# Places of Creation

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## Preface

Before entering academia, I was involved, both as an in-house design apprentice and as an external freelance designer, in industrial design projects that took place within industrial agglomerations. I noticed that these are contexts of practice that are significantly shaped by local culture and history, and that the management of design resources is not always simply a question of in-house or external designers, but sometimes also a question of local or global involvement. I was intrigued by the particular, unique and culturally entwined knowledge that was held by many local design professionals and which appeared to be essential for the quality and character of the end products.

These were all forces and aspects that had not been considered in my professional training, but which seemed significantly to influence both design practices and outcomes in the industrial agglomerations that I was confronted with. Industrial agglomerations as contexts of design practice had so much to say about the design activities that are situated in time, place and culture that I thought it would be of interest to others as well. This work is an attempt to describe what characterizes design practice and management in new product development within industrial agglomerations. It is an attempt to provide designers and others with a vicarious experience of design that is situated in time, place and culture.

In addition to this text, the research process has generated two conference papers, the first describing design in the Italian agglomeration of sports and leisure footwear manufacturers located in Montebelluna (Linder, 2009) and the second discussing and describing the particular and contextual design knowledge that was found in the three research cases that were part of the research project (Linder, 2011).

## Acknowledgements

This work would not exist without the generous help of many people and institutions. I owe the greatest gratitude to my two supervisors: Turkka Keinonen, who has been both a great source of ideas and inspiration, and a dedicated and balanced critic of my work, and my co-supervisor Toni-Matti Karjalainen who has been present from day one as an academic, human and moral support with inexhaustible patience and commitment. In addition, I would like to thank the scholars that participated in the activities of the Nordcode research network during the course of this research project, who provided me with inspiration, support, and friendship in the often lonely journey towards the completion of this work.

The essence of this study relies on the information and knowledge that has been shared by the many professionals who have devoted their time to interviews and conversations that have been conducted during the course of this work. Thank you. I would especially like to mention Professor Luciano Pilotti at the University of Milan, Aldo Durante and his colleagues at the Museum of Ski Boots, Sports and Leisure Footwear in Montebelluna, who helped me with the logistics of my study trip to Montebelluna, provided me with cultural and historical insights into the local footwear industry, and with useful contacts for interviews from their personal and professional networks. I am likewise thankful to Vilmar Æsøy, and Kjetil Tandstad for sharing their networks in the maritime industry in and around Ålesund, and the furniture industry in Sykkylven with me.

I am grateful to my family and friends who have been an indispensable support during the course of this work. Thank you Salvatore, for your endless patience and unconditional presence, and the joy you bring to everything.

Last but not least, I wish to express my appreciation to all the people who have directly or indirectly helped me in the endeavor of producing this piece of work, but who because of limitations of space or memory are not mentioned above.

## Abstract

This work reports a study of industrial design practice and management in new product development that is undertaken within regional agglomerations of industries. The study was motivated by the importance of regionally agglomerated industries in the global economy, the peculiarities of this phenomenon as a context of practice, and the limited attention that it has received from the design research community. The context of regional agglomerations of industries brings a geographical dimension to the study of design, which to a great extent has been overlooked in existing design research literature. The study shows that design practice and design management is situated in time, place and industrial cultures.

The research results are grounded in careful qualitative analysis of design and design management practices in three regionally agglomerated industries: the Norwegian industries of shipbuilding in and around Ålesund and of furniture in and around Sykkylven, and the Italian production system of sports and leisure shoes in Montebelluna. The interview data that was collected from stakeholders in design in the three industries shows that design in industrial agglomerations is performed by both local and non-local design professionals who contribute to the local context in distinct ways. The study results are condensed in a framework which shows that the design competences that are used in new product development in industrial agglomerations are both sticky and ubiquitous, and that different design professionals are integrated into new product development accordingly. Sticky design knowledge is situated in place and thus held exclusively by local design professionals, while ubiquitous design knowledge is inherent to a global design community and thus travels across industries and space.

The local design community, that consists of in-house designers, ace designers and to some extent all-round designers, is extensively integrated in local new product development processes. Local designers contribute to both intra-regional and knowledge inegration of sticky and ubiquitous design knowledge. Non-local designers, such as global star designers, global ace designers and global all-round designers, whose practices take place within the global design discourse, are loosely integrated in local new product development and build their contributions on ubiquitous design knowledge. They thereby bring new perspectives and product languages to industrial agglomerations and afford learning across industries and space. Based on these findings, the respective sticky and ubiquitous nature of symbolic and synthetic design knowledge is discussed.

Through detailed case descriptions and excerpts from the interviews this text further shows how local and global designers experience practice in regionally agglomerated industries as opposed to more conventional contexts of new product development. The concluding section of this text exemplifies how this work may be relevant to both design and design management practitioners, design education, to the design research community, and in policy contexts.

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# Introduction

Despite an ongoing globalization of both production and consumption, researchers have found that knowledge intensive and innovative activities tend to agglomerate in space, and that this tendency is increasingly significant (Asheim & Gertler, 2005). It is manifested in the persistence of regional agglomerations in industries that are often referred to as business clusters, regional innovation systems, innovative milieus or industrial agglomerations (Brown & Duguid, 2002; Malmberg, 1996; Maskell & Malmberg, 1999; Scott, 2002; Storper, 1997).

Industrial agglomerations, which are mainly studied within the field of economic geography, house spatial concentrations of companies that design and produce similar and related products. They often become famous for the production of superior and innovative products. Well known examples are located in Silicon Valley, which is a center for information technologies, Milan, as a fashion metropolis, and Antwerp, where many specialists in diamond processing locate their premises.

The increasing importance of industrial agglomerations in the global economy implies that the design community can expect the volume of future work opportunities from companies that are located in industrial agglomerations to increase. The overall aim of this work is to contribute knowledge on the use and practice of industrial design in new product development in industrial agglomerations for researchers and practitioners of design and design management.

## 1.1   Design and Place

The industrial agglomeration perspective adds a geographical dimension to the management and practice of design in new product development. The geographical dimension is influential in this work and is positioned in the tradition of human geography, which means that it includes considerations of the spatial organization of human activity from an economic, political and cultural point of view. Following Bathelt and Gluckler, a relational economic geography stance is taken which uses space as a perspective to illuminate and inform an understanding of the social and cultural processes of organization, evolution, innovation and interaction, rather than as an object of study (Bathelt & Gluckler, 2003; Bathelt, 2009).

From the point of view of design management, a geographical perspective means considering where design activities are based and performed, and how their location influences both their integration into the new product development process and their contribution to the design outcome. From a design practice perspective, geography and the agglomeration of industries raises issues that are related to the interaction with local cultures and practices in new product development, and to creativity in places that are characterized by one or a few products.

The conceptual position of the contributions that are made by this work are marked by the overlapping areas between geography of innovation and design practice and design management respectively as illustrated in Figure 1. The geography of innovation area is represented in this work by the study contexts of new product developments in industrial agglomerations.
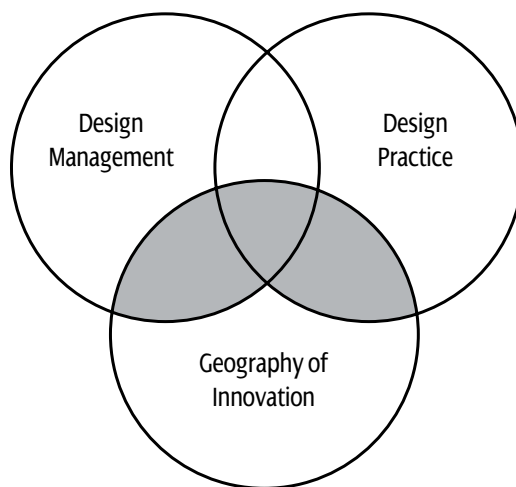


*Figure 1.    The conceptual position of contributions that are made within this work.*

There are a few characteristics of industrial agglomerations as contexts of new product development that are noteworthy from a design practice and design management perspective. First they present a homogenous product environment where sophisticated local knowledge is the basis for just one or a few related products (Malmberg, 1996; Marshall, 1916). Second, the long histories of many industry agglomerations give rise to local production cultures wherein practices are extensively determined by traditions and thus are path dependent (Breschi & Malerba, 2001; Storper, 1997; Walker, 2000). And third, they are often characterized by a functionally dissociated workforce where the design and production of products is distributed across a high number of specialized SMEs (Becattini, 1979; Piore & Sabel, 1984). As a point of departure for the following chapters, the sections below briefly relate these aspects of industrial agglomerations to design management and design practice.

Design is a knowledge and skill intensive creative activity. Creativity has been understood as a process that occurs in the intersections between individuals, cultural or symbolic domains and social fields (Csikszentmihalyi, 1999). The human centred practices of designers have, by their very position between users, producers, disciplines and cultures, the potential to contribute creatively to innovation of products, processes and services (Borja de Mozota, 2003; Brown & Katz, 2009; Csikszentmihalyi, 1999; Kelley & Littman, 2001). The homogeneous product environment that characterizes industrial agglomerations and the degree to which the local new product development practices are determined by history, and thus path dependent, pose challenges to the creative practice of designers in industrial agglomerations. The research results that are presented in this text relate to both different designers' experiences with creative design practice in industrial agglomerations, and to strategies that are used by designers and design managers in industrial agglomerations to conceive and source creative design ideas.

In addition to their creativity, design practitioners are often recognized as boundary spanners in new product development, where they contribute to shared understandings and meanings across functions and better communication in the new product development team (Leonard-Barton, 1991; Sonnenwald, 1996; Veryzer & Borja de Mozota, 2005). The activities of designers, who are situated between users, producers, disciplines and cultures, often turn them into brokers, integrators and gatekeepers of knowledge in new product development, where they have an overarching focus on the needs of the user and contribute to holistic and visionary products (Bertola & Teixeira, 2003; Bruce & Daly, 2003; Hargadon & Sutton, 1997; Kelley & Littman, 2001; Commission of European Communities, 2009; Utterback et al., 2006a; Verganti, 2003; Walsh & Roy, 1985). The distributed nature of new product development in industrial agglomerations thus influences the functional boundary spanning, knowledge gate keeping, brokering and integrating activities of designers. In this context, this work considers the activities and competences of individual design professionals who work for clients who are located within industrial agglomerations and how they are managed and used in locally distributed innovation activities.

Design is situated within social, material and cultural contexts, and there is a mutual influence between design activities and their social and cultural settings (Brereton, Cannon, Mabogunje, & Leifer, 1996; Bucciarelli, 1994; Krippendorff, 2006; Molotch, 2003; Nelson & Stolterman, 2003). Nelson and Stolterman contend that the design milieu, which is constituted by the people, systems, purposes and the history of events that result in the formulation of a design project, determines what is possible for a designer to attain. They thereby related the social, cultural and material aspects of design practice to history (Nelson & Stolterman, 2003). The history of place is accordingly part of the context which shapes situated design practice (A range of examples are given by Molotch, 2002). Following this reasoning, the knowledge, competence, practices and contributions of

individual designers are shaped by the social, cultural, historical and material context of their respective locations of practice. This perspective implies that the contributions of designers whose practices are situated within industrial agglomerations are distinct from those of their non-local colleagues. Accordingly, significant attention is paid in this work to understanding how the physical layout (the places) of design operations in industrial agglomerations influences the competences, expertise and contributions of individual design professionals.

Design research has often emphasized the adaptive and general nature of design expertise that facilitates practice across different industries, but some design researchers have shown the importance of specific design knowledge that is tied to particular contexts (Cross, 2004; Dorst & Reymen, 2004; Kuutti, 2009; Lawson, 2004; Popovic, 2004). Scholars of economic geography, who consider human capabilities from a cultural and geographical perspective, refer to knowledge that is particular to a place and time, and which cannot be copied and used by others elsewhere, as "sticky", and to knowledge that is general and accessible to anyone, anywhere, at any time as "ubiquitous" (Asheim & Isaksen, 2002; Maskell, 1998). These concepts are central to the analyses that are described in this work. In addition to the geographical perspective that is brought by the study of new product development in industrial agglomerations, the study thus introduces a new spatial perspective on design competence.

The cultural and geographical perspective on the management and practice of design in new product development that is taken by this study is potentially of relevance to design research, design management, design practice and design education communities. The design research community can benefit first from the detailed case descriptions that confirm and exemplify the situated and specific nature of design in different industries and from the perspectives of different stakeholders. Second, from the findings related to the breadth of design practices and design management strategies that are present in industrial agglomerations, they can broaden the conventional idea of design as performed by either in-house designers, external designers or a mix of the two. And third, their studies can be enriched by the examples and descriptions of sticky and ubiquitous design knowledge, which relate design competences to geography and culture.

The research findings that deal with the sticky and ubiquitous nature of design knowledge have further implications for design educators, who may want to adapt their design curricula to prepare their students better for the potential variety of situated design practices that their future professional life may bring. In addition, it can be assumed that the examples that are given of challenges and opportunities related to the use of individual design professionals with distinct general, specific, sticky and ubiquitous competences can inform design management practices.

At first glance, design in industrial agglomerations may appear to be a subject that is peripheral and relevant to few, but research in economic geography has shown, on the contrary, that the tendency for innovative activities to agglomerate in space increases. Design practitioners and design managers can thus expect an increasing volume of design opportunities to come from companies in industrial agglomerations. Design practitioners can accordingly benefit from the accounts given in this work of design practice in industrial agglomerations and the opportunities and challenges that are part of such contexts of practice.

## 1.2   Research on Design in Regional Industrial Agglomerations

The intersection between design practice, design management and geography in the context of new product development has received little attention from the design research field. There are, however, a range of studies that are related to the subject in different ways, and which can illuminate aspects that are of relevance to this work. The following sections give a brief outline of the studies that have been performed by researchers in design, economic geography and innovation studies.

In the context of new product development in industrial agglomerations, it is relevant to consider how different professionals contribute to the knowledge dynamics that make local companies innovative. The disintegrated production of industrial agglomerations requires companies to consider how to benefit from appropriate human capabilities that are located inside or outside the company or agglomeration (Chesbrough, Vanhaverbeke, & West, 2006; Lakhani & Panetta, 2007; Von Hippel, 1988). The ways in which designers contribute as knowledge agents to new product development has been studied in both design research innovation studies and by scholars of economic geography (Bertola & Teixeira, 2003; Hargadon, 1998; Leonard-Barton, 1991; Sunley, Pinch, Reimer, & Macmillen, 2008; Verganti, 2003), but few have explicitly related space and regional culture to design competences and contributions.

The three studies of design in industrial agglomerations that are summarized below were published within the academic arena of design research, and were all informed by knowledge management (Ashton, 2004; Bertola & Teixeira, 2003; King & Spring, 2001). Ashton studied the dynamics of knowledge that characterize a number of focal companies in two different industrial agglomerations. Her analysis showed how four focal local companies in two different industries attain external knowledge. She also gave a few examples of how high profile design consultants who work globally with small and medium sized companies in regional agglomerations with design knowledge of market and user trends and of activities and methods of other manufacturers (Ashton, 2004). Her findings show how design

professionals contribute to local organizations with external knowledge, and the results are useful and further developed in the present work which, in addition to the considerations that Ashton takes into account, discusses differences between contributions that are made by different design professionals whose activities are based at distinct locations in relation to the agglomerations.

In their study of two companies in the luxury textile production industries of Italy and the UK, King and Spring (2001) discussed the links between design and knowledge management in the light of location, production processes, network effects and history. They found a tendency in both companies toward vertical integration, and explained this by the high degree of tacit knowledge inherent in the production of their respective products (King & Spring, 2001). They argued that external designers lack the tacit knowledge related to the craft-oriented production that characterize both of the industries that were studied. Such knowledge provides an understanding of how pattern concepts will appear and significantly determines the quality and character of the individual products. They further showed how a significant body of tacit design knowledge related to the brand heritage of the individual companies resides in the material archives that are kept in-house. Access to these archives facilitates the creation of brand coherent products. The study thus exemplifies two types of design knowledge that appear to be specific to the context of production: one related to craft-oriented production and the other to brand language.

Bertola and Teixeira whose study focused on designers as knowledge agents in different contexts, compared the activities of designers who are involved in product development of new complex technologies for large global organizations and in the design of products of mature technologies in the networked organizations that characterize Italian industrial districts. They found that the large global high-tech corporation of the study had internalized most of the new product development functions including design. This was explained by the risk of spillovers of intellectual property in high risk innovation activities, and by the complexity of their products and technologies which require in-depth designer knowledge in new product development. In addition to design services obtained from their in-house designers, external designers were occasionally hired as a means to access design knowledge that was located outside the boundaries of the organization. The internal designers were thus found to act as mediators and integrators of knowledge into different functions in internal cross-functional new product development, and to incorporate external user knowledge where appropriate.

In the SMEs of a range of industrial agglomerations, on the other hand, they found that design was mainly performed by external entrepreneurs who, by way of their sophisticated local network knowledge and their knowledge of user communities, contributed to their clients as knowledge brokers (Bertola & Teixeira, 2003). Since Bertola and Teixeira included companies that are located in industrial agglomerations in their study, some of their find-

ings regarding designers as knowledge agents are relevant to the research results of this work. The researchers do not, however, provide a thorough discussion of the distinct competences and contributions that are made by different design professionals with distinct geographical places of practice. An interesting discussion on the role of design in Italian regional economies was made by Arquilla, Simonelli, and Vignati, who related the historical success of the italian industry, and its future potential to the close and particular relationship that can be found between Italian design and industry (Arquilla, V., Simonelli, G., & Vignati, A, 2005). They touched upon the situated practice of new product development in italian industry agglomerations, and generally discussed the role of local knowledge in new product development. Although specifically performed in the italian industry, and in italian industry agglomerations that are usually characterized as a specific type, their study has informed this work with aspects and perspectives that can be useful in the more general approach that is taken in this study to industrial design in industry agglomertions.

Researchers in economic geography have studied the spatial distribution of design, and the impact of a variety of mechanisms that are characteristic of agglomerations on design, as one of many creative industries (Power, 2009; Power & Scott, 2004). One example is provided by Sunley, Pinch, Reimer, and Macmillen (2008) who focused on the knowledge dynamics that occur in design agencies and in the interactions between design agencies and their clients. In line with studies that have been performed by scholars in design and design management (for example Bertola & Teixeira, 2003; Hargadon, 1998; Leonard-Barton, 1991; Verganti, 2003), they found that designers act as creative brokers between the knowledge bases of the design agency and the client. More significantly, they found that the cognitive content of design knowledge, which can be tacit, codified, aesthetic, analytic, symbolic or synthetic, varies across design agencies with different profiles and thus gives individual design professionals distinct mediating roles in innovation. Accordingly they emphasized that it is important to consider innovation in the light of the knowledge and activities of key creative figures located in their distinct industrial architectures (Sunley et al., 2008). Like many other studies that have been conducted in this academic field (for example Faulconbridge, Taylor, Beaverstock, & Nativel, 2010; Faulconbridge, 2006; Reimer, Pinch, & Sunley, 2008), their study focused on design service agglomerations consisting of a large number of design consultancies. In contrast with this, the present study examines the contributions of a variety of design professionals to agglomerations of industries that produce different kinds of products. Although Sunley et al. recognize that design agencies build on design knowledge of various natures, they neither go into detail about the knowledge bases and contributions of individual designers to an industry as a whole, nor compare across industries.

The knowledge basis upon which different occupations build, and the degree to which these are sticky or ubiquitous, has recently attracted the attention of scholars in geography and

innovation studies (Asheim, 2007; Martin & Moodysson, 2013). One such study was conducted by Tether, Li, and Mina (2012), who inquired into the differences in spatial implications between the symbolic-synthetic knowledge bases of architects and the analytical-synthetic knowledge bases of engineers. They found that globally renowned architecture agencies, that rely on symbolic, synthetic, and analytical knowledge bases, tend to concentrate their design operations in one or a few metropolitan locations, whereas the activities of agencies that rely primarily on synthetic knowledge bases operate in a more distributed and dispersed manner. Based on their findings, they called for more attention to be paid to the different knowledge bases of knowledge intensive service providers operating in the same or related occupations. The present study responds to that suggestion by considering the knowledge bases and contributions of different designers in relation to geography.

The contributions that have been summarized in this section are all relevant to this study. The findings of the present study confirm, specify and expand on the contributions made by these researchers in relation to designers as knowledge agents in new product development. What is missing in the extant literature is thorough descriptions of the contributions made by diverse design professionals, whose practices are socially and culturally situated in different geographical locations, to companies in industrial agglomerations, as well as a systematic description of each aspect of their knowledge. This work aims at filling this gap.

## 1.3   Research Approach

In order to gain a deep understanding of industrial design practice in industrial agglomerations a qualitative case study approach was chosen. This offered the possibility of considering the great range of interrelated dimensions that are present in different industrial agglomerations and that have a bearing on the management and practice of industrial design, without having to control any of them.

Three case studies were included in the research design and provided a variety of constellations of the themes that are relevant to the research subject. The regionally agglomerated industries of shipbuilding and furniture design located on the Norwegian west coast region of Møre og Romsdal and the Italian production system of sports and leisure shoes in Montebelluna were chosen for their potential, individually and collectively, to add to existing experience and understanding (Stake, 2000), and for their theoretical relevance (Flick, 2006, p. 128). First they produce objects aimed at different uses and consequently have distinct main customer values. Second they exhibit different kinds of product and organizational complexity. And third, they have different traditions of industrial design. The geographical location of the three industry agglomerations that were studied is shown in Figure 2.

*Figure 2.    The locations of the three industry agglomerations that were included in the study. The first spot (1) represents the maritime industry agglomeration in and around Ålesund. The second spot (2) indicates the furniture agglomeration in Sykkylven. The third spot (3) shows the location of the agglomeration of sports and leisure footwear of Montebelluna.*

The data were mainly collected through semi-structured interviews with stakeholders of design in the three agglomerations. The different stakeholders shared their individual experiences of new product development in each of the industrial agglomerations.

The results of the research that are presented in this text include detailed case descriptions of design practices that were found in the three cases, comparisons of industrial design across the three different industrial agglomerations and some general statements about how industrial design practice is influenced by the context of new product development in industrial agglomerations and how industrial designers contribute to innovation in that same context. In particular, the conclusions that are drawn include considerations of the geographical aspects of design competence and related implications for design management.

## 1.4  The Structure of this Work

Chapters Two and Three are based on literature reviews of research that has been conducted in the fields of economic geography and design research. The literature reviews discuss the themes and concepts that are relevant to the research endeavor described in this work. These themes and concepts are synthesized in Chapter Four, where they are linked to the research problem, research questions, and to the research design in a more explicit manner. Chapter Five describes the research process and the approaches and methods used to arrive at the research results. Chapters Six, Seven and Eight contain detailed descriptions of the three study cases of the research project. The high level of detail in the case descriptions provide the basis for the generalizations that are subsequently made in Chapter Nine, where the findings from the individual case descriptions are discussed and compared, leading to the conclusions of this work.

**2**

## Industrial Design in New Product Development

This chapter, which is based on a review of the literature, will outline the main issues that are relevant to discussion of the practice and management of design in new product development and innovation for industry. It serves as a theoretical backdrop to the research case descriptions and the following discussion of the research outcomes.

The word "design" is used to indicate a range of concepts. It is important to be clear about the intended meaning of the word as it is central to the research descriptions. The research questions of the study call for an understanding of design as a professional activity that takes place within a social and material context. Dorst (2008) outlined a framework for studies of the complex creative human endeavor of design. This framework identifies the dynamics of the activities that are undertaken in design, the actor (the designer or the design team/designing organization), the object of the activities (the design problem and the emerging design solution) and the context where the activity takes place (Dorst, 2008).

This framework is a useful point of departure in the quest for an appropriate understanding of what determines design activities in different contexts. It can accommodate questions such as, "What does a designer do?", "Who is a designer?", "What are the competences of a designer?", "What type of products does the designer design?", "Where are the design activities undertaken?" and, "How are design activities influenced by their context?", where "context" may refer to industrial, organizational or social contexts. The following sections set out to delineate the actor and the activities that are involved in design in general, followed by a more specific description of design competence, and of the design professionals and activities that are considered in this study. The design competences of individual designers are central in reflections on the role and contributions of design professionals in industrial agglomerations. Therefore, an entire section is dedicated to this theme, where concepts that are useful for the purpose of this research, such as design knowledge, skills, knowing and competence are reviewed.

After a brief discussion of the contributions that are made by design professionals to new product development and innovation, the context of design and the object of design are described in sufficient detail for the purposes of this work. The context of design is considered to include social, cultural and material dimensions that have implications for design practice, as well as for the design management strategies in different industrial settings. Design in different industrial settings is further discussed in the light of product types, design competences and industrial traditions.

### 2.1   Professional Industrial Design

In order to contextualize the research, the following section clarifies the concept of industrial design and the relevant dimensions for discussion of professional design practice and

management in new product development and innovation. The research aim and objective calls for an understanding of design as an activity. A range of design scholars have produced such definitions, a few of which are drawn upon in the following sections.

A definition of design as an activity that has frequently been used in academia was formulated by Herbert Simon: "The transformation of existing conditions into preferred ones" (Simon, 1981). This definition was presented together with a plea for a "science of design" built upon a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrines about the design process (Cross, 2001). Simon was part of the design methodology movement, which had the aim of creating a number of orderly, systematic and sequential procedures, by which design problems could be accurately diagnosed and formulated, and their solutions could be prescribed (Gedenryd, 1998). This view of design as rational problem solving applied to distinct problems performed by an objective designer has been criticized by both practitioners and scholars, who maintain that it cannot account for their practice. In addition, the definition potentially includes activities that are far from the common understanding of design, such as washing a dirty car or eating. The contrast between the design methodology worldview and that held by many design practitioners, as well as the professional focus and fundamental assumptions upon which this work rests, make Simon's view of design inappropriate in this context.

Many of Simon's opponents welcomed the ideas of Donald Schön, whose epistemology of practice was the result of ethnographic studies of a range of action-oriented professionals at work. Schön argued that, "Real-world practice problems are seldom given, but must be constructed from the materials of the problematic situations" (Schön, 1991, p. 40). He further recognized the experimental and artistic character of design activities, where there is a close and reflective relationship between thinking and doing. Even Archer who was among the founders of the design methods movement stated that "there exists a designerly way of thinking and communicating that is both different from scientific and scholarly ways of thinking and communicating, and as powerful as scientific and scholarly methods of enquiry when applied to its own kinds of problems" (Archer, 1979, p.18).

Schön's description of a design inquiry is taken from the study of an architecture student and her tutor in their quest for a satisfactory house layout, and can accommodate design as a general activity that can be performed by a wide range of design professionals. It is thus useful as a general account for how a designer works in the conceptual parts of the design process, but it does not account for how the work of a professional designer is influenced by the object of design, his or her professional training or specialty, or the social and professional context of the design activity. These are aspects of design that are important in the present work. The weight of the social aspects of design is an essential part of the process, as neatly expressed by Maldonado in the phrase "the designer is never alone, never works alone, therefore he is never a whole" (cited by Borja de Mozota, 2003, p. 5).

A useful activity-oriented definition of design that also says something about the object of design, design competences and the social context of the design activity was proposed by Krippendorff. His overall approach is that the activity of design is making sense of things, through sense creating activities. (Krippendorff, 2006). Professional design activities take place in networks of stakeholders with different and sometimes conflicting interests in the design process and its outcome. The success of a design relies on the designer's ability to understand how users and other stakeholders understand the artifact (Krippendorff, 2006, p. 66). In contrast with the design theory outlined by Simon, Krippendorff's theory conforms to the nature of design activity as concerned with what does not yet exist, with innovation and making things happen. Krippendorff's understanding of design activity, together with his recognition of its social nature, provides a useful holistic idea of design activities and its constitutive elements.

Some scholars have conceived design activity primarily as a fundamental human approach (for example Nelson & Stolterman, 2003 ; Simon, 1981). This work however is limited to design as performed by professional designers. With this in mind, the description of professionalism that was made by Misha Black is useful:

> *"The offering to the public of a specialized skill, depending largely upon judgment, in which both the experience and established knowledge are of equal in weight, while the person possessing the skill is bound by an ethical code and may be accountable at law for a proper degree of skill in exercising this judgment".*
> *(Black as cited in Potter, 1980, pp. 15–16)*

Although both the ethical responsibility of individual designers, and the extent to which they may be held accountable at law for their practice, vary across individuals, schools and nations, there are various reasons why Misha's description of professionalism is appropriate in a design context. First, it acknowledges the interplay that takes place between skill and judgment in the design process. Second, it endorses the importance of experiential knowledge in design. And third, it recognizes that designers are providers of services to clients, who can be businesses, end users or others with a stake in the design outcome.

Since this work deals with design as performed by professional designers, it is appropriate to delineate who is a design professional. Krippendorff excludes both design that is performed by laymen by way of the innate human design capability and design that is performed in an engineering context from his definitions of professional designers. He contends that designers are easy to recognize by way of their approach to design situations, as well as their shared design discourse. Although a shared design discourse may be found among engineering designers, their professional focus is not on man-machine relationships and they are therefore excluded from the design community that is considered by Krippendorff (p. 35). Following Krippendorff, and Black, professional designers are

those who by way of their training at design schools, internships and work experiences are able to perform design activities as a service offered to a client. Their primary focus is on the relationship between users and products. Their practice is socially determined as it involves the interests and needs of a wide range of design stakeholders. Professional designers operate in a shared design discourse which provides them with ethics, principles and approaches that are useful in their practice.

This outline can embrace a wide range of design professionals, such as commercial artists, product designers, industrial designers, graphic designers, fashion designers, interaction designers and architects. Although their creative approach and the way of handling design situations may be similar, their respective competences rely on the knowledge and skills, relating to the materials, tools, methods, languages, traditions and styles that are found in each of their specific design fields (Nelson & Stolterman, 2003, p. 23). Correspondingly, the design activities that are performed in any specific field of design and the corresponding expertise have their own flavor.

In this study, the term design practice is used to describe the design activities that are usually assigned to industrial designers when they design industrially produced goods. However, this does not necessarily exclude from the study professionals who are trained in other subfields of design. Indeed, industries that engage design professionals with various backgrounds are included in the study and are considered opportunities to enrich and nuance the research outcome.  The International Council of Societies of Industrial Design (ICSID) defines industrial design as:

> *…a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanisation of technologies and the crucial factor of cultural and economic exchange.*
>
> *(International Council of Societies of Industrial Design, 2008, para 1)*

ICSID further emphasizes the responsibilities of designers to, with the logic of industrialization, enhance global sustainability, to give benefits and freedom to the entire human community including final users, producers and market protagonists, to support cultural diversity, to give products, services and systems those forms that are expressive of and coherent with their proper complexity (International Council of Societies of Industrial Design, 2008). This definition of professional industrial design can encompass the professional designers and design activities that are considered in this research project.
It has therefore been used as a rule of thumb in the identification of possible designers to interview in the three case studies that are described in this work.

## 2.2  Design Competence

The focus on design practice, management and contributions across industrial settings that has been chosen for this study calls for an understanding of the basis of design contributions, namely design competence. In addition to aspects that will be reviewed in the following chapters, the contributions that are made by designers in different contexts depend on the knowledge and skills of the individual designer. For this reason, the following sections review and specify what is intended by design competence, design knowledge, design skills and design knowing, and their respective importance for the current work.

With the widespread popularity that the term and concept of design thinking has earned in recent years, this appears to be a mandatory passage point in a discussion of design contributions to new product development. The term design thinking was first introduced by Peter G. Rowe who already in 1987 described how architects and planners design (Rowe, 1987). However, the way designers work and handle design problems of different complexity and nature had been described earlier by design theorists (for example Rittel & Weber, 1973, Schön, 1983, Simon, 1969). Following those pioneers, Cross made a significant contribution to the understanding of what constitutes design thinking through studying designers and engineers in action and describing their 'designerly ways of thinking' (Cross, 2004[1]).

The use of the design thinking concept got a widespread upswing in the early 00's as it was recognized and used by theorists and practitioners in design, organizational science, and management to indicate an important asset with potential beyond product and service deign (Boland & Callopy, 2004, Brown, 2008, Buchanan, 1992, Martin, 2009, Cross, 2007, 2011, Johansson, Woodilla & Cetinkaya, 2013, Nassbaum, 2005). The revival in interest for design thinking is thus due to findings related to new contexts of application rather than designerly ways of working or thinking as a phenomenon (cf. Cooper, Junginger, and Lockwood, 2009). While design thinking is an inclusive and popular term for the cognitive activities that are used in design, this work will use the more practice oriented term design competence for describing the knowledge, skills, and tools that are used by designers.

A general understanding of a competent professional is that he or she is able to perform and produce as expected within his or her specific occupation. The ability to do so is usually attained through some kind of education or apprenticeship. The knowledge and skills that are associated with the practice of a particular occupation are further refined through practice. A competent designer is thus one who is able to produce a design outcome purposefully and successfully, so that it fits the situation for which it is intended. While the competences required from professionals such as doctors, nurses and lawyers are standardized and controlled through licensing, no such licenses, laws or controls apply to industrial design professionals (Julier, 2000, p. 34; Valtonen, 2007, p. 13). Most designers

are, however, educated in a formal way by three to seven years in a design school (Potter, 1980, p. 13). Competence is not limited to knowledge and skills, but also includes attitudes, or mindset. Nelson and Stolterman define a competent designer as one who has developed the right sets of knowledge, skills and tools, and a mindset that fits the situation. Beyond education, the craft of designing in a specific design milieu is thus learned in situ (Nelson & Stolterman, 2003, pp. 224-225). The various contributions that are made by designers in different industrial contexts accordingly require different sets of knowledge and skills, and tools, (as exemplified by Valtonen, 2007, and Järvinen & Koskinen, 2000, pp. 171-172) as well as appropriate mindsets. The strategic level of design practice, its organizational setup, its social, cultural and industrial setting, and, last but not least, the type of product that is dealt with in design call for various foci and levels of expertise.

Holyoak identified two different types of expert: routine experts, who are able to solve familiar types of problems quickly and accurately but who are modest in dealing with what is new and unfamiliar, and adaptive experts, who invent new procedures that are useful in solving the problems of new and unfamiliar situations (Holyoak, 1991, p. 310). Design expertise has typically been characterized as adaptive, where experienced designers identify patterns of resemblance that underlie seemingly distant design situations and use them in their production of innovative design solutions (Jonas & Meyer-Veden, 2004; Lawson, 2004; Popovic, 2004).

However, in order to produce design solutions successfully that fit their purposes, the adaptive expertise of designers needs to be supported by a familiarity with the particular problems, tasks and conditions of the specific field of endeavor. In other words, as has been confirmed by scholars in design cognition and expertise, design knowing based on previous experience facilitates the framing of what should be attended to in a design situation and is thus a crucial part of design competence (Cross, 2004; Dorst & Reymen, 2004; Lawson, 2004; Lawson & Dorst, 2009). This was confirmed by Popovic in her studies of design cognition and the process that transforms a design novice into an expert designer. She found that expert design performance is indeed adaptive, but also tightly connected to domain-specific knowledge, where the latter contributes to finding satisfactory solutions efficiently in context (Popovic, 2004). The expertise of a design expert is thus partly connected to specific contexts of design.

Cross described design knowledge as knowledge "about the artificial world and how to contribute to the creation and maintenance of that world". It includes knowledge inherent to the activity of designing, to the forms and configurations of artifacts and to manufacturing processes (Cross, 2001, pp. 54–55). In their review of research performed in different fields of design, from fashion to architecture, Lawson and Dorst found that competent designers build their work on design schemata, which consist of "a coherent set of design elements interrelated in ways that relate consistently to sets of guiding principles" (Lawson

& Dorst, 2009, p. 168). These elements and their relations are part of the material culture of the field where design contributions are made. Designers who produce design proposals that are too far from the prevailing design schemata, either because of an urge to challenge existing frames or because of a lack of knowledge related to the field of endeavor, may produce more original and creative results, but may also increase the level of risk for the design client (Lawson & Dorst, 2009, p. 170).

Nelson and Stolterman argued that design wisdom is the ability to create the right thing, for the right people, at the right time, at the right place, in the right way and for the right reasons (Nelson & Stolterman, 2003). Design wisdom includes the applied, particular and timely nature of design knowledge used in context. The ability to deal efficiently with design situations that are typically indeterminate, paradoxical and sometimes complex and indefinable, and synthesize them into a new whole requires design judgments, which are the means for wise action (Nelson & Stolterman, 2003, p. 145). Design judgment is "best understood when it is considered within the context of knowledge, knowing, and the knower. It is knowing based on knowledge that is inseparable from the knower" (Nelson & Stolterman, 2003, p. 141).

Gedenryd, who researched design activities from a cognitive point of view, characterized design knowing as a capacity rather than a stable thing stored in mind, that is manifested in the social and cultural context of action and is not assumed any existence beyond that (Gedenryd, 1998, pp. 78–79). Design competence thus appears to have two sides, one that is general and universal, which can be used across contexts, and one that is specific and tied to the context where it is created and used in design judgments. Although the need for knowledge tied to context has been articulated by the above scholars, little attention has been paid to illuminating exactly what constitutes context specific design knowledge, except for a few examples that are given below.

The local, particular and timely nature of design knowing, as opposed to the global and general knowledge that is produced in traditional science, was exemplified by Kuutti, who argued that contextual knowledge is crucial in the production of design outcomes that fit their purposes and which thereby become successful contributions to the world (Kuutti, 2009, pp. 71–72). He gave the example of the long lived and sustainable design of a salmon dam in northern Scandinavia, which had been designed with the catch of the first year in mind, but which, with only limited maintenance, lasted intact for almost four hundred years. Its longevity can be ascribed to the contextual knowledge of the local and particular conditions of the rapids, their stability, as well as the designer's familiarity with the activity of catching salmon. This example echoes the conclusions of Molander, who argued that knowing entails the ability to make appropriate judgments, and to appreciate what is relevant, what can potentially be developed and what may go wrong in a specific design situation (Molander, 1996, p. 34). Another essential part of specific design knowledge

regards use and users. The raison d'être of industrial design is the existence of a user who is helped or enriched by the design outcome. Knowledge about users and use is to a great extent tied to specific contexts of use. Kotro showed how the need for knowledge about users and use sometimes blurs the border between designers and users to a point where the designers are the users. Her study was performed at a sports equipment manufacturer where most in-house designers take part in the sports that they design for. By actively testing and using the products themselves and by taking part in the user culture, they gain a deep and contextual knowledge, hobbyist knowing, that is hard to assimilate in any other way, and which is invaluable to product development (Kotro, 2005). Hobbyist knowing is another typical example of what in this work is conceived as specific design knowledge.

It is challenging to research design knowledge and knowing, since parts of it are of a tacit nature. The term "tacit knowledge" was coined by Polanyi, who used the concept for knowing that is difficult to articulate or codify. Through a range of examples he showed that "we can know more than we can tell" (Polanyi, 1967). Tacit knowledge is often referred to as the antipode to explicit or codified knowledge. Tacit design knowledge relates to acts of doing or making, trial and error, routines or habits, and is thus difficult to assimilate through verbal or written accounts, but is typically learned in context through apprenticeship and face to face interaction (Gertler, 2003; Heap, Jerrard, & Burns, 2007; Polanyi, 1967). Further, it is best shared between people who take part in the same institutional environment and consequently speak the same language and know the conventions and norms of their shared context (Asheim & Gertler, 2005, p. 293). The face to face interaction in context with the material of production that is required for the assimilation of tacit knowledge adds a geographical dimension to parts of design knowledge and practice, which thus can be referred to as "sticky" (Gertler, 2003). In the context of this study, design knowledge and knowing, often tacit, that is produced and used in a specific, delimited context, from which it is difficult to separate it, will be referred to as "sticky design knowledge".

The sticky or ubiquitous nature of knowledge in general, has been considered by scholars of geography (Asheim, 1999; Gertler, 2003; Maskell & Malmberg, 1999), knowledge management (Brown & Duguid, 2001; Lave & Wenger, 1991), and innovation studies (Von Hippel, 1994). In the knowledge management field, and in situated learning theory in particular, Lave and Wenger relate the ease or difficulty of learning to the existence of communities of practice (Lave & Wenger, 1991). They defined a community of practice as a naturally evolving group of people who share both a craft or profession and an interest in a particular domain or area. They argued that learning in communities of practice is natural and self reinforcing, and facilitated by the shared repertoire of communal resources such as language, routines, artifacts and stories that emerge among its members through their ongoing interactions in joint enterprises. Brown and Duguid discussed the stickyness or leakiness of knowledge, referring to the ease or difficulty with which such knowledge is

transferred between professionals and organizations. They emphasized that the knowledge on which innovation builds is simultaneously sticky and leaky, since it can be embedded in products or widely acknowledged practices that can travel as far as those products and practices (Brown & Duguid, 2002). They further argued that knowledge is inherent to communities of practice that span organizational boundaries rather than to organizations, and its stickyness or leakiness is related to the organization and extension of the community of practice to which it is inherent (Brown & Duguid, 2001). The recognition of the situated and social nature of learning upon which situated learning theory builds is adapted in this work. However, because of the focus on collectives of practitioners who participate in shared endeavors, rather than individual practitioners as part of a greater socio-cultural context, the concept of communities of practice does not directly support the research objective that have been formulated for this study.

In his studies of new product development and innovation, Von Hippel used the term "sticky information" to refer to information that is used in problem solving which is costly to acquire, transfer and use in a new location (Von Hippel, 1994). The primary focus of Von Hippel was on the sticky information that is held by lead users and how to capture and integrate it into product development and innovation, and how it can be dispersed throughout the organization. The sticky design knowledge that is the focus of this work is the embodied knowledge and knowing of designers in specific contexts, which is usually not disconnected information, and the ways in which such knowledge can contribute to new product development. Sticky design knowledge may well relate to users, use and the particular conditions that determine use (as exemplified by Kotro, 2005; Kuutti, 2009), but is also presumed to be connected to the social process of design in particular industrial and geographical settings. This work aims at a more detailed understanding of what constitutes sticky design knowledge, and how it is learned, used and managed.

## 2.3   The Social and Cultural Context of Designing

In line with Brown and Duguid's understanding of practice, this work refers to design practice as the full engagement in professional design activities that are situated in a social, historical and cultural context (Brown & Duguid, 2001), and there is a mutual influence between the design activities and their social and cultural setting. The practices of designers are situated not only within their own cultures but also within the cultures of their clients and users of the design outcome. For the clarity of the case descriptions and following discussions, table 1 summarizes what is intended with the terms designer, design stakeholder, user, client, and customer within this work.

