefully protected from the random visitor, which I could also observe in all five companies.

It is no surprise from a business-competition perspective, since for example Stokke and HAG have experienced many imitators, but it may also protect a creative physical space that is both safe, informal and stimulating. Kao (1996) reminds us of the need to build and secure a place or "hot zone" to nurture creativity at work. Based on HAG H05, it is worth noticing the need to protect not only the design & development territory but also the time context for genuine innovation-efforts. This indicates a temporality in designmaking that can be staged with more or less practical wisdom.

Designmaking Frontstage

In the external design work, HÅG excelled compared to other firms investigated and therefore this firm - and especially its last product model HÅG H05 - can be used as illustration. In addition to a managed visual profile, this company exploits design as a conscious medium for building knowledge and understanding for the company's product designs, user benefits and philosophy of dynamic sitting that have become cornerstones of HÅG's philosophy. Design is also explicated literally on stage by the designer and other experts, e.g. during the recent launch events of the H05 (see Jevnaker, 2001). In fact, the designer takes on an expanded role as guiding "teacher" and also storyteller (long before this came in fashion). To sustain its innovative profile, it seems significant that HAG and the allied designers continue to invest in design developments and suffuse the firm's activities "inaugurating" its networks not forgetting its internal audience (Jevnaker, 1993).

In the above ways the company has created *new territories* for its product innovations sometimes blurring frontstage with backstage insights - and vice versa; as experienced during the launching of HÅG H05 (e.g. internal events are covered and explicated in the press). The passion and creativity, which can be repeatedly experienced at HÅG, may suffuse also the frontstage events, such as when internal staff perform in humoristic ways on-stage even catwalking or role-playing with the company's chairs. With a critical eye this might resemble corporate religion. Yet what I found more triggering is that this spirit can be traced also in the daily struggle for new and better "sitting solutions", that can refurniture the world, as framed by the main owner and former top manager. This suggests valuesseeking through a humanized design ethos (Jevnaker, 2000b) and courage (Svengren, 1995). Imitators do not readily copy it since it involved a bold emphasis to expand value-creation combined with complementary assets full of life. It is a paradox - that designers are aware of -that in order to build longterm values the designmaking, at least in these firms, tends to set new standards, which create need for a constant flow of design-enriched activities. Perhaps this dilemma is why "staging" them with considerable practical wisdom within the corporate networks seems so important to enable and sustain value innovation.

Still, it is suggested that even in some of these design-committed firms people from diverse disciplines and departments can have continued problems to fuse their views. What does it take to reaching beyond the structural holes as depicted in network theory (Burt, 1992)? Based on this study's insight into the case of design, we may appreciate the human-human interaction and indeed creative friction rather than the previously embraced "fit" to a firm's (static) position. This new understanding may bring us towards a more dynamic framework for how design partners can contribute strategically to a particular business and its networks. Barbara Chamiawska (1997:95) notes that:

"Ideas do not diffuse; it is people who pass them on to each other, each one translating them according to their own frames of reference. Such encounters between travelling ideas and frames of reference, that is, ideas in residence, can be called "friction", but now the term has a positive ring to it It is precisely from friction, that is, the meetings between ideas, between ideas and their translators, and so on, that energy arises."

The present study illuminates how even "design-illiterate" firms (Kotler and Rath, 1984) can gain access to new ideas and design-innovative abilities, which may realize enriched interaction within their task environments. To achieve the relevant dynamic and imaginative capability, the collaborating interplay within mutually acknowledged design/business relationships seemed significant, what we may call "relational constructing". The parties experiment and probe-and-discuss within the frames of productive relationships valuing "thick" design/business experiences and their spillovers. This is gained through not merely exploring and exploiting design but also explaining the new designs and innovation practices. Furthermore, wise experts tend to repeatedly show-and-tell with their body gestures and models and constantly inquire around prototypes in order to figuring out problem or opportunity settings as well as setting the stage right. This "hidden treasure" can accumulate into a dynamic value-creating capability connecting backstage and frontstage resources and activities in engaging ways, but it requires creatively composing relations that are richly interacted, recognized and sustained.

