

# CHALMERS



## Knowledge Sharing in an Architect Firm

The case of Knowledge Sharing Networks

*Master of Science Thesis in the Master's Programme Design and Construction  
Project Management*

ABDERISAK ADAM

JONAS JULIN

Department of Civil and Environmental Engineering  
Division of Construction Management  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Göteborg, Sweden 2013  
Master's Thesis 2013:88



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Department of Civil and Environmental Engineering  
Division of Construction Management  
Chalmers University of Technology  
SE-412 96 Göteborg  
Sweden  
Telephone: + 46 (0)31-772 1000

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ABSTRACT

This study investigates the facilitation of knowledge sharing in a large architectural firm based in Sweden, referred to as ArchFirm. In particular, the Knowledge Sharing Network (KSN) of ArchFirm is examined in order to establish the factors involved in facilitating knowledge sharing in the organization and subsequently the ways to encourage knowledge sharing in such a setting. The study is based on a qualitative approach consisting of a literature review and an interview study. In total, 11 employees of ArchFirm were interviewed in order to gain insights into their perception of knowledge sharing in KSN. The results that were derived from this study were analyzed through Actor-Network Theory (ANT) which was used as an analytical lens to interpret the results and thereby produce the previously mentioned factors involved in facilitating knowledge sharing. The study reveals six such factors: interactions with internal and external parties, network structure, personal commitment, architectural identity, flexibility and knowledge type. These factors were identified to carry the potential to either facilitate or hamper the facilitation of knowledge sharing in the architect firm. The main conclusion of the study is that flexibility is of the utmost importance in facilitating knowledge sharing in an architect firm due to the many professions represented in such firms. Furthermore, due to the intricate complexity of large architectural firms, the factors that facilitate knowledge sharing in the organization are both plentiful as well as difficult to deconstruct. The ANT approach which was undertaken has created an opportunity to view the intricate nature of knowledge sharing in architectural firms from a different perspective compared to previous research and consequently may have served in opening a window for further research in the area of knowledge sharing as it relates to architecture.

Keywords: actor-network theory, architects, case study, experts, interviews, knowledge sharing

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## Preface

This Master's Thesis was completed during the spring of 2013 final part of the Master's Program *Design and Construction Project Management*. In addition, this Master Thesis is also part of a research project with the overall purpose of investigating knowledge exchange between different social groupings in the construction industry.

We would like to extend our deepest gratitude towards our examiner and supervisor, Associate Professor Pernilla Gluch. Pernilla has been one of the most important pillars of support for us in our research process; her insights have been invaluable as well as her ability to provide encouragement and scrutiny when needed.

We would also like to thank Fredrik Nilsson who assisted us in identifying and establishing contact with interview persons at the architecture firm where the case study was performed. Finally we would like to thank all the interview persons at the studied firm for taking the time to participate in our study.

Gothenburg, June 2013

Abderisak Adam and Jonas Julin

## Notations

ANT	Actor-Network Theory
ArchFirm	A pseudonym for an architectural firm based in Sweden
HR	Human Resources
KM	Knowledge Management
KSN	Knowledge Sharing Network
NM	Network Manager
OPP	Obligatory Passage Point

# 1 Introduction

From the dawn of human existence, humanity has engaged in the acquiring and transferring of knowledge from one individual to another. This age old tradition has gradually become more clearly articulated in the 20<sup>th</sup> century. In the middle of the 1980's, a revolutionary movement began to emerge from the organizational sciences. In a short span of less than a decade, the concept known as Knowledge Management (KM) would come to gain significance exposure in the industry sphere. In essence, the goal of KM was to find ways to manage knowledge and expertise in an explicit fashion. The KM tsunami swept across business disciplines worldwide leaving behind a trail of new organizational functions, such as Chief Knowledge Officer (CKO) and new organizational departments (Wiig, 1997). The importance of knowledge in shaping the new economy was appropriately summarized by Robert Reich, the former U.S Secretary of Labor, who in this regard stated: "in a knowledge-based economy, the new coin of the realm is learning" (Reich, 1998). The source for productivity in this new economy were traced back to knowledge generation, information processing and symbol communication (Castells, 1996). In line with the shift towards a knowledge based economy, academic perspectives on organizations and knowledge have shifted as well. For example the resource based view of the firm (Wernerfelt, 1984) where competitive advantage is achieved through heterogeneity derived from use of internal resources, have been complemented with the knowledge based view of the firm (Grant, 1996) where competitive advantage derives from knowledge e.g. the capability to use the resources available to the firm.

Along with the explosion of articles in the business press on knowledge and how to manage knowledge, several consultancies have lined up offering their services to organizations with the promise of increased profitability. Arguable one of the most cited authors is Ikujiro Nonaka whose theories have posed as a theoretical foundation for KM. However, there has been criticism against Nonaka's (and other researchers') ways of handling knowledge as a form of commodity which can be sent, received and transformed. For example, Nonaka's model for describing knowledge creation has been criticized for not sufficiently addressing issues of power and political dynamics in organizational knowledge creation (Newell et al., 2009). Furthermore, conceiving knowledge as a commodity runs the risk, as Styhre (2003) from a post-modern perspective points out, that ontological, epistemological and political qualities of knowledge is ignored and consequently that an over simplistic view of knowledge is adopted.

The change towards a knowledge based economy has naturally affected the construction sector; an industry which can be conceptualized as a wide range of actors interconnected in a fragmented and project based production process (Dainty et al., 2001). Moreover, these actors can be seen as loosely coupled and hence favor short term productivity while impeding learning and innovation (Dubois & Gadde, 2002) and where authors *inter alia* have called out for better efficiency (Egan, 1998) and a need for cultural change (Forcada et al., 2013). One of these actors is the architect, a profession subject to change during the course of its age old history (Blau, 1987; Styhre 2009). Elements such as the role and the status of the profession differ depending on where the architect practises (Winch & Schneider, 1993). In Sweden the architect has regressed from having the role of master builder in the 18<sup>th</sup> century to having a much more limited role in the current era (Gustafsson, 2007). The role of master builder in Sweden has subsequently been overtaken by contractors. It is in this

context we find the contemporary Swedish architect; in a dynamic environment where the use of experts is common practise and where the creation and diffusion of knowledge is essential to sustaining a competitive advantage, both over other architect firms but also against contractors aiming at overtaking more of the traditional architecture firm's tasks. A great deal of research has been conducted on the topic of architects and their relation to their profession e.g. Styhre (2009) in regards to architects' work as a complex social practise conducted in the intersection between the symbolic and the material; Blau (1987) explored the inherent contradictions in architecture practise and poked a hole in the romanticised myth of the strong and independent architect while arguing that the participatory office with shared responsibilities creates the best designs. Moreover, some studies shifted the focus towards the architectural firm instead of the individual architect. Articles in this category are concerned with describing the organizational structure of the architectural firm as typified by a study authored by Winch and Schneider (1993).

Traditionally sociology has had a strong focus on human to human interaction. However, with the introduction of Actor-Network Theory (ANT) in the 1980's, the possibility to consider non-humans as an active party in shaping the social began to emerge (Law, 2009). In regards to ANT, few studies have been conducted that apply the ANT approach to architecture, examples of these are Kjetil (2011) and Stickels (2011). However no publications have been issued which deal with knowledge sharing in architecture from an ANT perspective. ANT helps researchers understand for example the success or failure of an innovation, since it helps researchers in situations where the social, technical and political are regarded as particularly important (Tatnall & Gilding, 1999).