*Table 1.    Overview of the terms that are used in relation to the social context of design activities.*

| Designer | Professional who is involved in the design of industrially produced products that are aimed at a professional or consumer market, and a user. |
|---|---|
| Design stakeholder | Design stakeholders are people and professionals who have a stake in a design project and its outcome. Stakeholders are experts in their own worlds, knowledgeable about the stake they claim in design, and are willing to mobilize the resources they command in order to act in support or opposition of a design object or process (as defined by Krippendorff, 2006, p. 64). |
| User | The end user of a product. |
| Client/customer | Someone who buy a product or service. A client can thus be an organization that commissions a design service from an external designer, and a user who buys a product from a manufacturer. He terms are used interchangeably but generally a more long term or ongoing interaction is indicated by the use of "client". |

Through their situated practice, designers develop socially and culturally entwined knowledge that is determined by the particular context where everyday design activities take place. In line with this view, the design outcomes are expressions of the design, production and user cultures that constitute their raison d'être. Moreover, the management of design, the experience of design practice, and the contributions that are made by designers to the objects of design, are all related to the intended and actual use and consumption of the object. In other words, the character of the product influences the character of design management and practice. All the aspects that are mentioned above make up the context of design activities as they are conceived in this work. The mutual and reciprocal influences of design activities, objects of design and the social and cultural context where design activities take place are thus carefully considered and reported in this work, which aims at a thorough and transparent understanding of design activities across different industrial contexts.

The following sections will therefore outline what is included in the concept of context of design within the framework of this study. In particular, it is argued that design management, practice and design competences in industrial settings are determined not only by the corporate culture of their client and user cultures, but also by industrial cultures and in

some cases by the global design discourse. The aspects that shape the context of design have been influential both in the sampling of cases, and within the descriptions of the case studies, where the aim is to contribute to a complete and meaningful reading experience.

The culturally and socially situated nature of design has been recognized by a range of authors (for example Brereton et al., 1996; Bucciarelli, 1994; Cross & Cross, 1995; Feast, 2012; Krippendorff, 2006; Shaw, 2010). Because of its capacity to embrace aspects of culture that are central in designing, Heskett's understanding of "culture" is used in this work. Heskett defines culture as "the shared values, way of life, and the learned behavior patterns of a community or social group. It is expressed through such aspects as values, communications, organizations, and artefacts (Heskett, 2002a, p. 47). The engineering and technology scholar Bucciarelli emphasized the importance of studying design in its social context and historical setting (Bucciarelli, 1988, p. 18). In a number of longitudinal ethnographic studies of engineering design teams in product development projects he found that designers live in, and act in line with, object worlds.

An object world is determined by the personal knowing, interests and motivations that are connected to a specific design endeavors. The design process is, according to Bucciarelli, the social process wherein the individual object worlds of the project participants intersect in continuous negotiations of shared meanings and consensus on common ends-in-view for the project (Bucciarelli, 1994). Bucciarelli further underlines the need to consider the "norms and practices of the subculture of the firm where the object serves as icon" in the production of any thorough understanding of design practice within a corporate environment (Bucciarelli, 1994, p. 20). Bucciarelli's research results are, however, limited to the level of multidisciplinary collaboration within the framework of the design project, and at most stretches to corporate levels of analysis. The industrial focus that is chosen for this work calls for concepts that influence design at an industry level.

Like Bucciarelli, Krippendorff articulated how social and cultural dynamics may have an impact on the everyday practice of designers. He characterizes designing as a social activity that is determined by a large number of stakeholders, who claim their stake in a design and its consequences. Stakeholders are experts in their own worlds, knowledgeable about the stake they claim in design, who are willing to mobilize the resources they command in order to act in support of or opposition to a design object or process (Krippendorff, 2006, p. 64). The success or failure of a design endeavor depends on the designer's ability to enroll stakeholders in the project, convert opponents into supporters, negotiate diverging perspectives, utilize diverse expert knowledge that is found elsewhere and to rely on stakeholders to move the development of the artifact forward (Krippendorff, 2006, p. 66).

Users and buyers of a product, commissioners of design services, product development team members, marketers, vendors, retailers, production staff, stockholders and even

competitors are all stakeholders of a design. In some industries there are stakeholders such as representatives of government agencies or private classification societies, who are less evident at first but who have a major impact on the design outcome. In contrast to Bucciarelli, Krippendorff's analysis stretches beyond organizational boundaries to include extra-organizational stakeholders. However, it does not focus on the intersection of cultures that occurs when stakeholders of a design collaborate in professional endeavors. The concept of stakeholders in a design is useful as they are individuals who influence the success or failure of a design project, and their respective cultures must be identified.

Stakeholders in a design, including the designers themselves, live and act within cultures, which in their turn are part of professional, industrial, regional and national cultures. According to Nelson and Stolterman, the design milieu, which includes other people, systems and purposes, and the history of events that end up in the formulation of a design project, facilitates or limits what a designer is able to attain (Nelson & Stolterman, 2003). With the concept of the design milieu they affirm that design activities are situated in social and historical settings. Moreover, like Krippendorff and Bucciarelli, they emphasize the dialogic and negotiable nature of design activities. They state that the more a design milieu accepts design as a valid approach for intentional change, the better it provides support for the design activities (Nelson & Stolterman, 2003, p. 225). Building on the unique way of being, thinking and acting of designers, Nelson and Stolterman thoroughly elaborate the constituents of a design culture. But their discussion does not take into account what happens in the encounter of separate cultures that occurs in the temporary constellation of a design project that crosses organizational boundaries. If the context of design is determined by people, systems and purposes, and the history of events that end up in the formulation of a design project, it ought to be connected to the culture of the stakeholders who are involved. The concept of design milieu says little about what happens in the encounter of cultures that occurs within the temporary framework of a design project. Inter-organizational new product development and innovation is typical for many industrial agglomerations that rely on the dispersed production of goods that involves a large number of small and medium-sized enterprises (SMEs).

In addition to the cultures of users, designers, and manufacturers, any thorough understanding of design activity in context should also consider industrial cultures. An understanding of the regional industrial culture of a design milieu has the potential to enrich accounts of situated design practice as well as to explain differences in design knowing, management and practice that exist between various industrial settings. It may also explain why professional design is used in certain ways, how it is considered, managed and consequently practiced by in-house designers, local design consultants and non-local design consultants in a commercial context. James (2003) described how individual corporate practices in innovative regional economies are embedded in a cultural hierarchy that consists of

corporate cultures, regional industrial cultures and wider regional cultures. Specifically he showed how the shared cultural values, norms and attitudes of a region penetrate corporate boundaries and influence decision-making processes, behaviors and the ability of local firms to innovate (James, 2003).

The geographical and cognitive affiliation of design professionals, who fully or partly perform their practice in the framework of a specific industrial agglomeration, should, according to the reasoning set out above, influence their respective contributions to innovation. This fact further underlines the importance of considering the spatial, cultural and cognitive connections of different industrial designers when their individual contributions to specific industrial agglomerations are to be understood. The geographically bounded regional and industrial cultures where design activities take place are given a central position in this work, which aims to produce a rich understanding of the study matter of design practice and design management in specific geographically, culturally and cognitively bounded industrial agglomerations.

## 2.4 The Material Context of Designing

If designing is socially and culturally determined, it is also influenced by its material object. The industrial and commercial setting for professional industrial design is part of the aspects that frame possible design contributions. Beyond technology and economy Wartofsky argued that "the artifact is to cultural evolution what the gene is to biological evolution" (as cited in H. L. Molotch, 2003, p. 205). From a design point of view this expression illustrates how design development is intertwined with the material culture wherein it takes place. Specific industrial cultures both shape and are shaped by design. The attention that has been paid by the authors above to artifacts in historically and culturally situated practice is congruent with the orientation of this work. The material and cultural contexts for different product types influence both design management and practice (good examples of this are provided by Järvinen & Koskinen, 2000).

This section draws from literature that illustrates how product type influences the scale and scope of design interventions as well as how design practice is experienced. It provides a product type related foundation upon which the sampling of industries for the study and following discussions of the research findings can rest. It is suggested that complexity and main use function are important determinants for how design is used and practiced across industries and those aspects are following considered in the research design and in discussions related to the research outcome. The following section will outline the frames of this study in terms of product type, and briefly introduce aspects that are specific to different product types that are expected to be of relevance to this study and that can support the case descriptions and inform the internal comparison of the cases.

Industrial designers are involved in the design and development of a range of objects. Traditionally industrial design has dealt primarily with the design and production of material artifacts. The Industrial Designers Society of America (IDSA) states that design outcomes range from products and systems to identities, packaging, and interiors (Industrial Designers Society of America, 2007). Together with the ongoing transformation towards a more immaterial and digital consumption the scope of design activities have expanded. Beyond physical products and immaterial images or identities, an increasing portion of design now relates to services (Kunkel, 1999; Norman & Verganti, 2012; Secomandi & Snelders, 2011). The focus of this work on industry agglomerations that are typically the result of a long historical evolution however limits the research to industry settings where more mature physical and material artifacts for different markets and uses are produced.

Design practice in consumer product industries has been extensively described by a range of design scholars and practitioners (Dreyfuss, 1967; Heskett, 1989, 2002, Julier, 2000; Kunkel, 1999; Molotch, 2003; Norman, 1998; Design Council, n.d.; Utterback et al., 2006b). Beyond the Proactive design project, which was focused on the application of industrial design in Finnish engineering business-to-business industry, the design research community has paid a limited attention to design practices within industrial and professional product domains. This may be connected to the restricted use of professional industrial design competences in many such industries. Their significance in the world economy should however not be underestimated as they are the instruments that are used in manufacturing and in the provision of services and thereby constitute the 'technological backbone' of the modern economy (Hobday et al., 2000).

The morphological complexity that is common for the product category makes industrial products and interesting complement to consumer products in the study. The following sections will explore the aspects of the category that are considered to be of relevance within the context of this study. The industrial products category as used in this work, can be described in terms of 'complex products and systems' (CoPS), where the term 'complex' reflects the large number of customized components, the breadth of knowledge and skills required and the degree of new knowledge involved in production (Hobday, 1998).

Examples of CoPS are flight simulators, aircraft engines, avionics systems, e-commerce networks, train engines, air traffic control units, and offshore oil equipments (Hobday et al., 2000). Because of their large number of capital-intensive customized and interrelated elements, many of them tailored for specific customers, they can be characterized as an opposite to mass-produced goods. All of the functions, technologies, and instances of CoPS embody distinct expertise that is held by different stakeholders who are often located within separate organizations (Sosa, Eppinger, & Rowles, 2003; Ulrich, 1995). From a designer perspective this means coping with little overall control of the emerging product. An example is provided by Keinonen, who illustrated how the endeavor of transforming

the Finnish steel supplier Rautarukki from a material supplier into a supplier of integrated products and systems turned out to be a complex endeavor involving major organizational challenges rather than traditional product design:

> *Only understanding the dynamics of the business networks allowed Rautaruukki*
> *to have a say about the products and upgrade its role from material supplier to*
> *provider of products. The challenge is remarkable because even a small project*
> *involves dozens of stakeholders in combinations that are unique to each project,*
> *and their interests are typically in conflict. Paradoxically, gaining control over*
> *the design requires the supplier to give it up, and Rautaruukki had to patiently*
> *negotiate each design with the multifaced and changing customers.*
>
> *(Keinonen, 2008)*

In addition to challenges related to comany industrial product industries have a limited tradition for the use of industrial design. The mere opportunity to make even limited interventions in such industries may thus be difficult to attain as it requires design to "rein-novate its unique meaning within engineering dominated organizations" so that the physi-cal presence of designers in the everyday practices becomes a matter of fact (Keinonen, 2008). The evolution of design in industries is further discussed in chapter 2.7.

The examples above together with literature that describes design in consumer industries clearly illustrate how the inclusion of different product types into the study have the potential to contribute to a rich understanding of industrial design in a variety of industry agglomerations. The following section discusses a few dimensions that have been used by others to make sense of design contributions to the different product types.

Järvinen and Koskinen structured their study of design across industries according to the intended use of the products and the markets that are addressed by specific products. Their examples ranged from objects designed for private consumers, such as household products that include art objects and consumer electronics, to industrial machinery prod-ucts and medical equipment that are intended for professional markets.

Guy Julier, who structured his analysis differently, categorized objects based on the designers contribution to the product and the type of consumption that products incite (Julier, 2000). Julier draws a line between high design and anonymous design. High design includes objects that are results of a "conscious designer intervention and authorship" and where the designer's main task is to establish the cultural and aesthetic credentials of the artifact (p. 69). The value of an object of high design is connected to the meaning that the product has to its owners, admirers and critics. The design contribution in this case is primarily symbolic and is mediated by form language (p. 85). Anonymous design out-comes on the other hand, are conceived by non-famous designers and sold essentially in

the name of their functionality. Juliers model thus positions objects on two extremes of a continuum departing from objects with a product value that builds exclusively on symbolic use functions to objects with a product value that is entirely connected to their instrumental use function. The symbolic or instrumental function of a product is likely to determine on the one hand how design practice and capabilities are managed, and on the other the focus of design interventions and how design practice is experienced. Although industrial products are not part of Juliers analysis, his continuum can be a useful framework when design contributions are to be understood across different product types, especially if the focus is moved from categories such as high design or anonymous design to main use functions such as symbolic and instrumental.

Since this study aims at a comprehensive understanding of design in different industrial contexts, both from a management and a practice perspective, a discussion of the experience of design practice across product types is in place the disintegrated design and production that is a defining characteristic for industry agglomerations, and which often mirrors the product architecture can be expected to have implications for how a design situation is experienced (as exemplified by Keinonen and others above). Stolterman argues that the complexity experienced by a designer in a design situation depends on the infinite sources of information connected to technological possibilities, constantly changing contextual factors and societal preconditions, client, customer and user demands and desires (Stolterman, 2008). While a product with a simple architecture not necessarily springs from an uncomplicated design situation and straight forward design process (Wakkary, 2004), the converse is common in the context of industrial products where the scale, nature, and complexity of the product in question is mirrored in the organizational forms and technological processes (Davies & Hobday, 2005; Hobday, Rush, & Tidd, 2000). The more parts, connections, and relations are part of a product, the more complex is the design situation wherein its form is defined. The reasoning above suggests that product morphology and industry structure are likely to influence both the experience of design practice, design activities and design knowing across industries and therefore should be considered in the research design.

This section showed that there the management, practice, and experience of design is likely to vary with product type. In order to grasp the product type related dimensions that are of relevance to the research questions posed in this work, products can be classified according to their use contexts and markets - whether professional or private, their main use function - whether symbolic or instrumental, the nature of the design contribution and its relation to the core value of the product, and product and industry complexity as described above. The nature of the main use function and the architectural and morphological complexity of products are considered important dimensions in the endeavor of understanding the role that is given to design in the industries that were studied in this work.

## 2.5 Industrial Design in New Product Development and Innovation

When the possibilities for designers to act and contribute to different industries are to be understood, an overview of the different design and innovation paradigms that dominate product development in individual industries is needed. This chapter reviews and defines concepts that are related to design in new product development and innovation that will illuminate and position the research findings that are made in the individual cases and support their internal comparison.

Designers have been recognized for a range of qualities, roles and contributions. In a report of a study of the creative industries in Britain, Pryce (2005) listed a range of potential contributions for design across industries:

> *Design, as a structured creative process, is an important competitive tool for firms in many sectors, although design activities can take many forms across those different sectors. Design can enhance non-price characteristics, improving quality and creating niche markets. Creativity and, in many cases formal design activities are also important for marketing, company image and brand loyalty. They can also impact production costs and overall firm productivity. But the gains from creativity and design are not limited to firms – the economy as a whole can benefit. Consumers benefit from greater variety and improved products and services.*
>
> *(Pryce, 2005, p. 31)*

The contribution of design to new product development and innovation is a focus for this work, where innovation is conceived as the process of bringing good new ideas into use. When designers participate in this endeavor they usually do so in processes that are referred to as new product development (NPD).The terms are thus used interchangeably within this work.

The creative and human centered practice of designers is commonly acknowledged to contribute to both innovative products and innovation processes (Brown & Katz, 2009; Cooper & Press, 1995; Kelley & Littman, 2001; Nassbaum, 2004; Norman & Verganti, 2012; Commission of European Communities, 2009; Utterback et al., 2006b; Von Stamm, 2004; Walsh, 1996). Tim Brown, who is the CEO of the renowned design firm IDEO even named design thinking a critical human centered ingredient of innovation. The widespread and popular use of the term innovation and its centrality within this work calls for further clarifications on its meaning within the context of design. Based on the object of innovation, the economist Schumpeter identified two types of innovations: product and process innovations. The former comprises new goods, new qualities of goods, new markets for goods and new industry structures. Process innovations include new methods of production and new

sources of supply of raw materials or semi-finished goods (Schumpeter, 1942; Schumpeter & Opie, 1934). By adding a third category of service innovations, Tidd, Bessant, and Pavitt made Schumpeter's framework representative of the majority of the innovations that are produced in the modern economy (Tidd, Bessant, & Pavitt, 2005). Beyond the object of innovation, Schumpeter classified innovations according to their degree of novelty. In the same spirit, Tidd et al. classified innovations according to their perceived extent of change, from minor incremental, through radical, to transformational innovations that change the way a product or process is perceived (Tidd et al., 2005). While Schumpeter specifically focused on radical, world-changing innovations, other more recent studies have acknowledged the economic importance of continuous incremental innovations (Walsh, Roy, Bruce, & Potter, 1992). Walsh found that design plays important roles in innovation throughout the industry lifecycle, by contributing both to the transformation of radical inventions into innovations and in incremental innovations that increase the competitive strength of an existing product in the market (Walsh, 1996, pp. 516–517).

Veryzer and Borja de Mozota suggested that industrial designers contribute to innovation by designing new or enhanced products that better meet the needs of the users, and by contributing as team members to an enhanced new product development process (Veryzer & Borja de Mozota, 2005). Designer contributions to new product development processes are, according to the authors, a result of the visual and physical outcomes of the design process that trigger an increased cross-functional understanding, discussion and collaboration within the team. A prototype or a sketch has the power of spanning cultural and language boundaries between disciplines. Boundary spanning qualities of professionals may be essential in open and distributed innovation processes (as described by Chesbrough, 2003, and ; Von Hippel, 1988) where the innovation activities of companies cross functional and organizational boundaries.

The integrative quality of design professionals in new product development teams was also recognized in the comprehensive 2009 European Commission staff working document on design as a driver of user-centered innovation, which reviewed the contributions of design to innovation and competitiveness (Commission of European Communities, 2009). This document was based on literature reviews and consultations with stakeholders, and the authors found that companies that invest in design tend to be more innovative, more profitable, and grow faster than those that do not. In addition to the integrative capacities of design, the document commented on the human-centered nature of design, where designers focus on user needs, aspirations and abilities and integrate them into holistic and visionary solutions. Finally, it contends that design has the potential to put the user at the center in strategic decision making by "permeating the innovation process, from product development, customer service and management up to the highest levels of hierarchy" (Commission of European Communities, 2009, p. 18). From this perspective

it can be assumed that the boundary spanning and integration of designers impact the disintegrated new product development of industrial agglomerations.

The emergence of regional agglomerations of industries is often a reaction to the local need of a range of interrelated products. The co-location of design, production and users in industrial agglomerations can thus be expected to influence the approach and paradigm that is used by design locally. Designers have been recognized for their contributions to user centered innovations as well as to radical innovations in meanings (Norman & Verganti, 2012; Redström, 2006; Commission of European Communities, 2009; Verganti, 2009). Innovations that are characterized as user centered are often the results of a design process that starts from the needs and desires of future users (Jordan, 2000; Mitchell, 1993). According to Redström, user centered design has its roots in the modernist movement that considered design a way to design the "use" of products, rather than its shape or decoration, in order to enhance the everyday well being of people (Redström, 2006). User centered design processes are supported by a range of methods and means for discovering, capturing, interpreting, making explicit and embodying the needs of existing and new users in the development of products or services that afford positive user experiences (Battarbee, 2004; Jordan, 2000; Mattelmäki, 2006; Sanders, 1992). The usability of objects is addressed through considerations of physical and cognitive ergonomics and through the use of product semantics as a way to communicate product function to users (Monö, 1997; Norman, 1998; Vihma, 1995). In user centered design, the user is given a direct or indirect voice and agency in the shaping of his or her future. User involvement in the design process ranges from "limited", when the user is "used" as a source of information or inspiration, to "deep", when the designer is a facilitator of a user-led design process (Sanders & Stappers, 2008).

Norman and Verganti argued that design is involved in both incremental and radical innovation. Although the latter has traditionally been associated with the commercialization of technological breakthroughs, they argue that designers who radically change the meanings that are associated with a particular product are dealing with radical design innovation. Controversially they argue that such practice rarely is of a user centered kind. User centered design, they say, is important but, because of its iterative nature in addressing intended users, it is a form of "hill climbing" that can only lead to incremental innovation. Radical innovation requires changes in technology or meaning (Norman & Verganti, 2012). Verganti referred to radical innovations in meaning as "design inspired" innovations where product languages are used to create meanings that give products an emotional and symbolic value (Utterback et al., 2006a; Verganti, 2008, 2009).

Design inspired innovation is based on the research that is performed by members of "the design discourse" simply by being part of it. The design discourse is a "free-floating" networked community of architects, designers, suppliers, photographers, critics, curators,

publishers and craftsmen, who, by way of their practice and interactions, take part in this huge socio-cultural "research laboratory", where the meanings, aspirations and desires of people and users are created (Verganti, 2003, 2008, 2009). The use of design to create new meanings and the view of designers as cultural interpreters and participants in a global design discourse are rooted in the experimental design ideals that characterized Italian design during the 1980s. The most famous example is the Memphis group that became famous, loved and despised for its provocative design exhibition in 1981, where modernistic values were challenged by products that had been designed with a focus on symbolic and representative functions, and on their relations with human emotions (Vihma, 2005, pp. 175–180).

In addition to the human centeredness and design thinking of designers, their creativity contributes to innovation. The psychology professor, Mihaly Csikszentmihalyi described creativity as a process that occurs in the intersection between individuals, cultural or symbolic domains and social fields (Csikszentmihalyi, 1999). Design practice, which is located between users, producers, disciplines and cultures, is creative because of its very position and integrative character. While innovation is the successful implementation of new ideas, design is the domain of creativity, where ideas are coupled with their technical possibilities, market demands and opportunities to create practical and attractive propositions for users or consumers (Cox, 2005; Walsh, 1996). Borja de Mozota described industrial designers as the diffusers of innovation in society:

> *If designers are not inventors, they diffuse new material and new technology throughout society and accelerate the sociological acceptance of technology. Their creativity stimulates innovation at the cultural level and on the corporate level by inspiring companies to push the limits in new product development.*
>
> *(Borja de Mozota, 2003, p. 45)*

Beyond their direct influence on design outcomes, designers have been acknowledged for their qualities as knowledge brokers, integrators and gatekeepers for innovation. External designers who work across different industries are recognized for their contribution to horizontal cross-industry learning (Hargadon & Sutton, 1997; Kelley & Littman, 2001; Utterback et al., 2006a; Verganti, 2003). An early example was provided by Hargadon and Sutton who studied the innovation practices of the product development agency IDEO. They illustrated how the designers of IDEO, whose clients work in more than 40 different industries, occupy a network position in which they learn about technologies and solutions from a broad range of design situations. The experiences of individual designers are not only stored in their minds, but also in IDEO's organizational memory through collections of products, prototypes, drawings, notes from brainstorming sessions and the written records of previous projects, where they inspire links between past experiences and new solutions across client industries.

The knowledge that is created, used and transferred between industries may be practical and instrumental as well as cultural and symbolic. The latter end of the continuum was especially valued by the famous Italian office equipment manufacturer Olivetti, who deliberately and extensively used external designers from the metropolitan area of Milan because of their knowledge of, and participation in, contemporary cultural movements. The designers were encouraged to work across industries and companies in order to gain a wide ranging knowledge of materials, aesthetics, trends, manufacturing requirements and markets from fields such as furniture, architecture, consumer goods and graphics (Kircherer, cited in Järvinen & Koskinen, 2000, p. 48).

While external design consultants contribute to learning across companies and industries, in-house designers are often acknowledged for their integration of knowledge between disciplines within the company in interdisciplinary product development teams, and vertically across the supply chain (Bertola & Teixeira, 2003; Blaich & Blaich, 1993; Bruce & Daly, 2003; Leonard-Barton, 1991; Sonnenwald, 1996; Walsh & Roy, 1985). While the studies that are exemplified above consider design as knowledge agents within firms or between them in design consultancies who work for clients in different industries, this study focuses on the knowledge dynamics that are connected to different uses of industrial design in new product development and innovation within the context of regionally agglomerated industries. This fills a gap in the existing design research literature, as it brings in a geographical dimension which appears to have consequences for both how design is used and for the contributions that are made by different designers in new product development.

## 2.6   The Organization of Professional Design

Professional designers, as conceptualized in the context of this study, work for clients or employers in a business context. The way the design function is managed bears upon the role that is assumed by design and the contributions made by design, as well as the competences that are developed by individual designers. The research questions of this study involve all these aspects. The interface between design and its business context is studied in the design management field. In order to advance the logic of the research questions and the research design, and relate the research findings that are connected to the use and integration of design across industrial settings to the broader design management field, this section provides a brief and general account of the relevant concepts and issues from design management.

The overall aim of design management is to coordinate design resources so that they contribute to corporate strategic goals (Blaich & Blaich, 1993). The influential design management researcher, Brigitte Borja de Mozota, outlined two directions of design management: from a designer perspective, which deals with managing the design process, the design

team, or the design consultancy in relation to products and portfolios, and from a management perspective, which deals with how specific organizations can best benefit from design competences. These are the how, why, what and when of design integration (Borja de Mozota, 2011, August 16, post on the PhD-Design email list). The management perspective, which is the more relevant to this work, accounts for how design activities are organized in relation to the client organization: whether design is an internal or an external resource, and whether it is occasional and temporary or continuous and long term. In addition, this perspective on design management takes into account the strategic level of design activities of an organization. In other words, it examines whether design is performed at an operational, tactical or strategic level.

There are three main approaches to the organization of design: internal, external or a mix of internal and external design (Borja de Mozota, 2003, p. 168; Bruce & Morris, 1994, 1998; Cooper & Press, 1995). Which strategy is chosen depends on the amount and accessibility of design services that are needed, the familiarity required from both the designer and the organization for a smooth and efficient collaboration, the need for control and the traditions of design in the client company and industry. In many cases however, decisions as to whether to use design and how to manage it appear to be a result of evolution, accident, habit and culture, rather than deliberate strategy (Walsh, 1996). Therefore, in line with the arguments that were made in the previous chapter, any effort to understand the organization of design practice should be informed by both design management theories and evolutionary and cultural perspectives.

After their education, the knowledge and skills that are developed by individual designers result from their everyday practice. It is not only the knowledge of the designer that determines whether the collaboration between a designer and a design client is successful or not. Bruce and Morris (1994) referred to familiarity as the reciprocal knowledge of the designer and the design client on the working styles, personalities, design constraints, corporate cultures and company ethos of their counterpart. The process of gaining familiarity is a learning activity that both the designer and the design client need to go through in order to establish a smooth collaboration (Bruce & Morris, 1994, p. 594). A designer who is familiar with the practices of a company is likely to create products that fit with the expectations of that company. A client company that is familiar with a design supplier has learned how best to manage and integrate the knowledge and practices of design into their organization (Borja de Mozota, 2003, pp. 172–174).

The familiarity that is developed within an in-house department, or with a long term external design consultancy partner, is the result of a continual deep integration, availability and commitment (Blaich & Blaich, 1993; Bruce & Morris, 1994; Von Stamm, 2004). Such knowledge has material, cultural and symbolic aspects. Material knowledge typically relates to the product type, the technologies involved in its production and its use and

function. Cultural familiarity dimensions are connected to the production culture of the company and industry, its networks and the culture of user communities (Bruce & Morris, 1994). Symbolic familiarity may address the corporate and brand styles of the company (Karjalainen, 2004), or the style or visual language that has traditionally been used within an industry.

The development of familiarity may take a considerable time. Järvinen and Koskinen found that a designer might need at least two years in order to learn what is customary in a company (Järvinen & Koskinen, 2000, p. 106). Depending on the material, symbolic and cultural complexity of a company's offerings, a designer needs more or less time to gain the familiarity that is required for a productive collaboration.

When the complexity of a product is mirrored in the organization of product development, and product development is distributed across a number of organizations, the designer will need to be familiar with the organizational practices, cultures and networks of all the parties involved. Consequently, if a company produces complex products, products that are aimed at complex use situations, or products that require specific knowledge of technologies or production processes in a distributed manner, it may be economically convenient to establish an in-house design department or a long term relationship with an external design consultancy, thereby reducing the cost associated with familiarization, which then only needs to be borne once. Since feedback loops caused by a lack of familiarity are costly, it may take repeated positive exposure to design before leaders gain enough confidence and trust in design to establish a more permanent role for it in their organization (Bruce & Morris, 1998; Dumas & Mintzberg, 1989). In addition to indirect costs caused by a lack of familiarity, the direct cost of design is ultimately connected to the volume of the design services that are needed, this will influences the choice of design strategy. While in-house design may be less expensive when design is needed consistently throughout the year, external designers can be considered a variable cost which can be switched on and off if design is needed only intermittently (Bruce & Morris, 1994, p. 594; Von Stamm, 1993). In the context of this study, how familiarity relates to the physical and organizational location of a design professional is relevant. Are there, for example, any aspects of familiarity that are related to geographical proximity, and the designer and design client "being there", rather than just their repeated exposure to each other?

In addition to costs, the familiarity of the designer has implications for his or her creativity. While the profound product and process knowledge that is held by in-house designers gives them the ability to act on deeper levels, over time and product generations, their awareness of restrictions and conventions of the company and industry, and the homogenous product environment that characterizes their everyday practice, can cause them to become stale (Blaich & Blaich, 1993; Heskett, 2002, p. 70). Sometimes the potential knowledge production benefits that come with external designers are the sole motive for

the choice of an external design strategy (Borja de Mozota, 2003, p. 168; Bruce & Jevnaker, 1998; Von Stamm, 2004). With this in mind, it is clear that any choice between an in-house or an external design strategy should be informed by the balance between novelty and continuity that is sought. While many innovations and fresh ideas emerge in the interface between internal and external knowledge, the work and concepts of an in-house designer or a long term design ally is easier to control (Blaich & Blaich, 1993, pp. 143–148; Hargadon & Sutton, 1997; Kelley & Littman, 2001). Controlling the novelty and continuity of design concepts is especially important in relation to brand strategies. With time, the "design signature" of a long term external design ally or in-house designer merges with the visual and recognizable brand style of the client organization (Järvinen & Koskinen, 2000, p. 106; Karjalainen, 2004; Von Stamm, 2004). Such long-term relationships are especially supported by companies whose product value relies predominantly on brand recognition. In order to maintain continuity over product generations as well as getting fresh input, some choose a combination of in-house and external design (Bruce & Morris, 1998). An alternative strategy was used by the Italian company, Olivetti, in order to maintain the creativity of their designers. The in-house designers at Olivetti were required to work half of their time on external projects (Heskett, 2002, p. 135).

The material culture that characterizes a specific industrial agglomeration is shaped by a few products, or even a single product. From the perspective of design knowledge production and creativity, it is interesting to consider how firms that are located in industrial agglomerations source new design knowledge and creativity, and whether there is any difference in the knowledge production and creative outputs of in-house, local freelance and non local freelance design professionals. Those issues were central in the formulation of research questions and influential in the research design.

The role of design in a company, or more generally in an industry, is ultimately connected to how central design contributions are to the consumer perceptions of product value. In the present, post-Fordist mode of manufacturing, where flexible specialization is attained through vertically dissociated and networked organizations, it is customary to externalize functions that do not represent the core competencies of a company (Prahalad & Hamel, 1990; Sabel, 1994; Storper, 1994). Conversely, where the perceived product value depends predominantly on the competence of designers, the design function represents a core competence that should be kept in-house (Joziasse, 2000). There are exceptions to this rule of thumb in the design industry, as is illustrated by the example of high design objects. Their core value depends extensively on the symbolic design knowledge of external designers. There are also manufacturers of industrial capital products that are intended for professional use that have chosen to integrate design as an in-house resource, despite the fact that it is not part of the core value of the product. Two examples are the Finnish paper mill manufacturer Metso and the Swedish industrial machinery manufacturer Atlas Copco

that both have in-house industrial design departments (Alsenas, 2011; Keinonen, 2008; Mutanen, 2008; Valtonen, 2007). In order to be successful in these companies, industrial designers need to be familiar with the specific products, industries, markets, users and uses, which are very different from those of traditional consumer products. In addition, the number and variety of products and brands that are sold by Atlas Copco entail a high volume of design work, which is performed in accordance with Atlas Copco's consistent brand language by the in-house design department. The need for familiarity, consistency and the high volume of design work that is needed has made the choice of an in-house design department strategically appropriate for Atlas Copco. These examples illustrate that it is important to consider the organization of design in an industry from a holistic perspective rather than from a mechanistic perspective, built upon a predetermined and fixed set of rules.

In a literature review of design management research published between 2000 and 2010, Geisby Erichsen and Rind Christensen found that most of the recent design management focus on aspects such as branding, competitive strategy, and transformational marketing with the organization as a unit of analysis, while few design management researchers focus on strategic alliances, relationship management, and co-creation among firms and business communities (Geisby Erichsen & Rind Christensen 2013). A study of practices of design management and design in industry agglomerations therefore has the potential to contribute to the design management research community with new knowledge on how designers that are distributed in space, and with different competences contribute to distributed new product development in local production contexts. The discussions on design management strategies in relation to familiarity, product type and core vlue, product and organizational complexity that have been made in this section will be used as a context for the discussions and comparisons of design in the three cases that are included in this study.

## 2.7  The Evolution of Industrial Design in Industries

Design is used to a varying extent and in various forms and focus across industries (Julier, 2000; Järvinen & Koskinen, 2000, p. 148; Pryce, 2005; Walsh, 1996, p. 518). The rich variety of contributions that are made by industrial design professionals to different businesses and industries is the result of a range of interrelated variables which include traditions for design (Järvinen & Koskinen, 2000; Keinonen, 2008), the stage of evolution of professional design (Valtonen, 2007), design maturity (Danish Design Center, 2003), the lifecycle of the industry (Gemser & Leenders, 2001; Walsh, 1996), competitive strategies and eventual design strategies (Borja de Mozota, 2003; Joziasse, 2000), and the expertise held by individual designers. Since the present study deals with design practice and management

at an industrial level, a review of a number of variables which influence the role of design in an industry is appropriate. The following sections provide a foundation for the reading, interpretation and sense making of the individual case descriptions, as well as for their internal comparison. The first section reviews literature that deal with the various manifestations of design practice in companies and industries during the course of evolution of design from a design immature to a design mature stage. This is followed by a discussion that relates the perception of design's value at an industrial level to the local evolution of design, design maturity nd industry lifecycle.

## The Evolution of Design Practice in Industries

The evolution and diversification of design practice was central in the work of Anna Valtonen, who researched the professionalization of Finnish industrial design (Valtonen, 2007). She found that the practice of Finnish industrial designers has diversified since the 1950s and evolved into a mature state. Valtonen identified focus areas of design contributions and corresponding designer roles that have emerged through the evolution of design practice. Each new focus area for design has contributed to a broadened design discipline and an increased specialization among design practitioners. The design pioneers of the 1950s often had an artistic background and thus focused on product styling and aesthetics. In the sixties, designers stepped away from the limelight, where they had been considered lone design geniuses, to a more anonymous existence as team members in the product development process.

With the rise of ergonomics in the 1970s, designers started to focus on the user and promoted early designer involvement in new product development in order to influence the definition of the product. In the 1980s, the attention of many designers turned to design management and the coordination of whole product portfolios. With the focus on brand building which characterized the 1990s, designers wanted to take part in the creation of the entire end-user experience, from concept to retail. Finally, in the new millennium, designers took on the role of innovation drivers (Valtonen, 2007, pp. 280–309). All of these practices can still be found in various proportions across industries. The further design has come in its evolution, the more strategic it is. At strategic levels design is given the space and authority to interact with key organizational activities. Companies that limit the use of design competence to styling tasks restrict its strategic influence and importance.

The evolution of design within an industry drives the traditions that determine its design practices. The strategic level, or the scale and scope of design practice that is performed in a company, and more generally in an industry, reflects the design maturity (Kretzschmar, 2003; Valtonen, 2007). The "design ladder", which is shown in Figure 3, was introduced by the Danish Design Center and builds on the results of a survey on the use of design competences in Danish organizations (Kretzschmar, 2003; Lauritzen, 2008). It was intended

as an assessment tool for design maturity, and has been used by a range of design policy institutions in their estimation of the design maturity of organizations (Whicher, Raulik-Murph, & Cawood, 2010).



**DESIGN AS STRATEGY**
Design is a key strategic means of encouring innovation

**DESIGN AS PROCESS**
Design is a integral to the product or service development process

**DESIGN AS STYLING**
Design is relevant in terms of style

**NO DESIGN**
Design plays no role in product or service development
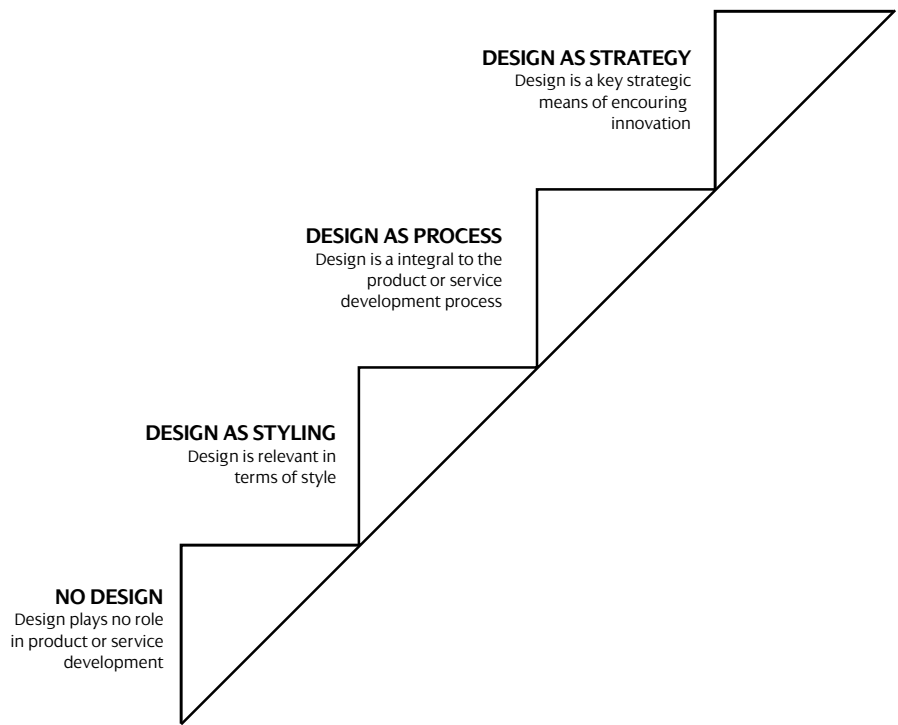
*Figure 3.    The design ladder® originally developed by the Danish Design Centre (Kretzschmar, 2003)*

The four stepped ladder represents four levels of design maturity, where each step upwards indicates an extended scale and scope of design interventions. The higher a company is ranked on the Design Ladder, the greater strategic importance they attribute to design. Companies that do not use industrial design at all position themselves on the first step of the staircase. An increased but still limited use of design is made by companies that are placed on the second step of the staircase where design is used for styling or appearance. The third step of the staircase is held by companies that integrates design into the product development process. This requires an extended presence of design in the product development.  The highest level of the design staircase is occupied by design mature

companies that consider design to be a key strategic element. The design maturity concept has been used mainly to assess and explain the scale and scope of design in organizations, but will here, in line with the previous discussions be used also industry-wise. The more design mature an industry, the more positive is its community members towards design and the more are companies predisposed to hire designers.

Following the above line of argument, the design maturity of a specific industry, and the corresponding roles that designers are given, shapes design practice and consequently the knowledge, skills and tools that designers use.

### The Perceived Value of Design

In addition to education, disciplinary traditions and previous experience lived in person, the predisposition of individual industry members to first use design depends on their perception of design as a potential contribution to the value to their product or service. Despite efforts that have been made by the design community to disrupt the form-function divide, this has often been present in discussions concerning the presence or amount of design in different industrial contexts. Unfortunately, in some industries, this has nurtured a narrow view of design as only dealing with aesthetics This divide was illustrated in the research results of Järvinen and Koskinen, who found that the Finnish capital intensive machine manufacturing industry considers design to be of little importance and clearly secondary to engineering (Järvinen & Koskinen, 2000, p. 56). The perceptions of capital intensive machine buyers they say, are "driven by economic investment thinking" (Järvinen & Koskinen, 2000, p. 147). Such investment oriented thinking is typical of business-to-business industries that manufacture products aimed at professionals and whose main function is instrumental. However, as the perception is growing among industrial product manufacturing managers that designers are valid contributors to human centered design of physical and cognitive work interfaces, those are more open to the integration of design competence into product development (Järvinen & Koskinen, 2000, p. 147). In most consumer goods industries, on the other hand, where product value relies mainly on trends and market fluctuations, design competence is recognized as something important and is used more widely (Järvinen & Koskinen, 2000, p. 172).

Heskett argued that depending on type of business, and the point in time in a product's lifecycle, designers are variously involved in imitations, adaptations, major redefinitions of functions or the origination of profoundly new concepts (Heskett, 2002, p. 193). The perception of design's potential value in an industry and the corresponding scope of design activities can thus be related to the evolution of the industry itself, to its technologies, markets and product lifecycles. In the early phases, design may focus on finding an appropriate level of innovation with respect to related archetypes that are already established. When the industry and market settles, and product characteristics become

standardized, design interventions will focus more on quality and cost (Heskett, 2002, p. 77). An example of how design contributes in different ways, depending on industry life cycle, was provided by Gemser and Leenders who, compared companies in a home furniture industry with those of a precision instrument industry to study the relationship between industrial design investment and company performance (Gemser & Leenders, 2001). Among other things, they showed that the impact of industrial design on company performance depends on the intensity of technological innovation and the character of competition that is found in the industry. At the time of their study, the precision instrument industry exhibited a decreased intensity of technological product innovation and innovations aimed at cost efficiency in favor of the creation of product ranges, variations and families aimed at different markets. This opened up alternative means of competition, such as industrial design for differentiation. The companies in the home furniture industry, on the other hand, had used industrial design as an integral part of product development for long. Gemser and Leenders found that the positive impact of industrial design on business performance was greater in the precision instrument industry than in the home furniture industry. In order to be beneficial, design investment in the furniture industry had to aim at more radical design innovation. The competitive environment and the stagnation of technological innovation that characterized the precision instrument industry made design, which had no previous tradition the industry, a valid means of adding value.