To engage the multiple diverse stakeholders repeatedly is challenging and interpretive barriers are typically found in firms' development teams (Dougherty, 1992). Insight from the present study of design-business relations suggests that designers with empathic inquiring methods and a contextual "fingerspitzgefühl" can be beneficially combined with a somewhat detached creative ability - to move in and out of potential dramas and play with possible design-spatial arrangements that frame user experience in striking ways. This could be observed, in particular, at HÅG, the furniture-maker that now offers "sitting tools" rather than chairs. Its design philosophy is continually evolving and becomes suffused in a range of media with compelling images and bodily expressions; e.g. the posters made by Swiss-Norwegian graphic designer Bruno Oldani. In short, design is exploited as a living way of doing business. It has become institutionalized among the company's core assumptions, values, and rules of the game but remains a dynamic cultural force, which I suggest is enabled by the constant new-staging of product innovations through creative relationships. This power of design is still underused and may contribute to first-mover and other advantages.

Conclusion

As expected, industrial design consists of visualizing matters and meaning, but it is more to it than a visual-expressive ordering. Based on five Scandinavian manufacturing companies and their allied designers, this paper has identified a range of processual advantages and fundamental creative capacities that can be gained through a relational design constructing; i.e. between firms and their design partners. Four important capacities are first, *empathic inquiry* or field expeditions, which provides learning and immersion into less articulate user problems and desires. Second, design provides not simply prototypes (Schrage, 2000) but can develop a product integrity, potential *icons*, and mediating aesthetic experience that can be further interacted-on. Third, design contributes to replicating a more dynamic innovation staging encompassing procedural *routines*, which seems to help the involved parties to take advantage of a fresh understanding and experiment (probe-and-learn) with new combinations of resources and activities. And, forth, design may engage and move people (including

oneself) through symbolic *or design-expressive talk* and other interacts that can inspire, focus and commit further value creation to get innovations realized.

Taken together, these design-related processual capacities suggest that design relations may build dynamic capabilities for the firm even renewing or transforming the firm's core products and competencies, as found in the present study. Yet industrial design as practiced (temporarily or more sustained) in the five Norwegian-Scandinavian firms did not evolve as a fully firm-owned capability, neither was design fully out-sourced. Rather, it emerged as a design-enriched innovation capability embedded in retained design/business relationships that in varied manners all were able to stage and replicate new dynamics between design and innovation efforts. Although some of these companies may seem exemplary "design-competent" (Kristensen, 1998), industrial design actually had to establish its relevance perpetually to dominant competence-groups and management, over time and through often fragile collaborative efforts (see Bruce and Jevnaker, 1998). It is thus worthwhile to notice how industrial design actually unfolds and becomes strategic within design/business relationships.

Although not an easy process, design advancements became organized through sustained collaboration, empathic inquiry, creative immersion, and a lot of testing and other procedural routines unfolding mainly backstage. Most of the five firms also "tested" the new products partly frontstage, e.g. through design award competitions and dealer networks. Moreover, the five firms took advantage of the new product designs mediating the firms' new product innovations and even exhibiting them as icons. The present study shows how firms can create events as compelling rituals for dealers, distributors, international networks, etc, and last, but not least, a lot of talk and symbolic expression of the new offerings were exposed to multiple stakeholders and external audiences. Although a demanding multidimensional process, and thus difficult to replicate (Teece, 1998), this organizing seemed to mobilize and engage people despite diverse functional and disciplinary perspectives.

Grounded in the exemplary cases, the staging of design-related advancements can therefore illuminate how resource-providing activities backstage can enable and link constructively with frontstage activities. In particular, enhancing the insight into backstage value-creation including experimental "foolishness" (March, 1991/99) is essential for frontstage activities, which otherwise can be too superficially focused on novelties or merely conveying impressions or images as conventionally expected in product markets, which may hinder innovation. It was typically not a pre-conceived vision; rather designers and design-collaborating managers were more or less continually striving to put design into the appropriate striking words and expressive symbols, signs and narrating media. This "design as talk" clearly enabled innovations to be distinctively focused in both development and commercialization processes, indeed, designmaking as a creative process continued within launch and marketing activities as well.

New modes of more mobile or transient work (Garsten, 1999) suggest that especially innovation-seeking firms need to combine more creative imagination, friction and open disclosure without losing a sense of dramaturgical discipline and backstage protection allowing loyal and tactful interactions within a multiplicity of relations. Indeed, the very staging of design development, although expressively and interactively unfolding rather than being linear, seems to be capable of infusing at least a kind of perceived temporal order. Temporary design products (prototypes etc.), procedural impacts, as well as design-enriched

communication seem to build trust into managerial relations and into what tends to sound like a polyphonic team of innovation contributors. Sometimes design can build an overall theme uniting backstage and frontstage activities but also this theme tends to be constantly elaborated.