There is a body of research on knowledge and various ways of managing it in the construction sector. Styhre (2009, p.170) in his extensive work on knowledge management in the construction industry reached the conclusion that there is no "one size fits all theory" for knowledge management in the construction industry since the body of know how used by the various actors are idiosyncratic. Furthermore Forcada et al., (2013) examined the implementation of KM in the Spanish construction industry and came to the conclusion that construction companies and architects understood KM differently, thus supporting Styhre's (2009) conclusions. Moreover Forcada et al. (2013) in their conclusion calls out for "Further qualitative studies, such as in-depth case studies, are required to examine the interactions between different types of KM activities in detail" (Forcada et al., 2013, p.89).

## **1.1 Purpose**

The primary goal of this thesis is to investigate the factors involved in facilitating knowledge sharing in an architectural context. In particular, the focus is placed on deconstructing and mapping the use of a knowledge sharing network (KSN) in an architectural firm. In order to address this, the research adopts a qualitative approach consisting of a case study and a literature review. The literature review's purpose is to create a frame of reference for the various concepts involved in knowledge sharing in an architecture firm as well as to help to describe the use of a KSN by means of Actor-Network Theory (ANT).

## **1.2 Research questions**

- What factors influence knowledge sharing in an architectural firm?
- How do these factors interact?
- In which way can knowledge sharing activities be encouraged in an architectural firm?



## 2 Research approach

The purpose of this study, elaborated in the introduction, involves exploring a complex social phenomenon hence a qualitative research approach have been adopted in line with Silverman's (2001) recommendations. The purpose involves attempting to understand human beings and their actions in an organizational context and consequently a strict positivistic approach has been rejected in favour of a phenomenological approach as Remenyi et al. (1998) describes it.

However, the researchers refrain from labelling the approach as phenomenological due to the ambiguity surrounding the approach (see Remenyi et al. 1998 for a discussion) but instead choosing to describe it as an interpretive approach which include, but are not limited to, the following methodological implications: treating interview persons as essentially human, as social issues and not as objects; collecting evidence in a natural environment; and relying on interpersonal skills of the interviewer (Remenyi et al., 1998). However, declaring that a qualitative interpretive research approach will be adopted do not foretell enough, indeed as Silverman (2001) remarks, there is a range of qualitative methods: observation, analysing texts and documents, interviews and recording and transcribing. Although often combined, this study primarily relies on the latter two with a certain degree of use of the former two, described further in the method section.

As described earlier the approach of this thesis is qualitative; the overall research strategy is that of a case study. In the same way as the choice of either a qualitative or quantitative research approach is a direct consequence of the nature of the research question(s), so too is the choice of whether to use a case study or not. The aim of the case study is to serve as an empirical inquiry which:

*investigates a contemporary phenomenon within its real-life context: [when] the boundaries between phenomenon and context are not clearly evident, [and in which] multiple sources of evidence are used (Yin, 1984, p.23)*

Hence, in order to fully grasp knowledge sharing in an architectural context, an interpretive case study strategy has been adopted due to its argued ability to accommodate the complexity of social phenomenon (Remenyi et al. 1998). By adopting a case study strategy, the researchers hope to offer a more in-depth perspective on the topic of knowledge sharing in an architectural firm.

### 2.1 Literature review

A literature review was conducted in order to create a theoretical framework and also identify the research space as described in the introduction. The selection consisted mainly of scientific articles and published anthologies found through primarily SciVerse Scopus and Google Scholar. The keywords used related to knowledge sharing, architecture, expertise and ANT. Due to the nature of current architectural research in which written scientific publications are relatively limited (Holm, 2007), the literature used were mainly published books.

### 2.2 The case

The study is based on narratives extracted from a case study of an architectural firm (henceforth referred to as ArchFirm) based in Sweden with 14 offices spread around Scandinavia. ArchFirm is considered one of the larger architectural firms in the

country, employing approximately 700 hundred individuals with a turnover of 800 million SEK. Although the company works primarily with matters relating to architecture such as design and other aesthetical aspects, it also encompasses supporting areas such as project management, civil engineering, landscaping, environmental science, IT and other related areas. The focus of the study was to examine the Knowledge Sharing Network (KSN) developed at ArchFirm by conducting a series of interviews and site visits. The network was further organized into different sub networks, each denoting a particular field of interest. In total, eight sub-networks were investigated: health, education, urban planning, project management, interior design, landscaping, construction technology and environmental science.

### **2.2.1 The Knowledge Sharing Network (KSN)**

The historic roots of the Knowledge Sharing Network (KSN) can be traced back to the 1980s after which it gradually evolved, surrounded by a certain degree of turmoil; changing names, strategic directions and responsible individuals up until approximately the millennium shift when the current, more consolidated, organization with a responsible management group and network managers was settled. The increased awareness toward research in ArchFirm has gone hand in hand with the growing shift towards more research in architecture. ArchFirm has during recent years increased their involvement in knowledge building practices and research within this field; made evident by the increased demand for PhD graduates and others working within academia.

The KSN is, in the words of the management of the KSN, an investment from ArchFirm's Research and Development division, described as a network based academy intended to be an important meeting place without a specific geographical position. Two specific goals have been specified for the KSN:

- (1) To continuously develop ArchFirm's knowledge so that the firm can offer clients and users the largest possible value.*
- (2) To make use of, tie together and make visible all the knowledge, competence and richness of ideas from all of ArchFirm's employees.*

The KSN is divided into 11 sub-networks (as shown in Figure 1), each of them managed by a Network Manager (NM).

Each of the sub-networks is open for all employees and membership is not restricted to a certain amount of sub-networks; employees simply chose which network they feel most affiliated to. ArchFirm assigns a higher priority to certain networks. The area which is currently given a priority in terms of allocated resources is the Healthcare Buildings Network. There is a growing interest to study the interrelations between aesthetic features of a hospital and the well-being of patients. This area is also emphasized due to the number of hospital projects undertaken by the firm at the moment, including the building of a major hospital in Sweden.

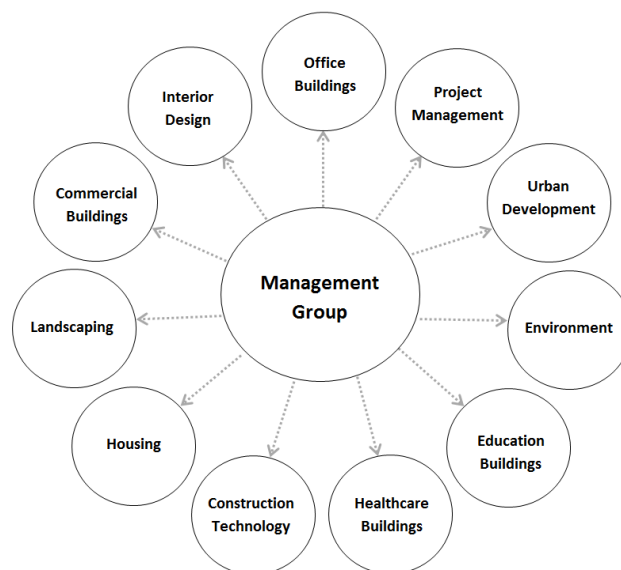
In addition to labelling one specific network a priority, ArchFirm further divides the different networks according to their market position. A network is either labelled a market area or a core competence. A network belonging to the former category consists of individuals from varying backgrounds (engineers, project managers, architects etc) who are all working in one specific area. The latter category is however comprised of one core competence such as architecture or environmental management. In the market area category, one finds the healthcare, office and housing



network. The networks classified as core competence includes the networks: project management, environment, urban development, landscaping and interior design.

KSN has been an integral part of the ArchFirm brand and a marketable trait for the organization in so far as recruiting new employees. Although nearly all of the employees represented at ArchFirm are to some degree involved in KSN, only two members are committed to it fulltime as part of their job description. The rest of the network is comprised of individuals whose job tasks involve working with the network to a lesser degree.