The literature that has been reviewed in this section suggests that studies of design practice and management across industries should be informed by an understanding of industry and product lifecycles, the evolutionary stage of design practice and the corresponding design maturity, and the predominant focus of innovation in each individual industry that is studied. These concepts can illuminate why design is used in certain ways, how it is perceived as a potential value contributor and how design practice is experienced at a given time in a given context. These aspects will ultimately determine the contributions that are made by design at a point of an industry's lifecycle and are therefore carefully described in the individual case descriptions in the following chapters.

## 2.8 Summary

The initial sections of this chapter provided a theoretical basis of professional design, design knowledge and competences, and situated design activities, which can direct the study and support the formulation of research questions, and guide the choice of an appropriate research design. The first step was to specify what is considered to be professional industrial design within the framework of this study. This was followed by a section where the content and nature of design competence were considered. It was concluded that design expertise relies on both general, ubiquitous and specific, sticky design knowledge. While the former type of design knowledge has been the subject of careful studies, the latter has been considered less in design research. The lack of knowledge about the nature and content of specific, sticky design knowledge further indicates the relevance of the geographical perspective that have been chosen for the study. In order to delineate the context of practice that determines the need for, and content of, design knowledge, and to support a theoretically robust research design, the following sections outlined design activities as situated in, and determined by, their social, cultural and material context. It was concluded that different design stakeholders, product types with various main use functions and of diverse complexity, and corporate, industrial and professional cultures should be considered in the research design.

The three final sections of this chapter aimed to provide a theoretical backdrop for discussion and comparison of the research findings. First, the ways in which different forms of design competences contribute to new product development were discussed. It was concluded that industrial designers may contribute to incremental and radical product and process innovation, as well as to new product development processes as gatekeepers, brokers and integrators of knowledge. The way the design function is managed bears upon the role that is assumed by design, the contributions that are made by design, and the competences that are developed by individual designers. Therefore, the following section reviewed literature from the design management field that could inform the present study with perspectives on how design is organized in relation to corporations, and what determines the design strategies of individual companies. It was concluded that the design management choices that are made by individual organizations about the use of in-house designers, external designers, or a mix of the two are often the result of industrial traditions or chance rather than deliberate strategies based on the need for designer familiarity, integration, freshness or creativity, and the volume of design services that is needed throughout the year. In order to understand the various contributions that are made by individual designers to new product development in industrial agglomerations, the scale and scope of design activities, design management strategies and design contributions need to be considered at the level of the industry.

The literature that was reviewed in the last section of this chapter indicates that the way design is used and managed in different industries is not static, but depends on forces of isomorphism that make individual companies in shared industrial settings act in similar ways. It was concluded that the scale and scope of the contributions that are made by designers in different industries at certain points in time depend both on the design maturity of the industry and the corresponding perception of design as a potential contributor to product value, and on the local evolution of design practice. These concepts can potentially illuminate why design is used in certain ways, how it is perceived as a potential value contributor, and how design practice is experienced at a given time in a given industrial setting. Accordingly, it was concluded that the present study should be informed by an evolutionary perspective on design management and practice at industrial levels.

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# The Geography of Innovation

The existence of regional agglomerations of industries is a paradox in a globalized econ-omy where efficient transport and communication infrastructures ought to diminish the importance of physical location to businesses. It appears, however, that physical proximity of similar or related companies in regional agglomerations of industries sometimes creates advantages that make them more successful than their non-local competitors (Storper, 1997). In fact, research performed in economic geography and innovation has shown that knowledge-intensive innovation activities are not distributed uniformly or randomly across space, but tend to cluster, and this tendency has become more marked over time (Asheim & Gertler, 2005).

The advantages of co-location have been ascribed to dimensions such as diminished trans-action costs (Krugman, 1991), the specialization and flexibility that emerge among SMEs that take part in the disintegrated production systems of industrial districts (Becattini, 1979; Piore & Sabel, 1984), knowledge spillovers that occur locally between the companies in industrial agglomerations which accelerate and facilitate innovation (Audretsch & Feld-man, 2004), and the existence and immobility of local resources such as knowledge, skills, institutions and organizational structures, and their importance for innovation and change (Breschi & Malerba, 2001; Scott, 2002; Storper, 1997, pp. 4–22).  To explain the resurgence of a variety of regional economies with territorial specialization, and to focus on change, which is central to design, the perspectives that focus on knowledge and innovation are adopted in this work.

## 3.1   Approaches to the Study of Regional Industries

Scholars of economic geography have approached a variety of localized production systems of various geographical and institutional breadths and foci. They have tried to understand why economic activities are concentrated, and why companies that are located in regionally agglomerated industries are more competitive or innovative than others. A thorough description of the many approaches that have been used to study regional ag-glomerations of industries is beyond the scope of this work. Rather, a brief introduction of a few major themes that are relevant to this work are outlined below.

The industrial district school of thought draws on a range of studies that were first con-ducted in successful industrial districts of central and northeast Italy. Becattini conceived an industrial district "a socio-territorial entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area. In the district, unlike in other environments, such as manufacturing towns, community and firms tend to merge" (Becattini, 1990, p. 38). These districts constitute what has often been referred to as "Third Italy", and are agglomerations of specialized

SMEs that compete and collaborate across disintegrated and flexible production systems. This line of study has particularly focused on the social and cultural embeddedness of economic and innovation activities in the district. Social embeddedness was first considered by Granovetter, who contrasted "over socialized" theories, which consider economic action to be totally determined by social dynamics, and "under socialized" theories, which ignore the influences of social dynamics on the economy. Instead he argued that economic activities are not exclusively rational, but are also influenced by networks of social relations and structures. The attempts of economic actors to "purposive action are embedded in concrete ongoing systems of social relations" (Granovetter, 1985, p. 487). In line with the ideas of Granovetter, this study understands design practice and design management in industry agglomerations in light of both social and economic contexts.

The reciprocity and trust that emerges among community members of industrial districts is given a central role in explaining the overall success of the local companies (Becattini, 1979; Brusco, 1982; Piore & Sabel, 1984). The concept of trust that lies at heart of the industrial district school of thought is especially relevant when new product development and innovation activities are performed across organizational boundaries. New product development and innovation deals with what is new and what is supposed to be the next competitive asset of organizations, and the knowledge that is shared within new product development endeavors is thus sensitive in a competitive industrial setting. The valuable knowledge and familiarity of individual project participants that is learned in product development and innovation projects can only produce its maximum return when work is performed in such a trusting environment. The trust that is developed at an industrial level between organizations of an industrial agglomeration therefore has the potential to unlock knowledge dynamics that lead to learning and innovation in product development and innovation.

Another approach that has been very popular among economists and policy makers was developed by Porter, whose main focus was on theorizing the competitiveness of firms located in business clusters (Porter, 1990). According to Porter, a cluster is "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (Porter, 2000, p. 16). The geographical boundaries of a business cluster are identified and isolated by mapping the distance over which informational, transactional, incentive and other efficiencies occur. Such a loose definition may be problematic where production and distribution occurs in a global manner. An alternative is provided by the systems of innovation approach, which studies the innovation of products, processes and services and the geography of such activities from a systems perspective. Scholars of systems of innovation try to isolate the important determinants of innovation in a holistic way across disciplinary boundaries. An evolutionary and relational perspective suggests that there is non-linearity in knowledge creation,

learning and innovation processes, and that innovating organizations are interdependent (Cooke, 2001; Edquist, 2005, pp. 184-185; Morgan, 1997). A central concept that is used in explaining the practices that take place within systems of innovation is that of institutions. Institutions are sets of common habits, norms, routines, established practices, rules and laws that regulate the relationships and interactions between individuals, groups and organizations (Edquist, 2005, p. 188). In the context of production, institutions include habitual patterns of behavior that often build on tacit and skill-like knowledge (Morgan, 1997). The institutions and activities of systems of innovation are mutually constitutive.

The shared institutions in systems of innovation nourish trust beyond organizational borders, which in turn makes intra-system interactions run smoothly, and facilitate learning and innovation processes. Edquist (2005) proposed that innovation systems can be identified and studied along geographic, sectoral and activity dimensions. In the first case, a geographical area with a high degree of coherence or inward orientation with regard to innovation processes is chosen as the unit of study. According to Edquist such areas typically have high levels of skilled worker mobility and knowledge spillovers, together with at least some inter-firm interactions. The sectoral boundaries of systems of innovation are defined by specific technologies or product areas, while the activities connected to the development, diffusion and use of innovation in a particular system of innovation may be useful in the definition, study and description of the system. The approach is useful for the isolation and study of regionally agglomerated industries, as in the present study.

The economist Alfred Marshall took a knowledge perspective on localized industries at the end of the 20th Century. He ascribed the success of the companies in locally agglomerated industries to their access to specialized and skilled workers, specialized inputs and services, and the presence of continuous technological spillovers (Marshall, 1920, Book 4, Ch. 10). Marshall was also a pioneer in emphasizing the social aspects of economy. In order for a localized industry to be competitive and innovative, its society needed to be involved in a common industrial project embedded in an "industrial atmosphere" (Sheppard & Barnes, 2002, p. 153). Marshall underlined the essential role of the industrial atmosphere for knowledge dynamics and creativity:

> The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously. Good work is rightly appreciated; inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas.
>
> (Marshall, 1920 Book 4, Ch. 10)

The industrial atmosphere is thus the soil where trust and formal and informal collabora-

tion and competition between the companies of the district can grow. The interactions that are part of the local everyday practices in industrial agglomerations produce knowledge dynamics that contribute to innovation (Cooke, 2001; Florida, 1995; Gertler, 2003; Lundvall & Johnson, 1994). Storper showed that the interactions and relations between organizations in industrial agglomerations rely heavily on untraded interdependencies, which take the form of conventions, informal rules and habits that coordinate economic actors in conditions of uncertainty (Storper, 1997, p. 5). Untraded interdependencies can thus be considered a geographically constrained collective framework for action that permits participants to develop knowledge and to interpret and communicate the information that is necessary for learning (Storper, 1999, pp. 44–45). Knowledge of the local untraded interdependencies that determine product development is therefore a form of relational asset. Untraded interdependencies link activities to the history and culture of an industry and shape its evolution. In this sense, the untraded interdependencies that are present in an industry make it path dependent. With path dependence, the evolution and future of an industry is understood as the outcome of its past. Richard Walker explains that:

> …choices made in the past – technologies embodied in machinery and product design, firm assets gained as patents or specific competencies, or labor skills acquired through learning – influence subsequent choices of method, designs and practices.
>
> (Walker, 2000, p. 126)

Path dependence and the conventions, informal rules and habits that are part of an industry have implications for how industrial design is used in new product development and innovation practices. Obvious examples of conventions that influence the manifestation of design in individual industries are whether industrial design is used at all, if there is enough trust between organizations at an industrial level for innovative activities to be distributed beyond organizational boundaries among external design consultants, and whether consultants are allowed to work for other local clients, who may even be competitors. Leonard-Barton commented on the negative consequences of too much path dependence and contended that, "Yesterday's core competencies are today's core rigidities" (Leonard-Barton, 1995). In other words, while path dependence may reduce uncertainty, it may also cause inertia.

The case narratives illustrate how the evolution of design in individual industries as described in Chapter Two, as well as untraded interdependencies, have the power to influence the existence of design, its evolution, the way it is generally managed, and shape the contributions of designers to companies in an industry. Bathelt and Gluckler proposed a relational framework for studies in economic geography consisting of the four ions of organization, evolution, innovation and interaction. Rather than treating space and terri-

tory as research objects or looking for universal spatial laws, a spatial perspective is used in research endeavors to understand particular, localized aspects of economic processes and outcomes. In relational economic geography, particular efforts are made to understand the mutually constitutive relationship between institutions and contextual action. The study framework of Bathelt and Gluckler recognizes that the four ions are driven by both economic and social processes that are favored by relational proximity, and thus integrates economic geography and social theories (Bathelt, 2009). Relational economic geography pays special attention to institutional learning, creative interaction, economic innovation and inter-organizational communication. Bathelt and Gluckler exemplify the types of questions that can fruitfully be addressed through their framework:

> How do firms interact with one another and what are the consequences for localized processes and structures? In which ways are firms influenced by institutional and socio-cultural contexts in their home base and how do this change when they expand to other contexts? How are firms, networks of firms and production systems organized and how does this organization vary from place to place and which territorial consequences result from this?
>
> (Bathelt & Gluckler, 2003, p. 138)

The recognition of the social and the cultural in organization, evolution, innovation and interaction from a spatial perspective resonates with the stance taken in this study. The research results of this work build on a thorough understanding of the organization, evolution, innovation and interactions of design professionals within local industries, whose individual technologies, histories and cultures are carefully described.

## 3.2   Types of Industrial Agglomerations

The localized industries that were originally described by Marshall have later been referred to as Marshallian industrial districts. Belussi (2008) listed three typical characteristics of Marshallian industrial districts: they are dominated by a range of geographically concentrated small and medium sized enterprises (SME's) specializing in different phases of the production of similar or related products; they are sustained by a highly skilled and specialized workforce; and they enjoy a continuous advent of subsidiary industries and specialized suppliers. The vertically disintegrated production chain of the Marshallian industrial districts can be compared to the production chain of a vertically integrated company, with a complementary client-supply chain with overlapping knowledge bases.

Marshallian industrial districts share many of their defining features with the extensively studied Italianate industrial districts (Becattini & Rullani, 1996; Becattini, 1979; Belussi, 2008). In addition, the concept of Italianate industrial districts emphasizes an elevated

intra-district mobility of personnel, a high degree of intra-district firm cooperation, a sig-nificant proportion of workers engaged in design and innovation, the existence of strong trade organizations and the important role played by the local government (Markusen, 1996). The extensive and specialized division of labor of the district stimulates intra-district interaction, facilitates the introduction of new technology and leads to interdependence between the local companies. There is a broad and fast circulation of information about markets, alternative production techniques, materials, components and administrative techniques which contributes to the knowledge collective of the district. The competences and tacit knowledge that are held by the work force is partly transferred between genera-tions and professional interactions and partly a result of formal training and apprentice-ships (Garofoli as cited in Asheim, 2002, p. 418).

In addition to Marshallian industrial districts, Markusen (1996) outlined three archetypical regional agglomerations with varying characteristics: hub-and-spoke districts, satellite industrial platforms and state-anchored industrial districts. Hub-and-spoke districts are dominated by one or several large, vertically integrated firms surrounded by suppliers. Like Marshallian and Italianate industrial agglomerations, hub-and-spoke districts are character-ized by a substantial intra-district trade between dominant firms and suppliers, but there is also a high degree of cooperation and linkages with firms that are located outside the industrial agglomeration. Satellite industrial platforms are dominated by large, externally owned and headquartered firms. State-anchored industrial districts are characterized by one or several large, government institutions such as military bases, state or national capitals or large public universities, which are surrounded by suppliers and customers. A detailed description of each type of industrial agglomeration is beyond the scope and focus of this study. The case studies that are included in this research project were conducted in industrial agglomerations that can be characterized as Marshallian-Italianate and hub-and-spoke districts. Because of the elevated degree of intra-district collaboration that characterize Marshallian-Italianate districts and additional inter-district connections of hub-and-spoke districts, these types were considered to offer the best opportunity to study industrial design activities performed by in-house and local and non-local freelance designers in regionally agglomerated industries.

## 3.3  The Geography of Knowledge

The links between knowledge and innovation have been recognized across disciplines. In economic geography, the tacit or explicit nature of knowledge has been used to explain the agglomeration of industries (Asheim & Gertler, 2005; Bathelt, Malmberg, & Maskell, 2004; Breschi & Malerba, 2001; Malmberg, 1996; Scott, 2002; Storper, 1997). Bathelt and Gluckler, for example, explained the spatial organization of innovation in terms of the de-

gree to which production activities are vertically disintegrated, the availability of potential local innovation partners and the type and "stickyness" of knowledge that is needed in the innovation process (Bathelt & Gluckler, 2003).

The tacit or explicit nature of knowledge has attracted a lot of attention in the knowledge oriented stream of studies in economic geography and regional innovation systems. It is argued that the spatial, cultural and cognitive proximity of the organizations within industrial agglomerations that results from decades or even centuries of evolution is a condition for the assimilation of the sticky and tacit knowledge that is required for much innovation (Asheim & Gertler, 2005). While spatial proximity has a limited bearing on innovations that build on explicit or codified knowledge, such as knowledge that is embedded in scientific texts or patents that can easily transfer across distances, the unique and sticky knowledge and skills base that are involved in the regional culture and institutions of industrial agglomerations are conditioned by proximity (Brown & Duguid, 2002; Maskell & Malmberg, 1999). Such knowledge is passed between generations, and through face to face interactions with clients, suppliers and colleagues, and through local labor mobility, and is thus difficult to transfer to distinct industrial contexts (Bathelt et al., 2004; Belussi & Pilotti, 2002; Hudson, 1999). Shariq states that this type of knowledge is the historical bedrock of an industry and constitutes the basis on which new knowledge can build and be used in accordance with the prevailing schemata (Shariq, 1999). This suggests that regional belonging gives companies of industrial agglomerations a competitive advantage in innovation which is difficult to copy (Maskell & Malmberg, 1999).

Although the local and sticky knowledge of regional industries is considered one of their major strengths, there is also a need for complementary knowledge and competences that are of a more global and general nature. Bathelt et al. contend that, "New and valuable knowledge will always be created in other parts of the world, and firms that are able to attain such knowledge from sites of global excellence will gain competitive advantage" (Bathelt et al., 2004, p. 46). They found that while local knowledge is transmitted throughout the industrial agglomeration through local "buzz", general and transferrable knowledge is attained through "global pipelines". Local buzz consists of information, gossip and news about what is going on in the local industry and is transmitted through intended and unanticipated learning processes at organized and accidental meetings with neighbors, colleagues, suppliers and so on (Bathelt et al., 2004, p. 38).

Global pipelines, on the other hand, are built between individual organizations in the local industry with external actors located elsewhere in the world. Since the trust that is part of intra-agglomeration connections is absent in these cases, they are more formal. Global pipelines are a means for the firms within the local context to reach beyond the routines of what is local and access external leading edge knowledge which can eventually lead to innovation of products and processes (Bathelt et al., 2004, p. 42). The assimilation of external

knowledge into the local context is possible due to the existence of local gatekeepers and boundary spanners, who are able to transform the external knowledge into a form that can be understood and used locally. These are professionals within or between the organizations of the agglomeration who are knowledgeable in the local language, institutions, market, technological and network possibilities and sufficiently informed in the field related to the external knowledge that is to be made useful (Bathelt et al., 2004, pp. 44–45). The roles of different professionals in the knowledge dynamics that are described above are highly relevant to this study. As argued in Chapter Two, designers are recognized as gatekeepers and brokers of knowledge in new product development and innovation activities that take place within and across organizations. If this idea is applied at an industrial level, it is appropriate to consider how design professionals are organized in different ways to perform part or all their daily design activities in the setting of the industrial agglomeration and contribute to the knowledge dynamics described above. In addition to considerations of the tacit or explicit nature of knowledge in relation to geography and innovation, the knowledge bases upon which an industry relies have implications for how innovation is distributed spatially. Asheim (2007) underlined the importance of considering the knowledge bases upon which industries build when innovation across industries is described. He distinguished three archetypical knowledge bases that are found in various mixes in industry: analytic, synthetic and symbolic.

These knowledge types differ, not only in their content, but also in their respective tacitness or explicitness. Analytic knowledge dominates in industries that are characterized by scientific research and knowledge that can be codified. Research is performed in-house in dedicated research and development departments or accessed through ties with universities, and innovation can often be characterized as radical. Examples of industries that rely predominantly on analytical knowledge are the biotechnology and information technology industries. Synthetic knowledge, on the other hand, prevails in industries where new product development and innovation, mainly incremental, relies on existing knowledge or on new combinations of existing knowledge. Where research and development is used, it has an applied nature and is motivated by the urge to solve problems of efficiency and reliability that have been articulated by clients or suppliers (Asheim, 2007). Learning occurs mainly by doing, so much synthetic knowledge is also tacit. Asheim and Gertler offer the examples of specialized industrial machinery manufacturers, plant engineering and ship building as cases that depend predominantly on synthetic knowledge bases (Asheim & Gertler, 2005). These are typical examples of CoPs, as described in Chapter Two of this work. Innovation and design intensive industries build on creativity that derives from symbolic knowledge bases.

They focus on the creation of new ideas, cultural meanings, images and sign value rather than use value (Lash & Urry as cited in Asheim, 2007; Coenen, 2006). Here, innovation

consists of objects that challenge existing conventions and which are the result of research performed in the company or confining professional communities or in youth/street/art/popular cultures. Knowledge is often tacit and learned through engagement in practical and craft oriented activities. Asheim argued that because the interpretation of signs, images, stories and designs is shaped by the culture that characterizes the context of use, symbolic knowledge is context specific (Asheim, 2007). Industries that rely extensively on symbolic knowledge are creative industries such as film, fashion and advertising. Although few industries depend exclusively on analytic, synthetic or symbolic knowledge in isolation, these archetypes can be useful as a basis for discussion of the role of design in new product development and innovation, and how it is managed and organized spatially in different industries. Because of the limited use of design in industries that rely on analytic knowledge, such industries have been excluded from the present study. Instead, the research is designed to include industries where design is used, at least to some extent. The industries that have been studied all build on mixtures of synthetic and symbolic knowledge.

Martin and Moodysson showed how the importance of proximity for innovation activities in different industries is related to the knowledge base they build on (Martin & Moodysson, 2013). In their research they compared the innovation activities of a life science industrial agglomeration that builds predominantly on analytic knowledge, a food industry agglomeration where innovation depends on synthetic knowledge, and an agglomeration of moving media producers whose work relies mainly on symbolic knowledge. They found that learning and innovation processes that are enabled by spatial proximity are essential in industries that rely on symbolic knowledge and important in industries whose innovation activities build on synthetic knowledge. Innovation activities in analytically based industries, on the other hand, are performed on a wider geographical scale. Martin and Moodysson considered design knowledge to be symbolic.

However, design research has shown that design practice consists of analytic, synthetic and symbolic elements (see for example the descriptive examples given by Schön, 1991). They also argue that symbolic knowledge as used in design is highly tacit. This is also questionable, since symbolic design knowledge can be considered to be codified in the design outcomes. Furthermore, the research on contributions that are made by designers to innovation which was performed by Norman and Verganti suggested that meaning-centered innovation, which relies predominantly on symbolic knowledge, is connected to the knowing that exists in a global design discourse, and is thus not entirely local (Norman & Verganti, 2012). The extent to which design competence is local and sticky or global is thus unclear. This is one central question that is addressed through the research described in this text. The idea of synthetic and symbolic knowledge bases and the nature and focus of the innovation and design activities that takes place in different industries

and on different types of products can be related to Norman and Verganti's association of innovation to human centered innovation and innovation of meanings in design, as shown in Figure 4. Product types and industries can be characterized through their position on a continuum where the predominant knowledge base, focus of innovation  and main use value or focus of design efforts is represented. In Figure 4, complex products and services (CoPS) and high design objects are positioned at opposite extremes of the continuum. The former build almost exclusively on synthetic knowledge bases and rely mostly on innovation aimed at an increased efficiency and reliability of the product. The use value of CoPS is purely instrumental, and the focus of design efforts, if design is used at all, is mainly on usability and human centered issues. High design objects, on the other hand, are positioned on the opposite side of the continuum, and build on symbolic knowledge bases and are often the embodiment of innovations of meanings as conceptualized by Verganti (2009).
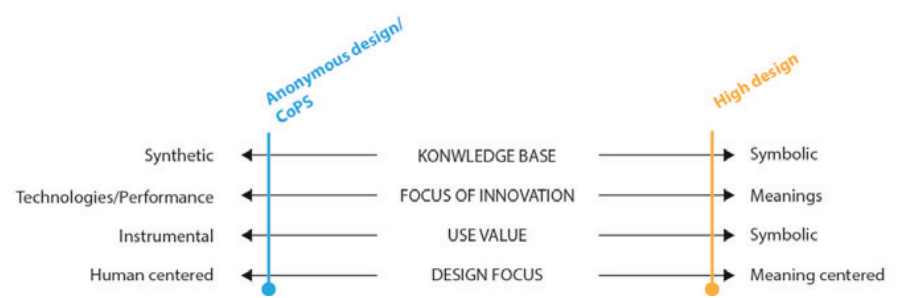


Figure 4.    *The knowledge bases, innovation, use, and design model. For explanatory purposes the archetypical groups of objects of CoPS and high design objects are positioned at opposite sides of the continuum.*

## 3.4  Summary

Chapter Three reviews the literature related to the geographical perspective that was selected as relevant to the present research. In particular, the perspectives of economic geography that focus on knowledge dynamics and innovation in regional agglomerations were adopted. Scholars who represent this line of study have shown that knowledge intensive innovation activities are not distributed randomly across space, but tend to agglomerate in geographically delimited areas, and that this tendency is related to the benefits that individual companies gain from their access to unique and locally rooted knowledge that is held by the local workforce and which is inaccessible for non-local companies. The

sophisticated knowledge bases of local professionals in industrial agglomerations are often distributed across the production chain. The shared culture that evolves within industrial agglomerations supports trust and facilitates interactions and learning in product development processes that span organizational boundaries. Concepts of economic geography that were identified as central to this study were those of untraded interdependencies and path dependence. Untraded interdependencies are the conventions, informal rules and habits that shape a shared framework for action in an industrial agglomeration. These link activities to the local history and culture and make an industrial agglomeration more or less path dependent. With path dependence, the evolution and future of an industry is understood as the outcome of its past. This has implications for whether and how industrial design is used and practiced in product development in different industries.

In addition to useful concepts from economic geography, this chapter outlined different approaches to the study of regional agglomerations of industries and to different types of industrial agglomerations that are characterized by particular organizational structures and levels of internal interaction. The knowledge centered perspective that was chosen for the study makes use of the Marshallian-Italienate and hub-and-spoke types of agglomeration in the research design. These types of agglomeration are characterized by a substantial amount of intra-district interaction between firms and suppliers, and the latter type has, in addition, interactions with organizations that are located outside the industrial agglomeration. The innovation systems approach to regional agglomeration can be identified along geographical, sectoral and activity dimensions and provides appropriate criteria for the choice of research cases. All three industrial agglomerations that have been chosen for this research project consist of a large number of companies involved in product development, design and production activities of a limited set of interrelated products in a geographically delimited area.

The final section of the chapter discusses the geography of knowledge, where concepts that were introduced are useful when the interactions between different design professionals and companies in industrial agglomerations are to be considered from a knowledge dynamics perspective. In this context it is important to distinguish the tacit or explicit nature of knowledge and how the former is situated in local practices and therefore sticky and difficult to apply away from its original context. Such knowledge is central to much of the innovation that goes on in industrial agglomerations and is transmitted locally through face to face interactions and local buzz between clients, suppliers, colleagues, neighbors and friends.

In addition to sticky knowledge, some local companies also rely on global knowledge. This is brought into the industrial agglomeration through global pipelines, which are interactions between local companies and professionals located elsewhere. The local assimilation of global knowledge is facilitated by local gatekeepers of knowledge, who are professionals

who are able to transform global knowledge into a form that can be understood and useful locally. The concept of a local gatekeeper is central when the different roles of design professionals in industrial agglomerations are to be understood.

Finally, a categorization of different knowledge types that are used in industries, with implications for the character of product development and for the importance of proximity in innovation activities was introduced. The taxonomy includes symbolic, synthetic and analytic industrial knowledge bases, where the first two are useful when the design and innovation activities of the different industrial cases are categorized and understood in the light of the main product use value of their products. It was concluded that design knowledge is a mix of symbolic and synthetic knowledge, where the former is predominantly situated in different user cultures and in globally distributed designer communities, and the latter is found in local product development and production communities.

# 4

## The Study of Industrial Design in Industrial Agglomerations

The review that was made in the previous two chapters suggests that industrial design in new product development and innovation in the context of industrial agglomerations merits more attention. A general understanding within the design research community has been that design is either performed by in-house designers or disconnected external design consultants in long or short term relationships (Borja de Mozota, 2003, p. 168; Bruce & Morris, 1994, 1998; Cooper & Press, 1995). However, the existence of local design communities in industry agglomerations (Oterhals &  Johannessen, 2009; Sammarra & Belussi, 2006) suggest that the combination of design professionals that are used in industry agglomerations is more nuanced.

In line with the call for knowledge contributions on the management of design in strategic alliances, co-creation, and in business comunities that was made by Erichsen and Christensen (2013), the regional agglomeration context of this study brings a spatially and functionally distributed design perspective to design management, that is rare in the existing design management research discourse. The literature that was reviewed shows the usefulness of a knowledge and competency centered perspective when design practice, design management and design contributions in the context of product development in industrial agglomerations is studied (See for example Asheim & Gertler, 2005; Ashton, 2004; Bathelt et al., 2004; Bertola & Teixeira, 2003; Martin & Moodysson, 2013; Maskell & Malmberg, 1999).

The multifaceted division of design in industrial agglomerations is examined in the present study, which will describe regionally agglomerated industries where design practice is performed by design consultants who work exclusively in the local productive context, in-house designers and non-local design consultants. The co-existence of in-house designers, global and local design consultants indicates that each has specific competences and contributes to the local product development in a distinctive way. This calls for an understanding of how design professionals in various organizational constellations and integrations contribute to companies in industrial agglomerations, and how the design competences of individual designers support those contributions. By addressing these matters, this work contributes to a more nuanced understanding of a differentiated design community that currently contributes to the global economy.

The discussions of socially, culturally and materially situated design practice that were presented in Chapter Two suggests that the spatial and cultural links of individual designers shape and distinguish their respective practices and contributions, and the ways in which they are integrated into product development. In the context of product development in industrial agglomerations, their respective design knowledge contributes in distinct ways to the knowledge dynamics and innovation of the local industry. Therefore, the regional and industrial cultures where design activities take place are an important focus of attention in the present work. Figure 5 illustrates the physical position and the expected cultural

and cognitive connections of different groups of design professionals who contribute to a given industrial agglomeration.
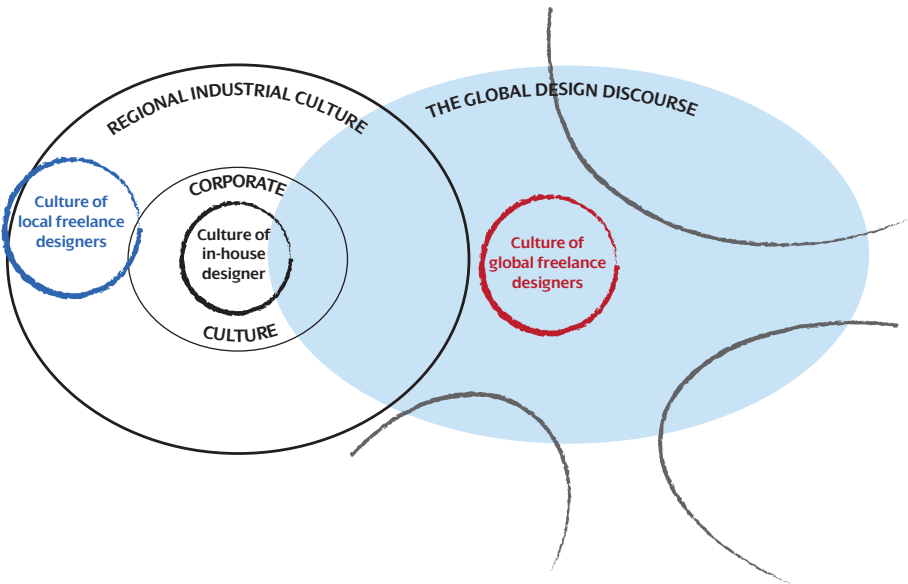


*Figure 5.    The spatial and cultural links of the various groups of design professionals.*

While in-house designers and design consultants whose professional activities are located in the geographical and cultural setting of an industrial agglomeration can be expected to develop a local expertise and contribute to product development and innovation accordingly, design consultants who are not local build their contributions on expertise that has been developed at the global level. From a design practice, design management and innovation perspective, it is thus important to understand how designers are organized, both functionally and spatially, in relation to the context where design contributions are made, and how different groups of design professionals each contribute to local innovation. This work provides a thorough description of the differentiated design community that contributes to innovation in product development in different industrial agglomerations in terms of design competence, design management and spatial organization.

Local design consultants are not part of an in-house design department, even though they are involved in product development and innovation activities, and their familiarity with the local industry practices can be expected to be deeper than that of their non-local counterparts. This means that a part of the design knowledge that is needed in industrial

agglomerations is tied to the local industrial context and can be characterized as sticky. While the use of in-house designers or local design consultants may imply less risk of costly feedback loops caused by a lack of sticky knowledge, the fact that some companies in industrial agglomerations prefer to collaborate with non-local design consultants (as found by Oterhals &  Johannessen, 2009) suggests that the ubiquitous design knowledge of the latter group of designers is sometimes needed in the local context. Figure 6 shows a pre-liminary map of the different types of design professionals who are expected to be found in product development in industrial agglomerations. The figure illustrates the integration of each group in product development to the extent of their specific and sticky or general and ubiquitous design knowledge. Based on the research findings of this work, this model is advanced in Chapter Nine with an even more differentiated picture of the division of design labor that contributes to product development in industrial agglomerations.
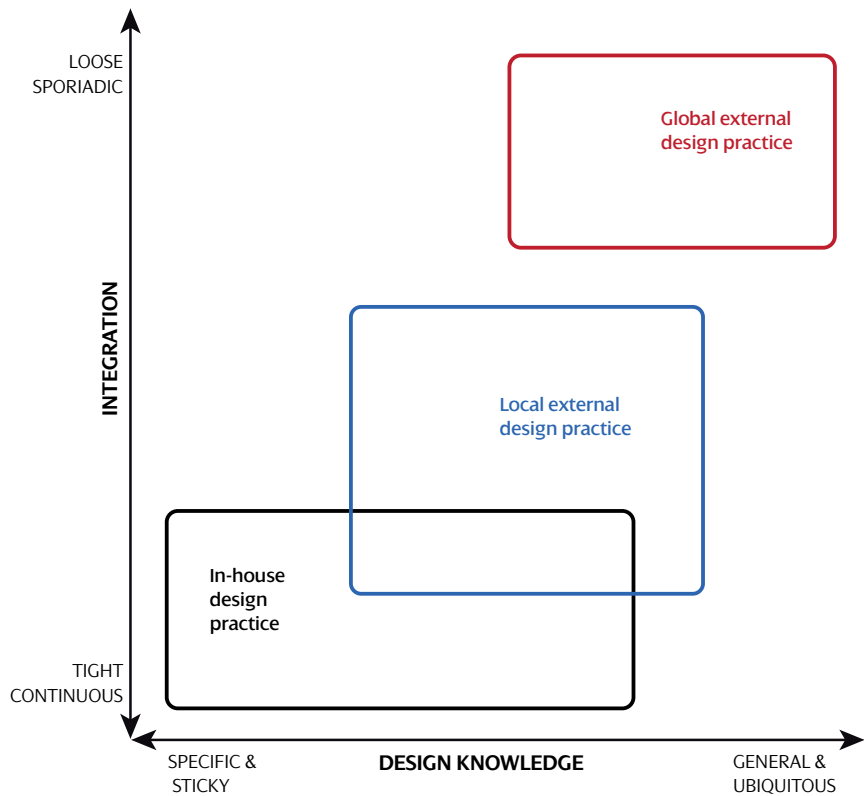


*Figure 6.    In-house, local and global external design: integration and nature of knowledge.*

Although design research has often emphasized the adaptive nature of design expertise, there are examples of research that have shown the importance of specific design knowledge that is tied to particular contexts (Cross, 2004; Dorst & Reymen, 2004; Lawson, 2004; Popovic, 2004). Only a few scholars have exemplified its content. (Exceptions to this are provided by Kotro, 2005, and ; Kuutti, 2009; Lawson & Dorst, 2009; Von Hippel, 1994). No studies have systematically considered design knowledge from the perspective of a geography of innovation. Considering that industrial agglomerations assemble product development and production activities of similar and related products, it can be assumed that the sticky design knowledge that is held by local design practitioners regards the product, its use, and the culture and traditions that determine the local product development practices. Since the share of design projects that take place in the setting of industrial agglomerations can be expected to increase, together with the importance of industrial agglomerations in the global economy (Asheim & Gertler, 2005), it is crucial to understand what constitutes sticky design knowledge and what determines its importance in different industries.

The particular institutional and material environment that characterizes and permeates industrial agglomerations can be expected to influence the everyday practice of industrial designers. The disintegrated production which is distributed across a range of SMEs adds an inter-organizational dimension to design practice. While issues connected with inter-organizational product development have been studied thoroughly by scholars in open and distributed innovation (Chesbrough, 2003; Von Hippel, 1988), few design researchers (As stated by Erichsen & Christensen, 2013) have paid attention to what happens in the encounter between different cultures that are represented by design stakeholders located in different organizations who are involved in a shared design endeavor. A designer who works in an industrial agglomeration needs to interact with the local culture that is tightly enmeshed with the local practices. If he or she is not part of the local agglomeration in person, it can be assumed that at least a basic understanding of the traditions and institutions that determine the local practices and products will be needed. Considering that the cultures and traditions of individual local industries are unique, the best way to contribute to the design practice community is through the provision of a vicarious experience of the individual cases that have been studied. Such experiences can potentially introduce prospective designers to the situation-based thinking strategies that are essential in design expertise (Lawson & Dorst, 2009).

The traditions of design in individual industries influence how design is practiced, used and managed within companies. The role that is given to design in an industry, and the relative emphasis and scope of design activities, are related to the potential contributions of designers to the main value of the product, which is determined by the use and consumption that the product incites. In addition, the way design is managed across different industries

is also related to the knowledge and degree of familiarity that is needed by designers in order to be productive. The literature review in Chapter Two indicates that industries that produce complex products and systems demand more familiarity on the part of designers than industries that produce products that are characterized by simple architectures, traditions and production processes. The connections between design competences, the management of design and product type that were outlined in Chapter Two suggest a need to consider product type in relation to the main use value and architectural and morphological product complexity in the research design.

To this end, these dimensions are synthesized into a model that accommodates four types of design outcome as shown in Figure 7. The model is a basis for discussion related to the choice of research cases based on products and industries that has been made for this research project. It is based on the two dimensions "main use function" and "product complexity". For clarity, an illustrative product example is positioned at each extreme of the model's four quadrants.
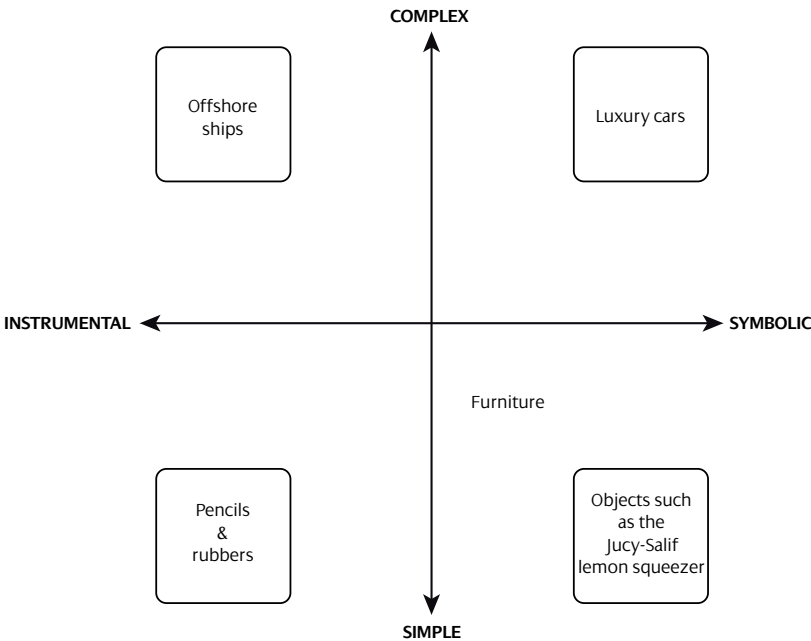


*Figure 7.   Model for the characterization of products based on their type of use and their morphological complexity. The product types that are used as examples in the four quadrants serve for illustrative purposes.*

## 4.1 Research Objective and Research Questions

The aim of the research was to contribute to practitioners of design and design management with useful knowledge on the use and practice of industrial design in product development in industrial agglomerations. In order to meet the aim of the study, and address the issues that have been outlined above the following objective was defined for the study:

> *To explore and describe how the context of industrial agglomeration influences design practice, design management and design competences, and how industrial designers can contribute to product development in industrial agglomerations.*

In order to meet the aim and the research objective of the study, answers were sought to the following research questions:

1. What characterizes design practice and design management in industrial agglomerations?

   - How are industrial designers currently used in product development in different industrial agglomerations?

   - How are designers who contribute to new product and development in industry agglomerations organized functionally and spatially in relation to the local industry and its companies?

   - How are the bases of design knowledge of different design professionals who contribute to product development in industrial agglomerations shaped by their individual places of practice?

   - How does the physical location of designers influence how they are used and integrated into product development in industrial agglomerations?

   - In what ways do product and industry complexity influence the integration and practice of designers in industrial agglomerations?

   - How is design practice and design management influenced by the regional cultural context of industrial agglomerations?

2. How does industrial design contribute to product development in industrial agglomerations?

   - How do individual designers whose practices are located in distinct places in relation to different industrial agglomerations contribute to the knowledge dynamics that facilitate local innovation?

- How can the sticky design competence that is used in product development in individual industrial agglomerations be characterized?

- How do companies in industrial agglomerations benefit from design knowledge that is general and ubiquitous?

- What determines the relative importance of sticky and ubiquitous design knowledge in different industrial agglomerations?

Individual industrial agglomerations as research contexts offered the possibility to study a variety of design practices in different spatial and organizational constellations tied to specific product types in shared industrial cultures. The inclusion of more than one industrial agglomeration in the study allowed for comparisons across different product types which are of different uses and of different complexity.

## 4.2 Case Studies

In order to gain an understanding of industrial design practice in industrial agglomerations, the professional worlds of design practitioners was studied and the opinions of other local design stakeholders were sought. Since the research questions were of a "how" and "why" nature, and a rich contextual understanding was sought, a qualitative case study research design appeared to be an appropriate choice (Yin, 2003). Gomm, Hammersley and Foster define case studies as investigations of one or a relatively small number of naturally occurring cases, where information is gathered and analyzed about a large number of features of each case (Gomm, Hammersley, & Foster, 2000). The primary concern is not to control variables in order to quantify and measure their effects, but to understand the case itself or to provide the reader with vicarious experiences as a basis for naturalistic generalization or transferability (Gomm, et al., 2000, p. 4).