In conclusion, this staging of innovation dynamics fostered by design/business relations can thus be recognized beyond the visual styling matters or "face lift" designs of the firm's products. It may take on the strategic role of creating a coordinated synergy - or *drama* - of richly expressed offerings of also technology-improved innovations that are not visible as such, but which can still engage and help the various actors contribute in common projects.

Theoretical Implications

What are the implications for theory? In line with the American economist and business historian William Lazonick we should take effort to understand what contexts and relationships that create and sustain organized innovation processes (Carstensen, 1996). The concept of a dynamic design capability can add to previous insights into "organizing capabilities" (Lazonick) and "dynamic capabilities" (Teece, 1998) expanding the understanding to groups of diverse expertise with a possible "high capability for improvisation" (Weick, 2001), and, we may add, for staging a creative dynamics of innovation. The within- and cross-case comparison indicates that the design-related dynamics helped embed new perspectives on core challenges such as user problems as well as providing visual media and enriched language in the development teams. Ample evidence also suggests that design relationships link the firm and its product development groups to innovative themes cultivated within broader networks of new-technologies or rooted in mundane everyday-life. The paper summarizes how this can happen in practice through industrial design collaboration and innovative efforts, that partly originates "outside" the firm.

To understand this, we thus need to extend our investigation beyond the designer *per se*. The *mutual interactive construction* in design/business relationships - what we may call a "relational constructing" - were significant for the five companies' product innovation and indeed, how their new paths of industrial marketing were constructed. This relational constructing of new paths for the firm emerged over some time by entrepreneurial or design-championing initiatives, often from both parties (Jevnaker, 2000b). Hence interacting parties, as suggested by Hakansson and Johanson, constituted the new paths:

"The patterns and character of the connections between the relationships constitute the structure of the industrial network. To some extent such structures are conditioned by technical and cultural factors, but, primarily, they are interacted, that is they are formed and modified through interaction between the actors. The network structure is the result of history" (Håkansson and Johanson, 1998: 54).

The paper has extended this interactive industrial perspective by more in-depth exploration of how designers, as part of a variety of micro processes, are actually moving innovation based on an ongoing co-specialized approach rooted in multi-dimensional intensive interaction. I found that industrial designers, relatively continuously, revisit problem/solution boundaries in order to open up for new alternatives. An important implication is an interactive perspective encompassing more creative and "thick" experiences of production development staging. Designers were not merely planners (Gorb, 1990), they improvised by reassembling familiar and unfamiliar components and immersed themselves in creative efforts and interactive rituals

that presented both joint and more separate activities as embedded in the relationship between the designers and the firms and their networks. Only recently have researchers begun to focus on the specifics of developing "dynamic capabilities" (Teece and Pisano, 1998) and, in particular, design as a competitive tool for business is still fairly unexplored and more complex than previously conceived (Svengren, 1995; Kristensen, 1998). Based on the Norwegian case material, there is not one simple answer to how dynamic capabilities in design can be developed. The cases reveal that there are varied practices but all were embedded in strategic acting by designers and interacted with managers to develop "something more".

Acknowledgement

The funding from the Norwegian Research Council (Food-processing program) within the ongoing research project Dynamo, in collaboration with Nidar, is highly acknowledged as the main source for this paper. Further, I thank for additional funding to my research on industrial design within Integrated Product Development Project/P2005 through NTNU/Product Design, and for previous support through the Norwegian Design Council, the Ministry of Industry and the Research Council. Thanks also for inspiring comments to this paper-writing early on from Oystein feldstad, Norwegian School of Management BI. Last, but not least, this paper would not have been written without the good access to the five companies Damax (Moller), HAG, Stokke, Grorud Jernvarefabrik and Tomra as well as the allied design firms.

The paper was first presented, after a double blind referee process, at the 17th annual IMP conference hosted by Norwegian School of Management BI, Oslo 9-11 September 2001.