The strategic, and to some extent tactical, operation of KSN is performed by a management group (the centre of Figure 1) consisting of the head of R&D at ArchFirm, one project manager for the KSN, one network coordinator responsible for coordinating the 11 leaders for the different sub-networks and two research coordinators responsible for research projects that KSN is organizing in the ArchFirm organization. The operational and tactical, tasks of each of the networks represented in the KSN have assigned managers - Network Managers (NMs) - whose responsibilities include managing and coordinating the knowledge sharing efforts in their respective network (the areas connected to the center of Figure 1). This typically includes participating in annual network meetings and establishing contacts with experts in related areas. The NMs are located in several cities throughout Sweden; they are however centered in the capital Stockholm. The primary objective of NMs is to serve as facilitators of knowledge. They constitute the central connection points in the network and are required to be knowledgeable of the different skills that are needed for a particular project and the individuals who possess those skills.



**Figure 1:** A conceptualization of the Knowledge Sharing Network in ArchFirm.

A core activity of the KSN is the yearly network events in which every sub-network arranges at least one such event. The yearly events are intended primarily for the employees of ArchFirm, albeit some sub-networks invites external lecturers and guests in order to disseminate ideas within the organization. This is also accomplished by allowing for site visitations to other branches and in some cases by attending conferences abroad. As mentioned above, every KSN-activity is open for all employees at ArchFirm but the time duration and cost for each activity is decided by

the office manager or group leader. The network further consists of regular seminars and workshops, some which are held in cooperation between different sub-networks.

### 2.2.2 Interview design

Initially, the interviewees were selected based on a list of recommendations from the director of KSN. The list consisted of the names of six current NMs, two former NMs, two senior architects and two experts (denoting the two individuals as experts was done by the manager of KSN and not the researchers). The complete list of interviewees is listed in table 1.

**Table 1:** Functions of the interviewees along with their respective network affiliation.

#	Function	Network affiliation
1	Senior Architect	Healthcare Buildings Network
2	Senior Architect	-
3	Network Manager	Landscaping Network
4	Network Manager	Healthcare Buildings Network
5	Network Manager	Interior Design Network
6	Network Manager	Construction Technology Network
7	Network Manager	Project Management Network
8	Network Manager	Urban Development Network
9	Expert	Environment Network
10	Expert	Environment Network
11	Former Network Manager	Education Buildings Network
12	Former Network Manager	Environment Network

The interviews were booked in February 2013 and conducted during the first two weeks in Mars and held in Swedish in the interviewees' respective offices. The interview lasted on average an hour each. Six of the interviewees came from the head office in Gothenburg and five from Stockholm.

The interviews were structured around a set of approximately 30 questions concerning the perceived purpose concerning the KSN and its relation vis-à-vis their professional role in ArchFirm, the use of the KSN including the intranet, how they perceived the various activities and their opinions of experts and knowledge. The approach used can be categorized as a semi-structured approach.

### 2.2.3 ArchFirm official documents and the Intranet

Descriptions of ArchFirm and their KSN were found in several documents providing a source for data and offering a general overview of ArchFirm and the KSN. In this case, reviewed documents consisted of PowerPoint presentations and the corporate website, both describing ArchFirm and the KSN. The rationale for analysing documents from ArchFirm was to create a background for the research however

always bearing in mind that documents are not a replacement for interview data; in this case they were used, in line with Silverman (2001) as a complement to interviews. Since the documents are produced by the management of the KSN they provided a valuable insight into how this group of individuals chose to present the KSN which renders several opportunities; comparing the rhetoric in the presentation with the rhetoric in the interviews with KSN management representatives; and analysing the rhetoric of the KSN in the presentations with the view of KSN by the members of the KSN. Furthermore, the researchers got an oral presentation of the presentations by the manager of the KSN which also generated important insights vis-à-vis his relation to ArchFirm and the KSN.

An important tool for documenting and facilitating knowledge sharing employed by ArchFirm is their intranet. The first page of the intranet has eleven icons, one for each sub-network; clicking on one leads to a sub-networks homepage where each sub-network is responsible for adding content to which everyone in ArchFirm have access. The adding of content is maintained by a group of editors who have exclusive access to publish news, publications or other materials on the intranet.

### **2.3 Analysis of data**

The analysis consisted of reviewing and examining official documents provided by ArchFirm as well as interview transcripts and field notes. The results were analyzed according to themes regarding knowledge sharing, KSN and expert knowledge. This was followed by grouping the data under the heading of different keywords.

The results were later analyzed through Actor-Network Theory (ANT) which provided a lens whereby the results could be interpreted. This interpretation was useful in describing the different factors that influence knowledge sharing in the architect firm.

The analysis and subsequent discussion were continuously revised according to how the research questions evolved and came to become more focused on how knowledge sharing can be facilitated through KSNs in an architectural setting.



### 3 Literature review

Establishing a knowledge base in architectural firms is crucial to the very idea of the architect profession. If architectural firms cannot produce a strong basis rooted in knowledge and expertise of their domain, the same services could equally be produced by others. The issue of establishing a strong knowledge base is therefore a necessary condition for the existence of architecture as a profession and conversely without a strong knowledge base, there is no lasting foundation for the profession (Holm, 2007).

The literature review begins with a brief overview of contemporary research regarding knowledge and knowledge management. This is followed by a review of network theory, the nature of experts and expert knowledge as well as architects and architect firms. The literature review is concluded with an explanation of Actor-Network Theory (ANT).

#### 3.1 Knowledge Management (KM)

Knowledge Management (KM) emerged in the 1980s as organizations sought new ways to improve their performance (Wiig, 1997). This occurrence came about alongside the IT revolution during which it became possible to manage and disperse large quantities of information (Hansen et al., 1999).

The discussion of what knowledge is can be derived thousands of years back in history. The subject of knowledge has its own branch of philosophy, epistemology, encompassing problems regarding the nature, origin and scope of knowledge. Despite having a branch of philosophy there is no commonly agreed definition of knowledge among researchers. Oxford Dictionaries (2013) define knowledge as: *facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject*. Shifting focus towards an organizational context, Newell et al. (2009) conceptualizes organizational theories of knowledge in two ways, the epistemology of possession (knowledge as something that individuals have) and the epistemology of practice (knowledge as something people do).

Theories belonging to the epistemology of possession emphasizes the cognitive aspects of knowledge conceptualizes it as a possession of the human mind, a personal property of the individual owner rendering it possible to use it as a mental resource in work places. Polanyi (1969) introduced the notion that knowledge can be divided into explicit and tacit. Whereas explicit knowledge can be expressed and codified without much difficulty, tacit knowledge is difficult to explain or articulate. The distinction between tacit and explicit knowledge is ambiguous. In order to share explicit knowledge, one resorts to tools gained through tacit knowledge. The two terms are thus dependent on each other and the idea that knowledge can be strictly explicit is contradictory. In addition to this, explicit knowledge constitutes only a limited share of knowledge and by focusing exclusively on explicit knowledge; one ignores the majority of that which is typically categorized as knowledge. Although tacit knowledge is personality and contextually dependant, it is nevertheless possible to share. Socialization offers a means to share tacit knowledge and is therefore considered an important method to facilitate knowledge sharing (Fernie et al., 2003).

Nonaka (1994) building on the works of Polanyi conceived a model for describing the interaction between explicit knowledge and tacit knowledge which is based on the foundation that individuals know more than they can tell. This view of knowledge has received criticism; Styhre (2009) warns that viewing knowledge as commodity simplifies the very nature of knowledge and ignores important epistemological and ontological aspects such as how knowledge actually is used in a workplace or sent between individuals.