According to Stake, cases are always studied through some kind of structure. Usually this structure is built up of a small number of research questions based on issues that are presumed relevant in the study of that case. Issues are complex, situated, problematic relationships (Stake, 2005). While the research questions were formulated before any structured encounter with the data, the initial exploratory phase of the first research case study generated the issues (as defined by Stake) of cultural, social, organizational, and product complexity, product use, and design institutions. First, those appeared to have little to do with the research questions, but eventually they could be seen as useful perspectives from which to consider the research questions.

5

# Research Approach

This chapter describes the choices that have been made of how to perform the research in order to attain the research objective. It describes the research process and the methods that have been used to produce the research outcomes that are described in this text.

This work has been performed using a qualitative research approach, which means that it recognizes that what works in the natural sciences may be less successful in the social world where phenomena are determined by a myriad of variables that cannot be controlled. According to Flyvbjerg, it is even impossible to find predictive laws in the study of human affairs. Rather, such fields of study offer researchers the possibility to gain concrete and context-dependent knowledge (Flyvbjerg, 2006). This is acknowledged by qualitative researchers who collect and interpret rich data in natural settings with the aim of describing and understanding social life in the terms that the social actors use to describe their own motives and understanding (Blaikie, 2007). After a small exploratory study of the maritime industrial agglomeration in and around Ålesund in Norway, combined with a review of the literature, a few issues that seemed interesting to explore further, and to consider in the research design, were identified. These initial interrelated issues which appeared to be influential in the industrial designer's everyday practice in industrial agglomerations were related to the culture and history of the agglomeration, to social, organizational and product complexity, product use purpose, and traditions for industrial design. As the following research was open to further emerging issues and insights, those issues were not conclusive, but they guided the choice of research strategy and the research design.

## 5.1   Case Sampling

The underlying aim of this study was to produce an understanding of local practices rather than broad explanations and general predictive laws. However, the many variables that determine design practice in context, and the strong social, cultural and institutional peculiarities of individual industrial agglomerations suggested a multiple case design. The aim was to choose cases that had the potential to add to existing experience and humanistic understanding (Stake, 2000), and doing so by being theoretically relevant rather than statistically representative (Flick, 2006, p. 128). This approach provided the opportunity to understand how various circumstances and issues influence the phenomenon of study (Flyvbjerg, 2006). The sampling of cases was conducted together with the process of collecting and interpreting data. Decisions were based on the expected level of new insights that each case could give to the overall research outcome. The process of data collection was controlled by the emerging research results (Flick, 2006, pp. 117–118).

Each case consisted of one regional industrial agglomeration, and therefore offered the possibility to study a range of design management strategies, design practices and respective contributions to a single product type in a fixed industry where organizations share

the same history and culture. The results from individual cases could subsequently be compared in order to gain insights into how design in industrial agglomerations changes with product type and industrial setting.

The first case was the agglomeration of ship builders and ship equipment producers in and around Ålesund on the west coast of Norway. This case provided the opportunity to study industrial design in a capital intensive business-to-business industry that produces morphologically complex objects aimed at professional and strictly instrumental use, and with limited traditions for industrial design. Innovation in that industrial agglomeration is primarily focused on the optimization of production and performance.

The second case was the agglomeration of sports and leisure footwear producers located in and around Montebelluna in north eastern Italy. It was chosen as a fundamental contrast to the first case. Here, design has a long tradition and an unquestioned role in the production of consumer products aimed at sports and leisure use. The products are less complex than those in the previous case. They are affordable and new collections and styles are launched continuously. Innovation efforts that are made are connected to both performance and to meaning and style.

The third and last case was the agglomeration of furniture producers and related industries centered in the municipality of Sykkylven in the Norwegian west coast region of Sunnmøre. This case provided the opportunity to study an industry that is typically associated with the use of design, but where the role of designers has often been strongly conditioned by the traditions for rational production in the agglomeration. The products are aimed at consumers and can be characterized as a "medium investment" which is made only a few times in a lifetime. The products are used both as symbols and as utility objects. A few key characteristics of each case are presented in Table 2.

Table 2.    Key characteristics of the cases that are represented in the study.

| | The agglomeration of ship builders and ship equipment producers in and around Ålesund | The agglomeration of sports and leisure footwear producers of Montebelluna | The agglomeration of furniture producers in the municipality of Sykkylven |
|---|---|---|---|
| **Product character** | Industrial – capital intensive – complex | Consumer – affordable – medium complexity | Consumer – medium investment – low complexity |
| **Product use** | Instrumental | Instrumental/ symbolic | Instrumental/ symbolic |
| **Focus of innovation** | Technological/ performance | Meaning/performance | Meaning/comfort |
| **R&D cycles** | long | rapid | medium |
| **Traditions for design, design maturity** | Limited | Unquestioned | High |
| **Type of agglomeration** | Hub-and-spoke | Italianate-Marshallian | Hub-and-spoke |

As illustrated in Figure 8 below, each of the industries can be positioned in the two dimensional space determined by product complexity and main use function that was first introduced in Chapter Two.
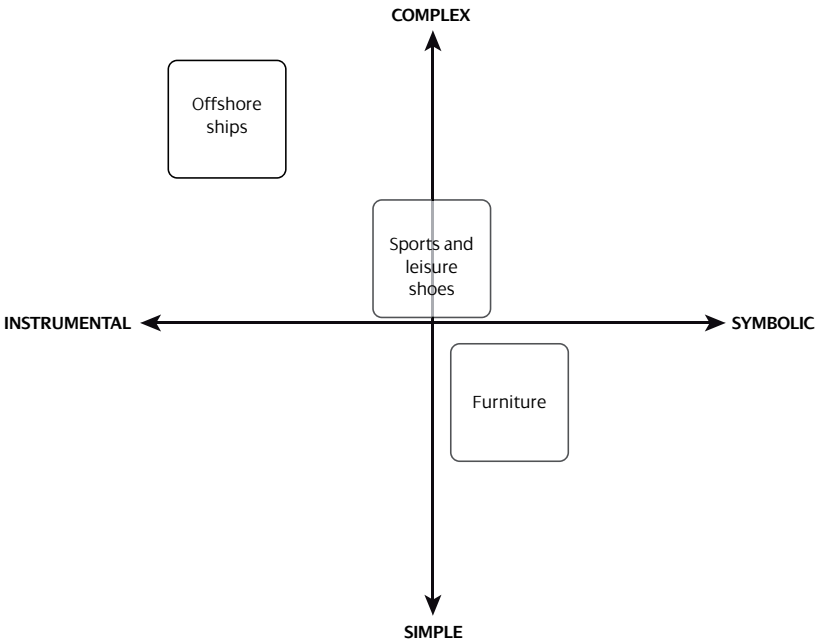


Figure 8.    *Product complexity and the main use function of the products of the industrial agglomerations.*

Every case was studied in its own right, but insights and outcomes from each individual case were used in following cases. Once a basic understanding had been gained about each case, cross-case comparisons were made in order to identify similarities and differences that could advance the understanding of each case as well as enrich and deepen the conception of the phenomenon as a whole. The cross-case comparisons showed that, although every case was unique and limited to a particular set of interactions, there were at least some commonalities between the cases.

In line with Gomm et al., (2000) one aim has been to provide the readers of the case descriptions a vicarious experience of the professional world of designers in different industrial agglomerations as well as a more general understanding of the aspects that

influence it. Generalizations were not the main goal of the study, but some general state-
ments regarding design practice in industrial agglomerations can be considered part of the
research outcome.

## 5.2   Data Collection

According to Yin (2002) data collection may be a challenge in case studies as researchers
need to consider the contextual richness of the case. There may be more relevant variables
present in a case than there are data points. Case studies thus rely on a range of data
sources that are capable of bringing variables from various perspectives into the light. Data
collection methods can be oriented towards quantitative as well as qualitative data. Yin
(2003) lists documents, archival records, interviews, observations and physical artifacts as
possible data sources. As the present study focuses on meanings, understandings, experi-
ences and habits of professionals in industrial agglomerations, interviews were considered
an efficient means of data collection. Interviews are here understood as active processes
in which the researcher and the interview subjects together produce knowledge through
their conversational relationship (Kvale & Brinkmann, 2009, p. 18).

Like the sampling of cases, the choice of interview subjects was guided by the emerging
research results and the potential of research subjects to contribute to a deeper under-
standing of the research themes. First, one "gatekeeper" was identified for each case.
The gatekeeper was interviewed about the general history, culture and structure of the
industrial agglomeration where they worked. The gatekeeper was subsequently asked
to propose a number of potentially interesting interview subjects who were successively
contacted. In the context of data collection for this study, gatekeepers are individuals who
have an overall knowledge about who is who and who does or did what in an industrial ag-
glomeration. A gatekeeper is therefore able to suggest relevant interview subjects for the
proposed study. He or she often has a central or coordinating role in the local industry and
is thus also well known within the agglomeration.

By referring to the name of the gatekeeper at the first contact with interview subjects,
the research project earned credibility and trust among the interview subjects, who were
encouraged to take a positive attitude to the study and made themselves available for
interviews. In the ship building industry there were a number of gatekeepers, mainly
colleagues at the department of advanced maritime operations at the University College
of Ålesund. In the sports and leisure shoe manufacturing industry in and around Montebel-
luna, the gatekeeper was the director and principal of the "Museo dello Scarpone" (the Ski
Boot Museum). The Museo dello Scarpone doubles as a museum that exhibits the products
and history of the agglomeration and is a coordinating institution for shared initiatives in the

local industry. The current director of the Museo dello Scarpone is also the author of several books on the history and culture of the local industry. Similarly, one of the gatekeepers for the furniture industry in Sykkylven was the leader of Norsk Møbelfaglig Senter (Centre for Norwegian Furniture History) in Sykkylven. The Centre for Norwegian Furniture History is a museum and an institution that exhibits and documents the present and the history of the Norwegian furniture industry. The second gatekeeper in the furniture industry was a furniture historian who has written several books and publications about the history of the industry and its products.

The interviews were organized around the themes of everyday practice, design management, designer knowledge, skills and tools, contributions, competence and general information about the agglomeration. These themes were all developed from the research questions. Questions were open ended so that new potentially significant themes could be followed up continuously during the interview and potentially integrated into following interviews.

The different "design stakeholders" who were interviewed for each industrial agglomeration were all able to illuminate the research theme from various perspectives and provide rich pictures of each individual case. It was therefore a priority to interview professionals who had collaborated in product development projects so that their individual experiences regarding the same episodes could deepen the understanding of the research phenomenon. This can be considered a means for triangulation, which according to Flick increases the scope, depth and consistency in methodological proceedings (Flick, 2006, p. 445). In addition to general questions about the individual interview subject's background and current role, the companies and innovation in the setting of the industrial agglomeration, the themes, the types of professionals that were interviewed, and the perspectives on the themes that were taken in the interviews are shown in Table 3.

*Table 3. Professionals, themes and perspectives taken in the interviews.*

|  | Everyday practice in the agglomeration context | Knowledge skills and tools | Competence | Contributions |
|---|---|---|---|---|
| **In-house designer** | The experience of everyday practice in the agglomeration context. | The knowledge skills and tools that are experienced as particularly useful, or essential, for a successful professional practice within the agglomeration. | Idea of own competences. | Narratives of own contributions to product development and innovation. |
| **Local freelance designer** | | | | |
| **Non-local freelance designer** | | | | |
| **Research and Development managers** | The everyday design management in the agglomeration context. | Specific qualities, knowledge skills and tools of designers that are considered particularly useful, or essential, for a successful designer within the agglomeration. | Experience of the competences held by different industrial designers who practice within the setting of the agglomeration. | Narratives of different designer contributions to product development and innovation. |
| **Gate-keepers** | From a general and historical perspective. | | The role that design competence has had during the evolution of the industry agglomeration. | Narratives of contributions made by designers to various companies within the agglomeration. |

The interviews were performed at the office sites of the interview subjects. The duration of the interviews ranged from one to two hours depending on each interview subject's availability and willingness to talk and contribute to the interview. They were recorded with the permission of each interview subject, and then personally transcribed, verbatim. The total of recorded time and the total amount of transcribed interview material for each case is presented in Table 4. At the end of each interview, memos and recordings were made of the researcher's impressions or ideas related to the interview, and before each interview adjustments based on the experiences from previous interviews were made to the interview guide.

*Table 4.*     *The total time of recorded interviews and the total number A4 pages of transcribed interviews that were the result of the interviews performed in the three cases.*

|  | The Ship building industry in and around Ålesund | The Furniture industry in and around Sykkylven | The Sports and Leisure shoe industry in and around Montebelluna |
|---|---|---|---|
| Total time recorded from interviews | 11 hours, 29 minutes | 5 hours, 24 minutes | 10 hours, 8 minutes |
| Total number of transcribed A4 pages | 100 | 64 | 108 |

In the Norwegian ship building and furniture industries, interviews were performed in Swedish and Norwegian, while the interviews that were performed in the Italian sports and leisure shoe industry were conducted in Italian, except from one interview that was performed in English. Some of the quotes that are provided in the case descriptions have therefore been translated from the original interview language. To protect the anonymity of the interview subjects, any data that may reveal their identities has been removed from the quotes in the case descriptions. Only where the case descriptions are enriched by, or for meaning integrity require the inclusion of information about companies, brand names and individuals, are these made explicit. This was only done after careful evaluation of whether the accounts could harm or violate the personal or professional integrity of individual interview subjects.

The interview data of the ship industry case were collected in two phases. The first six interviews were performed between December 2007 and April 2008. In this initial phase of the study the focus was to explore and identify themes and issues that could be relevant

to further study. These initial interviews were complemented by five additional interviews conducted between May 2010 and November 2010. These ensured that the case could count as an equal and valid unit in the overall study context. Table 5 provides an overview of the interviews that were performed in the ship industry.

*Table 5.    Interviews that were performed for the maritime industry case.*

| Interview subject role | Number of interviews | Age of interview subjects | Years of work experience |
|---|---|---|---|
| Gatekeeper at the University College of Ålesund | 1 | 49 | n.a. |
| Previous local freelance designer, current inhouse designer at a ship equipment supplier (of education and training equipment for ship crew) | 1 | 32 | 8 |
| Research and Development manager at ship design company | 2 | 34 <br> 39 | n.a. <br> 16 |
| Research and Development manager at ship equipment manufacturer | 3 | 44 <br> n.a <br> 33 | n.a <br> n.a <br> 8 |
| Local freelance designer | 2 | 45 <br> 33 | 22,5 <br> 6 |
| Global freelance designer | 1 | 49 | 23 |
| In-house designer at a ship design company | 1 | 35 | 6 |

The interviews that were conducted in the setting of the sports and leisure shoe industry took place during one week in April in 2009 and are represented in table 5. The concentration in time of this data collection was due to the geographical distance of the agglomeration from the researcher's home institution, which limited the opportunities to access the field repeatedly. A total of eleven interviews were performed of which four were group interviews where several stakeholders of design were interviewed together. The first group interview included the marketing manager, the research and development manager, the human relations manager, and the in-house designer of a ski boot manufacturer. The second group interview included two local freelance designers, a retired research and development manager with a long career behind him at a major ski boot producing company, and the director of the local industry museum who was also the gatekeeper

of the case. The third group interview included two in-house engineering designers and design managers of a roller skate manufacturer. The fourth and final group interview was performed at a trekking boot manufacturer with two in-house designers, one of them also the design manager of the company. Since the group interviews included professionals who collaborate on shared projects in their everyday practice, they ran rather smoothly. Only on a few occasions was there a need to hold back individuals who tended to take on a dominant role in the interview, and make more space for the other interview subjects. Generally the group interview situations were characterized by a reciprocal respect among the participants for the competences and narratives of individual interview subjects and for the researcher as the moderator of the conversation.

*Table 6.    Interviews that were performed within the Sportsystem.*

| Interview subject role | Number of interviews | Age of interview subjects | Years of work experience |
|---|---|---|---|
| Gatekeeper | 2 | 65 | n.a. |
| Group interview with marketing manager, the research and development manager, the human relations manager, and the in-house designer of a ski boot manufacturer | 1 | n.a. | Designer: 14 |
| Group interview with a local freelance designer and his assistant, the director of the local industry museum, and a retired research and development manager | 1 | Designer: 33 | Designer: 8 |
| Group interview with two product developing engineers and design managers of a roller skate manufacturer | 1 | n.a<br>n.a | 12<br>5 |
| Group interview with two in-house designers whereof one was also design manager of a trekking boot manufacturer | 1 | n.a.<br>23 | 34<br>3 |
| Local freelance designer | 4 | n.a.<br>39<br>59<br>n.a | 19<br>19<br>33<br>20 |
| Research and Development manager at a trekking boot manufacturer | 1 | 50 | 20 |

The furniture industry case was built up around ten interviews performed during November 2010, with different stakeholders of design in the agglomeration. An overview of the interviews is presented in table 7.

*Table 7.    Interviews that were performed in the furniture industry in and around Sykkylven.*

| Interview subject role | Number of interviews | Age of interview subjects | Years of work experience |
|---|---|---|---|
| Gatekeeper | 2 | n.a<br>n.a. | n.a.<br>n.a |
| In-house designer at a major furniture manufacturer | 2 | 34<br>34 | 5<br>5 |
| Design manager at a major furniture manufacturer | 1 | 66 | 40 |
| Local freelance designer | 2 | 49<br>67 | 22<br>42 |
| Research and Development manager of a furniture manufacturer | 3 | 59<br>41<br>46 | n.a.<br>10<br>25 |

The interviews were complemented with secondary data such as literature and newspaper articles that could position them within a cultural and historical frame. Some of the accounts given during the interviews were supported and enriched by product catalogues, designer sketchbooks, physical prototypes and products.

## 5.3  Analysis of data

The interview transcripts were imported into the for qualitative data analysis software Atlas Ti. The transcripts were coded. Coding followed the process suggested by Schwandt in which data is disaggregated and broken down into manageable segments that are given descriptive names and then constantly compared and contrasted internally in order to ensure consistency (Schwandt, 2007). The software facilitated the tracking of the interviews and the many codes that emerged.

The transcribed interviews were read thoroughly and repeatedly with the research objective and research questions in mind. Text segments that were related to the overall research objective and to the research questions were identified and assigned codes. The codes were labeled according to the essence of the meaning that was interpreted from the text segment. Each case was analyzed in its own right, but as the research questions and the research objective of the three cases were identical, the codes that were used in one case were often related, similar or identical to the codes that were used in the other cases. Some text segments were assigned multiple codes as they represented more than one theme of relevance to the research. Once all the interviews of a case had been analyzed, overlapping codes were identified and merged, and codes with limited relevance to the research project were eliminated.

The codes that were identified in the interviews and the number of quotations that correspond with each code are presented in Appendix 1. At this point of the process, the codes that had been identified in the different cases were compared, and codes that had a similar or identical meaning in relation to the research questions and research objective were merged and given a single representative name. The codes were then arranged in a number of themes that were chosen with the presentation of the research results in mind. The themes roughly correspond to subchapters of the case descriptions that are presented in Chapters Six to Eight. Finally, each code was listed together with its quotes, and the quotes that were considered typical examples for the individual case descriptions were selected and inserted into this work. The data analysis process thus ensured consistency between the overall research objective, the research questions, the data and the reported research outcomes.

**6**

# Industrial Design in the Agglomeration of Maritime Producers of Sunnmøre

## 6.1   The Origins of the Agglomeration

The success of the Norwegian Vikings was to a great extent due to their superiority in building ships and their great ability as seafarers.  Between the year 800 and the year 1050 their ships reached as far as north eastern South America (Norway, 2014). The important maritime traditions of Norway have been carried forward through the history, and today the country is the cradle for some of the most technically advanced ships and competent seamen in the world.

The regional agglomeration of maritime product producers of the Norwegian west coast county of Møre og Romsdal is mainly concentrated to the region of Sunnmøre. Its origins can be traced back to the production of industrialized, all-year fishing boats that started in the region in the 1860s. While the industrialization of many European industries followed the Fordist model, with the factory as a central organizing unit, this industry followed a "French model" which depended on a traditional craft-based production in small work-shops and later a natural adoption of flexible specialization (Pollard, 1981; Wicken, 1995).

The transition from the traditional small and open sailing fishing boats to bigger covered boats driven by diesel combustion engines enhanced both the security of fishermen and the productivity of the fishing industry. The first engine that was used in the region of Sun-nmøre was imported from Denmark in 1901, and over the following years local blacksmiths modified the technology to fit the local fishing fleet. The knowledge spread throughout the region and resulted in the genesis of a large number of specialized ship yards and suppliers of motorized fishing boat equipment. The funds that were needed for the construction of a fishing boat were raised locally by the fishermen, their neighbours and relatives, and the profits made by the boat were later divided between the investors. The fishermen, who were specialists in the operations that the boat was to support, were deeply involved in the boat building process. This arrangement can be considered an early version of the shipping companies that are an important part of today's maritime industry (Berge & Bjarnar, 2008; Wicken, 1995). The region was characterized by short social distances and a spirit of entrepreneurship. Shipping companies, fisheries, ship builders, fishermen, local communities and financial institutions were tied together in close collaborations in the evolution of a more industrialized fishery. Important innovations in anchor handling, steer-ing, stabilization and deck machinery were made by the many ship equipment suppliers that had started to emerge already in the 1930s, but whose number expanded significantly throughout the 1960s. The 1960s marked the transition from the traditional wooden boats to steel hulls (Berge & Bjarnar, 2008; Lillebrygfjeld Halse & Bjarnar, 2011).

With the first Norwegian North Sea oil strikes in 1969, followed by the discovery of natural gas in 1981, a new market for specialized ships equipped for the search and extraction of these natural resources emerged. The Norwegian shipyards and ship equipment suppliers

that for a long time had been producing products aimed at the fishing industry had a deep knowledge about the particular conditions of the North Sea. The same conditions needed to be mastered by the emerging petroleum industry, and the shipyards could with great advantage apply their know-how directly to this new market. They started to build offshore supply vessels and equipment for both domestic and international markets. The new market provided the local industry with alternative incomes in times when the fishing industry faltered due to restrictive conservation regulations that were imposed on fishing (Lillebrygfjeld Halse & Bjarnar, 2011).

The traditions for close user-producer collaborations in product development that was part of the success of the maritime product producers continued in the new industry segment (Berge & Bjarnar, 2008). It grew significantly, and in the period between 1960 and 1980 the maritime milieu of the region turned into what Lillebrygfjeld et al. term a "full blown cluster", where innovations emerge from close collaboration and competition between local companies (Lillebrygfjeld Halse & Bjarnar, 2011). According to Berge and Bjarnar, it is currently the most complete and comprehensive maritime agglomeration in Norway and of the world; it produces 40% of the world's modern fleet of offshore ships and designs more than 75% of the world's large, hi-tech offshore vessels (Berge & Bjarnar, 2008; NCE Maritime, n.d). In 2006, Norwegian research and innovation authorities appointed the regional agglomeration of maritime companies in Møre and Romsdal a "Norwegian Center of Expertise" (NCE) for the maritime sector. The NCEs are a limited number strategically selected regional agglomerations that are competitive on the international market. The NCE program acts in support of agglomerations, promoting research and education, innovation and reputation building. It supports research, education, conferences and seminars, networking and new start-ups (NCE Maritime, 2009).

The 14 ship yards, 17 ship owning companies, 15 ship designers and 155 ship equipment and service suppliers that are part of the agglomeration employ 20,000 people, of whom 17,900 are employed in the design and production of products and services for the offshore industry (Hervik, Oterhals, Bergem, & Johannessen, 2010). Because of the relative importance of petroleum-industry in the agglomeration, these products and services are the focus of the case study.

## 6.2 Product and Industry Structure

In order to explore the ocean floor and its possible oil reserves, create infrastructure around them and support the work of acquiring oil from the platforms, national oil companies buy some or all offshore services from ship owning companies. The offshore ships that are needed for the delivery of these services are ordered from ship design companies

and built at ship yards. The ship equipment needed for the various operations that the ship is destined for are delivered by ship equipment suppliers, and the furniture by producers of ship furniture. The ship design companies that sell plans of equipment and ship interiors, together with hull designs, to ship owning companies organize tenders where ship yards, ship interior producers and equipment suppliers compete for a share of the complete ship delivery (Hervik et al., 2010). The maritime industry in and around Ålesund can be characterized as a hub-and-spoke agglomeration as outlined by Markusen (1996).

 Although the services that are sold by ship owning companies makes up a significant part of the local economy in Møre og Romsdal (Hervik, Oterhals, & Bergem, 2007), this study is focuses on the physical products that are designed and sold by ship designers, yards and ship equipment suppliers. The ship equipment which actually constitutes the largest part of the agglomeration economy is anything found within or attached to the ship's hull or used on the working deck. There are dedicated maritime products, such as compressors for the engine rooms, and other more general instruments, such as screens and handles that are used on the bridge.

The products and systems that are developed in the maritime agglomeration of Sunnmøre are used in extreme environmental conditions and often in high risk operations. Their designs are to a great extent determined by rules and regulations worked out by national and international classification societies. This tradition started already in 1864 when ship owners initiated "Det Norske Veritas" (DNV), with the aim of calculating risk. These were indications of the actual risks that a particular shipment would not reach its final destination. With time the scope of DNV and similar agencies changed from the safety of the cargo to the safety of the fleet, and recently also to environmental issues. Today DNV is a global risk management organization that, in competition with about fifty others of its kind worldwide, collaborates with nations to create standards for the maritime industry and classify its products. Ships and equipment are built according to the rules of a classification society where the ship building company applies for the ship's certificate (DNV, n.d.).

Offshore ships are large and capital intensive floating systems that are built for specific operations connected to the petrol industry. Anchor handling tug supply vessels (AHTS), platform supply vessels (PSVs), multi-purpose service vessels (MPSVs), and specialized vessels for seismic operations, research, emergency responses and drilling are all examples of offshore ships. AHTSs are designed to tow oil rigs to their location and anchor them to the ocean floor. They have open sterns where the large anchors are kept and are fitted with winches for towing and anchor handling. PSVs transport supplies and return cargo between the oil rigs and land. The size and content of the vessels vary. During the study a PSV vessel belonging to the ship owning company Bourbon Offshore was visited, Figure 9.

*Figure 9.    Bourbon Topaz, designed by Ulstein design.*
*Photo: Bourbon*

Its size and structure can serve as an example of a typical physical end product of the maritime agglomeration. It was designed at Ulstein Design and was delivered by Ulstein Verft in 2005. At 86 meters in length and 19 meters in width, it was one of the bigger PSVs in Bourbon's fleet at the time of the study. Its layout is traditional, which means that cargo is loaded on a large after-deck, while the bridge, cabins and crew facilities are located in the five deck superstructure in the bow. It has the capacity to accommodate 25 persons in 13 single and 6 double cabins. In addition to crew cabins, Bourbon Topaz has one galley, one mess room, a day room, one conference room with internet communication facilities, one gym, one hospital room and one laundry room. The machine control room and chief engineer's office are situated on the port side of the deck. The bridge deck is located at the highest level of the ship's superstructure and offers a 360 degrees panorama of the surrounding ocean. This is the place from which most operations are controlled.

## 6.3   New Product Development and Innovation

The companies of the local maritime industry of Møre og Romsdal have gained national and international competitiveness through strong brands, punctuality and their ability to

produce high quality, innovative, functional and customized solutions (Hervik et al., 2007). There is strong rivalry among the core firms of the agglomeration which puts pressure on them to innovate (Isaksen, 2009). With the extension of oil search and extraction to less accessible areas deeper under the sea and in freezing geographical regions, the companies of the agglomeration have chosen to differentiate themselves from national and international competitors by focusing on advanced marine operations.

As in the early age of the industry agglomeration, the problem-oriented processes of planning, design and production of the end product is distributed between ship owners, ship yards, ship designers and suppliers (Hervik et al., 2007; Lillebrygfjeld Halse & Bjarnar, 2011). The open innovation policy that is adopted by many companies in the agglomeration was exemplified by the engineering design manager of a ship design company in the region:

> We do some concept development where we do not produce or manufacture the equipment ourselves. We bring our concepts to partners who develop them and subsequently make money out of them. The ideas and concepts behind the working deck of "Offshore supply vessel A" for example, were ours but are today marketed as "ship equipment supplier D" products. We own part of the intellectual property of the products, but we do not restrain them from selling the system to our competitors. On the contrary, we are proud of our contribution to that great product, and we want to be associated with it. We cannot deliver all the AHTSs that we would like to anyway, so if we can help our suppliers to grow in the meantime we will, and they need to be free to sell their products to anyone they want to. If we do not give them this freedom, they might not be there for us when we need them.
>
> [Design manager ship design company B]

The petrol industry is capital intensive, and the malfunction of a ship may cause enormous economic losses. Therefore the ship owning companies that invest substantial amounts of money in new ships have high expectations on their functionality and efficiency. They are usually involved in the design and planning of a new ship and are often the visionaries who push for innovative solutions. Their requirements, which are often a result of pressures from oil companies, new standards and regulations or new types of operations, are respected in the design process. The ultimate choice of ship equipment and ship hull is theirs. The call for any ship equipment made by a ship owning company, even if its producer is a competitor to the design company that delivers the ship, is also usually respected. The engineering design manager of a ship design company argued this is a major challenge to any producer who tries to design integrated systems of products:

> At the design stage there is often an intention to create a fully integrated ship, but then the customer asks for products from other manufacturers, and if these

> *manufacturers are not part of our supplier networks we will never be able to integrate them fully; we get a blue chair placed next to our own system. The customer has the final say.*
>
> *[Design manager at ship equipment supplier A]*

The open innovation approach that is embraced by many of the companies of the agglomeration contributes to flexible specialization within the industry, and thereby also to learning and innovation industry-wide. On the other hand, the distributed nature of product development is another challenge to companies that want to produce holistic and integrated systems. Some ship design companies have tried to overcome this by running future concept projects. This is a way to push and direct innovation from above in an industry where much of the design is determined at supplier level.

Others have tried to deal with this problem by internalizing large parts of the value chain. Although this has given them more control over the product development process, the challenges connected with the integration of ship equipment of various origins into a whole are only partly reduced. Although merged under the same roof, the cultural differences between the many actors that collaborate remain influential:

> *Ship designer company A is a good example, because they have bought a whole range of suppliers, and all those suppliers have a long history and good competence. But they are very different, and this makes it difficult to integrate their products into a whole. Controlling a total solution in such a situation may seem to be a hopeless endeavor. I can see it from the outside. Although they have performed huge development projects, such as the development of integrated bridges, which required a reassessment of a whole range of products, they still concentrate their time and efforts on technology or software.*
>
> *But I think they are starting to realize this is not the most appropriate way to do product development. Because if one focuses on a single product, that product is enhanced, but you are not sure it will work with the rest of the system. Instead, I think the focus should be on the development of a total solution that determines what needs to be done and how, and which includes the products produced also at a supplier level.*
>
> *[In-house industrial Designer at ship equipment supplier B]*

Any ship is more or less unique. This limits the possibilities for mass production. Rather, the design and production of offshore ships can be characterized as complex and craft-based. The design manager of a ship equipment design company argued the uniqueness of every product assembly calls for a pragmatic approach to product development:

> *Our business is characterized by a limited degree of standardization and re-use of systems, because the clients always ask for a new ship, a new product or a new functionality. We always need to make new solutions fit together, and what is sold today is probably very different from what will be sold in six months.*
>
> *[R&D manager, ship equipment supplier A]*

This pragmatic approach to product planning and design, together with the industry focus on advanced marine operations, requires experience-based and often tacit knowledge that the various actors in the industry access locally in their everyday interactions with users and suppliers. This knowledge is tightly conected to the local maritime culture and traditions and is not accessible to distant competitors (Benito, Berger, de la Forest, & Shum, 2003; Berge & Bjarnar, 2008). The engineering design manager of an equipment supplier described how his company accesses highly valuable knowledge about use by involving the end users of the products in new product development:

> *We maintain a close relationship with the end users and try to involve them in the product development. Sometimes we get phone calls from the chief officer of a ship, who upon using a winch has had ideas about how its functionality or usability could be enhanced. Relations are essential for our survival. At this moment we collaborate with an end user who works in shifts on a ship and who participates in a study of possible futures for our discipline and the industry.*
>
> *[Design manager, ship equipment supplier A]*

The regional learning effects are facilitated by the short relational and geographical distances offered by the region (Hervik et al., 2007; Isaksen, 2009). The story of the equipment supplier Odim exemplifies how a culturally grounded local actor has managed to access indispensible knowledge on use, markets and customer cultures, and to turn it into appreciated products.

Odim was started by Inge Dragsund. Inge managed to work across different fields. He collaborated with the clients at the clients' sites. He managed to establish a yearly forum on seismic operations in Ulsteinvik, attended by everyone who counted within that field, whether partners or competitors of Odim. He learnt so much about seismic operations that he eventually knew more about it than his customers. Further, he knew how to communicate this knowledge to the shop floor workers who transformed it into the products that his customers needed. You could say he spoke different languages. This culture is still present at Odim. During the last years they have gained an even more sophisticated knowledge about their clients' needs. They have managed to categorize their clients into groups according to how advanced operations they perform. If a "basic" client wants to buy an advanced system they will not get it from Odim, because Odim knows that they do not need it and that they will not be able to handle it. [Researcher, Høgskolen i Ålesund]

In addition to knowledge on users and markets that is found in the local value chain, companies in the agglomeration assimilate valuable knowledge from local and national research institutions, national and international maritime forums, and local and non-local professional consultants. The products and systems that are used on the ships operate in harsh conditions where they need to resist the stress of sea water and rapid changes in temperature and humidity. The need to satisfy the technical-functional requirements as well as those imposed by laws and standards has traditionally reduced the importance for more human centred innovations in the industry. When asked about important innovations that had been carried through in the industry during the last few years, interviewees mentioned innovations that are quantifiable in terms of reduced fuel consumption, increased performance of ships and equipment in demanding, deep and cold water operations, and reduced material and production costs.

These are easily made explicit in a contract that regulates the business transactions of an offshore ship between a ship design company and a ship owning company. However, at a later stage in the study (after three years) when a number of follow up interviews were performed, pressures from oil companies and ship owning companies were acknowledged to push forward a more human oriented product development related to safety and health at work for offshore crews. This was the result of a safe anchor handling seminar organized by a number of oil companies where the theme of deck safety was raised. Both engineers and designers that were interviewed agreed upon the conservative and path dependent nature of the maritime industry where both product development processes and product requirements are influenced by history and traditions:

> The design and launch of new ship equipment is a demanding process. Many of the laws and standards that determine its design are results of how things used to be. They constitute obstacles to anyone who wants to think outside the box. In many cases the laws and standards need to be rewritten before changes can be made. One could say that most solutions build on the long maritime history of Norway rather than on a controlled design and engineering process. The only way to break with the traditions is to research, design and prototype more.
>
> [In-house industrial Designer at ship equipment supplier B]

At the time of the interviews, the demand for offshore ships and equipment was higher than the material and labour capacity present in the region. Rather than supporting the research and development of new and better products and systems, a general tendency among a majority of the ship design companies was to assemble known and accessible equipment that was good enough to satisfy the ship owner and keep up the momentum.

> The lack of equipment slows down the whole market. Although we have a three year delivery time, we cannot always be sure to obtain the engines or thrusters

*that we want to use on a ship. In the case we have a great idea about a new solution for a ship, there is even more uncertainty whether we will be able to deliver it on time. This is why choices made regarding ship equipment are determined by what is accessible on the market. When we are working out a contract we do not ask ourselves if we have this or that bolt in our assortment, but if we developed that ship before.*

*[Design manager at ship design company A].*

## 6.4   Use and Traditions for Industrial Design

Despite the fact that most ships can be considered vast human-machine interfaces, the maritime industry in question has a limited tradition for industrial design; its customer values have mainly been connected to technology, functionality and quantifiable product performance as described by the engineering design manager of a ship equipment supplier:

*The functionality of our products needs to resist the stress of salt water, rapid changes in temperature and humidity. These are the requirements that are prioritized in product development. A hydraulic or electric engine that is to be placed on a winch on the stern of a ship will no doubt appear very big and full of steel. Design in this context is of secondary importance.*

*[Engineering design manager at ship equipment supplier A]*

In addition to rigorous technical and functional requirements, the traditional engineering focus and path dependent character of the industry is a challenge to the introduction of design:

*The industry is filled with traditions of how things should be done. In addition the end product is so complex that the integration of design into the process may appear overwhelmingly complicated. One could say that this industry is like any other with the exception of its traditions that literally permeate product development and determine the outcomes.*

*[Product developer at local product development and design agency A]*

There are relatively few and scattered examples of industrial design use in the Norwegian maritime industry in general and in the region of Møre og Romsdal in particular. The first ones occurred partly outside the agglomeration of Møre og Romsdal and concerned ship interior design. They were initiatives taken by an industrial designer who was employed at the ship design company Vik & Sandvik in Bergen.

Although employed in-house, he was given the freedom to work across the organizational boundaries and the value chain. One of the first projects undertaken by this industrial designer dealt with the development of modularized ship furniture in collaboration with the ship furniture producer Maritime Møbler located in Møre and Romsdal. The result was a series of ship furniture that could be produced with a 50% increase in efficiency and a reduction of product variants from 2000 to 160 (Figure 10). The product price could be reduced by 35% and orders more than doubled in a year (Norsk Designråd, 2007a). At about the same time ship design companies in the maritime industry of Sunnmøre tried to differentiate their ships from those of their competitors by creating "personal" and more visible and aesthetically appealing ship hulls and superstructures.



*Figure 10. The Alu Design Flexi Collection designed by Sveinung Åkra for Maritime Møbler. Photo: Maritime Møbler*

Until this moment the only conscious attempt to visually differentiate products of the industry had been made by ship owning companies who painted their ships in their corporate colours. Ulstein Design marked an end to this limited use of visual product differentiation when they introduced their fluid dynamic and highly visible innovation X-Bow on their ships. A ship designed with the X-Bow concept cleaves the waves instead of digging down into them (Figure 11). This innovation was neither the result of any industrial design

collaboration, nor of pressures from any ship owning company, but the fruit of an idea that was launched by an in-house ship architect.

However its visible character opened up discussions and consideration of aesthetics in relation to functionality in the industry. The merit of the naval architect who conceived the X-Bow was rewarded the "engineering achievement of the year" in 2005 by the readers of the Norwegian Technical Journal (Teknisk Ukeblad), and the first offshore ship that was built with the X-Bow was named "ship of the year" in 2006 by the Norwegian maritime magazine Skipsrevyn (The Shipping Review) and The Offshore Support Journal (Norsk Designråd, 2007b).



*Figure 11.   The x-bow ship hull of Bourbon Orca, designed by Ulstein Design.*
*Photo: Ulstein Group/Tony Hall*

Although it had the "functional alibi" of superior fluid dynamic and fuel performance in rough seas, the Ulstein X-Bow was initially not received as uniformly positive in the market.

> *It was difficult to carry through the X-Bow innovation. The industry is too*
> *conservative, and we had enormous problems with that. Many ship owning*
> *companies said that they would never use a ship like that, especially not in the*
> *Gulf of Mexico which is stone age. They said an appearance with an X-Bow type*

*of ship in the Gulf of Mexico would be laughed down.*

*[Haavard Stave, Design manager at Ulstein Design]*

Nevertheless, Ulstein Design was followed by Aker Yards Project (now VARD) who hired the in-house industrial designer of the cruise ship section of Aker Yards for a couple of workshops where they worked on a visual identity for their ships through design interventions on the ship hull and super structure (Figure 12).



*Figure 12.   Scandi Aukra, designed by VARD (formerly Aker Yards Project).
Photo: Harald M Valderhaug*

Other ship design companies have deliberately chosen to maintain a more traditional style as a way to signal something known, safe and functional to the conservative maritime industry. The initial scepticism towards the Ulstein X-Bow was, after some time, followed by positive recognition from communities far beyond the offshore industry. The Norwegian Design Council used the first anchor handler equipped with the X-Bow as a best practice case of industrial design in the maritime industry and argued that, "The innovative and creative ability that is behind the design of the anchor handling ship is conspicuous and gives both Ulstein and Norway a name on the map"(Norsk Designråd, 2007b).

In connection with the development of this ship, Ulstein hired a local external designer to work on the ship interior design. The same designer was later involved in several future concept projects where the aim was to understand how far offshore operations could be taken through innovative ship design. In addition, Ulstein Design continuously collaborates with students of Norwegian design schools in order to get new and innovative ideas that can be taken further by their in-house engineering design staff. Recent projects have focused on the ship bridge area where the human-machine interface and user experience of the captains have been addressed.

Rolls Royce Marine, which has internalized a great part of the technologies that are used on ships, has involved industrial designers in their creation of an integrated ship bridge design. In 2006 they commissioned Hareide Designmill, initially for the design of a joystick and an integrated operator's chair control system, and later for the design of the whole integrated ship bridge. Hareide Designmill is a renowned allround product design consultancy that is located in the Norwegian capital far from the actual maritime industry. The joystick was given an award for design excellence by the Norwegian Design Council in 2007, and the design group has since been commissioned by several actors in the national Norwegian maritime industry. In addition to Hareide Designmill, Rolls Royce has collaborated with two local engineering oriented design and product development consultancies. These have been commissioned in less prestigious product development projects.

In a recent and ongoing project that involves both the local Ålesund University College and the Oslo School of Architecture and Design, Ulstein Design has created a totally new and innovative ship bridge concept (Figure 13). The concept has been developed with the needs of the user at the center, where safety in advanced maritime operations are a priority. It involves both a re-conceptualization of the activities of the user and the introduction of new technologies that support them. Although the concept is still to be implemented in a commercial and tangible product, it breaks with what has previously been the state of the art of the ship industry (Oslo School of Architecture and Design, 2012; Ulstein, 2012).

*Figure 13.  The ULSTEIN BRIDGE VISION™. Design concept produced by Oslo School of Architecture in collaboration with Ulstein Design and Aalesund University College.*

*Image: The Oslo School of Architecture and design/Ulstein Group.*

Industrial designers have conquered a limited area among the ship equipment suppliers of the maritime agglomeration of Møre and Romsdal. One out of few examples is the design of a new range of starting air compressors for ships produced by Sperre Thermo and designed in collaboration with the engineering design consultancy Inventas located in Trondheim. Although the main focus of the project was to reduce material use and costs, the product range received an award for its design excellence from the Norwegian Design Council in 2009. In a close collaboration with the engineers of Sperre Thermo, the designers of Inventas managed to create a highly functional, visually compelling and easily recognizable product range (Figure 14).