References:

- Aldersey-Williams, H. (1996). "Design at a Distance: The New Hybrids." *Design Management Journal*. Vol 7. No. 2, pp. 43-49. Boston: The Design Management Institute.
- Barney, J.B. (1997). *Gaining and Sustaining Competitive Advantage* Reading, MA: Addison Wesley.
- Blaich, R. with Blaich, J. (1993). *Product Design and Corporate Strategy. Managing the connection for Competitive Advantage*, New York, McGraw-Hill.
- Blaich, R. (1995). *Design Management: Unfinished Business for this Millennium. Speech and Abstract*. Presented under The Challenge of Complexity, 3rd International Conference on Design Management, 21-22 August. Helsinki: University of Art and Design Helsinki (UIAH).
- Bruce, M. and Cooper, R. (1997). *Marketing and Design Management*. London: Thompson Business Press.
- Bruce, M. & Docherty, C. (1993). *It's all in a relationship: a comparative study of client-design consultant relationships*. Design Studies. Vol. 14. No. 4. pp. 402-422.
- Bruce, M. and Jevnaker, B.H. (eds) (1998). *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester: Wiley.
- Bruce, M. and Morris, B. (1998). "A Comparative Study of Design Professionals," in Bruce, M. and Jevnaker, B.H. (eds) *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester-N.Y.-Weinheim-Brisbane-Toronto-Singapore: Wiley.
- Bruner, J. (1986). *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press.
- Burgelman, R. and Sayles, L.R., (1986). *Inside Corporate Innovation*. New York & London: The Free Press.
- Burt, R. S. (1992). "The Social Structure of Competition," in Nohria, N. and Eccles, R.G. (eds.) *Networks and Organizations: Structure, Form, and Action*. Boston, MA: Harvard Business School Press.
- Carstensen, F. (1996). "William Lazonick," in Samuels, W.J. (ed.) *American Economists of the Late Twentieth Century*. Cheltenham: Edward Elgar, pp.159-173.
- Chia, R. (2001). *Phronesis and the Glance: Strategy Formation in the Blink-of-an-Eye*. Paper presented at the annual EGOS Conference, Lyon, France, 5-7 July 2001.
- Cohen, W.M. & Levinthal, D.A.1980. Absorptive Capacity. A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35, pp.128-152.
- Cooper, R. and Press, M. (1995). *The Design Agenda: A Guide to a Successful Design Management*. Chichester: Wiley.
- Cooper, R.G. (1993). *Winning at New Products. Accelerating the Process from Idea to Launch*. (2nd ed.) Reading, MA: Addison-Wesley.
- Cotton, B. and Oliver, R. (1992). *Understanding Hypermedia: From Multimedia to Virtual Reality*. London: Phaidon.

- Csikszentmihalyi, M. (1996). *Creativity: Flow and the Psychology of Discovery and Invention*. New York, Harper Collins.
- Czarniawska, B. (1997). *Narrating the organization: Dramas of Institutional Identity*. Chicago and London: The University of Chicago Press.
- Deasy, D., Flannery, P. and Rhea, D. (2001). "Using Research to Foster and Predict Successful Innovation: The Resolve Office System." *Design Management Journal*, 12 (3): 50-57.
- Design Management Journal* (1996). Design Management and Consulting, Vol 7. No.2, Boston: Design Management Institute.
- Dierickx, I. and Cool, C. (1989). "Asset Stock Accumulation and Sustainability of Competitive Advantage," *Management Science*, Vol. 35, No. 12, December, pp.1504-1513.
- Dorst, F. (1997). *Describing Design - A Comparison of Paradigms*. Dr. thesis. Delft University of Technology.
- Dougherty, D. (1992). "Interpretive barriers to successful product innovation in large firms." *Organization Science*, Vol. 3, No 2, pp.179-202.
- Dumas, A. and Whitfield, A. (1989). Why Design is Difficult to Manage: A Survey of Attitudes and Practices in British Industry. *European Management Journal*. Vol 7. No 1, pp. 50-56.
- Dumas, A. (1993). *The Effect of Management Structure and Organisational Process on Decisions in Industrial Design*. Ph.D. London Business School
- Dumas, A. (1994). "Building Totems: Metaphor-Making in Product Development." *Design Management Journal*. Vol. 5, No. 1, pp. 71-82.
- Eisenhardt, K.M. (1989). "Building Theories from Case Study Research," *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.
- Eisenhardt, K.M. and Martin, J.A. (2000). Dynamic Capabilities: What Are They? *Strategic Management Journal*, Vol. 21, No.10-11, pp.1105-1121.
- Follett, M.P./Graham, P. (ed.) (1920s/1995). *Mary Parker Follett - Prophet of Management: a celebration of writings from the 1920s*. Boston, MA: Harvard Business School Press.
- Ford, D., Gadde, L.-E., Håkansson, H., Lundgren, A., Snehota, I., Turnbull, P., Wilson, D. (1998). *Managing Business Relationships*. Chichester: Wiley.
- Freeze, L. with Powell, E. (1998). "Design Management Lessons from the Past. Henry Dreyfuss and American Business", in Bruce, M. & Jevnaker, B.H. (eds), *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester-N.Y: Weinheim-Brisbane-Toronto-Singapore: Wiley.
- Gagliardi, P. (1986). "The Creation and Change of Organizational Cultures: A Conceptual Framework." *Organization Studies* 7: 117-34.
- Galunic, D.C. and Eisenhardt, K.M. (forthcoming). "Architectural Innovation and Modular Corporate Forms." *Academy of Management Journal*, Special Issue on New and Evolving Organizational Forms.
- Geertz, C. (1973). *The Interpretation of Cultures*. London: Fontana Press.