Theories adopting views of knowledge placed into Newell et al. (2009) epistemology of practice share the view that knowledge is constructed and negotiated through social interaction. Knowledge is in these theories viewed as embedded in social practice and hence it cannot exist outside this context i.e. in stories, artifacts etc. This view is embraced by Gherardi and Niccolini (2000) who argues that knowledge, in an organizational context, is a social and cultural phenomenon, something that people do together and subsequently conceive organizational knowledge as:

- Situated in the system if ongoing practices
- Relational and mediated by artifacts
- Always rooted in a context of interaction and it is acquired through some form of participation in a community of practice
- Continually reproduced and negotiated and hence it is always dynamic and provincial

The epistemologies of possession and practice offer a simple way of understanding of the differences in the theoretical aspects of knowledge. However the division by Newell et al. (2009) can in some cases appear dichotomous, why cannot knowledge be both something that is possessed by individuals and something that is owned? And furthermore, when the two epistemological aspects are described by Newell et al. (2009), the focus is in both aspects on something that *people* do, in other words the epistemologies of practice and possession have an anthropocentric approach to knowledge.

### **3.1.1 Knowledge Sharing in Organizations**

Knowledge sharing has shown to offer a long term competitive advantage for organizations (Koch, 2002) and many organizations have thus sought to improve their knowledge sharing procedures. In doing so, there exist both facilitating factors that aid in knowledge sharing as well as factors that serve to hamper or hinder knowledge sharing (Johansson, 2012). A range of different factors have been identified as impediments for knowledge sharing including inadequate organizational structures and an unfriendly culture towards the sharing of knowledge. To counter these problems, many organizations have resorted to introducing technological tools to aid in the sharing of knowledge including document management systems, groupware applications and/or intranets. These tools have often been rather unsuccessful in producing a significant improvement with respect to knowledge sharing in the organization. If individuals are not motivated to share knowledge without the use of technological tools, introducing such tools will not drastically alter the preexisting attitude towards knowledge sharing (Hendriks, 1999).

Understanding motivational factors involved in facilitating knowledge sharing is important in order to persuade individuals to share knowledge with their fellow peers. In this respect, Hansen et al (1999) argues that the offering of incentives constitute a

necessary condition for knowledge sharing to occur. The means to motivating individuals to share knowledge differs depending on whether or not the knowledge can be considered tacit or explicit. In the former case, intrinsic rewards (i.e. task that are fulfilling in and of themselves) may be more useful than extrinsic rewards in the form of material gains or external acknowledgment (Osterloh and Frey, 2000).

The construction industry is typified by its project-based structure in which knowledge sharing between different projects has proven to be challenging. In studying this challenge, Styhre and Gluch (2010) make the case that knowledge sharing in the construction industry occurs, to a large extent, through means of personal networks and oral communication.

## 3.2 Networks

Buchel and Raub (2002) found in their survey that knowledge networks could: improve efficiency through reusing company knowledge, increase innovation through leveraging existing knowledge and raise employee satisfaction through exchange of ideas with like-minded, feeling of belonging to a group, increasing the chances of faster career movement and using the network too look for new talents. Units are more likely to connect when the resources they possess are seen by the other as complementary etc.

The challenges of managing a network are addressed by Thompson (2005); in this case the network was conceptualized as a community of practice which means that the network contained elements of joint enterprise (shared understanding of core values), relationships of mutuality (built up trust amongst the members of the network) and a shared repertoire (a common history sustained through language and artifacts). The core question posed by the author is if such a network is best left alone or if management can provide some kind of support. The conclusion came to support the following standpoint:

“The organization should organizations should sponsor the creation of certain loose organizational structures, around which it is hoped that communities of practice may then interact” (Thompson, 2005, p. 151)

Although it is crucial that management is very careful when balancing the level of interference since too much control, interference or structure very well can spell the end of the network. This was exactly what happened to the network in the case study; originally the network consisted of 40 core members in one division of the company, with a remarkably high output thus attracting the attention of the head office which then in attempt to leverage the results, started to expand the division in a nonorganic way by introducing several new co-workers, introducing outside consultants, making a sharp distinction between work and non-work etc. This caused de-identification from the original members with the community and consequently creativity and productivity was reduced. The conclusion made by Thompson (2005) is that controlling structures, i.e. best practice, targets, introduction of consultants etc., is likely to fail, while using seeding structures such as providing individuals with things that are needed for communicative interaction such as infrastructural instruments, symbolic monuments, points of focus etc., is more likely to work, or even to be necessary.

According to Buchel and Raub (2002) there are four key activities in building a successful knowledge network. 1) Focusing the knowledge network on strategic

objectives will ensure managerial support since the network is formed around a current issue for the company and this can also facilitate the initial links. 2) Creating a network context is important for being able to use and understand the knowledge from different contexts (making the colleagues visit each other's plants or using a shared document). It is also important to choose communication according to task complexity and interdependence and also to create the right levels of trust since trust is a base for knowledge sharing. 3) Routinizing network activities are important in order to establish and legitimize the network in the context. There are also different roles in the network which have to be established over time; coordinator, support structure, editor who validate the current knowledge and also a sponsor who provides top management support. 4) Leverage network outcomes including transferring the knowledge in to the organization, which can be done through showing tangible outcomes. The most important factor and also one of the hardest, is to demonstrate tangible network outcomes. The risk is that networks that easily produce tangible outcome get priority over others which may produce very valuable outcomes over time, such as employee satisfaction, which are also hard to measure. In summary it is more important to manage the context than details.

### 3.3 Experts and expert knowledge

The expert is commonly understood as someone who possesses knowledge not available to others. There is no consensus with regards to its definition but there are common denominators between the various definitions. An expert is someone who is *highly knowledgeable* or skillful in a particular area (Princeton WordNet, 2013; Oxford Dictionaries, 2013), a person with high *level of experience* having received *training* in a field (Merriam-Webster, 2013). The focuses on specialization of knowledge coupled with long experience are both distinguishing features of 'the expert'.

Measuring the performance of experts in general is troublesome. Evaluating the performance of an expert who has been involved in a large project which can span months or years – as in the case of construction projects – is a difficult task indeed. This is, in part, due to the high number of individuals involved in such projects intricate nature of the project itself (Ericsson et al., 2007). The need for justifying the expertise of the expert is not a new emergence. Historically, experts had to provide justification for their expertise in a fashion that was deemed both storable and controllable. The expert was further expected to be supported by a larger cognitive base which provided and developed the specialized knowledge. Modern expert groups have expanded this by also stressing the use of technical means and the forming of political strategies to mobilize control and power (Reed, 1996). Experts are sought after for their ability to solve problems and transmit what is regarded as 'superior knowledge'. Furthermore, experts in their capacity as consultants are expected to act as middlemen between knowledge producers and knowledge users. The strength of their services lies in notion that knowledge seems to be impervious to the law of diminishing utility. In stark contrast to most services and products, knowledge increases in value the more it is consumed or applied. It is not strange then to discover that experts will always be able to argue that their contributions will add to the organization. As consultants, they may indeed find themselves in situations where they construe the problem itself before they can solve it. (Eversa & Menkhoff, 2004) Ericsson et al (2007) present the argument that the expert, in addition to embodying specialized knowledge, further needs to possess knowledge which produces tangible



results. If no such results can be ascertained, the expert's legitimacy may be questioned as in the famous case known as "the Judgment of Paris" in which wine tasting experts failed to distinguish between various wine brands in blind tests. Schein (1978) makes the case that expert consultants will face the peculiar dilemma of either acting in the role of a content expert or that of a process facilitator. The content expert, much like a physician, focuses on diagnosing a problem after which a remedy for the ailment can be found. Expert consultants who deal in this type of work are usually hired as a result of the client having faced a difficulty or a problem in the organization which needs a quick fix. Expert consultants can also be hired in the role of process facilitators. Instead of providing a service to solve a particular problem, these experts will attempt to reduce the problem by focusing on the process itself.