The Offshore Simulator Centre (OSC), which sets up on land offshore crew training facilities and runs courses where offshore crews are trained in critical maritime operations in a risk free but realistic environment, was the only company in the maritime agglomeration of Møre og Romsdal which at the time of the study had employed a designer in-house. Through close collaboration with almost all other industry actors, including the end users and research institutions, this company has become an important knowledge broker and is in a position to promote a more design-centered approach to the rest of the industry:

*Figure 14.   One of the starting compressors of the Sperre Thermo's X-range that was designed*
*in collaboration with the design and product development agency Inventas.*
*Photo: Sperre Thermo*

> *We are in contact with many skilled ship captains. They are able to see quickly*
> *what may work and what will not. When we train people from ship owning com-*
> *panies in our simulators, they see how things may be done differently, and bring*
> *these ideas as requests to ship design companies when new ships are ordered.*
> *Because the request comes from a client it is less likely to be considered an un-*
> *necessary development cost, and ship owning company A is definitely willing to*
> *pay a little more for a better and safer design.*
>
> *[In-house industrial Designer at OSC]*

In addition to the examples presented above, interviews revealed that there is a great deal of silent design going on in the maritime agglomeration of Møre and Romsdal, particularly in ship design companies where many design decisions and considerations are made by ship architects and engineers. One of the designers who currently works for companies in the industry exemplified how solutions are conceived by many silent designers in the industry:

> *The setup of controls and panels in the bridge area is made by electricians and*
> *engineers, not by designers. Their decisions are based upon considerations such*

*as where it is easiest to pass cables. They are technocratic and do not give any*
*good solutions from a design point of view. An engineer or a technician would*
*say that the usual set up is to place one DP chair (dynamic positioning) next to*
*another because of a DNV (Det Norske Veritas) standard, or that a window needs*
*to have this or that angle. These are uses that derive from technology, rules and*
*traditions, but that are not considered from a design point of view.*

*[Designer]*

There was a great variety in perceptions of the designer as a professional among the
engineers of the maritime industry that were represented in the interviews. Industry actors
who were interviewed generally expressed recognition of the potential of industrial design
for the products produced in the agglomeration. One ship engineering design manager
discussed ideas about future applications for industrial design:

*Until now we have been concentrated on the exterior design of the ship hull.*
*When boarding a ship you realize that there is a great potential for design. We*
*are conscious about the need for design competence in bridge design, and for*
*the ship interiors. There are so many things that we could do regarding logistics,*
*materials and form. A ship is like a 7,000 square meter hotel and working space*
*that needs to be arranged and furnished.*

*[Design manager at ship design company C]*

The competences that were classified by some interview subjects as inherent to industrial
design and necessary for design practice in the industry differed considerably from the
competences that are typically developed at design schools. In addition, some engineering
design managers had very high expectations of industrial designers to have technological
and engineering related knowledge:

*The designer or product developer should not only be an expert in ergonomics*
*and aesthetic design, but should also understand the mechanics and strength*
*of materials. By smart design decisions, he or she should be able to make a*
*construction smaller, lighter and more user friendly with retained strength,*
*resistance, economy and use possibilities. A designer should be able to make a*
*product more compact by integrating functions that are currently separated in*
*different products.*

*[Engineering design manager at ship equipment supplier A]*

Others appreciated conventional designer skills as a competence which adds to the exist-
ing knowledge of the industry. An example is the engineering design manager at ship
design company B, who understands the most important function of external industrial
designers as helping the in-house staff to think different:

*We hire industrial design consultants to question, to indicate, and to energize our own engineers. They help us to get into an innovation spirit. A designer asks whether it is possible to do this or that, and then our own engineers, who are very competent, push their limits and carry things through themselves. Designers challenge us to think different, because thinking different is not the core competence of ship architects.*

*[Design manager at ship design company B]*

The character of innovation and design activities within the maritime industry in and around Ålesund can be illustrated by its position on the knowledge base, innovation, use, and design model , figure 15. Although a few organizations have used design as a means for differentiation, most designer involvements that have occurred within the industry have been focused on ergonomics and can be considered manifestations of design as performed within a "human centered design paradigm". The knowledge base upon which the industry rests can be characterized as primarily synthetic, innovation activities are mostly technological and focused on efficiency and reliability.

| Synthetic | ← | MARITIME | KNOWLEDGE BASE | → | Symbolic |
| Technologies/Performance | ← | | FOCUS OF INNOVATION | → | Meanings |
| Instrumental | ← | | USE VALUE | → | Symbolic |
| Human centered | ← | | DESIGN FOCUS | → | Meaning centered |
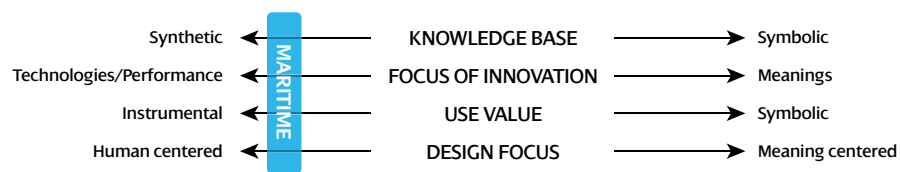
Figure 15.   *The primary knowledge base upon which the maritime industry in and around Aalesund rests, its focus for innovation activities, the main use value of its products, and the focus of design interventions in the industry.*

This section showed how the limited number of recent design efforts that makes up the design history of the maritime industry have been made with various and random design management  approaches. The following sections outline and describe the organization of design and the competences of the designers that contribute to the industry.

## 6.5 Competence and Professional Profiles of Design

At the time of the interviews, only one local company had industrial design competence in-house. The rest of the design interventions in the maritime agglomeration of Møre og Romsdal were performed by external design consultants. Based on their competence, the design professionals can be divided according to their generalist or specialist practices performed at different places into in-house designers, local ace designers, and global all-round designers. Generalist design practices take place across different industries and product domains and specialist practices are performed by designers who work exclusively within the maritime industry (Table 8). The different groups of design professionals each have distinct design expertise, and accordingly they emphasize different aspects of design in their practice.

Table 8.    *Professional profiles and expertise of designers who contribute to the maritime agglomeration in and around Ålesund.*

| | Specialist practice ← | → Generalist practice | |
|---|---|---|---|
| **Professional profile** | In-house designer | Local ace | Global all-rounder |
| **Primary place of practice** | The Maritime agglomeration in Møre og Romsdal | The maritime agglomeration in Møre og Romsdal | Global design discourse |
| **Primary product domain** | Maritime products | Predominantly maritime products | Any product |
| **Type of design expertise** | General ubiquitous Specific and sticky | General ubiquitous Specific and sticky | General ubiquitous |

In-house designers and local aces are considered specialists since their design practice is performed almost exclusively on the products that are produced within the local maritime industry. The design expertise of global all-rounders is more general and applicable to any type of product. The various forms of design knowledge that were mentioned by industry actors in the interviews can be categorized into industry specific/sticky design knowledge and general ubiquitous design knowledge. Industry specific sticky design knowledge is inherent to the industry. It is embedded in the local design context which means it can only be gained through local practice. This type of knowledge is therefore predominantly held by in-house designers and local aces.

The choices of design partners that are made by maritime companies are more or less deliberate. Often they are connected to access and competence. The engineering design

manager at a ship equipment supplier explained the reasoning behind their decisions to collaborate with a local design and product development consultant and a non-local design and product development consultant respectively:

> "Local product development and design agency A" was our first design and product development partner. At that time we were very busy and did not even think about integrating industrial design into our product development, but parts of the design industry had identified the maritime industry as a potential market for design services. Agency A was actively trying to establish relations with businesses in our industry. We chose to accept their invitation because of their local geographical ties. Their office is located in Ålesund which is an important center for technology development in the maritime industry. The location of "Local product development and design agency A", close to our own offices supported an efficient collaboration.

> The decision to collaborate with the "Non-local product development and design agency B" located in Trondheim was based on considerations of their ability to contribute with general product development expertise. Further they had a greater work capacity than Agency A, whose intentions were to remain a small but specialized consultancy. Agency B works broader as they wish to be a partner in the design process rather than an industry specific expert.

> [Engineering design manager at ship equipment supplier A]

## 6.6  Local Aces and In-house Designers

At the time of the study there was not yet any significan market for design services within the maritime industry in and around Ålesund. The in-house designer of a local company, who previously worked as a local ace was a rich source of information on the design activities performed by himself and others in the maritime industry. In the beginning of his career in the maritime industry, he lacked any sticky design knowledge inherent to the local maritime industry and focused on aspects of design that he knew from his previous employment at an interior design consultancy:

> In the beginning I focused on what the maritime agglomeration did not have. I studied how people move within a ship, and how this could be considered from a safety perspective in the case of an accident. I thought of things I learned from the interior design industry, really simple things that had not been considered previously in the maritime agglomeration.

> [In-house industrial designer at ship equipment supplier B]

With time he gained more and more sticky design knowledge. This was gained by on site observation of offshore life and operations and through close collaborations with actors across the industry including ship design companies, ship equipment suppliers, academic research institutions and experienced offshore crew in connection with his design work at the ship equipment supplier B. He discussed advantages and drawbacks of having such expertise:

> Over time you build yourself a picture of the industry and its products. My picture is currently only close to complete. It is important to have this picture, but it is equally important that it is balanced, because if it becomes totally clear you will lose your ability to think out of the box. This balance is not easy to maintain.
>
> [In-house industrial designer at ship equipment supplier B]

The same designer explained how he tries to remain open to new ideas by learning from outsiders through self-organized meetings and tutorials with experts from other industries:

> I have learned a lot from outsiders. I invited a British expert in cognitive ergonomics who has a lot of experience from car and train design. Cars, trains and ships have a lot in common from a design perspective. Learning from other industries is an easy way to go from where we are today into the future.
>
> [In-house industrial designer at ship equipment supplier B]

The discourse of a design consultant who has worked for different and competing producers in the industry revealed an important aspect of sticky design knowledge that at least to some degree distinguishes in-house designers from industry expert design consultants. Through their practice for multiple and sometimes competing companies within the industry, the industry expert design consultants become experts in the differences between competing companies. As exemplified by the statement below, these differences may regard target markets, end users and corporate philosophies that all need to be considered in product design:

> We have collaborated with competing companies. We make this work by really focusing on each of their specific philosophies and profiles in our design activities. Ship equipment supplier E and ship equipment supplier A, for example, have totally different philosophies regarding how a ship should be handled. Where ship equipment supplier A has integrated all the commands into a chair, ship equipment supplier E has placed them on consoles. It depends on their target markets, and we try to create an expression of each of their DNA.
>
> [Industrial design manager at non-local design agency A]

## 6.7   Global All-rounders

Examples given in the previous sections show that in some cases, non-local consultant designers have been successful in the maritime agglomeration of Møre og Romsdal. The global all-rounder who designed the integrated bridge for Rolls Royce Marine believed he was contracted because of his long experience as a design manager in the car industry:

> They probably wanted to get access to the knowledge I had gained in the car industry. I am sure the maritime industry could learn a lot from the car industry when it comes to work environment and safety.
>
> [Industrial design manager at non-local design agency A]

His focus on the contribution of design knowledge connected to projects performed in specific industries rather than general design knowledge or a process or working methodology knowledge did not entirely mesh with the experiences of his maritime clients. As illustrated in the following statement made by the engineering design manager of a ship equipment supplier, the positive experiences of generalist design consultants are rather connected to their general transferrable design knowledge of ergonomics and aesthetics and to the designer's approach to product development processes:

> It was an extensive and prestigious project. They contributed with knowledge on form, color and aesthetics as well as with ergonomic interventions on the whole bridge. But maybe their most important contribution consisted of their way of thinking, their work methodology and approach to a design problem.
>
> [Engineering design manager at ship equipment supplier A]

The designer that was used in this project did not have any industry specific knowledge of the product and use operations. Therefore most of the analysis was made by the ship equipment supplier who specified their specific needs to the designer. The involvement of the design consultancy was thereby limited to a few stages of the product development process, as described by the design manager at the design consultancy:

> They made almost all analysis of use and needs in-house and discussed the results with us. Based upon their analysis we designed ergonomic and aesthetic solutions that we visualized. We created the foundations for their following prototyping process.
>
> [Industrial design manager at non local design agency A]

As an outsider this designer did not have any industry specific user knowledge nor local relational assets that are held by local designers which gives them access to the geographically and culturally intertwined user knowledge present in the agglomeration. He acknowledged his limited access to the end users of the industry but downplayed the importance of user involvement in product design:

*Compared to other industries, it was more difficult to get in contact with the end user. But as long as the client company understands the importance of design it is possible to regard user needs. Sometimes the client lacks knowledge of what is best for the user anyway. Our task as designers is to show the client how things can be made better. I think few innovations are the result of the needs, whishes or requirements of the customer.*

*[Industrial design manager at non local design agency A]*

## 6.8  The Design Knowledge of the Region

There was a general agreement among industry actors that in order to be efficient in the maritime industry, a designer needs some industry specific knowledge. This was exemplified in the following statement made by the engineering design manager of a ship equipment supplier:

*We get many inquiries from design consultancies who want to collaborate with us. They are very competent in their own field, but coming from the sideline they lack any knowledge about our products. A time consuming learning process is needed before they are able to contribute. Therefore I think a good starting point is that any designer who may want to offer design services to our company has a basic understanding of the maritime industry and its challenges.*

*[Engineering design manager at ship equipment supplier C]*

The engineering design manager of another ship equipment supplier stressed the importance of a designer's ability to grasp industry specific knowledge quickly.

*The designers with whom we have collaborated successfully have had a great ability to acquaint themselves with both the task and the specific conditions and challenges of the industry. This ability is not held by any random design firm, but it is essential for any designer who wants to work in this industry.*

*[Engineering Design manager ship equipment supplier A]*

Also members of the design community with practice experience from the maritime industry did mention that they had experienced a need for industry specific knowledge in projects performed in the industry:

*In relation to other industries, this one requires more competence on its specific market. As an industrial designer you need to know about the industry and its products before you're allowed to make the slightest utterance.*

*[In-house industrial designer at ship design company D]*

The existence of "Design and communications consultancy A", which serves the maritime industry exclusively, is a manifestation of the quest for industry specific design knowledge in the maritime industry. It was founded by three ship architects, who were not able to find any design and communication consultancies that could understand their needs. Because of the lack of industry specific knowledge among existing consultancies, none of them were able to understand what the ship architects were asking for. The ship architects had to start up the design and communication consultancy that they were looking for themselves. An industrial designer employed at the agency underlined the importance of industry specific design knowledge in order to gain the trust of industry actors and interact with them successfully:

> We have an understanding of the real needs of the customer. The deep under-
> standing of industry specific issues held by our leaders reassures our clients that
> they will get what they really need; this is the key to our success.
>
> [Industrial designer at design and communications consultancy A]

Industry specific sticky design knowledge that was mentioned in the interviews regards the product and its history, technology, function and aesthetics; the user and client cultures; the use activities and situations; the structure of the product and the industry, its culture and working practices; and the rules and norms that regulate it. The latter was exemplified in a clear way by the engineering design manager at ship design company C, who collaborated with the in-house designer of the cruise ship section of the business group:

> He is a boat man. He has worked with boats since he graduated from design
> school. He knows how to handle situations where we say that something is not
> feasible. He is used to hearing that, and knows that he needs to have a counter-
> argument ready before making any proposal, or else nothing.
>
> [Engineering design manager ship design company C]

The previous example illustrates the importance of industry specific design knowledge related to both the product and the product development culture of the industry. The latter is connected to the work practices of the companies and the organizational structure of the industry. In order to work efficiently designers therefore need to understand the organizational structure of the industry, which in this case mirrors the morphological complexity of its end product. Only when such knowledge is present can a designer contribute on system spanning levels. The in-house designer of ship design company D argued that this type of knowledge is tightly connected to the industry and its location:

> As an industrial designer in this industry I need to establish relations with
> the people who have access to users and know about their needs. This core
> knowledge is not easily accessible, and I would never have been able to grasp it

> *without physically being here. You need to get it from the infinity of ship equip-*
> *ment suppliers whose products are part of each ship. If you do not, you can't*
> *really do a good job as a designer.*
>
> *[In-house designer at ship design company D]*

Although there was agreement among industry actors that designers need industry specific design knowledge, some expressed an appreciation of general design knowledge contributions. The generalist design consultants who work in multiple industries have limited industry specific design knowledge. Rather, their core contributions rely on general design knowledge which is learned both during design education and through practice and that can be transferred across industries. The contributions made by generalist design consultants that were mentioned throughout the interviews build on knowledge of ergonomics and usability as well as ways of thinking and working approaches. This is exemplified by the following statement made by the engineering design managers of a ship equipment supplier:

> *Maybe the most important contribution made by designers with whom we have*
> *collaborated consists of their way of thinking, their work methodology and ap-*
> *proach to a design problem.*
>
> *[Engineering design manager at ship equipment supplier A]*

A design consultant gave the example of how the knowledge of alternative materials and production processes that he had gained in design projects performed in other industries could be converted into an asset in product development and innovation in the conservative maritime industry:

> *My experience is that they (the engineering designers of the maritime industry)*
> *have a limited acquaintance with alternative production methods. The potential*
> *for plastic materials for example, is not well known and therefore rarely consid-*
> *ered an alternative to metals. The engineers know a great deal about welding,*
> *shaping and coating of metal sheets, but their knowledge of alternatives is*
> *restricted. I think this is limiting because it confines their view of what is possible*
> *to do and consequently their approaches in new product development.*
>
> *[In-house designer at ship design company B]*

The specific, sticky and the general, ubiquitous knowledge that is used by various design professionals in the regional agglomeration of maritime producers located in and around Ålesund is summarized in table 9.

*Table 9.*   *The specific sticky and the general ubiquitous design knowledge of designers who contribute to the maritime agglomeration in and around Ålesund.*

| | **Specialist practice** ◄───────────────► **Generalist practice** | | |
|---|---|---|---|
| | In-house designer | Local ace | Global all-rounder |
| **General ubiquitous design knowledge of** | Materials, ergonomics, design methods, cognitive ergonomics, aesthetics, designerly approach | | |
| | Applied to the products of the agglomeration | | As have been applied to different product types |
| **Specific sticky design knowledge of:** | Products and new product development practices, use conditions, local markets, use operations, products and industry history, the real needs and issues of the specific industry, rules and regulations | | |
| | Corporate design strategy<br><br>Corporate brand design | Differences between the strategic orientation of various companies within the industry<br><br>Differences between brands | |

7

# Industrial design in the Norwegian Agglomeration of Furniture Manufacturers of Sunnmøre

## 7.1   The Origins of the Agglomeration

The regional agglomeration of furniture producers and related industries of the Norwegian west coast county of Møre og Romsdal is mainly concentrated in the region of Sunnmøre and the municipality of Sykkylven.

The traditional economy of the region was based on seasonal small scale farming combined with fishing and hunting (Høydal, 1990, pp. 11–12). Only a small part of the population that did not own any land made their living as artisans. They did tailoring, shoe repairs, smith working and carpentry. Until the middle of the 19th century these artisans were the underdogs of society, but with industrialization and growth of Ålesund, there were more money circulating and people could afford to pay for their services (Høydal, 1990, pp. 16–17). In contrast to the maritime industry in the same region, the furniture industry is located far away from its main markets, users and raw materials. According to Høydal, it was a neighbouring effect that, despite long distances to raw materials and end users, stimulated the establishment of a large number of furniture factories in Sykkylven. Entrepreneurs who were successful inspired others to invest and try their own fortune (Høydal, 1990, p. 59).

The first known furniture maker of Sykkylven was Hans Bendik Nakken Straumsheim (1824), who made Windsor style chairs from local wood. The first local carpentry specialized in furniture such as beds, cabinets, chests of drawers, chairs, benches and tables for the local market, and was founded in 1871 by Ole Erstad. In 1907 the Norwegian organization Norsk Husflids Venner (Friends of Norwegian Home Crafts) organized a basketwork course in Stranda in the municipality of Sykkylven. After the First World War, one of the course attendees, Peder I. Langlo, started to produce wicker furniture for commercial purposes, and at the end of the decade three additional wicker furniture factories had been established in Sykkylven. Figure 16 shows a wicker chair that was designed and produced by Riksheim Kurbmøbelfabrikk. These factories were started by previous employees of Langlo, and they trained employees who would later start their own furniture factories (Høydal, 1991, pp. 81-82). Langlo was inspired by the US Ford car factory and assigned a small step in the manufacture of wicker chairs to each worker. This resulted in a specialized workforce, higher quality and more efficient production (Høydal, 1990, p. 44).

*Figure 16.   A typical example of the wicker chairs that were produced in Sykkylven in the 20s.
             This model was designed and produced by Riksheim Kurbmøbelfabrikk.
             Photo: Centre for Norwegian furniture history*

The hard working labor force in Sykkylven combined work in the factories and farming, and could therefore afford low and irregular payments (Høydal, 1991, p. 88). Until the 1930s, anyone who wished to be employed by a Sykkylven factory had to invest a substantial amount of money in "a share" of the company. This made the employees interested in the success of the company and motivated them to work hard and never complain about overtime or salaries (Høydal, 1990, p. 45). The low and flexible labor costs and the rational production in Sykkylven made the local furniture producers competitive on price compared to their national counterparts who hired trained craftsmen who demanded higher salaries, interesting work tasks and labor rights (Høydal, 1991, p. 84).

Between the First and the Second World War, the gross national product increased by 20%. Many new houses were built and the furniture industry in Sykkylven offered a cheap alternative to furniture produced elsewhere. The wicker chairs that dominated production offered comfort at a lower price than traditional Windsor furniture. Shortly after the introduction of upholstered wicker chairs to the market in the 1930s, wicker chair production was abandoned in favor for upholstered wooden armchair production (Høydal, 1990, p.

57). Between 1920 and 1939 the number of people employed by the industries in the area increased from 11 to 400 and the number of furniture businesses increased to 144. In 1951 half of the national furniture labor force worked in Sykkylven (Høydal, 1990, pp. 43–44). During the Second World War, many large factories had trouble getting the raw material they needed. Production was reduced and workers were dismissed. Since raw material was easier to come by in smaller quantities, many of the workers that had been laid off started up limited scale furniture manufacture or parts production in their own basements (Høydal, 1990). There is a saying that every second basement in Sykkylven at that time hosted a furniture factory. Generally, the small factories did not invest in any product development but their success lay in their ability to copy popular furniture quickly and bring it to market. The basement factories that were either specialized in tapestry or carpentry were very important for the specialization and growth of the local furniture industry, but in the 1950s, when international competition made the survival of small scale commercial activities difficult, most of them were either closed or were absorbed by larger furniture factories.

Around 1960 Norway reduced its regulations and import taxes on foreign goods in accordance with international trade agreements. The Norwegian furniture industry now had to face the challenges posed by foreign competitors in the domestic market, but could also expand their own horizons beyond the national borders (Hodne 1981 as cited in Wildhagen, 1991, pp. 41–42). The furniture industry in Sykkylven went through a transformation from labor intensive production towards more economic and industrial production, where the economy and rules of mass production determined what was produced and what was not (Sejerstad, 1982 as cited in Wildhagen, 1991, p. 40). The industrialized production, which involved the use and production of new materials such as foam for upholstery, synthetic fabrics and laminates, required substantial investments. The most successful entrepreneurs were those who managed to adapt to the new conditions by investing in equipment and training for their workers (Høydal, 1991, pp. 94–96). The substantial investments in industrial production equipment and the increased competition from foreign furniture producers pushed some furniture manufacturers in Sykkylven towards the use of designers as a means to secure product quality and increase demand and income (Wildhagen, 1991, pp. 42–43). Maintaining an efficient industrial production has remained a priority for many furniture producers in Møre og Romsdal, which is why a great part of their total investments is dedicated to production equipment (Oterhals & Johannessen, 2009).

The distinct industrial culture that characterizes the furniture industry of Møre of Romstal is a result of its history and stretches beyond the corporate cultures of each of its companies. It has contributed to a strong identity and a community spirit that is shared by anyone who is involved in local design and production. This supports further development among its companies as well as the establishment of new enterprises (Oterhals & Johannessen, 2009).

## 7.2   Product and Industry Structure

Sykkylven has maintained its position as a national center for furniture design and production. In 2007 there were 83 furniture related enterprises with a total of 3,618 employees in north western Norway, a majority of them located in the municipality of Sykkylven in the region of Møre og Romsdal (Oterhals & Johannessen, 2009, p. 6). Examples of products that are designed and produced in Sykkylven are sofas, arm chairs (easy chairs), dining-room suits, bedroom furniture, furniture for children and office furniture (Langlo, 1991). In addition, the area hosts producers of wood and laminates, plastics and molded foam, seizers, metal works, leather and textiles, sewing machines, and expert consultants in furniture, graphical and product design (Høydal, nd. a; Oterhals & Johannessen, 2009).

There is one major and a small number of large furniture producers that account for a considerable part of the total turnover of the industry. The industry can thus be characterized as a hub-and-spoke industry as defined by Markusen (1996). In a study of the regional furniture industry in north western Norway, five furniture producers together, out of a sample of forty seven, accounted for more than 70% of the total turnover of the industry, and the share of the largest was 43% (Oterhals & Johannessen, 2009). These numbers indicate that the majority of the companies that belong to the furniture industry in and around Sykkylven are small and medium sized. Some of the major furniture producers have internalized many of the functions that were traditionally performed by suppliers and now sell semi-manufactured products to their competitors.

The greatest challenge experienced by both the furniture producers and their local suppliers is connected to price levels. They are not able to compete in international markets based solely on product price. In order to reduce the cost of production many furniture producers have moved their production to low cost destinations. This has caused a reduction in the number of local sub-suppliers. While the furniture producers attribute little importance to "an efficient local supplier network" for their success, the remaining local suppliers rank short distance to customers as a major factor behind their own fortune (Oterhals & Johannessen, 2009).

Despite the limited importance ascribed to local suppliers by furniture producers, the interviews indicated that there are some medium sized and small furniture producers that depend on access to local specialized suppliers in both product development and production. This was exemplified in the following statement made by the product manager and owner of a local furniture producer:

> *The design and production of a sofa requires a broad range of specialists in the production of steel mechanics, foam plastics, woodwork and frames, and pillows. The local agglomeration gives us direct access to all this expertise. Few*

> *places offer such a density of different furniture related experts. You will always*
> *find someone who can help you solve a problem on the spot.*
>
> [Product manager, owner and CEO at furniture manufacturing company A]

The product development manager of another medium sized furniture producer mentioned that his company is willing to pay the higher price of components from local suppliers as they offer more flexibility than bigger suppliers located abroad:

> *Compared to global suppliers located far from our facilities, local suppliers give*
> *us many benefits. We are willing to pay a little bit more for a component if it*
> *is delivered by a local supplier. There are considerations of price and logistics*
> *behind any decision of where to buy parts. Local suppliers offer more flexibility,*
> *are available for smaller series, and on shorter notice than global ones.*
>
> [Manager of product development at furniture manufacturing company B]

In 1994, the municipality of Sykkylven together with the Norwegian Trade Union of Wood Industries (Norsk treindustriarbeiderforbund) and the Federation of Norwegian Industries (Norsk industri) recognized the central position of Sykkylven for the Norwegian furniture industry and established the Centre for Norwegian Furniture History (Norsk Møbelfaglig Senter) in Sykkylven. The initial aim of the center was to facilitate the development and growth of the industry by challenging and inspiring the local companies in different domains. One of these domains was design and product development which was targeted in various seminars and meetings. But with time, the interest in the arrangements among the local companies declined and the focus of the center transformed into documentation of what goes on in the local industry (Høydal, E., Personal communication, November 2010).

There have been other local industry-spanning initiatives with varying success in Sykkylven. During the 1950s and 1960s such initiatives were considered a means for smaller companies to obtain scale advantages (Høydal, 1990, pp. 98–99). The most successful initiative was Westnofa, an export and logistics organization shared between five furniture producers (Høydal, 1990, p. 100). Møregruppen was a local branch of the Association of Norwegian Furniture Industry. Its most active period was during the 1960s and 1970s when it gathered the local furniture producers in shared initiatives on the development of new technologies and courses on how these technologies could be used. The group was involved in the introduction of computerized production systems into the region. At that time no single company would have had enough resources to invest in such systems, but the shared efforts of Møregruppen made them available to the member organizations (Høydal, E., Personal conversation, November 24, 2011). Shorter-lived initiatives have dealt with shared buying of raw materials and production technology, and shared prototyping workshops (Høydal, 1990, pp. 122–123). In their recent study of the agglomeration of furniture producers in the area, Oterhals and Johannessen found a limited amount of

inter-organizational interactions that could support the competitive strength and growth of the industry as a whole (Oterhals & Johannessen, 2009). This study however shows a few exceptions to this among the local designers of the industry. In addition to informal meetings between local designers a few times a year, there are examples of local freelance designers who are competitors but who collaborate on single projects, share office space and workshop facilities, as well as workshop resources.

Today most local furniture producers have their own distinct targets. The globalization of the furniture market has widened their horizons, and they consider sets of international furniture producers rather than local neighbors their main competitors. But the rivalry between neighbors that was once a driving force for the development of the industry in Sykkylven can still be found in the mentality and practices of many furniture producers.

## 7.3   Use and Traditions for Industrial Design

Shortly after the Second World War, when the rationing of customer goods was removed in Norway, there was a high demand for the furniture that was produced in the region of Sunnmøre. The development of new pieces of furniture was performed by skilled carpenters and upholsterers whose designs were copies or modifications of well known models that already existed in the market. The focus of the furniture producers in Sykkylven was to produce affordable alternatives. This focus limited the need for professional designers, and the furniture producers were not aware of the possible contributions and benefits that could be obtained from using a designer. In addition, many of the local furniture producers thought it risky to hire a designer who did not have the necessary knowledge or motivation to design for their broad target market and rational production processes. Instead the furniture was often designed by the company owners. Educated furniture designers were confined to the big city regions where they linked with cabinet-makers, carpenters and upholsterers to create beautiful furniture that could not be produced in an industrialized manner (Wildhagen, 1991, pp. 22–24).

The Oslo School of Arts and Crafts started its activities in 1936. Before that, anyone with design aspirations had to go abroad to get a design education. Among the early graduates from the Oslo School of Arts and Crafts were the Relling brothers, who were to make several significant design contributions to the furniture industry in Sykkylven (Høydal, 1990, p. 58). During the 1950s, Ingmar Relling both introduced and developed design practice in the agglomeration of furniture producers in Sykkylven. By way of family connections, Relling was given part time employment as a designer at the furniture manufacturer Vestlandske Møbelfabrikker where he learned the "craft" of industrialized production. He gained a deep knowledge of the production machinery and the competence that was available in the

region and translated the handicraft ideals of form held by his contemporaries in Scandinavia into the industrialized reality of Sykkylven. Figure 17 shows the arm chair "Senior" which was launched in 1957 by Vestlandske Møbelfabrikk. This is an example of how Relling, by knowing how to use of a milling machine and with a minimal amount of manual labor, managed to obtain the organic shapes and soft joints that were the ideal of that time. Relling preferred to design products that could satisfy both the needs of the users and the needs of the many people involved in their production, rather than products aimed at self promotion (Wildhagen, 1991, p. 40). The Nordic armchair which he designed in 1954 is an early example of how the needs of both users and manufacturers were combined by the designer (Figure 18). It was easy to manufacture and transport, and flexible because it could be flattened (Relling, K. Personal conversation, May 23, 2013).



*Figure 17.    The arm chair "Senior", designed by Ingemar Relling in 1957, and produced by Vestlandske Møbelfabrikk.*

*Figure 18.    The Nordic armchair designed by Ingemar Relling in 1954 for Vestlandske Møbelfabrikk .*

After a few years at Vestlandske Møbelfabrikker, Relling choose the freedom to work for many of the furniture manufacturers located in Sykkylven and gave up his employment in favor for a local freelance career (Wildhagen, 1991, p. 21). The many small manufacturers of the area who were just starting to realize the potential of design but who preferred not to have designers in-house provided a good market for Relling's services. In addition to Vestlandske Møbelfabrikker, Stokke industrier was another furniture producer who early engaged designers. Already in 1952, they initiated an alliance with the furniture designer Arnt Lande, who was employed on a full time basis from 1954 (Høydal, E., Personal conversation, November 24, 2011).

With the introduction of modern industrial production equipment in the 1960s came a demand for a systems approach to furniture design and production. One example designed by Relling for J.P. Ekornes Fabrikker was the Combina series, which consisted of standardized modules that could be combined according to the needs of the users (Figure 19).



*Figure 19. A sofa from the Combina series designed by Ingmar Relling in 1960.
Photo: Relling*

This marked a beginning of a more rational, functionalistic and production friendly approach to furniture design that Relling retained and evolved during the rest of his career. His major contribution to the local furniture industry can be considered the "Siesta" chair which he designed as a personal project for a design competition in 1965 (Figure 20).

The basic philosophy of the "Siesta" chair was flexibility and springiness. Ever since, flexibility and movement have remained overarching industry philosophies that have been adopted by many of the successful furniture producers of the region.

*Figure 20.   The "Siesta chair" designed by Ingmar Relling in 1960 for a furniture design competition in 1965. Produced by Vestlandske Møbelfabrikk in 1966.*

The success of the "Siesta" chair was an eye opener for many of the local furniture producers of Sunnmøre, who started to recognize the potential of design, and to designers who started to consider Sykkylven a potential market for their services. In 1967 Peter Opsvik started to collaborate with the furniture manufacturer Stokke (Opsvik, n.d.).

The first successful outcome of that collaboration was the Tripp Trapp chair in 1972, which offered a flexible solution to how to bring children to the level of adults at the dining table (Figure 21). The chair is one of the iconic pieces of the region and is still used by families wordwide. Opsvik and his team also developed the influential Balans concept which consists of a series of furniture produced by Stokke, Håg, Rybo, and Sandella Fabrikker. The concept contributed with new perspectives to furniture design based on sitting as an activity. The first chair that was launched in the series was Variable Balans (Figure 22), produced by Stokke Fabrikker (currently produced by Varièr) (Gaardner, 2000).



Figure 21.  The Tripp Trapp® chair, designed by Peter Opsvik for Stokke in 1972. Photo: Stokke

Figure 22.  Variable Balans designed by Peter Opsvik for Stokke in 1979. It is currently produced by Varier Furniture, Copyright Variér®.

In 1970 three young designers (Svein Lerdal, Svein Asbjørnsen, and Jan Lade) established the Møre Designteam (Høydal, 1990, p. 124) that was to design a range of innovative furniture primarily for companies in Sykkylven. While Relling had represented a functional and production oriented approach to design, Møre Designteam developed innovations in both the symbolic and functional domain. One good example is the split concept. The furniture collection "Split" won an important Nordic furniture design competition in 1979, and the first products of the collection, as shown in Figure 23, were produced by HÅG

in 1980 (Ingjerd Asbjørnsen, Personal conversation, June 27, 2013). The collection has in recent years been developed by SAP design in projects aimed at the airline industry, and in office furniture. Another product designed by the trio in collaboration with J.E. Ekornes Fabrikker is the Stressless® chair which has contributed significantly to the success of Ekornes as well as the whole industry (Figure 24). In contrast to ordinary wing chairs, it incorporates technical and mechanical solutions that support natural body movement and rest (Gaardner, 2000).



*Figure 23.   The Split® concept developed by Svein Lerdal, Svein Asbjørnsen and Jan Lade in 1979, produced by HÅG.*

*Figure 24.   Stressless® Original designed by Svein Lerdal, Svein Asbjørnsen and Jan Lade for Ekornes in 1971.*

*In the 1980s many of the furniture producers in Sykkylven broke with their strictly functional and production focused approach to furniture design. The designers were given more freedom to experiment with form. Aesthetics were now considered an effective means of differentiation. Even Ekornes, which had made its fortune from the rational production of furniture with a broad appeal, had six designers working on a product range of furniture that would appeal to young and design focused users. The influence of experimental aesthetics was short-lived and with the economical recession in the beginning of the 1990s most furniture producers in Sykkylven returned to their rational and functionalist roots and focused their efforts on a reduced number of models with a broad appeal.*

*(Høydal, n.d., b)*

Since the introduction of professional designers to the furniture producers in and around Sykkylven in connection with the internationalization of the industry, design has had an important role in the success of the industry. Design competence was necessary in the reorientation of many companies towards foreign markets, and is still central in the companies that succeed on the international furniture scene (Høydal, E., Personal conversation, November 24, 2011).

## 7.4   New Product Development and Innovation

Høydal lists three constituents that have historically been significant for the success in the furniture industry of in Sunnmøre: technological rationalization, motivated workforce and design. Before the 1950s the Norwegian furniture industry was dominated by conservative handicraft based companies that were not open to new technologies, materials or design. This tradition was challenged by the new furniture factories in the area of Sunnmøre. Through investments in new machines and rationalized production methods they managed to conquer a broad mass market. A recent study showed that both the furniture producers and their suppliers in and around Sykkylven understand their particular strengths to be quality, functionality, tailored solutions and short delivery times. These strengths can all be considered results of the three constituents of success mentioned above. In addition, the suppliers regard their geographical proximity to customers, ability to innovate and strong brands to be important elements that give them a competitive advantage (Oterhals & Johannessen, 2009).

Although designers were not present when the first furniture factories in Sykkylven were established, they have had an important role in its later success. From the 1960s on, design has constituted a value adding element for the furniture producers in Møre og Romsdal. Their investments in design makes customers willing to pay more for their furniture, which would be impossible in pure price competition (Høydal, n.d., a). Design as a means to differentiate the brand in a global context is a necessary but surprisingly new insight among many of the furniture producers in and around Sykkylven. While design only accounts for 10% of the total investment that is made by the furniture producers, their major investments concern machines and equipment, and only a few large players do systematic research and development.

These numbers indicate that research and development efforts are still mainly focused on the rationalization of production (Oterhals & Johannessen, 2009). The focus on rationalized production is shared by the major furniture producers of the industry and it influences how design is performed within these organizations. Product design and product portfolios are dictated by what can be produced in a modularized way. In-house designers and design partners have had to learn how to deal with these technical and economic

constraints in a creative way, often through the creation of furniture that is flexible and modular. While the few large furniture producers of the region have internalized both design and production which was traditionally performed by suppliers, many medium and small sized furniture producers still make extensive use of local suppliers. Their product development is distributed over organizational boundaries in the regional agglomeration. The designers who are commissioned by these producers interact with a wide range of organizations in the local industry and their actions often have effects on both the products of the furniture producers and those of their suppliers.

The easy access to the expertise of local suppliers facilitates the distributed product development (Alnes, A., and Brunstad, H., Personal conversation, December 2010). The distributed practice of local designers sometimes contributes to product innovation. In these cases the designer is the unifying link between suppliers and furniture producers, especially when innovation on the furniture manufacturing level requires innovations on the supplier level. The focus on a rationalized production is not shared by all the furniture producers in Sunnmøre. There are small and medium sized furniture producers who try to target specific user groups that are disposed to spend more for specific furniture. Examples of such user groups are corporations who need office furniture, families in need for nursery furniture and high end clients who want iconic or exclusive and original furniture. The designers who work for these producers are more focused on use innovation and differentiation than on design for rationalized production.

The character of innovation and design activities in the furniture industry in and around Sykkylven can be illustrated by its position on the knowledge base, innovation, use and design model  (Figure 25). The knowledge base upon which the industry rests ranges from a mix of synthetic and symbolic to highly symbolic for individual iconic pieces of furniture. Although the major furniture producers focus their innovation efforts on rational production in order to remain competitive on price in the global market, most medium and small sized furniture producers innovate more in the domain of meanings. The focus of innovation activities thus ranges from a mix of technologies and meanings to highly meaning centered. Design interventions in the industry are often meaning centered in a similar way.

*Figure 25.* *The primary knowledge base upon which the furniture industry in and around Sykkylven rests, its focus for innovation activities, the main use value of its products and the focus of design interventions in the industry.*

## 7.5 Competence and Professional Profiles of Design

All the furniture producing companies that were represented in the interviews, and operate in Sykkylven and its neighboring areas, use design. Depending on their strategy, in-house or external design consultants are used. Based on how and where their practice is organized, the design professionals can be categorized as either "in-house designers", "local aces", "global star designers", "global aces" or "global all-rounders". The different design professionals are either furniture experts who perform "specialist practice" or product designers who work across different product domains in a "generalist practice".

The contributions that are made by local designers build both on industry specific sticky design knowledge, and industry specific ubiquitous design knowledge. Star designers and global aces who work within the global furniture industry rely on knowledge inherent to the design discourse of the global furniture industry, which is industry specific ubiquitous design knowledge. The global all-rounders, who work across product domains globally, mostly use general ubiquitous design knowledge in their practice. Although the furniture producers emphasize that it is the merit rather than the physical location of the designers that guides their choice of design allies, the following sections show that geography influences both the competence of the designer and the degree of integration of the designer in product development. An overview of the professional profiles of the designers who work for companies in the furniture industry in and around Sykkylven is provided in table 10.

Table 10. *Professional profiles and expertise of designers who contribute to the regional furniture industry of Sunnmøre.*

| | Specialist practice ◄――――――――► Generalist practice | | | |
| --- | --- | --- | --- | --- |
| | In-house designers | Local aces | Global star designers & Global aces | Global all-rounders |
| **Primary place of practice** | Local furniture industry | Local furniture industry | Global furniture industry | Global design discourse |
| **Primary product domain** | Furniture | Furniture | Furniture | Products |
| **Type of design expertise** | General ubiquitous  Specific and sticky | General ubiquitous  Specific and sticky | General ubiquitous  Industry specific | General ubiquitous |

A majority of the furniture producers in and around Sykkylven work with designers who are specialized in furniture design. The industry specialist designer group comprises in-house designers, and furniture designers who perform their practice in the local or global furniture industry. By way of their practice, these designers develop a deep product related expertise. However, the attitudes regarding such design practice varies among the companies within the industry; many of them consider it problematic. The most radical position is held by a group of furniture producers who require their designers to work exclusively for them.

Because of the limited number of designers with furniture as their specialty, this policy may be difficult to maintain in the long run. A majority of the companies who wish to work with external designers try to handle the issue in a more moderate manner. Their design allies are given the freedom to work for competitors as long as the design interventions are limited to types of furniture that are not part of their own portfolio. The product manager of a furniture producer whose brand value builds primarily on the use of design, and who uses a mix of more or less famous external designers, emphasized the risk of "brand contamination" when designers work in an indiscriminate manner for many clients in one industry. His company has chosen to control risks of brand contamination by using predominantly non-local design consultancies who do design for other furniture producers, but only for foreign competitors:

> *Many (Norwegian) designers are out of control. They design for anyone, without considering the profile of the client and possible consequences for the value*

> *of his or her name as a designer. When they choose to design for a low target*
> *furniture producer with a bad design reputation this will also devalue his or her*
> *own reputation as a designer, and also the reputation of all of his or her previous*
> *clients. I can understand why they need to do that, because their domestic*
> *market is limited, but we avoid these designers.*
>
> *[Product development manager at furniture manufacturing company A]*

The group of generalist designers include designers trained in industrial or product design and whose daily practices includes products from different industries. There are a very limited number of examples where industrial design consultancies have been commissioned by furniture producers in the region of Møre og Romsdal. One medium size furniture producer who has chosen to establish a strategic partnership with an industrial design agency did so with the hope of obtaining something different from what could be obtained from a furniture designer. They wanted to be challenged, and get new perspectives and impacts from other product domains. Because the agency had no previous experience of furniture design, this implied an initial learning period, where the designers familiarized themselves with industry specialist knowledge of production technologies, materials and the mechanics of dynamic furniture.