- Gemser, G. and Leenders, M.A.A.M. (2001). "How Integrating Design in the Product Development Process Impacts on Company Performance." *The Journal of Product Innovation Management*, 18 (1), 28-38.
- Goffman, E. (1959). *The Presentation of Self in Everyday Life*. New York: Doubleday.
- Goffman, E. (1974/1986). *Frame Analysis: An Essay on the Organization of Experience*. Boston, MA: Northeastern University Press (reprint ed.).
- Gorb, P. (ed) with Schneider, E. (1988). *Design Talks!* London Business School Design Management Seminars. London: The Design Council.
- Gorb, P. (ed) 1990. *Design Management*. Papers from the London Business School. LBS Design Management Unit, London: Architecture Design and Technology Press.
- Gorb, P. and Dumas, A. (1987). "Silent design". *Design Studies*. Vol 8. No 3.
- Hamel, G. and Prahalad, C.K. (1994). *Competing for the Future*. Boston, .A. Harvard Business School Press.
- Hargadon, A.B. (1998). "Firms as Knowledge Brokers: Lessons in Pursuing Continuous Innovation." *California Management Review*, 40 (3), 209-227.
- Hart, S. (1995). "Where we've been and where we're going in new product development research", in Bruce, M. and Biemans, W.G. (eds). *Product development. Meeting the Challenge of the Design-Marketing Interface*, Chichester-N.Y:Brisbane-Toronto-Singapore,15-42.
- Hatch, M.J. (1997). *Organization Theory: Modern, Symbolic, and Postmodern Perspectives*. Oxford: Oxford University Press.
- Hedberg, B., Dahlgren, G., Hansson, J. and Olve, N-G. (1997). *Virtual Organizations and Beyond: Discover Imaginary Systems*. Chichester: Wiley.
- Henderson, R. and Clark, &B. (1990). "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms." *Administrative Science Quarterly*, 35, 9-30.
- Heskett, J. (1980). *Industrial Design*. Thames and Hudson, London.
- Hunt, S. (2000). *A General Theory of Competition: Resources, Advantages, Productivity, Economic Growth*. Thousand Oaks, CAL: Sage.
- Håkansson, H. and Waluszewski, A. (1999). *Path-dependence: Restricting or Facilitating Technical Development*. Paper submitted to the 15th annual IMP Conference, Dublin 2-4 September.
- Jevnaker, B.H. (1991). Make the World a Better Place to Sit In! *Design Management Journal*, 4 (2), 48-54.
- Jevnaker, B.H. (1993a). Inaugurative Learning: Adapting a New Design Approach. *Design Studies*, 14 (4), 379-401. Oxford: Butterworth-Heinemann.