Although architects could be considered as experts by a wider audience, expertise in the professional sense typically entails an academic background; this relationship is not necessarily true in architecture. Rather, architects are rarely considered experts within a specialized area of architecture as a result of having received a formal university education on a subject matter. Instead, the expert architect, as (Holm, 2007) points out is typically one who has spent a considerable amount of time working with a particular area. The expertise is based almost solely on experience in contrast to engineering fields where specialization is typically embedded in the formal education. The lack of such a foundation has resulted in the contraction of architect or as Horst Rittel puts it:

"The territory of architecture has been shrinking. Architecture has never proliferated into specializations. Whenever an area within architecture became systematized and showed signs of life, it was happily abandoned and left to the claims of other professions – new or old." (Rittel, 1976, p.79).

In addition to shrinking the domain of architecture, it further carries the implication that architectural knowledge is broad and difficult to delineate. As a result of this, clients have become less willing to accept the terms of service provided by architects at face value (Holm, 2007).

### **3.4 Architects and architect firms**

Architecture is an area which contains several dilemmas; the dependence on commissions, poor distinction between architecture and building, the lack of congruence between those that the architect are ethically responsible for and those that the architect is accountable for, the constraints on design imposed by the growing size and complexity of firms and also the lag between the intimation of a project and the actual realization. Other authors mention the complicated situation between the architecture as an artistic expression on one side and on the other the dependence on the clients and their commission to be able to materialize the building (Blau & McKinley 1979)

Architects and architecture firms exists in a sector which can be described, on a institutional level, as a competitive collaboration; collaborative in the sense that architects have to collaborate with the other actors in the sector to achieve the clients goals of producing a building and competitive in the sense that they compete with the other actors in the sector over influence over the whole sector (Winch, 2007).

Architects may have a different culture than other actors in the construction sector as indicated by Holm (2007) and Styhre (2009). This is further elaborated on by Ankrah and Langford (2005) in a comparative study of contractors and architects

organizational cultures where they compared different cultural dimensions, degree of formality, sources of power, methods for control and coordination *inter alia*. Architects firms were described as informal organizations where control and coordination is achieved through empathy and direct personal contact and where decision-making is decentralized and everyone is asked to contribute. The architects themselves are described as having a need to impose their identity on the organization and since they also have a sense of their own importance they need to impose their identities on the organization which the firms recognize. Furthermore, the work tasks are focused around individuals rather than on teams. Several similarities were found between architects and contractors; the degree of centralization of management practice and the notion that authority and power emerges from expertise and experience rather than from formal positions (Ankrah & Langford, 2005).

The major differences found by Ankrah and Langford (2005) were that power emerging from relationships with managers was of lesser importance for architects, the architects had a lesser degree of formality around positions, procedures and work processes. The architects had a higher need for recognition of their work and also in regards to the extent to which the architects needed to impose their identity on the organization as well as the architects' higher tolerance of ambiguity. Even though Ankrah and Langford (2005) argue that relations with managers are less important in regards to power and influence in the organization, it shall not be seen as if the architecture firm is a place unaffected by issues of power. In their study of an award winning architecture firm Brown et. al (2010) directs attention to the notion that creativity is embedded in organizational based relations of power; which is manifested not by explicit rules, since they are seen to hamper creative work, but through tacit organizing which lead to a silent hierarchy and where the superiors corrected the employees conduct so that they all fitted in to the architecture firms way of doing things.

Although architectural firms are fueled by creativity, they are also constrained in the boundaries created by their clients. The friction that emerges between the two constitutes a common contradiction found in architecture which was dubbed *the Daedalean risk* by Blau (1984, p.17); a contradiction which is embodied by the notion that architect firms strive towards novel solutions in fulfillment of the profession's ethos whilst pursuing pragmatic solutions more in line with their clients requirements. In trying to come to terms with this conundrum, architect firms have resorted to a number of different strategies.

A key factor in assessing the strategy that the architect firm will adopt is indicated by the ratio of architects in the firm. This relationship was identified by Blau (1988) who noted that firms with a higher ratio of architects tend to produce more novel designs and focus on creativity whereas firms that have a relatively lower ratio of architects, and subsequently a higher ratio of engineers and supporting staff, tend to produce more standardized buildings.

Another influential factor is the size of the firm. This factor is noteworthy not only because it determines the firms overall strategy but also because it carries a dual opposite effect in regards to creativity. Large firms have been known to win more design awards. This may be due to the fact that larger firms possess greater resources than smaller firms. However, larger firms also have characteristics which hamper creativity such as the tendency towards hiring a larger proportion of engineers and the tendency to fragmentize the organization into many departments (Blau, 1988). The

argument in essence is – as stated by Cuff (1991, p.73) - that “the quality of a work of art decreases in proportion to the number of people involved in its creation”.

This mindset explains the importance of having a single individual as the master architect in any given project. The architect needs to not only be familiar with issues relating to design but also be familiarized with a wide range of different disciplines including; engineering, economics, law, psychology and ergonomics. For this reason, the traditional approach in architecture has been to foster a culture of acquiring interdisciplinary knowledge. Generalists have therefore been preferred over specialists on the grounds that the former will be able to form a more holistic picture of any given project (Blau, 1987). However, this emphasis on “*interdisciplinary eclecticism*” serves to undermine the idea of the profession itself, considering that professions are typically characterized by their expertise in one particular domain. As Holm (2007) argues, this expertise, albeit valuable for the profession, needs to be in agreement with the client’s desires. Therefore, the idea that the architect should avoid working within the client’s constraints and instead alter these constraints, needs to be avoided. Any insistence on convincing the client to follow the architect’s designs at the expense of the client’s considerations will risk future commissions as clients begin to fear that their considerations are unappreciated. Although it is common for clients to criticize architects for unwillingness to listen, it is also possible that the client loses sight of their own initial intentions to hire the architect in the first place. What is, after all, the point of hiring an expert if you continuously undermine their opinion? Such an exercise in futility serves only to hamper the relationship between the client and the architect firm (Holm, 2007).

Architects are a professional group with a strong focus on creative and aesthetic tasks, combined with strong professional norms, values and identities (Styhre & Gluch, 2009). Architects are further recognized as individuals who work long hours, in Brown et al. (2005) cases study participating architects said that it was not unusual to work 80-90 hours a week. The long working hours is an accepted part of the culture and is also important part of manifesting commitment.

Due to the project based nature of the sector there is also considerable amounts of travelling to visit projects. The long working hours and the long travels are embedded in the profession. Arguments can be made that individuals work a lot because they get satisfaction from working in a creative profession but as Caven and Raiden (2010) points out that economic uncertainty, job insecurity and the pressure to appear committed also increases the working hours. Creativity is seen by many architects as the core of architecture and what separates them from other professions (Cohen et al., 2005; Styhre & Gluch, 2009). This core is also seen by some as being constantly pressured by economical, political, managerial and cultural aspects (Cohen et al., 2005), however Styhre and Gluch (2009) argue that the creative core is more threatened by daily routine activities than by external factors. Cohen et al. (2005) takes a micro perspective on architects in private and public sector and argue that architects create their identity and explain differences in their work through three discourses: architecture as a creative endeavour, architecture as a business strategy and architecture as public service.

### 3.5 Actor-network theory

Actor-Network Theory (ANT) began emerging in the 1980's as a way to explain the differences in how something is and how it is perceived. Initially, the focus was on explaining the origins and the inner workings of scientific and technological breakthroughs. Subsequently, ANT has developed into a much wider framework which incorporates different disciplines within primarily the social sciences (Law, 2009). At its core, ANT is an application of semiotics, presenting the idea that entities take their form and acquire attributes by their interaction with other entities (Law & Hassard, 2005). The theory questions importantly held beliefs about causality and agency. In particular, it puts forward the controversial notion of non-human agency in which processes, technological tools and other similar concepts can be viewed as actants (non-human actors) who acquire an identity by repeatedly performing the same actions with predictable results. Networks are formed once the relationship between actors and their identities have become stabilized. If the network functions smoothly so that the separate actors can no longer be distinguished, the system can be described as an actor-network (Czarniawska, 2005). The social interactions that occur in the production and dissemination of knowledge are therefore seen as merely a patterned network consisting of heterogeneous material, i.e. various types of actors (human and nonhuman). Essentially, this would imply that the network is not composed of humans alone but that agency is also embodied by machines, tools, architecture and so forth. ANT emphasizes the role of artifacts in social constructions and goes as far as claiming that they not only mediate meaningful communication but indeed help to shape it. The removal of these objects would seriously alter the way in which communications occur and therefore alter the prevailing order (Law, 1992).