This involved steel structures and their thicknesses, and how they support stability, balance, movement and torsion dictated by body movement. The furniture producer considered this learning period an investment as the situation offered the opportunity to "design their own designers", co-shape their brand language together with the designers, and have the designers sign an exclusive contract. Their continuous partnership with the design consultancy secures consistency in the design language and strengthens their brand identity. On the other hand, the occasions on which the partnership has brought innovations that build on design knowledge gained in other product domains have been limited. In general few furniture producers were able to give any examples where analogies between product domains have resulted in material, structural, technological or functional innovations. The design manager of a furniture producing company whose intention was to use generalist design consultants in order to obtain such innovations argued that the furniture product domain is too particular to benefit from knowledge transferred from other domains:

> *We hoped that we would obtain something different from our generalist*
> *designers (author's terminology). We hoped that they would bring influences*
> *from other industries in order to create innovative furniture. But I realize that the*
> *furniture domain is very specific, and that it is difficult to benefit from broad and*
> *general design knowledge in this context.*
>
> *[Product and design manager at furniture manufacturing company C]*

Many of the managers at furniture manufacturing companies who were interviewed

mentioned the need for balance between consistency and novelty in design. The use of designers with little experience of furniture may result in new and fresh perspectives and innovative products, but it is also a risk. The product manager of a furniture producing company exemplified how the lack of furniture related knowledge of product designers may cause time consuming loops in product development:

> *Since there is no major difference in price between designers with experience from furniture design and designers without any such experience, we tend to choose the former. They will require less supervision from us and give us more complete deliverables that are ready for production. On the other hand, we sometimes see that new designers draw some innovative lines. I think it is important to have a mix of them. It is important to give inexperienced designers a chance to enter the field, but we do not really have any solution for how it should be done since they represent a risk. They have not proven anything, and involving them may require a long time and a lot of resources. There are examples where we have collaborated with less experienced designers, and where we have invested time and resources for maybe a year in order to give the designer good input on the product, technologies and market, and where the designer has totally failed to design anything useful for us.*

> *[Product development manager at furniture manufacturing company B]*

This section presented an overview of the design community that contributes to the regional industry of furniture manufacturers in Sykkylven. It showed that the design mature industry make use of a differentiated body of design professionals with distinct competences and locations. The following sections will outline how the local companies choose to manage the design competences that are held by different types of designers in a more detailed manner.

## 7.6   Local Aces and In-house Designers

In-house design departments were only found in three of the furniture producing companies located in and around Sykkylven, all of them with a turnover between four and 120 times the median value of the agglomeration (based on statistics performed by Oterhals and Johannessen, 2009).

The in-house designers of the furniture producers in the region are involved in the everyday product development, industrialization and commercialization activities of their companies. Furniture producers who have in-house designers or who have established long term relationships with local design consultants are able to integrate design throughout the whole product development process, from the definition of needs and future products

to product launch. Their designers are appreciated for their close contact with in-house or external production and marketing (Høydal, 1990, p. 124). The research activities of the in-house designers of the region are primarily focused on use, comfort and materials. Their in-house activities allow them to develop a deep understanding of the corporate brand language, available production facilities and technologies, and materials. The focus on rational production of many major furniture producers in the agglomeration has given the in-house designers a particular understanding of the economic aspects of their design interventions, where any design solution that is proposed is evaluated in terms of its cost.

Some furniture producers combine in-house and external design. This is a means to bring fresh perspectives and ideas into the company. Such arrangements often give the in-house designer a more production oriented role, where he or she adapts the design concept of an external designer for production. In these cases, the furniture will carry the signature of the external designer but is prepared for production and industrialized by the internal designer.

The local aces of Sykkylven account for a significant share of the design activities that take place among the furniture producers in the area. They often have long term partnerships with their clients, who are typically small or medium size furniture producers with limited resources for product development and design. Through this arrangement, the designer is only a cost when needed. He or she is free to work for a number of local furniture producers and they can therefore be considered the in-house designers of the industry. They give their clients access to sticky design expertise related to the products, brands, technologies, users and companies of the industry. Such knowledge could otherwise only be obtained by having designers in-house.

The short distance between the local aces and their customers, together with their local anchorage, makes it possible for them to spend a lot of time at their clients' sites. They are co-players rather than service providers. They are usually involved in the whole product development process, and sometimes even in activities connected to the product launch. A local ace exemplified how their position as partners in product development gives them more control over the emerging product than would be possible if their activities were distant and less integrated:

> *The development of furniture requires an awful amount of small decisions along the way. Non-local designers do not get the possibility to bring their designer perspective to these decisions. They typically send an image, and then the furniture producer makes all the small decisions in the industrializa-tion process. This means the design concept is not totally carried through. I rather bring my ideas to a local producer and bring it forward in a partner-ship with the producer. The final product is then likely to be very close to my*

*initial concept. I am the in-house designer of the agglomeration: a partner*
*rather than in-house or external.*

*[Local ace A]*

The owner and CEO of a medium size furniture producer who has a close collaboration with a local ace explained their choice of design ally with issues related to the unpredictable nature of upholstered furniture and geography:

*Distance means a lot, because the production of upholstered furniture requires*
*a great deal of trial and error. There are so many details in the materialization*
*of a design concept that require design decisions, and if the designer cannot be*
*on the spot to make those decisions there is a risk that the final product is far*
*from the design concept we paid for. This is very specific for the production of*
*upholstered furniture. The production of wooden furniture is much less demand-*
*ing in this sense, because in that context the final product is much more likely to*
*correspond to the drawings and renderings of the designer. The material is much*
*more predictable.*

*[Product manager, owner and CEO at furniture manufacturing company A]*

By way of their industry specific practice across organizations the local aces conduct indirect research on the variety of users that are targeted by the different furniture producers. They are thereby able to identify market opportunities for the different furniture producers. The combined knowledge about the users that are targeted and the product portfolios of the local furniture producers enables them to propose projects that fit the strategies of their different clients:

*You know the local companies well. In addition to presenting exciting new ideas*
*to them, you also know what is right or wrong in relation to their existing targets,*
*product portfolios and brands, and what could be a valuable contribution to*
*each one of them.*

*[Local ace A]*

In addition to their knowledge of the strategies and product portfolios of the local furniture producers, the local aces are appreciated for their network knowledge and expertise on materials and production processes and facilities. Their independent position and their tight and continuous collaboration with furniture producers and suppliers in the immediate surroundings make it possible for them to develop local networks of suppliers that support their practice. These networks give them access to a wide range of expertise and production facilities. They know the competences and facilities of their local suppliers as well as how these can be combined into innovative solutions. In this respect they can be considered local knowledge brokers. In some cases, the networked design interventions

of local aces send ripples to the product development of suppliers, who usually do not use design competence. This was exemplified by a local ace who conceives his own role in the local industry to be that of a cog in the wheel:

> *I know how and where things can be made, and who has the competences to make them. I know what people know at Ekornes, Formfin, Hjellegjerde and LK Hjelle, I know the competence of the various furniture producers very well. I am sort of a cog in the wheel. In my work, I have daily contact with suppliers, and sometimes I suggest new solutions to them as well. Small innovations are part of my everyday practice.*
> *[Local ace B]*

Since their small and medium size clients usually have parts of the production in-house, but also rely on suppliers for the production of their furniture, the network knowledge of the local aces is extremely valuable. Their relationships with suppliers and customers are facilitated by their locally rooted and personal social capital and they are thus an asset that is difficult for a non-local designer to obtain (Høydal, E., Personal conversation, date, 2011). A local ace described how his contributions are related to network, technology and use rather than to groundbreaking aesthetics:

> *Our practice is knitted into the area. In addition to relations with the big players, we have strong ties to the many small producers and suppliers of the area. Our products might not be the most visually distinctive, but we have contributed the development of a great range of systems of upholstered furniture and technology that have been beneficial for the region as a whole. This does not make you very visible in the global design discourse. The patents that we have obtained build on specific and locally rooted knowledge in technology and product functions.*
> *[Local ace C]*

## 7.7 Global Aces and Star Designers

Some furniture producers who wish to be in total control of their product and brand but who do not want to maintain an internal design department use a mix of external designers. They brief and commission one or a few global aces for a confined project and thereby obtain the flexibility to choose with whom to collaborate and when. Design proposals are based on the furniture producer's definition of what the product should be. Usually a prerequisite is that the product concepts should speak the language of the furniture producer rather than carry the personal expression of the designer.

The global aces are based outside of the agglomeration and perform most of their work in their own offices. Except for a few milestone meetings that are organized at the furniture

producer's site, their contact with the furniture producer is maintained by phone and mail. The extent to which the designer is involved beyond conceptual design varies. Some experienced furniture designers deliver finished production drawings to their clients. Others stop at renderings, sketches or prototypes that are prepared for manufacturing by the in-house engineers or designers of the client. However, very few are involved in the initial needs and product definition phase.

By way of geographically disseminated practice, the global aces provide the furniture producers with fresh impacts and perspectives from the external world. In contrast to the case where a more renowned star design competitor is commissioned, the control of the concept and process, and the ownership of the brand are maintained by the furniture producer. The outcomes of these collaborations thus match the market strategy of the furniture producer and are likely to appeal to the intended customer groups. A priority of the companies who use global aces is to find a designer who is able to capture and incorporate their corporate brand language into his or her design proposals.

Collaborating with many different designers implies challenges in terms of building strong portfolio-arching brands. There are furniture producers who try to meet these challenges by developing visual material that communicates their brand language to the designers. A further step is taken by other producers who use design manuals as a communicative bridge between themselves, their brand and the designer. The design manager of a furniture producer who collaborates with a mix of external designers and who sometimes agrees to produce furniture proposed on the initiative of designers explained how they use a design manual as a means to remain in control of their brand image.

> We have a design manual. We created it through a one year process together with "Global ace A", where we tried to understand and capture our soul. It shows both where we are, and where we want to go. You can always discuss to what extent our image is clear, but I feel it is quite easy to point out the products that carry our spirit, and the ones that have no place in our collection.
>
> [Product development manager at furniture manufacturer B]

The same design manager also dwelt upon the advantages obtained from long term partnerships with designers:

> We can see a difference between long term and short term designer collaborations. "Local ace C" is faster and more precise in capturing and incorporating our soul in their design proposals. In fact, the occasions on which an independent design proposal made on the initiative of a designer makes us thrilled are becoming rare.
>
> [Product development manager at furniture manufacturer B]

In addition to challenges connected with the expression of the brand through products, the use of global  sometimes implies that more internal resources are needed to support the global designer with sticky information on available materials, production facilities and technologies. A medium sized furniture producer who collaborates with external designers has set up an internal organizational structure to support the process in which the designer learns their corporate culture and thereby secure brand consistency. This arrangement is also a means to control of design proposals and their compatibility with the quality requirements, material and human production facilities available. The product and design manager describes how the product development coordinator contextualizes the external knowledge that is brought into the company by global freelance designers and thereby functions as a gatekeeper of external design knowledge :

> We have a product development coordinator who is the interface between our external designers and our internal product development team. Our product development coordinator has been in our company for many years. She has made her way up from the shop floor, and knows a lot about how to make furniture.
>
> [Product and design manager at furniture manufacturing company C]

Some furniture producers function almost as production facilities for furniture and interior designers. Their in-house new product development is limited, and their in-house product development staff is focused on the adaptation of product concepts to production. The process is often initiated by an external star designer who independently presents more or less finalized drawings and specifications of a piece of furniture to the furniture producer. Based on the potential of the product concept to enrich or contribute to their product portfolio, the furniture producer decides whether to establish a partnership with the designer or not. Sometimes the decision is based on the "star reputation" of the designer, or the potential of the concept to become a design icon and bring honor to the furniture producer as a design focused company rather than its likeliness to bring in direct profit. The furniture producer will market the product as much in the name of the designer as through their own brand. The focus on the expressions of single designers may come at the cost of a strong corporate brand that is easy to recognize across the product portfolio.

The activities of star designers are rarely based in the region of Sunnmøre. Most of them are located in the bigger cities of Oslo or Bergen where the major interior architect, furniture design and applied arts study institutions are situated and where they have an easier access to global customers and to the global furniture design discourse. This reduces their chances of being closely integrated into the whole product development process. Despite the limited extent of integration between design, industrialization and commercialization found in these cases, furniture producers with an external star design strategy market themselves as "design focused".

The contributions that are made by star designers often build on symbolic knowledge and are therefore visible on the global design scene. An example is the prize winning sofa system, UGO, designed by Norway Says and produced by LK Hjelle (Figure 26). One of the designers explained the intentions behind the product:

> We wanted to create a new sculptural landscape, a sort of an island in the room, a flexible sitting system which could break loose from the meanings of the conventional sofa concept. We simply wanted to encourage a different type of sitting.
>
> (Torbjørn Anderssen as cited in Fuhr, 2004, p4. Author's translation)



*Figure 26.   The UGU sofa system that was designed by Norway Says for LK Hjelle. Photo: LK Hjelle*

While the furniture may become differentiating icons they are not necessarily aimed at a broad market segment. The furniture producers who use star designers therefore often complement their product portfolio with more conventional, non-signature models designed by less famous external designers.

## 7.8   The Design Knowledge of the Region

The sticky design knowledge of the region is connected to the evolution of the local industry and its companies, users and products. The amount of sticky design knowledge that is required by different furniture producers varies. The ones that limit the involvement of external design consultants to the conceptual part of the product development process, and who provides the designer with a comprehensive design brief that includes descriptions of the target users, technologies and production methods that should be employed, may require little sticky design knowledge from their design allies. In cases where a furniture

producer wishes to obtain an extensive input and involves design from the initial identification of a market opportunity through production and product launch, more sticky design knowledge is needed.

Because of its sticky nature, this type of knowledge is held primarily by in-house designers and local freelance designers whose activities are performed within the local furniture industry. In-house designers, local aces, and their clients spoke about the content and importance of sticky design knowledge in the interviews. The sticky design knowledge of the furniture industry in and around Sykkylven concerns what can be done in the setting of the local industry. Without such knowledge one risks designing something which cannot be produced (Local ace C., Personal conversation, Nov 16, 2010). It is related to available production facilities and materials, local networks, markets and targets of local companies, traditions, brand languages, and strategic orientations of the different furniture producers, and design for rational production and economy, which is prioritized by many of the local furniture producers. The product manager at a furniture manufacturing company argued that "before a designer has learned the necessary amount of sticky design knowledge, more trial and error is needed in the product development process" (Product manager at furniture manufacturing company C. Personal conversation, November 26, 2010).

The contributions that are made by global aces and by some global star designers who are involved in product development in the local furniture industry build extensively on general ubiquitous furniture design knowledge. When used in the furniture industry in and around Sykkylven such knowledge relates to the design process, ergonomics and comfort, aesthetics and symbolic knowledge inherent in the global design discourse. The aesthetic knowledge of star designers who are inspired by the global design discourse is especially appreciated by furniture producers who want to have iconic pieces of furniture in their portfolio. The specific sticky and the general ubiquitous design knowledge that is used by different types of design professionals in the regional agglomeration of furniture manufacturers in and around Sykkylven is summarized in table 11.

Table 11. *Professional profiles and expertise of designers who contribute to the regional furniture industry of Sunnmøre.*

| | Specialist practice ← → Generalist practice | | | |
|---|---|---|---|---|
| | In-house designers | Local aces | Global star designers & Global aces | Global all-rounders |
| **Industry specific design knowledge of** | Internal structures in the context of furniture, materials in the furniture context, ergonomics. | | | – |
| **Industry specific sticky design knowledge of** | Internal furniture structures in the context of furniture and body movement<br><br>Locally available production facilities, technologies, and know-how | | – | – |
| | Users and strategic orientation of company<br><br>Brand language of company<br><br>Economical aspects of design interventions | Users and strategic orientation of the different local companies<br><br>Corporate brand language and differences in brand and strategy within the local industry<br><br>Users, targets, brands and market opportunities for the different local furniture producers | | |
| **General ubiquitous design knowledge of** | Design process, ergonomics and comfort, aesthetics | | | |
| | – | – | A symbolic nature from the global furniture industry design discourse | A symbolic nature from the global design discourse |

**8**

# Industrial Design in the Sportsystem of Montebelluna

The regional agglomeration of sports footwear related companies in the 30,000 inhabitant town of Montebelluna (the Montebelluna Sportsystem) is located in the hilly agricultural landscape south of the Dolomites in the central area of the Veneto region of north eastern Italy. The global impact of the Sportsystem is widespread. The cluster produces more than 50% of technical mountain shoes, 65% of after-ski boots, 75% of ski boots, 80% of motorbike footwear and almost 25% of the roller skates of the world (Montebelluna Sportsystem - Museo dello Scarpone e della Calzatura Sportiva, n.d., a). The product range that is produced in Montebelluna has made the city known wordwide as "The capital of the snow industry", where about eight thousand people are employed by almost 400 companies. In addition, the manufacture of products that are designed in the Sport system provide work for 70,000 people that are employed at production facilities located abroad (Durante, 2006b, p. 11).

## 8.1  The Origins of the Agglomeration

In his chronicles about the history and evolution of the footwear industry of Montebelluna, Aldo Durante states that it all started a thousand years ago as a response to the local demand for foresters' work boots (Durante, 2006a, 2006b). A few people who saw a commercial potential in the demand broke with the tradition of being full-time farmers and started to craft work boots from leather and wood. The first businesses were small workshops with one to five employees: a master shoemaker and a number of helpers and apprentices. They made galoshes, clogs and a limited number of shoes for special occasions. In order to maintain themselves and their families, many shoe makers had to complement their activities with a second, part time job.

Throughout history, shoe production has been adapted to changing market demands, with boots for late 19th Century pioneer mountain adventurers visiting the area, and for soldiers during the world wars. Many sports champions recognized and provided testimonials for the quality and performance of the products of Montebelluna. An example was Achille Compagnoni, who used boots that were made in Motebelluna in his conquest of K2 in 1954 (Figure 27).

*Figure 27.   The boot that was used by Achille Compagnoni in his conquest of K2 in 1954.
           Photo: Museo dello Scarpone*

At the beginning of the 20th Century, there were 350 family-run shoemaking operations in Montebelluna. A few workshops grew and introduced a rationalized approach to manufacturing where the production of shoes was divided into specific tasks that were performed by specialized labor. The first machines that were used in production were designed and made by the shoemaking companies themselves.

An important milestone for the industry came with the spread of recreational downhill skiing. The sport was introduced to Italy by the founder of the ski club of Cortina d'Ampezzo, Adolfo Kind, in 1903. The shoe makers of Montebelluna rapidly adapted their knowhow to the new product category and started to make leather ski boots. Product development was focused on the ski boot and involved the application of new materials and use.

Figure 28 shows the downhill ski boot made out of leather that was used by Zeno Colò when he won the Olympic gold medal in Oslo in 1952.



*Figure 28.   The leather downhill ski boot that was used by Zeno Colò at the 1954 Olympics in Oslo. Photo: Museo dello Scarpone*

The first ski boot made out of plastic was introduced by the American Bob Lange in 1967 (Durante, 2006b, p. 42). The plastic ski boot not only changed alpine skiing, but also had a huge impact on its product development and production. The ski boot producers of Montebelluna went from producing 250 thousand pairs of ski boots in 1960 to over four million pairs in 1979 (Montebelluna Sportsystem - Museo dello Scarpone e della Calzatura Sportiva, n.d., a).

The entire process, from ideation to the production of boots, which previously had been undertaken by a single designer and pattern-maker, was divided into a series of steps that required specialized labor. An early example of a ski boot made out of plastic is shown in Figure 29.

*Figure 29.   An early ski boot made of plastics.
              Photo: Museo Dello Scarpone.*

The shoemakers of the region, with their deep roots in manual skills, were now limited to working on the soft ski boot interior. Prototyping and production that required technicians were separated from design (Durante, 2006a). In addition, the new rigid material required careful studies of foot and lower leg anatomy and of the skiing activity.

Many ski boot producers decentralized production. This resulted in the birth of a large number of suppliers of outsoles, soles and accessories. In addition, third party support companies, such as mould makers, machine producers, die sinkers, injection specialists and shoelace manufacturers started to emerge. The visibility of local best practices and the relatively small investment required to start a small low-tech accessory company made Montebellunians eager to start their own businesses. Their individualist farmer mentality was suited to entrepreneurship and the number of small family-owned shoe and accessory producing companies grew (Durante, 2006a). Many of the entrepreneurs chose to create their own brands rather than to remain as suppliers of others. According to Durante, it is

the ability to diversify in response to changing markets, technologies and societies that has been the strength of the companies within the Sportsystem. In 1979, 77% of the total industry turnover was connected to snow sports, but not all companies in Montebelluna were able or willing to make the large investments required for the use of plastics that was established in ski boot production (Durante, 2006b, p. 11). Instead, new markets were invented by the introduction of after-ski boots, motorcycle boots, bicycle shoes, dancing shoes, ice skates and cross country ski boots (Durante, 2006b, p. 44). One product of great significance for the Sportsystem was the after ski boot which was first introduced by Tecnica. It was inspired by the first moon landing and was named "The Moon Boot" (Figure 30). Its great success inspired a myriad of companies, from small workshops to large corporations, to follow Tecnica and produce their own variants or copies of the Moon Boot.

The Moon Boot has had a major impact for Montebelluna as a region. At the end of the 1970s between 7.5 and 8 million pairs of after ski boots were produced in Montebelluna (Belussi, Pilotti, & Sedita, 2007, p. 198). Today, the product is considered a global fashion icon, and in 2000 it was chosen by the Louvre Museum as one of 20th Century's major design symbols. The density of small companies within the Sportsystem resulted in an optimal context for knowledge creation and learning. In the 1970s, when the number of small local footwear related laboratories reached its peak, there was almost one company to every two inhabitants of working age in Montebelluna. Many of inhabitants of Montebelluna worked for large companies during the daytime, and ran their own basement laboratories in the evening. It was not unusual for two members of the same family to be employed by competing companies.

The basement activities made objects and semi-manufactures that required little capital investment, such as after ski boots, upper soles or ski boot linings. Others sold assembly services or developed patterns for the larger companies in the area. In addition there were small transport companies that connected all the companies in a web-like structure. They made rounds where they picked up the objects that were produced in the various basement laboratories and delivered them to the larger companies. The structure of this web resulted in knowledge dynamics and the accumulation of a very high level of general knowledge of footwear and about what was going on in the local industry. The phenomenon was known as "radio scarpa" - not an actual radio station, but the phenomenon of everybody knowing almost everything (Gallina, Personal conversation, April 2009).

The high level of general knowledge which is rooted in the Sportsystem has through history attracted large multinational corporations such as Rossignol, Adidas, Puma, Fila, and Nike, which have absorbed many of the local companies and established satellite research and development departments in Montebelluna. These corporations have broadened the product range of the Sportsystem with non-winter-related footwear for running, tennis and football. A significant turn in the product variety of the Sportsystem was taken in the

*Figure 30.   The Moon Boot™ designed and  produced by Tecnica in 1970.
Photo: Tecnica*

1990s when the local companies Geox and Stonefly applied the technological know-how used in sports shoe production to casual "city-shoes". This product category played an important role in compensating for the economical downturn that struck the rest of the industry at that time (Belussi, Pilotti & Sedita, 2007).

In addition to new product categories, the multinationals also introduced ideas of modern forms of organization and inspired many of the local companies to relocate their labor intense manufacturing activities to low cost countries (Durante, 2006b, p. 46). At the turn of the last century there was a significant reduction in the number of local small suppliers and employees. At present only one in eight employees who are involved in the production of footwear is located in Montebelluna (Durante, 2006b, p. 58). The employees who have remained in Montebelluna do research and development, design, marketing, sales and distribution. The historical knowledge and manual skills of laborers in the region are thus transforming into knowledge of R&D, planning and design, production, commercialization and distribution. However, the history and roots of the region and its population still have a great influence on their everyday practice.

## 8.2   Product and Industry Structure

Montebelluna Sportsystem is world leading in the production of snow sports footwear, technical mountain boots and motorcycle footwear. In addition, the Sportsystem hosts a range of Italian and European leaders in the production of bicycle shoes, ice and roller skates, and football and tennis shoes (Durante, 2006b). Many of the products are compounds of semi-manufactures that are produced by different small and medium sized enterprises. The product architectures are thus to some degree mirrored in the organizational structure of the Sportsystem. Despite the influence exerted by large international corporations on the traditional organizational structures of Montebelluna, a majority of the firms have remained family run and of small or medium size with fewer than 50 employees. Among the local companies only 7% have between 51 and 250 employees, and 1% have more than 250 employees (Durante & Durante, 2008, p. 30).

The wide range of products that are designed and produced within the Sportsystem (table 12) have given rise to a heterogeneous and complementary knowledge base among the inhabitants of Montebelluna. Their competences are distributed in vertical divisions of labor that produce products, product components and production machinery.

*Table 12.* *Number of companies within the Sportsystem categorized by product (and service) type (adapted from Durante & Durante, 2008, p. 35, author's translation).*

| Type of company | Quantity | Percent |
|---|---|---|
| Footwear producers | 132 | 34% |
| Upper sole manufacturers | 46 | 12% |
| Producers of accessories and components | 35 | 9% |
| Design studios | 32 | 8% |
| Producers of clothes and sports equipment | 31 | 8% |
| Injection molders | 20 | 5% |
| Other/miscellaneous | 20 | 5% |
| Trading companies | 20 | 5% |
| Cutters | 18 | 5% |
| Producers of footwear, sports clothing and equipment | 11 | 3% |
| Machine makers | 11 | 3% |
| Mold makers | 5 | 1% |
| Sole manufacturers | 5 | 1% |
| Die cutters | 4 | 1% |
| Total | 390 | 100% |

Current figures show that the shares of the various consumer products that are produced in the Sportsystem are changing. The snow sports and mountain related footwear that once made the industry successful has lost its leading position to casual city shoes, sports and protective clothing, which now constitutes a significant share of the total industry turnover. An overview of the consumer products that are produced by companies located in Montebelluna is provided in table 13.

*Table 13.*  *The shares of various consumer products as a percentage of total industry turnover (from Durante & Durante, 2008, p. 88, author's translation).*

| Type of product | Share |
| --- | --- |
| Casual city shoes | 44% |
| Sports and protective clothing | 20% |
| Footwear for football, cycling, motorcycling, tennis, running, rollerblades and work boots | 15% |
| Winter sports footwear such as after ski boots, ice skates, ski, telemark and snowboard boots | 10% |
| Mountaineering and trekking boots | 9% |
| Other sports related clothing and footwear | 2% |

The consumer products that are produced by the Sportsystem build on a variety of knowledge bases. While the design and production of casual city shoes has remained craft-oriented and relies on traditional and often tacit knowledge, ski boots require both tacit knowledge and codified knowledge about new materials and modern production technologies. Comfort and style is essential for both types of products, but the instrumental function of the ski boot and other sports equipment require in depth knowledge on the use activity. The craft-oriented knowledge that is used both in the production of casual shoes and linings for ski boots and roller skates is predominantly tacit and is often related to the behavior of the materials that are used for the products which are less predictable than "hard materials" like plastics or metal.

In addition to producing comfortable and functional products, many sports footwear and sports equipment producers build customer value upon strong brands. They sponsor sports champions whose successes show customers the truly superior performance of their product. In addition, design and styling of the sports footwear has become important tools for differentiation.

The production of casual city shoes require limited investment in machinery and can in large part be performed by skilled labor. In contrast, the production of a ski boot involves costly production machinery. A new ski boot is produced in at least eight sizes. In addition to the various buckles and soles that are needed, eight sizes require the design and production of eight right and left foot plastic molds, and the development of 16 liners (Sartor, Personal conversation, April 24, 2009). Because of the capital intensiveness of ski boots,

producers try to give their collections longevity by making minimal changes to existing products with a maximum effect for the customer at their seasonal collection launches. These minimal changes are necessary in order to remain competitive across the different market segments that are targeted (Trentin, Personal conversation, April 22, 2009) and have implications for the way design is practiced. Because of this work's focus on industrial design, the interviews that were conducted in Montebelluna focused primarily on products where industrial design rather than stylist or artist competences are used, such as ski boots, roller skates and trekking boots.

## 8.3  New Product Development and Innovation

Montebelluna Sportsystem is a typical Marshallian Italianate industrial district, which consists of a large number of highly specialized SMEs that have a high degree of internal interaction and labor mobility (Markusen, 1996). The structure and constitution of the Sportsystem favors the consistent production of both radical and incremental innovation, and its companies have gained their success by being sensitive and reactive to changes in their environment (Belussi & Pilotti, 2002). Many have managed to cope with changing markets and competition by diversifying their product offerings and by continuously doing research and product development. Research and development activities are found in small, medium and large companies (Sammarra & Belussi, 2006). Product development is distributed across professions and organizations and suppliers are important sources of ideas. The designer and design manager of a medium sized trekking shoe company argued that truly creative ideas which lead to innovations often come from small suppliers:

> *Our small suppliers give us the most interesting ideas. Because the smaller, the more creative they tend to be. They are disposed to risk more in order to be creative and survive. Their survival depends on us, so they are always amenable.*
>
> *[Designer and design manager at trekking boot manufacturer A]*

He further explained how the knowledge of suppliers is absorbed, combined and contextualized into innovative products by their internal design department:

> *We owe many of our innovations to the Sportsystem. In their urge to sell, our suppliers of materials, processes or semi-manufactures constantly develop and upgrade their product assortments with news that they present to us. Often none of us first know the potential of their new products or services but they remain in our heads and archives, and suddenly we are able to see an innovative application of their novelties to our products. This application is often a result of a combination of products from other suppliers.*
>
> *[Designer and design manager at trekking boot manufacturer A]*

The learning which takes place between suppliers and producers is reciprocal. Suppliers learn from their clients, develop new products and contribute with new ideas to the producers who innovate. The offerings of the suppliers thus embed knowledge earned in the interactions with their different and often competing customers (Local ace A, Personal conversation. April 21, 2009). The research and development manager of a large ski boot producing company exemplified how their interactions with local suppliers contribute to horizontal learning, innovation and superior products for their clients:

> We get a lot of good input from our day-to-day partnership with our suppliers, because they collaborate with many of our competitors and thus gain a general knowledge of what is going on industry-wide. Our in-house designers and engineers contextualize their ideas, both functionally and aesthetically.
>
> [Product development manager at ski boot manufacturing company A]

While this openness results in horizontal knowledge spillovers that may appear harmful to ordinary consumer product producers, the same R&D manager argued that the same degree of openness between competitors that is present in the Sportsystem benefits them, their competitors and their customers:

> This morning, I needed some information on a concept originally developed by our competitor. I had a chat with their head of research and development, and he sent me the pictures I needed. We don't consider each other competitors like before when we exerted a lot of effort in copying the products of, or even directed piques towards, our neighbors. What we have now is a sane and honest competition. We know each other, and there is a reasonable level of general intelligence but it doesn't go too far. This leads to enhanced products for our customers.
>
> [Product development manager at ski boot manufacturing company A]

In addition to knowledge spillovers within the Sportsystem, important input for product development is obtained from small and specialized vendors who are located where the products are used and from end users. The marketing manager of a ski boot manufacturer named one of their retailers their most important innovation partner (Marketing manager at ski boot manufacturing company A. Personal conversation. April 22, 2009).

The product innovators and designers of the Sportsystem are, like those in many other Italian industry agglomerations described by Storper, typically former skilled workers who have attended technical schools (Storper, 1997, p. 141). Beyond this, many product developers local companies actively look for innovative ideas among professionals whose main activities are located outside the agglomeration. A combination of their own knowledge which is situated in the Sportsystem and the knowledge held by these external profession-

als often results in commercially successful product innovations. (Product developer and design manager at roller skate manufacturing company A. Personal conversation, April 23, 2009).

Historically, innovations in the Sportsystem have been both radical and incremental. The most important innovations have often followed the invention of new markets and the introduction of new materials (Local ace A, Personal conversation, April 21, 2009). A good example is provided by the downhill ski boot, first with the recognition of a market opportunity in recreational downhill skiing, followed by incremental and radical innovations in its quality and use. The first significant innovative change made to the ski boot was when the original sole, which was made from layers of leather that were stitched together, was replaced by a vulcanized rubber Vibram® sole that was glued on to the outsole of the ski boot (Durante, 2006b).

The plastic ski boot was not invented in Montebelluna, but the companies of the Sportsystem managed to commercialize it through "creative imitation" and refinement. Applying their deep knowledge of sports footwear, the ski boot producers of Montebelluna managed to improve the invention significantly. They combined their traditions with new knowledge related to technologies, markets and use. They formed new supply channels, and new managerial competences, which lead to a necessary organizational upgrade of the Sportsystem. The example shows how innovations cause ripple effects among the local companies as they upgrade the general level of knowledge available in the industry and accelerate research and development (Sammarra & Belussi, 2006).

Some of the products that are designed in the Sportsystem, such as casual city shoes and trekking boots, are not subject to much independent and systematic research. New collections are usually restyled versions of last season's collection. Innovations in these product categories are often connected to the application of new materials and their expressive possibilities. Although this approach to product development can be considered to be dictated by seasonal launches and incremental and fashion oriented innovation, the footwear producers of Montebelluna have a functional focus compared to producers of non-sports-related (Durante, 2006b, p. 56). One example is the successful city shoe producing company Geox which started with the functional vision of eliminating bad smelling shoes. This was achieved by the invention of a shoe with a breathing sole. While such a functional approach to the design and marketing of city shoes was unconventional, it had been the state of the art in the design and production of sport shoes and protective clothing for a long time, where product development is performed on a global level and may concern markets, product parts and architectures, materials, use and so forth.

Another recent innovation which is a good example of the functional approach and evolutionary nature of product development that is common among innovative companies in

the Sportsystem is the adjustable ski boot, IDEA. It was the result of a long, systematic and evolutionary research and development process by the skate and ski boot producer Roces. The idea of a ski boot that could be adjusted to fit growing feet came from a product development project of a roller skate called London. However, the point of departure for the London roller skate was not, as one would expect, to offer consumers with growing feet a roller skate that could be used for many years, but to rationalize production by reducing the number of moulds needed for each model. Before the project every second shoe size required one dedicated mould. This means six different moulds were needed for the production of one model. The design engineers who worked at Roces invented an outsole divided in two pieces, whose relative positions gave different sizes. Thereby, the number of moulds for one model was reduced by 50%.

The size of the roller skate was adjusted in product assembly, and the commercial potential of a roller skate that could be adjusted for size by the user him/herself was only realized after the launch of the production-friendly roller skate through feedback from users and retailers. The idea of user adjustable sizing for sports footwear was applied to a junior roller skate and subsequently also to two lines of ice skates. At this point, an external designer was involved. He introduced a new product expression and replaced the user interface that had been conceived by the engineers of Roces, and which required the use of a key for size adjustment (Figure 31) with a more user friendly interface (Figure 32).



Figure 31.   An early version of the user interface invented by the product developing
             engineers of Roces.
             Photo: Roces.

*Figure 32.* *The growth compensator designed by the external industrial designer that was*
*hired by Roces.*
*Photo: Roces.*

The user adjustable sizing invention posed different challenges to the design engineers at
Roces. One challenge was how to fit and balance the metal blade of the ice skate to differ-
ent sizes. Another challenge was how to obtain an even degree of thermal insulation from
the lining across the different sizes of the winter range of products. The solution of an
accordion-style liner opened up the possibility of applying the invention to ski boots. The
design award winning adjustable ski boot, IDEA, was introduced to the market in 2007, 14
years after the launch of the London roller skate (Figure 33). The evolutionary research and
development process that started with an idea of a divided upper sole for more economi-
cal production ended with a ski boot the size of which can be adjusted by users with grow-
ing feet. The patented IDEA boot is marketed as a product that is economical for the user,
the environment and also for retailers.



*Figure 33.* *The IDEA ski boot and inner lining.*
*Photo and illustration: Roces.*

## 8.4  Use and Traditions for Industrial Design

Before any formally trained designers offered their services to the companies in Montebel-
luna, design related choices were made by in-house creative people. They were shoe pat-
tern makers who developed models and sizes and who, through their practice, had learned
about the product and its markets. The first designers who were hired by ski boot produc-
ers were, in accordance with the Italian tradition, trained as architects. They were called
in connection to the introduction of plastics for ski boot production. Many of them came
from the domestic appliances industries where the use of plastics had been routine for a
long time (HR manager at ski boot manufacturer A, Personal conversation, April 22, 2009).

The new plastic material called for and allowed innovative solutions and gave designers
the freedom to explore form, color and surface finish. Many of the early designers focused
on aesthetics and often their proposals needed to be adjusted before they could be
brought into production. The product development process was thus still controlled by
in-house shoe pattern makers, who in a 20 to 24 months long iterative and craft-based
process turned the concept sketches of the designers into producible and usable products
(Montebelluna Sportsystem - Museo dello Scarpone e della Calzatura Sportiva, n.d.-b). The
external aesthetic knowledge that was brought by the designers before they had estab-
lished any stable presence or locally situated competence thus had to be contextualized by
pattern makers whose competences were grounded in the local industry. The local pattern
makers had the necessary design knowledge to act as gatekeepers in the initial phases of
design practice in the Sportsystem.

The modern design profession is the youngest in the Sportsystem. The first design studio
was opened in 1981, and since then the local design sector has been the fastest growing
segment in terms of number of practitioners. This is in sharp contrast with many other
sectors that have reduced their work forces in the last ten years (Durante & Durante, 2008).
Today there are 32 design studios in Montebelluna with an average of 3.3 employees each.
Most of the footwear producers of the Sportsystem use professional designers in product
development. In addition to freelance designers and designers employed at design studios,
some larger ski and trekking boot producers have in-house design departments.

The designers who work in the Sportsystem are either trained at universities and design
schools, at specialist shoe design schools of the Veneto region, or at EU financed courses
that are organized by the municipal "Museo dello Scarpone" and "Treviso Tecnologia". The
latter of these is connected to the regional chamber of commerce. Such courses with an
exclusive focus on footwear design have been organized when there has been a demand
for in-house designers in the local industry. In addition, some design related tasks of the
Sportsystem are undertaken by professionals who are not trained in design. Often these
professionals are either pattern makers or design engineers.

Innovation and design activities in the sports and leisure footwear industry in Montebelluna can be characterized by its position on the knowledge base, innovation, use and design model (Figure 34). The industry, and sports footwear in particular, depends upon a mix of synthetic and symbolic knowledge. Innovation activities aim at both enhanced performance and new meanings for the products, and can in most cases be characterized as incremental. Consequently, design interventions in the industry are often both human and meaning centered, but with a focus on the latter for seasonal restyling activities.
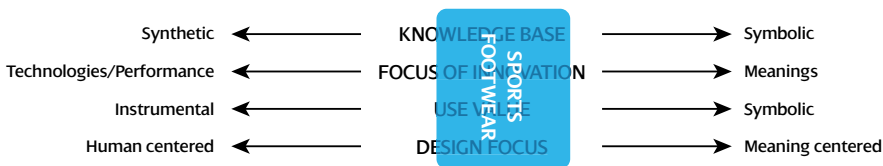


*Figure 34. The primary knowledge base upon which the Sportsystem rests, its focus for innovation activities, the main use value of its products, and the focus of design interventions in the industry.*

The complexity experienced by designers who work in the Sportsystem is mainly connected to the distributed product development which transcends organizational and cultural boundaries. The industrial culture determines the local practices and is a result of the evolution of the industry and its companies. The organization of product development is to some extent mirrored in the composition of the products that are produced in Montebelluna. Semi-manufactures of different kinds that are produced by different companies need to be matched. The production of a trekking boot may act as an example, and was described by the design manager of a trekking boot manufacturer, who talked about the collaboration needed between the in-house design departments of different companies:

> *The moment we have finished our first sketches of a boot, including a draft design of the sole, we send them to the designers of Vibram (producer of soles for trekking boots). Based on our sketches, they make their own interpretations and hypothesis of what could be an appropriate sole design. These are sent back to us, and the dialogue goes on until both parties are happy with the design.*
>
> *[Designer and design manager at a trekking boot manufacturing company A]*

This distributed design process is sometimes experienced as challenging because it may conflict with the holistic intentions of the in-house designers as the producer of the end product. Also, the distributed product development that is common within the Sportsys-

tem implies the integration of parts that build on different knowledge bases into products. A good example is provided by roller and ice skates. While the production of their soft lining is craft-oriented and determined by historically and culturally intertwined practices, the production of their injection molded plastic shell and the mechanics of their wheels or blades require knowledge of a more codified nature. The owner and designer of a local product design agency described the challenges connected to the interface between different knowledge bases held by a distributed design team.

> We designed a detachable skate that included both heavily engineered parts and parts of a more craft-oriented nature. The frame included plastics, metal and mechanics that were fixed to an interface by a fitting of micro-millimeters. And then there was the other side, the soft footwear where you operate with a 4 to 5 millimeter precision. Matching those two worlds was very challenging.
>
> [Local all-rounder B]

The same designer explained how the use of prototypes in a trial and error process helps him to overcome the challenges connected to combining different knowledge bases:

> We try to go as fast as possible to the stage of prototyping, especially when we are involved in design of these kinds of products [roller skates]. We do the hard part first, which then works as a point of departure for the production of the soft part. Because in contrast to the hard part, the production of the soft part is quick and easy, allows more flexibility and does not require any large investments.
>
> [Local all-rounder B]

Later, the same designer commented on the cultural complexity that is present in design practice in the Sportsystem. He compared his design practice with managing an orchestra:

> Design work is holistic. It is a product, not a shoe with laces and wheels, but this is our main challenge in the Sportsystem. Before I came here I didn't even know it would be such a challenge because I didn't know there was such a cultural complexity behind it. Here, design is like managing an orchestra. All these different people, instruments and musicians who need to fit together into a beautiful symphony.
>
> [Local all-rounder B]

In addition to prototypes as bridges between cultures, the same design agency has hired the son of a local shoe pattern maker for a model maker position. This model maker also functions as a cultural interface when cultural barriers challenge design practice. He understands the local culture and helps the designers to communicate effectively with the local entrepreneurs:

> *He speaks their language. I cannot put myself into their shoes because I'm not from here. He can, because his father and grandfather lived and worked here. He understands their approach. He acts as someone in between, a cultural liaison.*
>
> *[Local all-rounder B]*

Both in-house designers and local specialist designers spoke about the contradiction between their specialist practice and creativity. The owner and designer at a local design agency exemplified this:

> *You know all the problems connected to the product, and the boundaries they impose on the range of possible solutions. This limits your visions of something new and different. This leads you into a corridor where all the doors are closed. You are too biased to capture the real design opportunities. A designer who is not immersed in the footwear context every day, and who does not have all the expertise that I have, is probably able to come up with more original visions of what the product might be.*
>
> *[Owner and designer at local design agency A]*

A local all-round designer discussed how interactions with design apprentices help him to challenge his own conventions and remain inspired and creative:

> *My practice within the Sportsystem has given me more and more experience, but experience can also be considered ballast. You think more about the consequences of any design choice, what they could lead to, so the ballast restricts you, but just as ballast is needed for balance in a balloon, it gives you balance in design practice. But sometimes you need to get rid of the ballast. In that sense I learn from apprentices who do not have any ballast, they make you think again and freshen up your brain.*
>
> *[Local ace A]*

## 8.5   Competence and Professional Profiles of Design

The companies of the Sportsystem base their choice of design strategy on both economic considerations and the competence and possible contribution of the designer. Most small producers choose to use external designers because of their limited volume of design services and the possibility of paying for design only when needed. The large number of small and medium sized companies in the Sportsystem thus creates good opportunities for local design consultancies. In-house designers are only employed by larger ski and trekking boots producers.