- Jevnaker, B.H. (1995a). *Den skjulte formuen. Industridesign som kreativ konkurransefaktor* (The Hidden Treasure). Report 36/95. Bergen: Foundation for Research in Economics and Business Administration (SNF), (in Norwegian).
- Jevnaker, B.H. (1995b). Developing Capabilities for Innovative Product Designs: A Case Study of the Scandinavian Furniture Industry. In M. Bruce and W.G. Biemans (eds.) *Product Development: Meeting the Challenge of the Design-Marketing Interface*. Chichester: Wiley, 181-201.
- Jevnaker, B.H. (1996). *Industridesign som kreativ konkurransefaktor: En forstudie (Industrial Design as a Competitive Factor)*. Report 54/96. Bergen: Foundation for Research in Economics and Business Administration (SNF), (in Norwegian).
- Jevnaker, B.H. (1998). Building Up Organizational Capabilities in Design. In M. Bruce and B.H. Jevnaker (eds.) *Management of Design Alliances: Sustaining Competitive Advantage*. Chichester: Wiley, 13-37.
- Jevnaker, B.H. (1998). Absorbing or Creating Design Ability: HAG, HAMAX and TOMRA, in M. Bruce and B.H. Jevnaker (eds.) *Management of Design Alliances: Sustaining Competitive Advantage*. Chichester: Wiley, 107-135.
- Jevnaker, B.H. and Bruce, M. (1999). Design as a Strategic Alliance: Expanding the Creative Capability of the Firm. In Hitt, M. et al. (eds.) *Dynamic Strategic Resources: Development, Diffusion and Integration*. Chichester: Wiley, 267-298.
- Jevnaker, B.H. (2000a). How Design Becomes Strategic. *Design Management Journal*, 11(1), 41-47. BI-Reprint 9/2000.
- Jevnaker, B.H. (2000b). Dynamikk mellom design og innovasjon. *Magma, tidsskrift for økonomi og ledelse*, 3 (1), 21-39 (in Norwegian).
- Jevnaker, B.H. (2000c). Championing Design: Perspectives of Design Capabilities. *Design Management Journal Academic Review*, 1(2000), 25-39. BI-Reprint 41/2000.
- Jevnaker, B.H. (2001a). "Back-Stage and Front-Stage: Understanding how Design Becomes a Strategic Medium Organizing the Value-Seeking Innovation and Getting into Memorable Values," in Conference Proceedings of the 4th European Academy of Design Conference, Aveiro, Portugal, 10-12 April, 2001.
- Jevnaker, B.H. (2001b). Strategic Integration of Design and Innovation: Dilemmas of Design Expertise and Its Management. *International Journal of New Product Development & Innovation Management*.
- Jevnaker, B.H. (forthcoming). "Understanding People and Pleasure-Based Human Factors," in Jordan, P. and Green, B. *Pleasure with Products: Beyond Usability*. London: Taylor & Francis.
- Kao, J. (1996). *Jamming: The Art and Discipline of Business Creativity*. New York: Harper Collins.
- Kay, J. 1993. *Foundations of Corporate Success. How business strategies add value*. Oxford: Oxford University Press.
- Kelley, Tom (2000). *The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm*. New York: Doubleday.

- Kicherer, S. 1990. *Olivetti. A Study of the Corporate Management of Design*. London: Trefoil Publishers.
- Kogut, B. and Zander, U. (1992). "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology." *Organization Science*, 3 (4).
- Kotler, P. & G.A. Rath. 1984. Design: a powerful but neglected strategic tool. *Journal of Business Strategy*, 5 (2), 16-21.
- Kreiner, K. and Sevón, G. (1998). "Introduction," in Sevón, G. and Kreiner, K. (eds). *Constructing R&D Collaboration: Lessons from European EUREKA Projects*. Copenhagen: Copenhagen Business School Press.
- Kruger, M.P. (1999). "Utvikling av "high-end" kunnskap", in Friedman, K. and Olaisen, J. (eds). *Underveis til fremtiden* (in Norwegian). Bergen: Fagbokforlaget.
- Kristensen, T. 1998. "The Contribution of Design to Business: A Competence-Based Perspective", in Bruce, M. & Jevnaker, B.H. (eds). *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester-N.Y: Weinheim-Brisbane-Toronto-Singapore: Wiley, 217-241.
- Larsen, M.H. (2000). "Managing the Corporate Story," in Schultz, M., Hatch, J. and Larsen, M.H. *The Expressive Organization: Linking Identity, Reputation, and the Corporate Brand*. Oxford: Oxford University Press, pp. 196-207.
- Lawson, B. (1990). *How Designers Think*. London: Butterworth Architecture.
- Leonard-Barton, D. (1991). Inanimate Integrators: A Block of Wood Speaks, *Design Management Journal* (2), 61-67.
- Leonard-Barton, D. (1995). *Wellsprings of Knowledge*, Boston: HBS Press.
- Linn, C.E. (1993). *Metaproduktet. Idéen bak det fremgangsrike produktet* (new ed. in Norwegian, based on Swedish ed. 1985). Oslo: Bedriftsøkonomens forlag.
- Macneil, I.R. 1980. *The New Social Contract: An Inquiry into Modern Contractual Relations*. New Haven, Conn: Yale University Press.
- March, J. G. (1976). "The Technology of Foolishness," in March, J.G. and Olsen, J.P. *Ambiguity and Choice in Organizations*. Bergen: Universitetsforlaget.
- March, J. G. (1991/1999). "Exploration and Exploitation in Organizational Learning." *Organization Science*, 2 (1), 71-87. Reprinted in March (1999 see below).
- March, J. G. (1999). *The Pursuit of Organizational Intelligence*. Maiden, MA: Blackwell.
- Nardi, B.A. (ed.) (1996). *Context and Consciousness: Activity Theory and Human-Computer Interaction*. Cambridge, MA: The MIT Press.
- Nonaka, I. and Takeuchi, H. (1995). *The Knowledge-Creating Company*, New York & Oxford, Oxford University Press.
- Nonaka, I. and Teece, D. (eds.) (2001). *Managing Industrial Knowledge: Creation, Transfer and Utilization*. London: Sage.