ANT, contrary to its name, is not a theory (Law, 2009) but rather an approach or a method of analysis, a way to view the world, which does so in a descriptive way (Latour, 1996). The key problem for actor-network theory was formulated, according to Law, (2009), by Callon in 1980 when the latter posed the question: *“how can we describe socially and materially heterogeneous systems in all their fragility and obduracy?”* As indicated above, the concept of heterogeneous network is at the heart of ANT and is a metaphor for conveying the notion that society, organization, agents and machines are all effects generated in patterned networks of both human and nonhuman actors (Law, 1992). The concept of heterogeneous materials is controversial and ANT has had to withstand criticism because, as Law (1992) expresses it; *“it treads on a set of ethical, epistemological and ontological toes”*; where the critics have pointed to the ethics of giving machines or animals equal value to humans, however this is not an ethical statement from ANT theorists but rather an analytical stance. According to Tatnall and Gilding (1999), ANT is based upon three principles: agnosticism, generalized symmetry and free association. Agnosticism is a principle that implies, when analyzed, that all the actors in a system, human or nonhuman, needs to be treated impartially; generalized symmetry helps to achieve this by offering a neutral vocabulary which describe the conflicting viewpoints of the heterogeneous actors, since no actor should be given priority of interpretation; the principle of free association says that all previous distinctions between the social, technical and natural should be abolished. The word network is not to be confused with the technical use of the word in engineering contexts, such as a train or telephone network. The actor network can lack all the characteristics of a technical network. Further ANT have very little to do with the study of social networks (Latour, 1996).

Having provided a basic description of ANT, this section continues with an explanation of four key aspects of ANT. These aspects will be applied to the interview results as an analytical lens which subsequently provides a foundational starting point for the discussion.

### **3.5.1 Translations and punctualized actors**

The concept of translations in ANT is defined as the process which generates ordering effects such as devices, agents, institutions or organizations (Law, 1992), and thus generates the actor-network. It can also be viewed as a way to describe the movement of different forms of knowledge, cultural practices, technology and artifacts (Czarniawska & Hernes, 2005). Translation also implies transformation as stated by Law (2009) and for example, to translate two words means making two words equivalent. However, since no two words are exactly the same, translation is in this case also a form transformation.

Punctualization, simplified, refers to the event when a network acts like a unity, then it simply disappears and is replaced by the action itself and the seemingly simple author of that action (Law, 1992). For example when a person drives a car or use a computer, as long as they work, they tend to perceive both as a unity, or a single block as Law (1992) puts it, but when the car or computer breaks down the user will be exposed to all the complex systems that must interact in order for the block or unity to work; consequently something relatively simple is hiding the networks that make the unity or block work.

### **3.5.2 Obligatory passage point (OPP)**

An Obligatory Passage Point (OPP) is a concept that is used to denote the single node in actor-network in which all the actants have to pass through at some point (Callon, 1986). Law (2009) uses an ANT perspective to analyze Portugal's success in reaching India and controlling half of the world by combining conventional accounts of military power, trade, spices etc. and the technological infrastructure which made it possible to create ships and navigation. All these components are translated into a web giving each component a particular shape and which held together for 150 years with Lisbon as the OPP. The notion of an OPP is also used by Callon (1986) but instead of being a physical object his OPP consisted of the question on whether or not a certain species of scallops could anchor themselves to a special cage.

### **3.5.3 Semiotic relationality**

Semiotic is defined as "the study of signs and symbols and their use or interpretation" (Oxford Dictionaries, 2013). Semiotic relationality refers to the notion that different elements in an actor-network help define and shape each other (Law, 1992). Instead of perceiving the network as a solitary 'thing', it is rather viewed as a composition of different elements that shape one another.

### **3.5.4 Focal actants**

According to Onsrud (2007) the focal actant is the thing which initiates the process of structuring the actor-network. The focal actant, in a sense, defines both the identities and the interests of other actors in the network. The idea is tightly connected with translation since the focal actant is typically the actant that initiates the process of translation. An example of this is offered by Callon (1986) in a study in which he examined the domestication of scallops. The researchers in this study were viewed as

the focal actant by initiating the entire process and thereby defining the identities of the remaining actants.

### **3.5.5 Black boxing**

To simplify a network can also be called to “black box” the network. Networks are always unreliable and can hence become unstable and black boxes i.e. simplified views of a network, and the contents of this black box, the complexity becomes visible (Tatnall & Gilding, 1999). The actors in an ANT-network are themselves made up of networks and this is how simplification works. So when we change an actor we also change the network that this actor simplifies. So if we find a stable network we can often punctualize it and consider it as a single actor in order to simplify it. So according to Callon, an actor is a black box that consists of a network of other black boxes (Tatnall & Gilding, 1999).

### **3.5.6 Empirical applications of Actor-network theory**

As Law (2009) argues, it is possible to describe ANT in the somewhat abstract way as done above however in its essence; ANT is grounded in empirical case studies. Considering this, before proceeding to the results from the case study, some empirical examples of previous applications of ANT will precede the results in order to increase the understanding of the subsequent ANT analysis that follows the results from the case study.

One of the first applications of ANT comes from Michel Callon and his paper about the scallops of St Brieuc Bay. In this case the (heterogeneous) actor network consists of three researchers trying to find out if a new species of scallops can survive in St. Brieuc Bay, the new type of scallop (*Pecten Maximus*), the fishermen of St Brieuc Bay which need the new type of scallop to survive in order to save their future income, and the scientific colleagues of the three researchers who want research data of how the new type of scallop adopts to the new habitat. What Callon tries to explain with his paper is that all these actants are involved in the process of translation, that this process never is completed and can also fail and finally how the process of translation is the mechanism of how the social and natural world progressively take form.

A second example comes from France and one of France’s greatest scientific heroes; Bruno Latour uses ANT to theorize that maybe the discovery of the vaccine for anthrax by Louis Pasteur was not the result of one great man’s intellect as most people seem to think (Law 2009). When Latour applies ANT a new picture starts to emerge; because in the world of ANT, characterized by semiotic relationality, all actions are relational effects including actions by researchers. The actor-network in this case consisted of domesticated farms, technicians, laboratories, veterinarians, statistics and bacilli. Subsequently the vaccine for anthrax was the generative result of the actor-network and not the result of one great man’s intellect, from an ANT perspective.

A third and final example comes from the work of Gherardi and Nicolini (2000) which focus especially on the central notion in ANT on heterogeneous networks. They use this concept to explain organizational knowing and draw on a case study of safety knowledge in a construction site. Somewhat simplified they use the notion of heterogeneous networks to explain how safety knowledge is circulated in a construction site through the process of translation in an actor network consisting of individual, communities, organizations and institutions. The use of ANT helped the researchers to realise that not only human actors are part of the creation and

circulation of safety knowledge and also how these nonhuman actors influence the circulation of the knowledge.