Based on where and how their practice is performed, the designers can be categorized as "global all-rounders", "local all-rounders", "local aces", and "in-house designers". The expertise of each is a result of where and how a majority of their practice is performed and is more or less general and ubiquitous or specific and sticky() A distinction can be drawn between industry expert designers that are specialized in footwear design and generalist designers who work across different product domains. The interviews performed with various design stakeholders in the Sportsystem revealed that the geographical location of the designer has an impact on their practice, expertise and contributions.

*Table 13    Professional profiles and expertise of designers who contribute to the Sportsystem*

| | Specialist practice ⟵ ⟶ Generalist practice | | | |
|---|---|---|---|---|
| | In-house designer | Local aces | Local all-rounders | Global all-rounders |
| **Primary place of practice** | Sportsystem | Sportsystem & occasionally elsewhere | Sportsystem & occasionally elsewhere | Global design discourse |
| **Primary product domain** | Predominantly ski and trekking boots | Predominantly Leisure footwear (city shoes), but also sports footwear | Sports and leisure footwear, sports equipment, product categories that are not related to the Sportsystem | Any product |
| **Design expertise** | General ubiquitous  Specific and sticky | General ubiquitous  Specific and sticky | General ubiquitous  Specific and sticky | General ubiquitous |

The contributions of designers whose "specialist practice" is limited to the product categories that are produced within the Sportsystem build both on general transferrable and local sticky design knowledge. Such practice is typical for in-house designers, local aces, and some local all-rounders. Because of their sticky design knowledge their concepts are often more realistic and closer to what will be the final result of the project than those produced by non-local designers.

The wider the range of product categories that are acted upon by designers, the more general is their practice, and the greater is their reliance on general ubiquitous design knowl-

edge. The practice of local and global all-rounders is conducted across different industries and product types and is therefore referred to as generalist design practice. Their activities, together with a majority of their clients, are located outside the Sportsystem, and their practice builds predominantly on general ubiquious design knowledge. Their contributions are often perceived to be more creative and further away from the status quo than the contributions made by specialist designers. The choice to collaborate with generalist practitioners is in most cases connected to the innovative potential brought by their fresh perspectives and experiences from industries and product types that are not part of the Sportsystem. The product developer and design manager of the roller skate manufacturing company A, which does not have any in-house design resources, expressed his appreciation for generalist practice designers as knowledge brokers:

> We have always used external design. Beyond the economic aspect of not
> having to pay for design in periods of limited design activity, external (non-local)
> designers bring fresh ideas and perspectives that derive from their practice in
> other industries. This is why we like designers who do not limit their activities to
> the footwear domain.
>
> [Product developer and design manager at roller skate manufacturing company A]

The same person later described his experiences with both specialist and generalist designers. He argued that his company chose to move away from the global all-round designer in favor for a local ace because of the amount of work required to turn the design concepts of the former into finished products:

> We used a designer who was based in Milan and who previously designed for
> Lamborghini and some Japanese high tech companies. He was totally separated
> from any of the rules or norms that are customary within the Sportsystem. He
> helped us with the aesthetics of our products; he brought fresh air into our col-
> lections. The only problem was that we had to invest a significant effort in order
> to transform his ideas into finished products. The process required many loops.
> First you had to make sure he had understood what we were after, then wait for
> his sketches, and then often clarify again what it was that we were after and
> wait for additional sketches. The collaboration was not as smooth as it is with
> our current design ally who is based in Montebelluna. He has a pattern maker
> background, and during his career he has developed into a designer. He is able
> to deliver concepts that are very close to what will be the final product. He is
> closer to reality. There is an abyss between those two designers.
>
> [Product developer and design manager at roller skate manufacturing company A]

In his comparison of the competence, practice and contributions of the two designers, he listed the pros and cons for both of them. The local ace knows the product and its limita-

tions, and is therefore able quickly to grasp a design task and understand on which level to act. This results in design concepts that require a limited amount of work of the in-house design engineers. The global all-round designer lacks such experience, which means more work is required from the in-house staff in order to transform the concepts into products. On the other hand, his or her concepts are often more striking:

> There are two sides of the coin. A designer whose activities are based in the Sportsystem is more like an internal designer. He is in close contact with what constitutes our world. He knows the product and its problems, and is able to deliver more immediately useful concepts. A non-local designer on the other hand, is able to give you more unconventional ideas and perspectives that are useful for the creation of new product lines, but he or she doesn't know the product. Because of a lack of experience from our specific domain, he or she will struggle more to contribute with anything useful. You should know what you are after before choosing your design ally.
>
> [Product developer and design manager at roller skate manufacturing company A]

## 8.6   In-house Designers and Local Aces

In house designers are mainly found in larger ski boot or trekking boot companies where the volume of design services needed is large enough to justify the continuous costs of an in-house design department. In-house designers are appreciated for their broad knowledge on the products and processes of their employers. They are involved in and support the whole process from product definition to commercialization. The product development manager of a ski boot manufacturer compared their experiences with in-house and external design:

> In addition to producing beautiful objects and drawings, the in-house designer needs to be a support to the engineering and production processes. Before, the development process was like a mountain road full of hairpin bends. By hiring an in-house designer, we obtained a more efficient development process where less time is needed to get from A to B.
>
> [Product development manager of ski boot manufacturing company A]

The comprehensive specific design knowledge of their in-house designer eliminates the need for pattern makers and they are able to quickly move from design concept to production. They know about the technical, economical, functional, and production requirements for the specific product. A second aspect which is a priority among the companies that have chosen to invest in an in-house design department is a consistent brand. "By being full time in-house you breathe the atmosphere of the company eight hours a day, and you

are able to design products that incorporate the essence of the company and are recognizable on the shelves" (Designer and design manager at trekking boot manufacturer A. Personal conversation, April 2009). A large ski boot producing company that targets the market through two separate brands has chosen to manage design in different ways for each of them. Their high end brand is totally controlled by their in-house designer who is involved in the whole process from product definition to launch. The product manager of the first brand emphasized the importance of a deep product and brand related knowledge in the production of high end products:

> "Brand A" targets users who are focused on performance and excellence. Design is dictated by what gives the product a superior performance. This is why we have chosen to keep the whole design process in-house where employees have high levels of expertise and know-how.
>
> [Marketing manager at a ski boot manufacturing company A]

A majority of the design tasks that are connected to their less prestigious brand are performed by external (non-local) design agencies. In this case the in-house designer manages the interface between the in-house engineering and marketing departments and the external design agency. He or she contextualizes the concept proposals made by the external agency and other suppliers (In-house designer at ski boot manufacturing company A, Personal conversation, April 2009) Through their specialist practice, the local aces develop an expertise that is almost as specialized as that of in-house designers. They are predominantly commissioned by small, local companies that have no in-house design resource, but who are in need of sticky design knowledge. A product developer and design manager at a roller skate and ski boot manufacturing company placed local aces on an equal footing with in-house designers:

> The (local aces) designers that are located in the Sportsystem are almost like in-house designers. All their activities are related to sports footwear, and they know the issues that need to be known in order to be efficient within the sector. This is why they are able to give you solutions that are immediately useful.
>
> [Product developer and design manager at roller skate and ski boot manufacturing company A]

The same product developer further emphasized the need for a continuous and trusting relationship with a designer when brand recognition is to be obtained through product design. Such a relationship, he said, is easiest obtained with a designer whose activities are performed locally:

> We have chosen to maintain a close and continuous collaboration with one local designer. He knows our brand language and helps us create brand consistency and

*recognition. Before, our interactions with designers were limited to two short peri-*
*ods a year in connection collection launches. This was not optimal for our brand.*

*[Product developer and design manager at Roller skate and ski boot manufactur-*
*ing company A]*

In addition to small product producers, there are examples of large companies with
in-house design competence that hire local aces. This strategy is used in moments where
there is a high demand for design which cannot be met exclusively by the in-house design
capacity or when sticky design knowledge which is not held in-house is needed. The
first situation often coincides with the design and restyling of product lines for seasonal
launches. The second situation is connected to the launch of new types of products of
which the internal design department has little experience. By way of their interaction with
the local aces, the in-house designers learn some of the sticky design knowledge that is
needed for the design of the new product category (Designer and design manager at trek-
king boot manufacturing company A, Personal conversation, April 2009).

The product developer and design manager of a roller skate and ski boot manufacturing
company argued that the geographically and culturally situated practice of local aces cre-
ates the foundation for continuous and smooth collaborations. First, the limited geograph-
ical distances make it possible for the designer to spend a lot of time at their clients' sites.
This makes them co-players in product development rather than outsiders who are limited
to the conceptual phases of product development. Second, the sticky cultural design
knowledge held by the local ace facilitates communication:

*We have chosen to assign a majority of our design tasks to a local (ace) designer.*
*His geographic location facilitates communication. You call him and he is able to*
*be here physically within a moment of time. Communication is further simplified*
*by the fact that he originates from our own productive reality. He has a lot of*
*expertise and sometimes he is even able to tell us what is feasible or not. You will*
*have his answer to a brief within a week, and his sketches are very close to what*
*will be the final product.*

*[Product developer and design manager at Roller skate and ski boot manufac-*
*turing company A]*

The practice of local aces spans organizational boundaries. Consequently, they become
experts on the organizational strategies, the users that are targeted, the product port-
folios, the competences and the facilities held by different competing companies in the
Sportsystem. They are thus able to make well-judged project proposals to their clients. In
this sense, the local aces function as external market researchers or antenna for what is "in
the air" in the industry. A local ace who specialized in children's footwear argued that, in his
eyes, his clients are not competitors. He articulated an "in-depth" knowledge of the differ-

ences between the brands and product portfolios of his clients:

> I am one of the few people who design footwear for children. I'm in control of almost all the shoes for children that are produced in Montebelluna. Given that the child collections of different producers depend on me, it would be suicide to copy and paste their different designs. At first sight, my clients may seem to be competitors, but they are not because they live in separate worlds. You may be able to discern my personal style across all the shoes that I design, but that is not what makes the shoe.
>
> [local ace B]

The different worlds of the shoe producers correspond to each of their brands. Local aces are knowledgeable and sensible to the different brands that are present in the Sportsystem. They are able to capture and understand the subtle differences that characterize the brands of each footwear producer and translate them into distinct products. And they often play an active role in the production of brand recognition through product design (Design engineer at roller skate and ski boot manufacturing company A, Personal conversation, April 2009).

The social and cultural sticky design knowledge of local aces gives them social capital which helps them in the creation of design networks within the industry. These networks give them access to a wide range of expertise and production facilities. They know the competences and facilities of their local suppliers as well as how these can be combined into innovative solutions (Local ace A, Personal conversation, April 2009).

## 8.7   Local and Global All-rounders

For various reasons some design agencies that are based in Montebelluna have chosen to limit the amount of work performed for clients within the Sportsystem. The owner and design manager at a local design and product development agency commented on the reduced risk that is connected to the choice of working across different industries. Further he held that it would be unethical to work for more than one producer of a specific product because of the risk of transferring knowledge between competing clients:

> It is not very professional to work for competing companies. It has to do with intellectual honesty. Even if you try not to, it is impossible not to transfer ideas from one company to another. What you learn from one of them will unconsciously be transferred to the other. I am not talking about explicit knowledge on innovative materials or technologies, but more about intuitions of what is more or less beautiful or trendy. This is why I choose to work across different industries

*and limit my services to one client per product type.*

*[Local All-rounder A]*

The design manager at a local product design agency with clients both within the Sportsystem and outside it argued their strategy was a means to obtain greater visibility and recognition as a design agency and thereby more opportunities:

*The sports industry exposes the pilot. A sports equipment designer doesn't get any direct promotion from the results of his projects. In the furniture industry on the other hand, the name of the designer is almost more important than the product itself. This is why I decided to combine my business in the sports industry with projects in the furniture industry. This has given us a lot of visibility.*

*[Local All-rounder B]*

A majority of the local all-rounders that were interviewed mentioned the benefits connected to creativity and inspiration as the main reason they chose to target a broader range of customers. Through their practice across industries and product types they continuously learn and transfer knowledge into and out of the Sportsystem. The local all-rounders are commissioned by both companies within the Sportsystem and outside. The local companies appreciate their social and cultural sticky design knowledge in combination with the general transferrable design knowledge that they obtain in projects performed outside the Sportsystem. Clients from other industries appreciate their sports-inspired and functional approach to design and product development.

Global all-rounders are commissioned by companies in the Sportsystem who want something different that they cannot obtain locally. One example is when the ski boot producers of Montebelluna "imported" global design consultants with general ubiquitous design knowledge of plastics in connection with their transition from leather to plastic ski boots in the 1960s. In other more recent examples global all-rounders have been commissioned because of their lack of sticky design knowledge, which results in critical perspectives on what is taken for granted in the Sportsystem and which often results in fresh ideas. The in-house designer of a ski boot producing company who systematically use global all-rounders for one of their brands expressed the importance of the external inspirations that are brought by these designers:

*We use external (global all-rounders) designers when we want something different from what can be conceived in-house. We are often looking for inspiration in the new perspectives that are brought by their concepts. We choose external designers with experience from industries that are conceptually far from our own.*

*[In-house designer at a ski boot manufacturing company A]*

The contributions that are made by global all-rounders are generally limited to isolated occasions and to the initial and conceptual phase of product development. The commissioning company contacts the designer who makes proposals in response to a brief that has been formulated in-house. Once the proposals are handed over to the client firm, the role of the global all-rounder is limited to supervision. The concept is carried through by in-house designers and engineers (Product development manager at ski boot manufacturing company A, Personal conversation, April 2009). Often the value of their input lies in new aesthetics or on a symbolic plane.

The experiences of collaborations with global all-rounders differed between the companies that have design competence in-house, and those that do not. While the companies with in-house design competence were often positive about the contributions that had been made by global all-rounders, many of the companies that did not have in-house design resources expressed frustration about the limited utility of such design proposals. The interviews revealed that in-house designers compensate for the lack of sticky design knowledge of the global all-rounders as they are able to contextualize their design proposals. As companies that have no in-house design department lack any such knowledge contextualizer, they struggle to integrate the valuable external knowledge held by the global all-round designer.

## 8.8  The Design Knowledge of the Region

Few examples of successful design partnerships across distance were found in the sportsystem. These were generally limited to occasions where resourceful local companies wished to explored ways in which totally new product types could be fashioned and often resulted in long and precarious new product development processes characterized by a high number of feedback loops. The limited presence of any type of global design professionals can be considered a manifestation of the importance of sticky design knowledge within the industry. The specific knowledge that is inherent in new product development and design of sports and leisure shoes is difficult to find elsewhere. The interviews even revealed cases where local aces in Montebelluna where commissioned as experts by global corporations make related products. The global corporations could through the local aces access some of the sticky design knowledge of the local design community in Montebelluna.

The interviews revealed that part of the design knowledge that is used in the Sportsystem is sticky, and can only be learned through continuous practice on site. The sticky design knowledge that is rooted in the Sportsystem concerns what can be done in the setting of the local industry. Without such knowledge there is a risk of designing something

which cannot be produced. An in-house designer at a ski boot producing company which systematically uses global all-rounders as sources for inspiration and ideas spoke about the challenges connected with their design consultants' lack of such knowledge:

> *The problem is that these designers (global all-rounders) lack knowledge and experience from our domain. They don't understand where it is, and where it is not possible to push a concept. They often suggest changes that will never get through or fail to see possible directions where significant change could potentially be accomplished.*
>
> *[In-house designer at a ski boot manufacturing company A]*

What is possible to do or not has social, cultural, and technical dimensions on product, brand, company, and industry levels. The social, cultural, and technical dimensions of sticky design knowledge are found in both design and use activities. The existence of socially and culturally sticky design knowledge was indicated by designers whose main activities are performed outside of the Sportsystem, and who experience practice in Montebelluna as culturally challenging. The challenge lies in the contrast between the culturally intertwined modus operandi which is a result of the industry's evolution, and modern non-local practices. The discourse of two product developers that are employed at a roller skate and ski boot manufacturing company whose practice interface with external designers further illustrated that the interaction with designers is facilitated if the latter holds some cultural and social sticky design knowledge. They found it easier to collaborate and communicate with local designers because of their shared social environment and culture (Design engineer at roller skate and ski boot manufacturing company A. Personal conversation. April 2009).

The cultural dimension of sticky design knowledge also relates to the visual cultures of the various companies in the industry and of the industry and product category itself. Such knowledge is developed over time together with the evolution of the industry, companies and their products. An in-house designer at a large ski boot manufacturing company exemplified how external designers sometimes, because of a lack of historically situated cultural design knowledge, tend to challenge the product archetype too much:

> *Many of our external collaborators propose product concepts that are very distant, even too distant from what visually and functionally defines the product. I am not talking about the visual expression of our brand, but that of the whole product category, the ski boot.*
>
> *[In-house designer at ski boot manufacturing company A]*

The sticky social design knowledge of the Sportsystem relates to the constitution and membership of the industry. A designer who holds such knowledge is aware of the orienta-

tion, competence and facilities held by various competitors and suppliers, and how these can assist and be strengthened through design. This knowledge is typically useful for local aces who want to sell ideas and projects to producers. They know which idea is suitable for which producer, and strategic compatibilities within the local network.

By way of their practice, which is performed exclusively on the products that are produced in the specific industry, the local aces become knowledgeable about the use side of social and cultural sticky design knowledge. This relates to how the product offerings and design of the various companies within the industry shape, and are shaped by, the socio-cultural use activities of different user communities. One example is how products and brands are turned into symbols with different meanings by diverse social and cultural groups. Such knowledge may well determine the success of a product in the market and is therefore an essential input for the design activity.

Performance and fit is of major importance for the products that are produced within the Sportsystem. The use dimension of sticky technical design knowledge relates to how the product is used. Designers who do not have in depth knowledge of use often struggle to produce successful concepts. The former R&D manager of a large ski boot producing company argued that it was the lack of technical sticky knowledge on design and use which was the main reason why the collaboration with a global all-rounder had failed:

> He didn't understand why the buckle remained closed after closing it. He was not able to understand why the ski boot buckle remained closed or open, or that the angle between the bootleg and the upper boot needed to be 14 degrees. He made beautiful but useless sketches on a ski boot with a 25 degree leg angle and a low profile upper sole which didn't even leave enough space for your toe nails. The result of our collaboration was limited to a few pimped drawings whose only use application was as artwork for the walls of a museum.
>
> [Retired product development manager at ski boot manufacturing company B]

Although many modern design schools teach their students methods and approaches aimed at capturing design knowledge that resides within user communities, the assimilation of sticky design knowledge often requires a learning period on site. The designers of the Sportsystem learn sticky design knowledge in different ways. A former in-house designer of a large ski boot manufacturer who now works for a trekking boot manufacturer related how he went through a one-year introduction program in the company before he was able to be productive as a designer:

> My first year at "ski boot producer B" I did little design. They asked me to perform quality controls and test the products that had been designed by others by using them. This helped me to understand the product, its function and how it was made. After testing, they asked me to copy the product and show them that I

*was able to design an identical product and prepare it for production. This gave me an understanding of what is required from the engineers that would later be the ones to industrialize my design proposals. School couldn't possibly prepare me for such a specialist practice.*

*[Designer and design manager at trekking boot manufacturing company]*

A local ace exemplified how his specialist hobbyist knowledge on the practical use of skates was considered a resource within the Sportsystem and gave him opportunities to design roller skates for local producers:

*I got called by "Multinational sports and leisure products manufacturer A". They needed a designer for designing rollerblades, their in-line skates. They wanted to access my experience with skating. Skating was my hobby, I taught college students speed skating. That's why I also did my thesis on the design of a skate, because I like skating and I did a skate.*

*[Owner and designer at local local design agency B]*

The technical dimension of sticky design knowledge in the Sportsystem relates to materials, such as the possibilities and restraints of different types of plastics used in ski boots, which qualities of leather are suitable for different types or parts of footwear, how to design for different sizes, how to respect the different shapes and movements of feet, mechanisms, standards and norms and available production methods. The product developer and design manager of a roller skate and ski boot manufacturing company described how their local ace operates within the industrial paradigm by proposing concepts that are ready for production and that do not need to be modified any further by the in-house engineers. Those concepts are very close to what the final product will look like:

*His concepts are sketched directly onto the shape of a piece of footwear. You can see that the lines on this drawing are very close to the lines that will be seen on both the soft and hard parts of the final footwear. We give him input on what we want, and he is actually able to contribute on a deeper level. He is able to tell us what can and what cannot be done.*

*[Product developer and design manager at roller skate and ski boot manufacturer A]*

The general ubiquitous design knowledge that is used in the Sportsystem concerns the design process and different approaches that can be useful in different contexts; production methods, materials, and solution principles that are used in different industries; ergonomics; aesthetics; and symbolic knowledge inherent to the global design discourse. The interviews revealed a few examples of where design knowledge from distant fields brought material, structural, technological or functional innovation. A historical example where transferrable design knowledge contributed to structural innovations without being the source of the idea

is provided by the "import" of global product designers in connection to the development of the plastic ski boot.

The Tubiquitous design knowledge on the behavior of the plastic material and its expressive possibilities contributed to the success of the product in the market. A second example is provided by the involvement of a global product designer in the development of the IDEA ski boot reported in Section 8.3. In this case, the transferrable design knowledge of user understanding and on principles of mechanical solutions that were brought by the global product designer contributed to a more user-centered product. However, in most of the examples where transferrable design knowledge was beneficial to the Sportsystem, the knowledge comes from industries that build on similar knowledge bases. The owner and designer of local product design agency explained how he thought experience from similar but separate industries could contribute to innovation:

> In addition to sports, we design medical products and orthopedic products. They are different, but also similar, so it is possible to cross fertilize the knowledge you gain in both worlds. The only difference is that in sports you damage yourself and you need braces to recover. They are all made out of flexible materials such as stitched metal bends and plastics. They all need to fit your body and movements and enhance your performance. One of them before you hurt yourself, and the other one afterwards.
>
> [Local All-rounder B]

Another local all-rounder who complements his work in the Sportsystem with commissions for the household appliance industry mentioned knowledge on ergonomics and human factors as something useful across the industries:

> We also design electronics and thermostats were we can see some similarities with sports. Compare a domestic thermostat and an electro stimulator which is used by athletes. In both cases you need to communicate with the user through a display, and in both cases you need to take ergonomics and human factors into consideration.
>
> [Local All-rounder A]

The transferrable design knowledge that is held by all-rounders is, in fortunate cases, a resource to the companies in the Sportsystem. A local all-rounder liked to think of his cross industry practice as continuous research made available to his clients for free:

> We do research. Not like an academic institution, but by way of our practice in different industries and through contacts with supply chains, suppliers and trade fairs…. Our research is embedded in our everyday work where we develop products for n companies and where knowledge spillovers are ever present.

*Therefore the cost of research is much lower than it is for a company that limits its activities to one type of product. It is a byproduct that we do not invoice.*

*[Local All-rounder A]*

The design knowledge that is used by the various professional designers that contribute to the Sportsystem is summarized in table 15.

*Table 15.    Professional profiles and expertise of designers who contribute to the Sportsystem.*

| | Specialist practice | | | Generalist practice |
|---|---|---|---|---|
| | In-house designers | Local aces | Local all-rounders | Global all-rounders |
| General ubiquitous design knowledge of | General design methods, tools, and approaches<br><br>Ergonomics | | Aesthetic and symbolic design knowledge from the global design discourse<br><br>Production methods and materials as applied in different product categories<br><br>Ergonomics<br><br>User cognition<br><br>"What is in the air in the global design discourse" | |
| Specific sticky knowledge of | Ergonomics and anthropometrics of lower leg and foot in specific use activities<br><br>Soft materials that are used for casual footwear and linings, as well as the knowledge that is needed in order to handle the interface between soft and hard materials<br><br>Usefulness of design concepts<br><br>Feasibility of design concepts<br><br>Aesthetic and symbolic knowledge related to the product category – the visual culture of the industry<br><br>Product portfolios of local companies<br><br>Untraded interdependencies that influence design activities in the industry | | | |
| | The real needs of the company<br><br>Brand languages of the company<br><br>Organizational strategy of own company and target users | The real needs of the different companies within the agglomeration<br><br>Differences in brand languages among companies within the agglomeration<br><br>Organizational strategies of different companies and their individual targets<br><br>Competences and facilities of different companies within the agglomeration<br><br>"What is in the air in the local industry" | | |

9

## Industrial Design in Industrial Agglomerations

The research described in this work focuses on the geographical dimension of design competence, and how both design practice and design management is influenced by the geographical and cultural setting of new product development. This is a matter that has received limited attention from the design research community, but which already in the initial phases of this research project was seen to have implications for design researchers, educators, practitioners and managers, and therefore merited more theoretical attention.

The spatial dimension of professional practice has been studied extensively in the field of economic geography (Asheim & Gertler, 2005; Bathelt et al., 2004; Belussi & Pilotti, 2002; Hudson, 1999; Storper, 1997). This stream of research has informed this work with useful spatial and cultural perspectives. A branch of economic geography research that has been of particular relevance to the study is that which focuses on why innovative activities of different industries tend to gather in geographically delimited areas referred to as clusters, regional innovation systems, innovative milieus or industrial agglomerations. This line of study assigns importance to skilled, competent and knowledgeable local professionals who are considered the key to successful product development and whose sticky knowledge is understood as a competitive asset for the companies that are located in industrial agglomerations.

Industrial design activities are performed mostly in the context of product development through knowledge intensive and skilled practices that have a range of manifestations, and make a variety of contributions to different industrial contexts. A geographical perspective on industrial design practice and management thus brought forth questions of how industrial designer competences that are organized in different spatial constellations contribute to innovation, and how industrial design practice and management is influenced by place. The answers to these questions could fruitfully be sought in different industrial agglomerations, since those are spatially and culturally delimited contexts of practice where design activities are performed by a range of design practitioners who are organized in different spatial constellations but whose practices address a limited and related set of products. The aim of the research was to contribute to researchers and practitioners of design and design management with useful knowledge on the use and practice of industrial design in product development in industrial agglomerations. This aim was attained through a qualitative case study and addressed the following main research questions:

1. What characterizes design practices and design management in industry agglomerations?

2. How does industrial design contribute to new product development in industry agglomerations?

The nature of the research questions, the desire to contribute to the design community with a vicarious experience of the rich environment, and the intertwined dimensions that

characterize industrial design practice and management in industrial agglomerations, suggested that a qualitative case study approach was appropriate for the work. Three cases that could potentially contribute to a rich understanding of the research theme were chosen. Each case consisted of one regional, industrial agglomeration, and therefore offered the possibility to study a range of design management strategies, design practices and respective contributions to a single product type at an industrial level. The regionally agglomerated Norwegian industries of shipbuilding in and around Ålesund and furniture in and around Sykkylven and the Italian production system of sports and leisure shoes in Montebelluna offered contexts of different character for the three cases. First they produce objects aimed at different uses with accordingly distinct main customer values. Second they present different kinds of product and industry complexity. And third they have different traditions of industrial design.

The data were collected through interviews with design practitioners, design managers and other stakeholders of design in each industrial agglomeration. The results from individual cases were compared in order to gain insights on how design in industrial agglomerations changes with product type, industrial setting and place. Although the cases represent different product types, geographical locations and traditions for the use of industrial design, they also share some characteristics that can be useful in understanding industrial design in industrial agglomerations, and when geographical aspects of design competence are to be understood more generally. The following sections answer the research questions by considering the three research cases described in Chapters Six, Seven and Eight.

## 9.1 The Character of Design in Industry Agglomerations

The character of design in the three industrial agglomerations that were included in the research project was understood by studying how industrial design is used and practiced in local processes of product development. The research suggests that the scale, scope and integration of industrial design in industrial agglomerations can be considered at an industry level and that, in addition to local, untraded interdependencies, it is related to a range of interconnected aspects, such as design maturity, the main use value of the product, industry lifecycle, the focus of innovation activities and the degree to which new product development and design is distributed across organizations in individual industries. Table 16 presents the three cases in relation to these dimensions.

Table 16. Key characteristics of the cases that are represented in the study.

| | The maritime agglomeration in and around Ålesund | The furniture industry agglomeration in and around Sykkylven | The industry agglomeration of sports and leisure footwear in and around Montebelluna |
|---|---|---|---|
| **Design maturity** | DESIGN AS STRATEGY — Design is a key strategic means of securing innovation; DESIGN AS PROCESS — Design is an integral to the product or service development process; DESIGN AS STYLING — Design is relevant in terms of style; NO DESIGN — Design plays no role in product or service development | DESIGN AS STRATEGY — Design is a key strategic means of securing innovation; DESIGN AS PROCESS — Design is an integral to the product or service development process; DESIGN AS STYLING — Design is relevant in terms of style; NO DESIGN — Design plays no role in product or service development | DESIGN AS STRATEGY — Design is a key strategic means of securing innovation; DESIGN AS PROCESS — Design is an integral to the product or service development process; DESIGN AS STYLING — Design is relevant in terms of style; NO DESIGN — Design plays no role in product or service development |
| **Knowledge bases, main use values, and focus of innovation and design activities** | KNOWLEDGE BASE: Synthetic → Symbolic; FOCUS OF INNOVATION: Technologies/Performance → Meanings; USE VALUE: Instrumental → Symbolic; DESIGN FOCUS: Human-centered → Meaning-centered. [MARITIME] | KNOWLEDGE BASE: Synthetic → Symbolic; FOCUS OF INNOVATION: Technologies/Performance → Meanings; USE VALUE: Instrumental → Symbolic; DESIGN FOCUS: Human-centered → Meaning-centered. [FURNITURE] | KNOWLEDGE BASE: Synthetic → Symbolic; FOCUS OF INNOVATION: Technologies/Performance → Meanings; USE VALUE: Instrumental → Symbolic; DESIGN FOCUS: Human-centered → Meaning-centered. [SPORTS FOOTWEAR] |
| **Degree of distribution of design interventions** | Disintegrated design interventions limited to fragmented parts | Disintegrated focused on the visible parts of furniture manufacturers | Distributed across organizational boundaries, integrative |

Apart from a few extraordinary exceptions, the scale and scope of design in the maritime industrial agglomeration of Ålesund has been limited to occasional interventions that have been made by a few large ship building companies and a minority of the many ship equipment suppliers. The industry in its current shape is relatively young, and innovation is still primarily focused on technologies and performance rather than on human centered values. The main use function of its products is distinctively instrumental. Consequently, until recently, design has been disregarded as an element that lacks any potential to add value to the customers. This state is, however, currently changing, with a few pioneering organizations that first used design as a means to visually differentiate their offerings from those of their competitors, and recently also in new product development processes that focus on usability issues of the ship's bridge. Design is, thus, at this moment in an evolutionary process of defining its proper role in the industry. Except from one major company of the ship industry, which has internalized the entire production chain, the product range of the industrial agglomeration is distributed across organizations. With few exceptions, industrial designers are rarely used on systemic levels but their interventions bear upon fragmented parts of the system of products that make up the industry and the end product.

In the furniture industry in and around Sykkylven on the other hand, design is used extensively. Although the industry first focused on innovations related to rational production and on the production of affordable products, it now has an established tradition for the strategic use of design. This has been a necessary step in order to remain competitive in the global market, where Norwegian companies have difficulty in competing on price. Compared with the products of the shipbuilding industry, the high symbolic use value of furniture and the established traditions for design in the global furniture design community make design a more natural value adding strategy here.

The design interventions that take place in the in-house design department of the major furniture producer can be characterized as a mix of human centered and symbolic. In-house designers are here are deployed to create both novelty in structure and use, and brand coherence. On the other hand, many of the SMEs in the industry focus more on pure symbolic and aesthetic designer interventions that communicate the identities and brands of their designers rather than producing visual coherence in the product portfolio. The production of the SMEs in the furniture industry in Sykkylven is distributed between organizations. However, beyond the mere identification of existing parts and pieces of suppliers that can satisfy the needs of design concepts, the case identified only a few isolated occasions where the design innovations of individual designers had been adopted in product development processes across organizational borders.

Those practices were found to be the everyday activity of designers who work in the Sportsystem in Montebelluna. This is the oldest of the three industries that were studied.

It presents a high degree of design maturity, where design is used as a strategy in many of the organizations. Despite the fact that industrial design professionals have only been present in the industrial agglomeration since the 1960s, they have an unquestioned role. Before the introduction of industrial design into the industry, design related considerations and choices were made by pattern makers. The evolution of design thinking in the industry can therefore be considered to have been going on for a long time, and is tightly woven into the evolution of the industry itself. The manual and craft-based traditions of the pattern makers have lived on in the design community of the industry, where designers are a natural integrating element in distributed product development. Design interventions thus span organizational boundaries in the integrative production of holistic products. The mix of instrumental and symbolic use values makes design essential for comfort, performance and for the fashion-oriented requirements that are shaped within the user communities and that are addressed through seasonal restyling of product collections.

## 9.2 The Use of Design Resources in Industrial Agglomerations

The geographical perspective that was brought by the study context of new product development in industrial agglomerations, and which acknowledges that design practice is a socially, culturally, historically and territorially situated activity, brought special attention to the organizational and physical distribution of design. While design management scholars have recognized the existence and contributions of in-house designers and external designers to corporations (Borja de Mozota, 2003, p. 168; Bruce & Morris, 1994, 1998; Cooper & Press, 1995), this study showed that companies that are located in industrial agglomerations make use of a more nuanced portfolio of design practitioners.

Design interventions within the industrial agglomerations that were studied are performed by in-house designers, local and global aces and local and global all-round designers. The category of local aces, who are external to the client company but who work exclusively for local companies, was found in all three cases. Although they are external to the client company, the contributions and practices of these designers are distinct from those of external designers as previously described in the design management literature. While the conventional idea is that the integration of external designers in new product development and their level of specific design knowledge are limited, making them useful as providers of fresh and creative ideas (Blaich & Blaich, 1993; Borja de Mozota, 2003; Bruce & Morris, 1994; Jevnaker & Bruce, 1998; Von Stamm, 2004;1993), the local aces that were found in industrial agglomerations are both highly integrated in corporate product development, and have a deep specific design knowledge which is intimately tied to the local production context, and is thus sticky.

In addition to the spatial and functional organization and integration of different designers who contribute to new product development in industrial agglomerations, the research considered the contributions of different design professionals from a knowledge perspective. The industrial design practices and contributions that were found in the three cases either relied on knowledge that is specific to individual industries in specialist design practices, or on more general design knowledge that is used in generalist design practices. While specialist practice requires knowledge and experience from a limited set of related industries, generalist practices rely on knowledge and experience that are learned in design schools or learned through practice across different industries. Table 17 shows the different types of designers that were found in the three cases, and the nature of their respective practices.

*Table 16.   The different design professionals that were found within the three industry agglomerations, and the nature of their practices*

| | | The maritime agglomeration in and around Ålesund | The furniture industry agglomeration in and around Sykkylven | The industry agglomeration of sports and leisure footwear in and around Montebelluna |
|---|---|---|---|---|
| **Generalist Practices** | In-house designers | x | x | x |
| | Local aces | limited | x | x |
| | Global aces | – | x | – |
| | Global star designers | – | x | – |
| **Specialist Practices** | Local all-rounders | limited | limited | x |
| | Global all-rounders | x | limited | limited |

In addition to the general or specific nature of the various design practices mentioned above, the geographical perspective of this study recommended consideration of the local and sticky or global and ubiquitous nature of design knowledge. The stickyness or leakiness of knowledge in general has been discussed by scholars from a variety of fields (Asheim, 1999; Brown & Duguid, 2001; Gertler, 2003; Maskell & Malmberg, 1999;

Von Hippel, 1994), but design researchers have not yet dealt specifically with the sticky or ubiquitous nature of design knowledge. This study adapted the concepts of sticky and ubiquitous knowledge as understood by economic geographers to design knowing, and the research showed and exemplified the existence of combinations of sticky and ubiquitous design knowledge in industrial agglomerations.

In the light of research that has been performed by others (Gertler, 2003; Kuutti, 2009; Maskell & Malmberg, 1999; Nelson & Stolterman, 2003), and in line with the research findings of this study, sticky design knowledge was conceived as design knowing that is tied to the context where it is created and used in wise design judgments. It is situated in the local industrial context and the extent to which it can be used elsewhere is limited. It is often tacit and thus difficult to obtain, except through face to face interactions or long term presence in a specific design milieu. Because it is closely connected to local practice, sticky design knowledge was only found among the practices of in-house designers, local aces, and to some extent of the local all-rounders of the study. Ubiquitous design knowledge, on the other hand, is general and adaptive. Because of its global nature such knowledge was found mainly among the non-local designers who contribute to the industries that were studied.

The volumes of design services that are performed by in-house designers in the individual industries that were studied vary, but generally their presences were found only in large companies that are responsible for the end products of their respective industries. Although these large companies are important parts of the industrial agglomeration economies, their size and functional internal integration means that they are not typical of the local context. From a knowledge dynamics perspective, it is more relevant to discuss the presence of local aces whose practices are conducted exclusively for local SMEs, local all-rounders, who work for both local SMEs and for non-local companies, global star designers and aces who are mostly industry experts who are not local, and global all-rounders. The last are occasionally commissioned by local companies, but as they work globally across industries they are not specialists in any specific product.

Through their local practice, the local aces become both industry experts, and gain the local sticky knowledge that is present in their home industry. Their local presence further makes continuous, tight and integrated collaborations with clients possible, where they, like in-house designers, are involved from product definition to product launch. The research exemplified how they are able to work in an integrative manner in industries where product development is distributed across organizations. Their tight integration gives them more control over the final product outcome, where all the small choices that are made along the product development process can be guided by the initial concept. No similarly tight and integrative collaborations were found in design partnerships that crossed the borders of the industrial agglomerations. A design manager of a furniture

manufacturing company even argued that local aces are the in-house designers of the region. They give the local SMEs who cannot afford to keep an in-house design department access to both industry specific and sticky knowledge.

Global star designers and global aces were found only in the furniture industry. They are specialized in furniture design, but work for a variety of global clients. They play an important role to furniture producers whose innovation efforts are focused primarily to symbolic or aesthetic product functions, and whose product value is connected to the name of a designer. Through commissions for globally prestigious furniture manufacturers, star designers have earned their reputations, which are used strategically by their clients as a means to spread star quality over their furniture brand. However, the physical distance between the star designers and global aces and their clients makes it difficult to integrate their work with local product development practices. Their contributions thus often need to be contextualized by in-house product development professionals. A similar need for integration of ubiquitous design knowledge was found in cases where global all-rounders are used.

Global and local all-round designers work across industries. The geographical distance to their clients reduces their integration in new product development. In contrast their local counterparts are easier to integrate into the daily new product development activities. This is due to both their sticky cultural design knowledge and to their local presence and possibility to participate in any decision that bears upon the final product. The various design practices that were found in the industrial agglomerations that were studied, their degree of integration into corporate product development, their levels of general or specific design knowledge, and the sticky or ubiquitous nature of their knowledge are summarized in Figure 35.
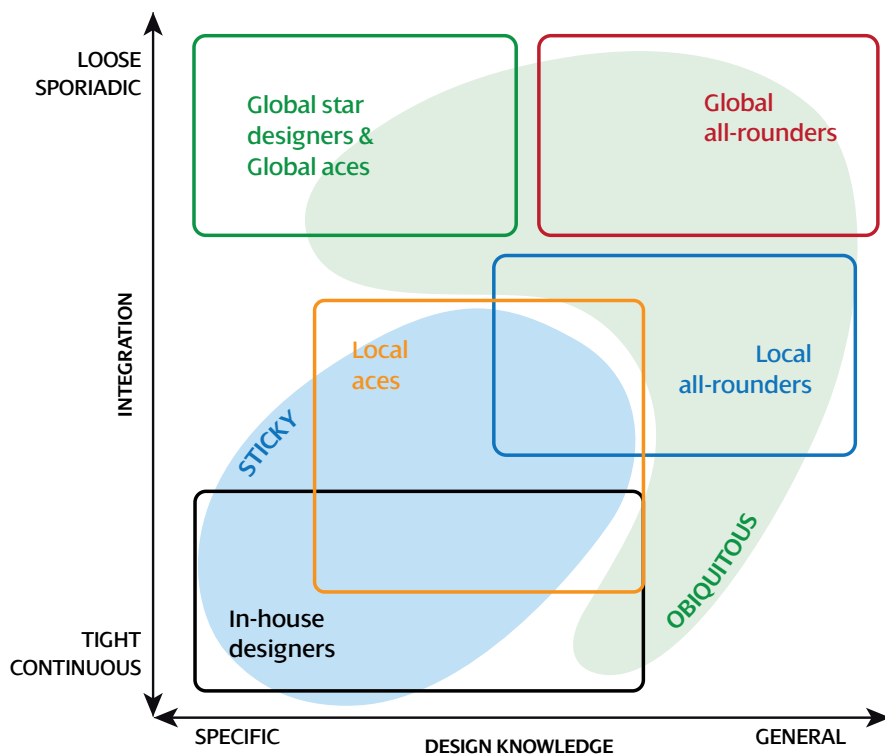
*Figure 35. The design practices that were found in the industrial agglomerations, their degree of integration into corporate product development, their levels of general or specific design knowledge, and the sticky or ubiquitous nature of their knowledge.*

## 9.3   The Contributions of Design to Industrial Agglomerations

In this work, industrial design and innovation are recognized as knowledge and skill inten-sive activities that are situated in time, place and cultures. This, together with an apprecia-tion of industrial agglomerations as local business contexts that are competitive globally due to the unique knowledge bases that are held by local communities of professionals, and their ability to assimilate and use global knowledge in new ways, flavoured the under-standing of designers as contributors to new product development in such contexts. The contributions of industrial design professionals to the product development of companies that are located in industrial agglomerations were thus studied from a place and knowl-edge perspective.