- Norman, D.A. (1988). *The Psychology of Everyday Things*. N.Y.: Basic Books.
- Normann, R and Ramirez, R (1998). *Designing Interactive Strategy: from Value Chain to Value Constellation*. Chichester: Wiley.
- Nygaard, C. (2001). "Introduction - Ten Approaches to Understand Strategizing," in Nygaard, C. (ed). *A Reader on Strategizing*. Copenhagen: Samfundslitteratur Press.
- Olins, W. (1987). Mysteries of design management revealed, in Bernsen, J. (ed). *Design Management in practice*. European/EEC Design Editions. Copenhagen/Barcelona: Danish Design Council ds Foundation BCD.
- Olins, W. (1989). *Corporate Identity. Making business strategy visible through design*. U.K.: Thames and Hudson.
- Orr, J.E. (1996). *Talking about Machines. An ethnography of a modern job*. Ithaca & London: Cornell.
- Penrose, E. (1959). *The Theory of the Growth of the Firm*. London: Basil Blackwell.
- Roy, R and S. Potter. (1993). "The Commercial Impact of Investment in Design". *Design Studies*. Vol 14. No 2. April. pp.171-193.
- Sakakibara, K. (1998). Global New Product Development: The Case of IBM Notebook Computers, in Bruce, M. & Jevnaker, BA. (eds) *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester-N.Y: Weinheim-Brisbane-Tononto-Singapore: Wiley.
- Schrage, M. (2000). *Serious Play: How the World's Best Companies Simulate to Innovate*. Boston, MA: Harvard Business School Press.
- Schiin, D. (1988). "Designing: Rules, types and worlds." *Design Studies*. Vol. 9. No. 3, pp.181-190.
- Sparke, P. (1983). *Consultant Design: The History and Practice of the Designer in Industry*. London: Pembridge Press.
- Sparke, P (1986). *An introduction to Design & Culture in the Twentieth Century*. London: Routledge
- Stabell, C. and Fjedstad, O. (1998). Configuring Value for Competitive Advantage: On Chains, Shops and Networks. *Strategic Management Journal*, Vol. 19, No. 5, pp. 413-437.
- Stacey, RD., Griffin, D. and Shaw, P. (2000). *Complexity and Management: Fad or Radical Challenge to Systems Thinking?* London and New York: Routledge.
- Starbuck, W.H. (1993). "Keeping a Butterfly and an Elephant in a House of Cards: The Elements of Exceptional Success," *Journal of Management Studies*, Vol. 30. No. 6, pp. 885-921.
- Svengren, L. (1995). *Industriell design sostrategisk ressurs* (in Swedish). Ph.D., Lund University Press, Lund.
- Svengren, L. (1998). "Integrating Design as a Strategic Resource: The Case of Ericsson Mobile Communications," in Bruce, M. and Jevnaker, B.H. (eds) (1998). *Management of Design Alliances. Sustaining Competitive Advantage*. Chichester: Wiley, pp.159-178.