### **3.5.7 ANT implications**

These central concepts give rise to a number of interesting aspects of the world when looked through an ANT perspective. First what may seem on the surface to be purely social is partly technical and vice versa. Consequently, according to ANT, nothing is purely social or technical and subsequently that a relation that is either purely social or technical is impossible (Tatnall & Gilding, 1999). ANT treats social relations, including power and organization, as network effects; networks that are materially heterogeneous and where all parts of the networks, humans and non-humans are treated equally. Tatnall and Gilding (1999) compares ANT with ethnography since it handles complexity without simply filtering it out. It extends ethnography because it allows for an analysis of both humans and nonhumans in a single register, hence not forcing one to be the context of the other. The authors conclude that ANT may help researchers understand the success or failure of an innovation, since it helps researchers in situations where the social, technical and political are regarded as particularly important. By allowing for this it helps researchers to develop a holistic narrative that builds on this common register (for humans and nonhumans) which gives the analysis inputs from all the aspects of the common register, social, technological and political (Tatnall & Gilding, 1999).





## 4 Results and Analysis

This section highlights the results from the case study conducted in an architectural firm, given the pseudonym ArchFirm, which was presented earlier in the Research Approach. The data was gathered from interviews with Network Managers (employees responsible for managing the sub-networks of the Knowledge Sharing Network) and regular employees such as architect and engineers. The overall purpose of the interviews was to offer an understanding of how knowledge is shared in ArchFirm through an understanding of the Knowledge Sharing Network (KSN) and its activities but also through the interviewee's perceptions of knowledge and experts. The results from the semi-structured interviews are presented according to six interview themes.

### 4.1 Interviewee perception of the knowledge network and its purpose

The interviewees described the network with different metaphors. One interviewee referred to it as a databank, another referred to it as a living organism.

We want KSN to be, what should we call it, like a database in which we can gather ideas, receive support and build up references. (Environmental Expert 1)

It kind of changes over time, it's like a living organism. (NM for the Project Management Network)

The interviewees seemed to have had quite a similar view of the purpose with the KSN. According to one interviewee, three distinct but interrelated perspectives were offered. Firstly, KSN's primary goal is to share knowledge. Secondly, it is also meant to strengthen the brand and thirdly to be market oriented.

Two purposes really, but they could be (categorized) as three; networking, internal knowledge sharing, but they are in essence the same thing, and business intelligence. (NM of the Urban Development Network)

There seemed to be several different perceptions of the KSN. Several of the interviewees mentioned that knowing what kind of knowledge or competencies that different individuals at the firm had, gave them better confidence when they were out on projects and talking to clients. Moreover, some of the interviewees mentioned that they use KSN when they recruit new members. They argued that by merely showing that they are a company that have the resources to invest in this kind of project they would attract the best new employees. This was confirmed by an interview with a recently hired employee; however this employee felt that once she was employed and was exposed to the KSN, she expressed disappointment as it was not what she had thought it to be. Several interviewees mentioned the social aspect of the knowledge networks as one of the most positive aspects. However, another interviewee thought of the networks as closed social clubs.

It is sort of like a Rotary Club; a club that holds [people] together [who] go around and meet up instead of being like: "now here is a good network meeting again, who wants to be in?" (Senior Architect 1)

Several of the younger members of ArchFirm expressed that KSN was an important part of getting to know other employees at different offices. Regarding verbal communication with the management of KSN, according to several interviewees (both NMs and regular employees) they did not have much verbal contact with them.

How often do I meet with the management? I do not discuss with them that much. {...} in regards to the daily managing of KSN, we have not had that much contact. (Senior Architect 2)

I have not had that much (contact). It so happens that almost all of them (KSN leaders) sit here in the Stockholm office. I speak with them sometimes. (NM of the Urban Development Network)

In cases when ArchFirm's employees do establish contact with coworkers outside of their own office, they usually contact people whom they have met in a previous engagement such as a network gathering. If the person is located in the same office, face to face communication seems to be preferred.

KSN could further be used to gather the competencies that exist within the organization. Speaking on this matter, one of the employees stated that KSN may possess even greater knowledge of the employees than the HR department.

Yes, it is a network that has an eye on skills, more so than the HR department actually. (NM of the Project Management Network)

## **4.2 The role as Network Manager (NM)**

The role as network manager (NM) is held by individuals with different professional roles some of whom are architects and others engineers. Although their professional background differed, the NMs described their role and their tasks, as NMs, in similar ways (with minor differences which will be discussed further in this section). Everyone mentioned that they had the overall responsibility to coordinate their network and arrange yearly network gatherings.

As Network Manager, I am responsible for the overall and continuous work to organize the network. (NM of the Construction Technology Network)

An important role for a Network Manager is to prioritize and make sure that it gets done and not just put it in the back pocket just because there are more important things to do and that no one is breathing you down the neck. Be a doer in that way; make sure that things get done. But no one has said this explicitly, it was more my indirect feeling on why they asked me, maybe. (NM for the Urban Development Network)

The role as NM is not exclusively reserved for older and experienced individuals, on the contrary, several of the NMs were in the earlier phases of their careers (one interviewed NM was in his early 30's). There is also a mix of female and male NMs; six of the eleven (55%) NMs are women. One NM said that he spends about 5% of his time performing tasks related to KSN, however this varied a lot during the year; for example before the yearly network gathering the time spent on planning tasks increased. Most NMs reported that they spent only a marginal time working directly with the KSN, although some NMs did make use of the KSN on a daily basis, and several expressed that they wanted to do more as NMs but that they were restricted by their busy schedule. A common perception of the role was that it was very flexible and each NM was, to a large extent, free to construct their network in a manner of their choosing. This was appreciated by all of the interviewed NMs.

I, feel that in the beginning it (the NM function) was very diffuse and you did sort of what you felt like, and that is still how it is. (NM of the Construction Technology Network)

**Q:** To which extent do you feel that you have had an impact on the design of KSN as it is today? **A:** It (the function as NM) has been quite unrestricted, there are no direct set of regulations [...] the networks look different depending on the knowledge area. (NM of the Interior Design Network)

Although being overall similar, the NM's roles seem to differ (between the NMs) in certain aspects. The difference could be attributed to two variables: differences in the size of the network and whether or not the network was a corporate market area or a core competence. Considering the size, one NM from a smaller network thought that it was part of her role to keep all the employees affiliated with her network from different offices together.

My role is to listen to the other offices and notice the demands of what we want to do. Indeed, [to maintain] a cooperative discussion for the Stockholm, Gothenburg and Malmö office. (NM of the Interior Design Network)

As a contrast to this, the role of the NMs for the larger networks typically implied more of a delegating role. The NMs of a corporate market area implied coordinating networks of a more homogenous group (higher proportion of one profession) whereas the networks labeled as core competence were more varied in terms of professions.

Several interviewees mentioned that it was important for the NM to be skilled at networking and analysing industry trends. A common trait of the NMs was that they were perceived as competent by their co-workers, had high ambitions combined with an elevated interest for their subject matter. As hinted in the above statement by the NM for the Urban Development network, several interviewees amongst both the regular employees and the NMs emphasized the importance of having a personal commitment for the NM to succeed.

Here in the Gothenburg office, I guess I have had a great influence in terms of the whole education (i.e. the education buildings network) in regards to my personal commitment that is [...] Everything in life is about personal commitment, is it not? (Former NM of the Education Buildings Network)

How did it come about that you became an NM of Construction Technology? **A:** [...] So it had to do with [my] interest in technology and its relation to architectural design. I then wanted to continue being involved with that. I therefore sought this network here in ArchFirm and was a part of it for a few years whereby I succeeded the former NM. (NM of the Construction Technology Network)

There are no apparent time restrictions imposed on the duration of the NM role. When a new individual succeeds the NM, the one resigning often becomes a type of mentor for the new NM although this is not formally specified.

Yes, one could say that I have somehow become a type of mentor. The important thing now is, here in the Gothenburg office, to find someone who can carry on with this. (Former NM of the Education Buildings Network)

She was the former NM of Urban Development so she is the one that I engage with a lot since she knows how our network functions. She is very knowledgeable and diligent. (NM of the Urban Development Network)

As a result of a more market oriented strategic initiative, ArchFirm, has decided to alter the current function of the NM in dealing with market related issues. Specifically, the new role as it is being conceived presently is to increase the degree to which the NM's role is market oriented. The main idea being that the NMs should engage with potential clients to a higher degree and conduct analysis of different market segments.