A number of studies have dealt with designers as knowledge agents (for example Ashton, 2004; Bertola & Teixeira, 2003; Hargadon, 1998; Hargadon & Sutton, 1997; Sunley et al., 2008; Verganti, 2003). Hargadon and Sutton described how global design consultancies are brokers of technological knowledge as they move between clients across industries. Sunley et al. argued that designers act as creative brokers between the knowledge bases of the design agency and the client. Verganti outlined how external designers are brokers of languages and meanings from the global design discourse. And Bertola and Teixeira showed that designers act as integrators of knowledge across functions within large cor-porations and as brokers of local network knowledge in Italian industrial districts. Ashton, who studied the knowledge dynamics of a number of industrial agglomerations, found that global design consultants and other professionals contribute to local companies in industrial agglomerations with global knowledge of markets and user trends and on activi-ties and methods of other manufacturers. This work advances the findings of the authors mentioned here as it identifies how differentiated design community contribute to the knowledge dynamics of industrial agglomerations. The findings are discussed in the light of both product type and spatially and culturally situated design knowledge bases. The following sections explain how industrial designers contribute to the knowledge dynamics that constitute the strength of industrial agglomerations.

The research explained how designers, through their practices, contribute directly to indi-vidual companies and, through the intra-regional knowledge dynamics that characterize industrial agglomerations, indirectly to their industries as a whole. The results suggested that the variety of competences that are held by different designers who work for client companies in regional agglomerations contribute to these knowledge dynamics in distinct ways. Figure 36, which is a development Figure 5, shows the places of situated design practice that shape the competences of individual designers who contribute to localized industries. In what follows it is used as a basis for discussion related to the cultural and cognitive connections of designers and their individual contributions to local clients.
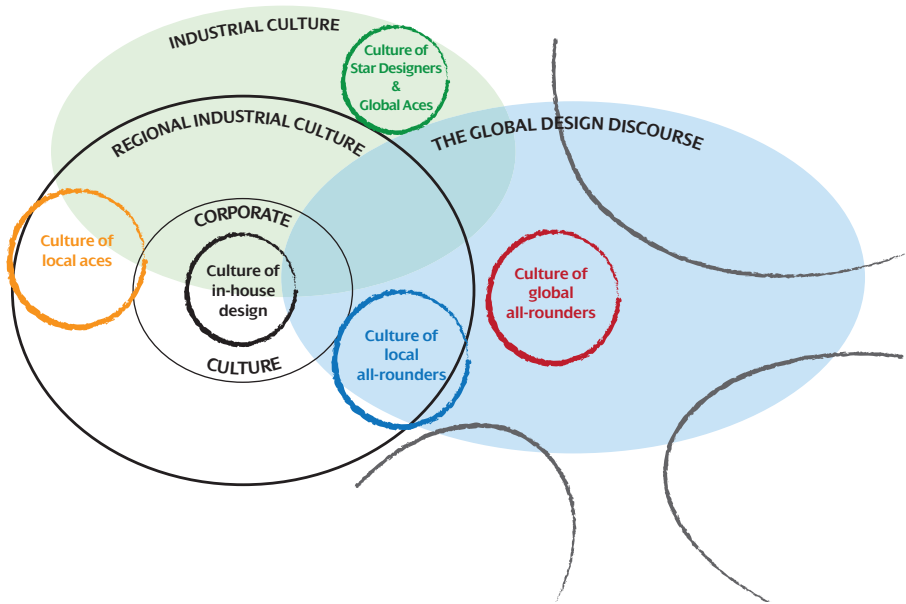
*Figure 36. The geographic, cultural and cognitive connections of different designers who contribute to industrial agglomerations.*

The practice of in-house designers, local aces, and local all-round designers are located in the geographic and cultural setting of the industrial agglomeration. They are therefore knowledgeable in the culture, traditions and untraded interdependencies that determine new product development within the local industry. In house designers and local aces take part in the creation of the local design discourse which builds on both sticky and ubiquitous design knowledge. It is part of the unique human capital that makes regionally agglomerated industries producers of superior products. Local designers thus contribute both directly to new product development and as design managers and as such local gatekeepers and integrators of external and global design knowledge.

The cross industry practice of both local and global all-rounders makes them participants and co-creators of the global design discourse. Consequently they function as global pipelines of ubiquitous design knowledge from the global design discourse into the local context. The ubiquitous design knowledge of global all-rounders is often contextualized

by local designers or product development professionals with sufficient design knowledge to interpret and integrate the external design knowledge into the local design discourse and products. By way of their local adherence and global practice, local all-round designers gain both sticky and ubiquitous design knowledge. Like their global counterparts they are appreciated for their ability to question established product languages and bring fresh perspectives to the design of the products that are produced within the agglomeration. But in contrast to global all-rounders local all-rounders have the relational asset of sticky design knowledge related to the cultures and untraded interdependencies that determine local new product development practices. This makes them a "safe creative alternative" to local alternatives. They can perform both the function of global pipelines of ubiquitous design knowledge from the global design discourse and local gatekeepers and integrators of the same knowledge.

Local all-round designers are thus able to do what other wise requires does what otherwise requires both global and local design professionals: They create, understand, interpret and materialize the ubiquitous knowledge that is embedded in the global design discourse in design proposals for the local context. These findings resonate with, and exemplify the general accounts of global pipelines that were made by Bathelt et al. within the context of design (Bathelt et al., 2004). Star designers and global aces, whose design practices were found exclusively within the furniture industry in Sykkylven are located within the global industrial culture of furniture design but outside of the industry agglomeration. Accordingly they have knowledge that is specific for the global furniture industry, but lack any eventual sticky design knowledge of the furniture agglomeration in Sykkylven. However, their knowledge often requires efforts of integration of local designers or product development professionals in order to be fruitful to the products of the agglomeration.

The research suggests that the degree to which each type of designer contributes to an individual industrial agglomeration is related to the need for specific, general, sticky, or ubiquitous design knowledge in local product development. This further appeared to be connected to the industry lifecycle, the main use value of the products and the corresponding knowledge bases upon which innovation relies, the complexity of the products and industrial organization, the organizational distribution of product development activities and the extent to which these permeated the local culture of the industry. This is exemplified in the following sections.

The three industries that were studied only used global all-round designers during the early phases of local design evolution, and at that point they contributed with ubiquitous design knowledge. The Sportsystem in Montebelluna, and the furniture industry in Sykkylven, which are the two design mature industries in the study, illustrate how time and industrial evolution produces a differentiated and spatially distributed design community and the establishment of a body of sticky design knowledge. The relation between product and in-

dustry complexity and the need for local design competence was showed by the roles that were played by local designers in the functionally distributed industries of shipbuilding in Ålesund and of sports and leisure shoes in Montebelluna. Although the innovation focus of the ship building industry generally calls for ubiquitous design knowledge in cognitive ergonomics and interaction design, few global designers had managed to contribute to the industry at systemic levels at the time of the study. Such design interventions require sticky design knowledge of the organizational structures and the untraded interdependencies that dictate the local every day. Untraded interdependencies likewise provide us with a key for understanding the distributed design activities in the Sportsystem of Montebelluna that are dominated by local designers. The design of footwear requires coordinated and integrative design efforts where the designer takes on the role as a central cog in the wheel in the distributed product development. Local design therefore depends on sticky design knowledge related to the untraded interdependencies that determine the actual product development practices.

The furniture industry in Sykkylven is a good example of how the main use value of a product influences the role of the different types of designers. In contrast to the synthetic design knowledge upon which many design interventions in Montebelluna and Ålesund rely, design services that are delivered to many of the SMEs in Sykkylven build mainly on ubiquitous design knowledge of a symbolic and aesthetic nature. The main use value of the actual furniture has created a local market for global aces and star designers who take part in the global design discourse. The ways in which different types of designers contribute to the knowledge dynamics of the industrial agglomerations in the study are summarized in table 18.

*Table 18.*    *The contributions that are made by different types of designers to the knowledge dynamics of the industrial agglomerations.*

|  | The maritime agglomeration in and around Ålesund | The furniture industry agglomeration in and around Sykkylven | The industry agglomeration of sports and leisure footwear in and around Montebelluna |
|---|---|---|---|
| **In-house Designers** | Gatekeeper and contextualizer of ubiquitous knowledge from the global design discourse | Gatekeeper and contextualizer of ubiquitous knowledge from the global design discourse | Gatekeeper and contextualizer of ubiquitous knowledge from the global design discourse |
| **Local Aces** | limited | Broker and integrator of local knowledge | Broker and integrator of local knowledge |
| **Local All-rounders** | limited | limited | Broker and integrator of knowledge from the local design discourse |
| **Global Star Designers & Global Aces** | – | Broker of knowledge from the global furniture design discourse | – |
| **Global All-rounders** | Global pipelines of ubiquitous design knowledge | limited | Limited, but when successful as global pipelines of ubiquitous design knowledge |

## 9.4   The Sticky and the Ubiquitous Design Knowledge of Industrial Agglomerations

While design researchers have recognized the existence of, and differences between, general and specific design knowledge (Cross, 2004; Jonas & Meyer-Veden, 2004; Kotro, 2005; Kuutti, 2009; Lawson, 2004; Popovic, 2004), the geography of design knowledge has until now been overlooked in studies in the field (exeptions are provided by Ashton, 2004; Bertola & Teixeira, 2003; King & Spring, 2001, each of whom considered isolated aspects of design knowledge and geography). As shown in the previous section, the results of

this study suggest that both sticky and ubiquitous design knowledge perform important functions in new product development in industrial agglomerations. The geography of knowledge in general has been considered to by scholars in knowledge management (Brown & Duguid, 2001; Lave & Wenger, 1991), innovation studies (Von Hippel, 1994) and economic geography (Asheim, 1999; Gertler, 2003; Maskell & Malmberg, 1999). Findings of economic geographers supported this study by providing the general concepts of sticky and ubiquitous knowledge, which were then adapted to design knowing.

The symbolic, synthetic or analytical nature of knowledge and the extent to which these types of knowledge are sticky or leaky has been considered by various scholars (Asheim & Gertler, 2005; Martin & Moodysson, 2013; Tether et al., 2012). Martin and Moodysson argued that knowledge that is symbolic is sticky, since meaning is interpreted in specific user cultures, and synthetic knowledge is partly sticky and partly ubiquitous. In contrast to the findings of Martin and Moodysson, the results of the present study suggest that symbolic design knowledge is in many cases less sticky than synthetic design knowledge. The following sections describe and discuss the proportions of sticky and ubiquitous design knowledge in individual industrial agglomerations in the light of industry lifecycle, product type, knowledge bases for innovation, distribution of new product development, culturally engaged innovation practices and product and industry complexity.

The existence and content of sticky design knowledge and ubiquitous design knowledge in the individual industrial agglomerations that were studied vary. Although ubiquitous design knowledge by its very nature is general, the variety of main use values and focuses of innovation, and design maturity of different industries influence the scope of generalist design practices and consequently also influence what kind of ubiquitous design knowledge is appreciated by the local clients. The particular and timely nature of sticky design knowledge similarly makes the body of sticky design knowledge inherent to any industry unique. Figure 36 above illustrates how the places of practice of the individual groups of designers who work in industrial agglomerations influence each of their contributions. It is clear that while ubiquitous design knowledge flows freely within and beyond professional communities and organizational boundaries, sticky design knowledge is primarily located in individual design practices that take place between the organizations of industrial agglomerations. An industrial level geographical approach was thus necessary when the content and nature of the sticky design knowledge that determines design practice in an industry was to be understood.

The research showed that the use of ubiquitous design knowledge is concentrated to occasions where companies wish to challenge or break with the local path dependent new product development practices that characterize industrial agglomerations, or where innovative aesthetics or product meanings need to be created for new product categories or product lines. The content of the ubiquitous design knowledge that is appreciated

in individual cases appeared to be connected to the main use value of the product, the design maturity of the industry, and to the local competitive "air". The research showed examples of ubiquitous design knowledge that was related to products and their use such as ergonomics, cognitive ergonomics, materials, and alternative production methods and technologies; to product languages and aesthetics as used in the global design discourse; and to design processes, approaches and tools. The sticky design knowledge of the industry cases vary and depend on product type, product lifecycle, and product and industry structure. Generally it was found that a designer who has sticky design knowledge is able to quickly grasp what is a balanced and wise design proposal that fit the industry, company, and market. Such knowledge minimizes the number of iterations that are needed before an appropriate design hypothesis is produced. It is useful in design evaluations and choices that regard relevance and usefulness, and how design can address current problems, issues or product or service opportunities of the industry.

The research showed that the content of sticky design knowledge is related but not confined to untraded interdependencies in new product development; political dimensions that regard  laws, rules, and regulations of the specific industry; product specific technologies, internal structures, mechanics, functions, materials, and ergonomics; corporate and industrial and structural dimensions such as production networks, production technologies and possibilities; corporate strategies; aesthetic and product languages of the industry, and company and user communities.

The creation and dissemination of sticky design knowledge depends on face-to-face contact and tight and consistent partnerships that are part of the everyday new product development practices in industry agglomerations. In particular, important sticky design knowledge is located between organisations within the local networks rather than within companies. This resonates with Marshalls ideas of knowledge of "what is in the air" of an industry (Marshall, 1920). Typically such knowledge results in a sensitivity of the differences between the facilities, strategies, targets, traditions, approaches and product languages of the local manufacturers. A designer with such knowledge is able to take advantage of the unique local know-how and production infra structures and to propose and contribute to innovative products and networks that fit the strategy of individual local manufacturers.

The research findings indicate that besides the design knowledge of local corporate and brand languages which are often tightly connected to the regional identity, symbolic design knowledge is ubiquitous rather than sticky. This contrasts with the findings of Moodysson and Martin (2013), but resonates with the arguments of Verganti related to design as the creation and brokering of meanings from a global design discourse (Verganti, 2003). The research further suggests that the more design activities are distributed across organizations in local new product development, the more it relies on synthetic design knowledge. Systemic product development activities of complex products that influence the products

of many local suppliers require a high degree of synthetic design knowledge which is rooted in the regional socio-cultural design milieu. In contrast, design interventions that address isolated items of such complex products require less sticky design knowledge.

The often tacit nature of sticky design knowledge sometimes made understanding its existence and content challenging. The examples of sticky design knowledge that have been presented in this section,  were obtained by open questions about courses of action in new product development, and more specific follow up questions on episodes that appeared to rely on sticky design knowledge. Since tacit and sticky design knowledge is primarily manifested in action, it is often of a practical nature. This means a complete picture can only be made through a combination of interviews and observations. In general terms however, the research indicated that sticky design knowledge is useful in making wise design judgments which means proposing the right thing, for the right people, at the right time, at the right place, in the right way, and for the right reasons (Nelson and Stolterman, 2003). Ubiquitous design knowledge on the other hand is essential when the aim is to break with the conventions that are part of path dependent product development.

## 9.5   Industrial Agglomerations as Contexts for Design

The research shows that there are peculiarities of industrial agglomerations as contexts of practice that influence how design is managed and how local design practice is experienced. The regional context of new product development in industrial agglomerations offers both opportunities and poses challenges to the local companies and design practitioners. First, the untraded interdependencies of individual industrial agglomerations heavily influence the behavior of the local organizations (Storper, 1997). These geographically constrained collective frameworks for action link activities to the history and culture of an industry, shape its evolution and make its practices more or less path dependent. The research exemplified how both design practice and design management in industrial agglomerations are influenced by untraded interdependencies. From a design management perspective, they affect whether and how design resources are used, and from a designer perspective they determine what constitutes a feasible product concept in terms of industrial and product traditions, use, and users, available means of production and materials.

An example of this is provided by the maritime industry in Ålesund, where design was not possible until just a few years ago. It had no established tradition for the use of industrial design, and in a path dependent manner innovation practices focused exclusively on technology and performance, as they had done from the advent of the industry. Design was only introduced when a ship architect conceived a visually appealing ship hull concept which had the functional justification of superior fluid dynamics and stability at sea. The

visibility and pleasing appearance of the concept gave it recognition, first within the global design community, and later also in the global maritime arena. The industry successively its borders to design as a potential value contributor and ship design companies started to hire design professionals more systematically.

The scope of design activities on the ship bridge area and on its man machine interfaces that currently dominate within the industry is the result of a new focus on safety and human factors which followed a series of serious accidents offshore. The accidents and following industry-spanning seminars and regulatory activities that focused on safety at sea caused a break with the established traditions of product development for equipment for the ship bridge, which opened up an opportunity for industrial design professionals as valid and potential contributors to safe user interfaces.

The introduction of design to the industry first required a break with path dependent ways of conceiving design (Walker, 2000). The example further illustrates how what is feasible or not within an industry is dynamic and depends on what is locally in the air at a certain point in time. The unquestioned role of designers in product development practices in the Sportsystem and in the furniture industry in Sykkylven can be considered the antithesis of the case in the maritime industry. The local traditions for design that are part of the foundations of those industries, and which are rooted in the original constitution of the production processes through pattern makers in Montebelluna, and through manually skilled and technologically oriented design professionals in Sykkylven, guides both design practice and design management in a path dependent manner. In Montebelluna, designers are an integral part of product development, and design activities span organizational borders and link parts and pieces that are produced in a distributed manner into holistic products, just as local pattern makers have done since the beginning of the industry.

The homogeneous product environment and the path dependence that characterize the product development activities of industrial agglomerations constitute both assets and challenges to local design professionals. First, the specialist knowledge of the local design communities of industrial agglomerations that is tied to one or a few products, and to the local industrial and regional cultures, makes design specialists proficient in the untraded interdependencies and product and use related aspects that may determine the success or failure of local design collaborations. But as discussed in the design management literature, too much familiarity may cause designers to get stale (Blaich & Blaich, 1993; Heskett, 2002a, p. 70). This issue was articulated by various local designers in the industries that were studied. In particular, they mentioned the knowledge of all the constraints as a challenge to creativity. One of the designers who was interviewed in Montebelluna illustrated this situation with the metaphor of a corridor where you find only closed doors, and where there can only be one outcome. However, in most cases the specialist knowledge of local designers in industry agglomerations is considered an asset. In line with the findings of

scholars in design management regarding the degree of familiarity of in-house or external designers (Bruce & Morris, 1998; Dumas & Mintzberg, 1989), this research showed that the use of a knowledgeable local freelance designer rather than of a non-local designer implies less risk of costly feedback loops caused by a lack of local familiarity.

The specific knowledge that is held by local designers, and which is related to the products of individual industrial agglomerations, makes them unique as potential closely integrated partners in new product development, and the industrial agglomeration is thus a perfect market place for their services. This market place extends beyond the agglomeration in cases when the specific knowledge of local freelance designers is sought by non-local companies. Moreover, the research exemplified how sticky knowledge about the regional and industrial culture of an industrial agglomeration is sometimes a prerequisite for success when designers are involved in local product development. In Montebelluna where new product development activities are tightly knitted to local culture, the foreign design manager of a local design agency even hired the son of a pattern maker as a cultural intermediary who could give his agency credibility and create trust among local clients and thus facilitate his contacts in the industry. The research thus confirms the importance of trust in intra-agglomeration interactions, as has previously been underlined by scholars of economic geography (for example by Asheim & Gertler, 2005; Storper, 1997).

The present study shows that non-local designers may find both opportunities and challenges in regional agglomerations of industries. While their outsider knowledge is sometimes sought by local companies as a way to break with established traditions, the distance to their clients makes deep organizational integration problematic and gives them little control over the emerging product. With the exception of the maritime industry in Ålesund, the research revealed that partnerships between local companies and global product designers are often characterized by long and precarious product development processes that result in products that are far from the initial design concept.

## 9.6  Summary

In line with the aim of this study, the research explored how geography influences design and design management competences and practices in industrial agglomerations, and how design contributes to the product development and products in such industrial contexts. The research results indicate that the organization and practice of industrial design in industrial agglomerations differ from the corresponding arrangements in many other contexts. They show how the limited variety of products that are produced in an individual industrial agglomeration, the distribution of product development and production of these products across organizations, the long and evolutionary history of the products that are tightly interwoven with the regional culture, and the geographical and relational proximity between the organizations influence how design is used, and practiced, and how different design professionals contribute to local product development.  More specifically, the research suggests that the scale, scope, and integration of industrial design activities in individual industrial agglomerations depend on interconnected dimensions of the main use function of the products, the industry lifecycle, the focus of innovation activities, design maturity, the degree to which new product development activities are distributed across organizations, local traditions and untraded interdependencies.

The study of a variety of design practices that are present in industrial agglomerations shows that the conventional idea that design services are performed by design practitioners who are either employed in-house, external design consultants, or a mix of the two does not always fully reflect reality. In industrial agglomerations design services are provided by a mix of in-house designers, local and global aces, local and global all-rounders, and global star designers, who each have a distinct expertise and thus contribute to individual companies and to the industry as a whole in different ways.

The competences that are held by individual designers and the extent to which they are integrated in corporate product development are influenced by the geographical and cultural place of each of their practices. It was found that designers whose activities are based in industrial agglomerations are integrated into local product development in a deeper and more continuous manner than their non-local counterparts. In addition, the competences of individual designers were found to be more or less tied to specific industrial contexts, and more or less sticky. The ubiquitous design knowledge that is appreciated and used some industrial agglomerations varies with the local scope of design interventions. This work describes in detail what constitutes the sticky, ubiquitous, general, and specific bodies of design knowledge that are used by the different groups of designers that contribute to industrial agglomerations.

From a knowledge dynamics perspective, the study shows that the spatial organization of design practitioners determines the ways in which they contribute to the knowledge

dynamics that are important for the innovative product development practices that occur in industrial agglomerations. While designers whose activities are based in an industrial agglomeration contribute as brokers of local, sticky and specific design knowledge, and as gatekeepers and contextualizers of general and ubiquitous design knowledge inherent to the global design discourse, non-local designers act as global pipelines of the latter type of knowledge. It can generally be argued that ubiquitous design knowledge is used by companies in industrial agglomerations when they wish to break with path dependent product development practices, and sticky design knowledge is used in everyday product development activities that need to be efficient and run smooth and result in product concepts that are appropriate for the company and feasible within the current product, user, use and production paradigm.

The data suggest that in design immature industries that lack any tradition of design and that have no established local design community, the design contributions are made by global all-round designers and address various aspects of product use and aesthetics and build on ubiquitous design knowledge. In design mature industries, on the other hand, where design contributions are made by a diversified range of design professionals consisting of local and global design practitioners, non-local designers are mainly used for their aesthetic and symbolic knowledge of the global design discourse. Except from aesthetic and symbolic knowledge that is related to local brands, such knowledge appears to be less sticky than design knowledge of a synthetic nature, which is often involved in the organization-spanning human centered design practices of local design practitioners.

In contrast to the practices of global designers, which in many cases can be characterized as styling, the practices of local designers often require structural changes that imply a more distributed product development in industrial agglomerations, where the designer needs to take on an integrating role in the endeavor of creating a holistic product concept. Such practices call for sticky design knowledge inherent to the local production context. The need for sticky design knowledge when design is used on systemic levels appears to increase with the morphological and organizational complexity of products and product development activities. From a design practice perspective, the study shows how the untraded interdependencies that make up a collective framework for action for different industrial agglomerations influence the evolution, scale, scope, and integration of design within the local organizations. They determine what is appropriate and feasible in the current industrial paradigm and thus connect current product development practices to history and makes it more or less path dependent.

Finally, the homogeneous product environment that characterizes industrial agglomerations poses both challenges and opportunities for designers. Local designers who have developed an expertise that is specific to the product type that is produced their industrial agglomeration have access to a unique market for their services. However, their sophisti-

cated knowledge also includes all the restrictions and limitations that determine the local practices and they therefore risk of becoming stale and uncreative. The wide experience from different industries and the ubiquitous knowledge bases of global designers, on the other hand, make them potential contributors of path breaking ideas to companies in industrial agglomerations. However, the research shows that they are often challenged by their lack of sticky design knowledge in the local product development process.

## 9.7   Reflections and Concluding Remarks

The conclusions that were outlined in the previous sections were carefully made based on the data that was collected in the three cases. In order to make the transition from data to conclusions transparent and open for discussions, the case descriptions included as much detail and were as rich as the monograph format allows. Despite the aim of a rich description of the phenomenon of study, the formulation of aims, objectives, and research questions necessarily narrows its scope and excludes dimensions of potential interest.

First, the study focused on design and design practice as a process that is more or less integrated in local new product development, and more or less in interaction with local industrial cultures. It does not however consider design as part of multidisciplinary practices within firms. Although the regional culture can be considered a "cultural umbrella" for local new product development, it can be expected that there are disciplinary flavors of the local culture within individual organizations (Bucciarelli, 1994), which influence the experience of local design practice.

Second, the history and cultures of the three industrial agglomerations that were studied are carefully described, but the analysis stops at a regional level. This means that the nationally shaped cultures and traditions for new product development and design, which accommodate regional new product development has received a limited attention within this study (Lundvall, 1992; Nelson, 1993). Although national traditions for innovation are modified and adjusted to the local cultures of regional new product development a national perspective could potentially explain some of the differences that were found between the design practices in the Italian and the two Norwegian industry agglomerations of the study (Asheim & Gertler, 2005). The body of knowledge that has been generated by this study could accordingly be deepened by additional case studies of regional industries that are located in other nations and by a thorough description of the national innovation cultures wherein specific regional agglomerations are emerged.

Third, the findings that were made in the study of design in the maritime industry agglomeration in and around Ålesund should be considered in light of the limited volume of design that was present at the time of the study. This case study could possibly be

illuminated further by a follow up study which illustrates how the evolution of design has pursued over time. Such a study could deepen the temporal dimension of this study and thereby enrich and possibly confirm the findings that are related to design maturity and the existence of diversified design communities in design mature industries. A temporal dimension could also illuminate the future shape of the many Italienate industry agglomerations that have been depleted by delocalization to low cost destinations and the role of design in their transformation into more sustainable regional economies.

Fourth, the study relies on an activity centered understanding of design practice. The contributions that are made build primarily on interviews of designers and design stakeholders and not on observations of design practice. Although attempts have been made to gain an understanding of the range of design knowledge that is used in new product development in industry agglomerations, this fact may have limited the understanding of the local body of tacit design knowledge. The findings could thus benefit from additional studies in similar contexts but performed with an ethnographic approach.

Finally a remark could be made on the collection of industries that were included in the study. As specified in chapter 2.4, the selection of study cases was made from industries that produce physical material products aimed at different markets. This excludes industrial agglomerations where the end product is immaterial such as services or digital products from the study. Although there are industry agglomerations that produce such products (examples are Silicon Valley in the US or the ICT cluster in Ireland), their range of products include both material and immaterial objects and compared to the cases that are included in this study they are part of a more recent phenomena. The research outcomes from this study are built on the understanding of industrial agglomerations as contexts that have evolved over a long time and where sophisticated knowledge and knowing has emerged over time. This does not exclude that similar studies of industrial agglomerations that produce immaterial products can enrich and illuminate the arguments of this research with perspectives on the type of design knowledge that is involved in the production of immaterial objects and the geography of such knowledge. With the increasing importance of digital products and services in the world economy, such a study should be of interest to both communities of policy makers, and design educators, as well as to the design industry.

Having mentioned the limitations in general applicability of the knowledge outcomes of this research, and the simplifications that the formulation of research objectives and questions necessarily mean to the research results, the conclusions that were outlined in this chapter have the potential to inform reflections on the role of design in a globalized economy. The findings that have been presented in this work have the potential to shed light upon how design can contribute to sustainible futures for a variety of regional agglomerations and thus take part in the production of high quality objects aimed at global markets.

In line with what has been shown within the field of economic geography, this work exemplifies how industry agglomerations often emerged where there was a historical market for a certain product. With time, the local workforce develops a unique and locally rooted knowledge base that is used in the design and production of high quality goods. The industrial agglomerations become known globally for their superior products. They are carriers of an idea, image, or brand which is connected to the region rather than its individual manufacturers. As much as the three case studies are manifestations of such an evolution, they are also examples of how globalization may affect regional economies. Digitalization and new communication technologies has created global accessibility to products and services. Local manufacturers turn to global markets and distant users. The same applies to the production of goods. The technical possibility to digitalize product development and production documents has enabled local businesses to source production services from distant low cost suppliers instead of local alternatives. Delocalization of production has stroke many Italianate districts, including the Sportsystem in Montebelluna that is transforming from an industrial agglomeration where all the steps in the production chain were represented locally, to a center for research, development, and design (see Arquilla, V., Simonelli, G., & Vignati, .A, 2005, for an exhaustive account on design and crising italian regional economies). One could ask whether the entire design function is likely to follow the production function to distant locations? Based on the findings that are presented in this work, a tentative answer would be probably no.

The research outcomes indicate that by using a combination of local and global design professionals in the production of high quality objects, companies that are located in industrial agglomerations are able to compete on world markets. While global all-round designers and global aces who are part of the global design discourse have the symbolic ubiquitous design knowledge that is sometimes a key to global markets local aces, and local all-rounders have the sticky design knowledge that is needed to fruitfully integrate the further into local new product development. If design is entirely externalized the integrating function that is performed by local design professionals will be lost and the products that are conceived in regional agglomerations will be closer to those of distant competitors. The integrating function of local design professionals thus appear to be essential if industry agglomerations are to remain producers of world leading products.

Beyond considerations on the role of design in the transformation of regional agglomerations into healthy local economies as part of the global economy, a reflection on the significance of the outcomes in relation to the identity of the design profession is in place. The findings challenge the idea of design practice as built extensively on ubiquitous competences. This view has been influential in the shaping of the identity and heritage of the design profession. The idea of ubiquitous competences of form language for example, can be traced back to the Bauhaus school, where design professionals were trained to approach

design situations through universal, and often scientifically supported first principles, and where the importance of the historic and cultural context of the design milieu was disregarded (Wingler, 1969).

The foundation courses that are part of many modern design school curricula are often inspired by the basic course of the Bauhaus school. Also, the design methods movement which, despite heavy criticism, is still influential in the curricula of many design engineering schools, and to some extent even in human centered design traditions, built on the idea of a ubiquitous design process where "THE user" or design problems in any culture are approached through tools, steps or methods that are prescribed and chosen, or designed by any designer in any culture (as discussed by Lee, 2012), and whose solutions, irrespective of their context sensitivity, necessarily are aimed at a generalized user.

The research that is described in this work contrarily shows that the contributions that are made by designers to industry agglomerations build on both specific and sticky design knowledge and ubiquitous and general such. The specific and sticky design knowledge that is held by local designers in industry agglomerations is an asset for the companies that are located within the industry agglomerations as well as for non-local companies who may get access to it by way of collaborations over distance. In addition, in line with the scientific traditions of other disciplines, much design research aims at ubiquitous knowledge about the objects of design, designers, users and the activity of designing, but pays less attention to the context of designing (Dorst, 2008), which is necessarily specific to particular times and places. From this perspective, the central findings of this work regarding the specific nature of design competence in context specific practice challenge both our professional heritage and the dominant ideals of designers, and many of the academic ambitions of design research. With this in mind, the findings of this work may be of relevance to design practice, design management, design education and design research communities.

Specifically, the design research community can benefit from the detailed case descriptions that confirm and exemplify the situated and specific nature of design in different industries and from the perspectives of different stakeholders. Also of value are the findings related to the amplitude of design practices and design management strategies that are present in industrial agglomerations, which broaden the conventional idea of design as performed by either in-house designers, external designers or a mix of the two. Moreover, the examples and descriptions of sticky and ubiquitous design knowledge which relate design knowledge and knowing to geography and culture in situated product development are significant, and add to the body of knowledge on design competence and expertise. The findings call for a nuanced focus of design research which, in addition to ubiquitous models of design practice, accounts for the interactive relationship between design activities and their context. It is suggested that this can be

attained through considerations and rich descriptions of the design milieu where the design activities that are described take place. Such considerations and descriptions can potentially be of use in the design of curricula that prepare design students for the variety of situated design practices that their future professional life may hold. For the specific design milieus that are found in industrial agglomerations, design students may need to learn how quickly to grasp and learn the sticky knowledge and the untraded interdependencies that determine local design practice and how to deal with these in their creative practices. Special attention may need to be paid to creative and learning strategies for design in contexts that are characterized by a limited set of products. In addition, designers whose future practices will be in industrial agglomerations would benefit from educational experiences of distributed product development, both from a technical and a social point of view. This research contributes to the design management field in that it shows how a variety of design professionals whose practices are located in different places, can contribute to new product development.

The potential contributions that are made by designers who hold specific and sticky knowledge and designers who use predominantly general and ubiquitous design knowledge respectively needs to be considered in strategic design management. The design competences that build on sticky design knowledge are found exclusively among in-house or local ace designers. Any company who does not have design competences in-house, but needs such knowledge will accordingly need to source it from specific geographical places such as industrial agglomerations. In this context, it is assumed that the examples that are given of challenges and opportunities that are related to the use of individual design professionals with distinct competences that are general, specific, sticky and ubiquitous in nature can inform design management practices.

Design in industrial agglomerations may appear as contexts of practice that are too peripheral and specific to bother about, but, as mentioned earlier, research in economic geography has shown the opposite, and indicates that despite ongoing globalization, the tendency for innovative activities to agglomerate in space increases. The above discussions together with the findings that have been made by Arquilla, Simonelli, and Vignati (2005) within the context of crising italianate industrial agglomerations indi-cate that design is likely to be central in the transformation of regional economies into economically sustainable local agglomerations of new product development and design. Accordingly, design practitioners and design managers can expect an increasing volume of design opportunities to come from companies that are located in industrial agglom-erations. Therefore, this work can potentially benefit design practitioners as a way to gain vicarious experiences of the practice of design in industrial agglomerations, and the opportunities and challenges that such practices may imply.

The findings should also be considered in public policy decisions regarding the European competitiveness. In the ruling knowledge economy (Lundvall and Johnson, 2004) where competitiveness is achieved through the production of products and services that offer superior user experiences, the places where specific and sticky knowledge, design knowledge in particular, evolve should be safeguarded. In particular, the findings of this research indicate that the specific and sticky design knowledge that has evolved over time in our European industry agglomerations together with a more general and ubiquitous design knowledge base may be a key to strengthening European countries as producers of innovative products and services that appeal to global markets but which are difficult to copy for distant competitors. Given the central role that designers may have in the production of products and services in industrial agglomerations, the education of designers who are able to contribute to industrial agglomerations should be prioritized. The use of local and global design professionals in combination should be considered a key to a healthy and sustainable European industry and thus to local occupation and growth.

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# Appendix

# Appendix

## Appendix 1: Data Codes for Interview Transcriptions

| The furniture Industry in and around Sykkylven | |
|---|---|
| Code name | Number of quotations |
| 1. About designer - producer relationships | 3 |
| 2. About Norskt Möbelfagligt Senter | 1 |
| 3. About specific companies from agglomeration perspective | 1 |
| 4. Agglomeration as a source of knowledge for global producer | 2 |
| 5. Attitudes on designers working for competitors | 10 |
| 6. Challenges in local design practice | 2 |
| 7. Competition | 3 |
| 8. Criteria for choice of designer | 5 |
| 9. Cultural interpreter for collaboration with global designers | 1 |
| 10. Design and brand management | 7 |
| 11. Design knowledge – global | 4 |
| 12. Design knowledge - local – brands | 5 |
| 13. Design knowledge - local – general | 2 |
| 14. Design knowledge - local – market | 5 |
| 15. Design knowledge - local – material | 3 |
| 16. Design knowledge - local – network | 7 |
| 17. Design knowledge - local – production | 8 |
| 18. Design knowledge - local – technical | 7 |
| 19. Design knowledge - local – user | 2 |
| 20. Design management strategies | 4 |
| 21. Designs importance for the organization | 6 |
| 22. Distributed local design practice | 3 |
| 23. Experienced or new designers | 5 |
| 24. Focus of innovation in agglomeration | 3 |
| 25. Furniture designer or industrial designer | 4 |
| 26. Global design process | 1 |
| 27. History of agglomeration | 8 |
| 28. In-house or local freelance designers | 2 |

| 29. | Interaction with the agglomeration | 5 |
|-----|-----------------------------------|---|
| 30. | Local design process | 3 |
| 31. | Local designer or non-local designer 1 | 12 |
| 32. | Local designer or nonlocal designer - product type | 4 |
| 33. | Long term designer collaboration or short term designer collaboration | 2 |
| 34. | Non-local practice or local practice | 2 |
| 35. | Agglomeration knowledge dynamics | 9 |
| 36. | Organization of Product development | 2 |
| 37. | Sources of creative ideas | 7 |
| 38. | Strategies for rapid local design knowledge briefing to non local designers | 3 |

| | The sports and leisure shoe manufacturing industry in and around Montebelluna | |
|---|---|---|
| | Code name | Number of quotations |
| 1. | About designer - producer relationships | 1 |
| 2. | About specific companies from agglomeration perspective | 3 |
| 3. | About the museum | 1 |
| 4. | Agglomeration as a source of knowledge for global producers | 3 |
| 5. | Attitudes on designers working for competitors | 2 |
| 6. | Challenges in local design practice | 6 |
| 7. | Agglomeration as local prototyping lab | 1 |
| 8. | Criteria for choice of designer | 4 |
| 9. | Cultural interpreter for collaboration with global designers | 2 |
| 10. | Design and brand management | 3 |
| 11. | Design knowledge – global | 12 |
| 12. | Design knowledge - local - brands/identities | 4 |
| 13. | Design knowledge - local - experimental craft | 3 |
| 14. | Design knowledge - local – general | 4 |
| 15. | Design knowledge - local – market | 1 |
| 16. | Design knowledge - local – material | 2 |
| 17. | Design knowledge - local – network | 2 |
| 18. | Design knowledge - local – production | 6 |
| 19. | Design knowledge - local – technical | 9 |
| 20. | Design knowledge - local - traditional/traditions/culture | 7 |
| 21. | Design knowledge - local - user/use | 4 |
| 22. | Design management strategies | 8 |
| 23. | Designer, graphic designer, stylist, modellista | 2 |
| 24. | Distributed local design practice | 6 |
| 25. | Drivers of innovation | 2 |
| 26. | Focus of innovation in agglomeration | 5 |
| 27. | History of agglomeration | 5 |
| 28. | In-house or local freelance design | 3 |
| 29. | Interaction with the agglomeration | 1 |
| 30. | Learning local design knowledge | 5 |
| 31. | Local design process | 2 |
| 32. | Local Designer as idea generator | 1 |

| 33. | Local designer as knowledge contextualizer | 2 |
|---|---|---|
| 34. | Local designer or non-local designer | 11 |
| 35. | Local designer or non-local designer - product type | 1 |
| 36. | Non-local practice or local design practice | 6 |
| 37. | Examples of agglomeration knowledge dynamics | 7 |
| 38. | Product, industry, and firm characteristics | 9 |
| 39. | Shoe design embedded in DNA | 1 |
| 40. | Silent design | 1 |
| 41. | Sources of knowledge and creative ideas | 29 |
| 42. | Specialist or generalist designer | 14 |
| 43. | Type of knowledge that is transferred in design | 1 |

| The maritime industry in and around Ålesund | |
| --- | --- |
| Code name | Number of quotations |
| 1. About designer - producer relationships | 2 |
| 2. About specific companies from agglomeration perspective | 6 |
| 3. Attitudes - designer - requirements for good interaction with industry | 5 |
| 4. Attitudes on designers working for competitors | 3 |
| 5. Challenges in local design practice | 18 |
| 6. Local designer as contextualizer of external design knowledge | 2 |
| 7. Criteria for choice of designer | 4 |
| 8. Design and brand management | 1 |
| 9. Design knowledge – global | 18 |
| 10. Design knowledge - local – general | 7 |
| 11. Design knowledge - local - industry culture | 2 |
| 12. Design knowledge - local – market | 2 |
| 13. Design knowledge - local – material | 1 |
| 14. Design knowledge - local – network | 1 |
| 15. Design knowledge - local - product owner | 1 |
| 16. Design knowledge - local – production | 1 |
| 17. Design knowledge - local - rules and regulations | 2 |
| 18. Design knowledge - local – technical | 3 |
| 19. Design knowledge - local - user & use | 8 |
| 20. Design management strategies | 2 |
| 21. Design's importance for the organization | 6 |
| 22. Specialist vs generalist designer | 2 |
| 23. Distributed development | 8 |
| 24. Distributed local design practice | 3 |
| 25. Drivers of product development and innovation | 6 |
| 26. Example of industrial design use | 19 |
| 27. Focus of innovation in agglomeration | 10 |
| 28. Difference between furniture and ship industry – local freelance designer | 1 |
| 29. Challenges for design and innovation | 7 |
| 30. Interaction with research institutions | 4 |
| 31. Local designer or non-local designer | 5 |

| | | |
|---|---|---|
| 32. | Local or non-local design practice | 3 |
| 33. | Agglomeration knowledge dynamics | 9 |
| 34. | Organization of product development | 1 |
| 35. | About the product and industry type | 9 |
| 36. | Recognized potential for industrial design | 12 |
| 37. | Silent design | 2 |
| 38. | Sources of knowledge | 12 |
| 39. | Strategies for briefing non local designers with local know-ledge | 1 |
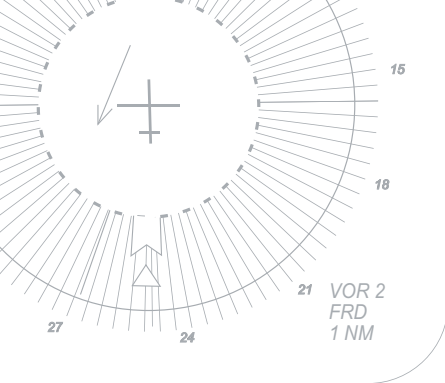
Emma Linder's doctoral dissertation addresses questions about the way in which design practice and design management are influenced by culture and geography, and how design professionals contribute to innovation in regionally agglomerated industries. The research describes and reflects upon the findings of case studies of the Norwegian industrial agglomerations of shipbuilding and furniture in the Sunnmøre region, and the Italian production system of sports and leisure shoes in and around Montebelluna. The theoretical contributions regard the sticky or ubiquitous nature of design knowledge that is held by local and global design professionals, and the way each type of design knowledge is integrated in and contributes to regional new product development. In addition to a general account of design in industrial agglomerations, the book offers rich descriptions of design practices situated in time, place and industrial cultures.

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