- Teece, D.J. (1998). "Capturing value from Knowledge Assets: The New Economy, markets for Know-How, and Intangible Assets." *California Management Review*, Vol. 40. No. 3, pp. 55-79.
- Teece, D.J., G. Pisano and A. Shuen (1990). Firm Capabilities, Resources, and The Concept of Strategy. *Economic Analysis and Policy Working Paper*. EAP-38. Berkely: University of California.
- Teece, D.J. and Pisano, G. (1998). "The Dynamic Capabilities of Firms: an Introduction," in Dosi, G., Teece, D.J. and Chytry, J. (eds). *Technology, Organization, and Competitiveness: Perspectives on Industrial and Corporate Change*. Oxford: Oxford University Press.
- Thachara, J. (1997). *Winners! How today's companies innovate by design*. Amsterdam: BIS.
- Tholke, J. and Lowe, A. (1996). The social psychological processes of "shuttling", "degitimising" and "surveillancing"; the hidden processes of successful product renewal. A grounded theory approach. Hidden vs. Open Rules in Product Development. NPD workshop report from TU DELFT.
- Thompson, J.D. (1967). *Organizations in Action*. New York: McGraw-Hill.
- Tidd, J., Bessant, J. and Pavitt, K. (1997/2001). *Managing Innovation: Integrating Technological, Market and Organizational Change*. Chichester: Wiley. (Second Edition, 2001).
- Vygotsky, L./Kozulin, A. (1934/1986). *Thought and Language*. (Translation newly revised and edited by Alex Kozulin, 12. oplag/2000). Cambridge, MA: The MIT Press.
- Walker, J.A. (1989). *Design History and the History of Design*. London: Pluto Press.
- Walsh, V., R. Roy, M. Bruce and S. Potter. (1992). *Winning by Design. Technology, Product Design and International Competitiveness*. Oxford: Blackwell Business.
- Walton, T. (1992). Exploring the in-between: Comments on the Nature of Design Management Research. *Design Management Journal*. Vol 3. No. 4. pp. 6-9.
- Weick, K.E. (2001). *Making Sense of the Organization*. Oxford: Blackwell (includes several previous articles, so it is only referred to this resource here).
- Williamson, O.E. (1985). *The Economic Institutions of Capitalism*. New York: The Free Press.
- Yin, R.K. (1984/89). Case Study Research. *Applied Social Research Methods Series*, Vol. 5, Beverly Hills: Sage

APPENDIX

TABLE 1. Pave Norwegian/Scandinavian Export-Oriented Manufacturers

<i>Product based firms</i>	<i>Core products</i>
HAMAX	Consumer-oriented plastics for leisure
TOMRAA	Automated machines for handling beverage containers returned by the consumer
GRORUD	Window and door metal-based fittings
HÅG	Ergonomically designed office chairs (for the contract market)
STOKKE	Ergonomically designed furniture (for the individual customer)

Table 2. Designers of Design Consultancies Selected for the Study of Industrial Design Collaboration

<i>I. Industrial Designers Working for the Norwegian Firms</i>	Position and Background
Roy Tandberg from Tandberg Total Design, Asker	<ul style="list-style-type: none"> • Part-time employed designer at Tomra, free to work for other clients. • Product design education from Art Center, L.A. and work experience from the US
Steinar Flo, Oslo.	<ul style="list-style-type: none"> • Independent industrial design consultant. • Metal design/industrial design education from Norway and Sweden.
Wolfram Peters from Ninaber/ Peters/ Krouwel, Leiden.	<ul style="list-style-type: none"> • Partner of one of the largest industrial design consultancies in the Netherlands. • Educated in industrial design at TU Delft.
Peter Opsvik from Peter Opsvik Ltd., Oslo.	<ul style="list-style-type: none"> • Founder, and alternative seating design pioneer (Balans design solutions). • Educated in furniture design in Norway and London, and further studies in ergonomics from Germany. Work practice from Tandberg Radio Factory where he worked as industrial designer.
<i>II. Additional International Design Consultancies</i>	Characteristics
IDEO Product Design & Development (Bill Moggridge, Ingelise Nielsen, Alison Black, Tim Brown), Palo Alto and London	<ul style="list-style-type: none"> • Industrial/product design and Engineering design with multiple complementary disciplines. • Offices on three continents: Tokyo, San Francisco, Palo Alto, Chicago, Grand Rapids, Boston, London
Fitch (Deane Richardson, Sandra Richardson, David Clare), Ohio and London	<ul style="list-style-type: none"> • Multi-disciplined design and branding consultancy; the British Fitch is famous for its strengths in retail design and branding, and the American Fitch merging with RichardsonSmith in Ohio has a special strength in industrial product design. • Offices on three continents: Ohio, San Francisco, Boston, London, Paris (through Peelers) and Singapore.