To share the business intelligence, both internationally and nationally, of course. What is going on? What are the trends? What is current? What can we expect to come here and [what] type? What is the competition that we will have? What prospects are there out there? You sort of enter into the market aspect here and we've tried to keep it away from that but in the new role of [the NM], market issues will - more clearly - be a part of it. [...] It has been one of the difficulties and it is why we have introduced this expanded [NM] role; to differentiate between KSN and market activities. There are different bosses and different budgets. (NM of the Urban Development Network)

But it has become more and more formal. There is a job description now regarding that NMs should have business intelligence [...] a clearer job description with several requirements for NMs. (Former NM of the Urban Development Network)

### 4.3 Network Activities

All the sub-networks share one aspect; they all feature at least one big activity each year in which all of the employees affiliated with a network are invited to participate. The yearly network gathering was generally described as a popular event; one interviewee noted that on average the attendance rate is 80% among employees affiliated with a particular network. The geographical location, and thus the responsibility for helping the NM organize the gathering, rotates every year between the offices. Furthermore, the disposition of the day is similar for all the networks; they usually start in the morning and eat breakfast together and then have activities during the day. In the evening they typically do something more informal and also eat dinner together. Some networks spend the night at a hotel and continue the next day with activities while other networks only have one day. Typical network gathering activities includes study visits, employees presenting projects, lectures from internal or external individuals and various seminars.

It is usually a full day [activity] where the sustainability manager - who is sort of the boss for [the] environment [network] at White - presents an overview and then there are different attractions which people find interesting. It could be solar cells or whatever, or energy calculations, projects that have been interesting. Then, it's usually [followed by] a dinner where everyone talks. [We] usually go for a full day and then around 4 ['o clock], [we] tend to go a little bit softer; present projects and like drink a beer and such. Then [we] go out to eat dinner, and then it's sort of over; something like that. (Environmental Expert 2)

There is however differences regarding each networks activities; whether external parties are invited or whether they collaborate with other networks (which was a clear ambition from several networks but few had actually managed to have a network gathering with another network). Two interviewees where faced with the question whether they have had any activity with another network to which they responded:

No, we haven't had that yet. We have talked about it. Not really. (NM of the Urban Development Network)

We actually have our own [network gatherings] but we have talked about it (i.e. participating in other network gatherings) a little bit. That [one] should sort of... and we do obviously notice [other networks], the health care buildings network has come really far, one could say. They are very diligent in [their area], a lot of people are engaged. (Former NM of the Education Buildings Network)

The Interior Design Network took the involvement of external parties one step further by planning one of their network gatherings in close collaboration with a customer. The NM explained it as a win-win situation for ArchFirm as well as for the supplier.

We have had our network gatherings at furniture retailers, they have been hosts so they provide food and accommodation, nice beautiful facilities, shows their products, or like how we had it last time; [He] is a guru in furniture, he is 80 years old now and he has created some amazing furniture... and then we got to visit his home and he told us about his life and his view on the profession and around sustainability a like everyone was completely sold on this afterwards and then we have made a deal, this was with [the] furniture company, and the new call them and say “would you like to be a part of a super exiting day where we invite researchers and lecturers and people from ArchFirm”, “would you like to be part of this, do a thing together?” “of course they said” and then we just did that so we paid for the lecturers and saw to that all interiors designers at ArchFirm and some more came and they we invited other furniture producers which we design for, so that network gathering was a mix of everything. (NM of the Interior Design Network)

Although several NMs and employees mentioned that they would like to see external parties at the network gatherings, more than a few also expressed concerns about the involvement of external parties. One NM explicitly said that the members of her network needed to spend time alone at their network gatherings without involvement of neither other employees at ArchFirm or external parties. The main benefits of involving external parties were also expressed differently by NMs and regular employees. According to several NMs the main benefit was the opportunity to create stronger bonds with clients or potential clients and display ArchFirm’s capabilities. One NM said that by sharing experiences together with a client, such as study visits, helped to generate a common frame of reference between ArchFirm and the client making it easier to conduct business in the future. According to several of the regular employees the main benefit was the opportunity to get new insights and perspectives.

Apart from the large event held by every network each year, some networks engaged in other activities such as lunch and breakfast seminars to which they invited suppliers, customers and sometimes competing architect firms. These activities tended to be confined to the networks regarded as market areas.

Then, following that, we had two: one external and one internal seminar about social sustainability in which our clients were also invited to join; three in number, two internal and one external. [...] Then we had lunch and after lunch we had a review of our [projects], a short presentation of projects. (NM of the Urban Development Network)

There were also activities that were not formally initiated by a NM but rather had emerged through the employees themselves, a grassroots’ initiative. At one office, employees from two different networks had started to have shared breaks in which a person could present a project or something interesting that he or she was currently working on.

A majority of the interviewees emphasized the social aspect of both the yearly network gathering and other activities such a lunch and breakfast seminars. One interviewee stated that it was important that architects from competing firms attended activities so that architects could discuss problems related to architecture as a profession. Moreover, another interviewee stated that the social aspect was at least as important as the lectures or seminars at the gatherings while another indicated that by doing activities within the networks, a “we” feeling was created within ArchFirm.

Particularly, several of the younger interviewees emphasized the importance of the social aspect in terms of meeting new colleagues from different offices who are working with the same type of problems. Meeting in person made it possible to connect a face to the name which made things easier, an opinion expressed by both young and old interviewees.

Yes, [you] get to meet some people sort of. There's a benefit in meeting face to face, I could see a great advantage in [doing] that. (Environmental Expert 2)

Yes, and integrate and work together, that is what creates strong connections. It is also that which let's [you] get to know people. [One] gets to know what they are capable of, that is also [very beneficial]. It creates a value which is not exclusively related to education knowledge, but it also creates a value for ArchFirm as a company, we get stronger connections within the company. (Former NM of the Education Buildings Network)

In terms of impact on knowledge, the interviewees seemed to have had a difficult time explaining what they learned on the gatherings. Very few of the interviewees could mention a gathering or a situation in a gathering when they felt like they learned something new or an event that was particularly memorable.

**Q:** Could you describe such an event, a network gathering where you learned something new and felt 'this is great'? **A:** No, it was a long time ago. None that I can remember. (Environmental Expert 2)

**Q:** Could you mention a network gathering activity which left an impression which you remember very well? **A:** As you can say, that was something I could not respond to immediately, had to think. No, nothing that I could [recall]. I have to think about what we have had for sort of [past network gatherings]. It hasn't always been the case that I have been available to participate either. We have had such nice moments. (Senior Architect affiliated with the Healthcare Buildings Network)

Even though all the interviewees expressed a desire to have a mix of professions on their network activities, few stated that they were satisfied with the current mix of professions at their respective networks activities. In other words, networks predominantly consisting of architects sought to have more engineers visiting their activities and vice versa for the networks dominated by engineers.

No, there are a lot of architects in the [education] network This is how it is. There should be a lot of engineers, environment [specialists] and all those things should be included. Environmental [specialists] are included a lot but the engineers have their own network where they often deal with technical solutions, technical innovations and the like. They are perhaps a part of that, then they aren't part of both. It is about [the idea] that [one] cannot take part, practically speaking, in more than [one network gathering] and [one] is not able to, or does not have the time to commit themselves to more than [one]. [...] Engineers will therefore often prioritize the technical networks. (Former NM of the Education Buildings Network)

One could say that there is an overrepresentation. We are overrepresented with people who [are] construction engineers, [one] might say that. A great share of such coworkers view this network gathering as their natural home. But I tried to get people from landscaping and interior design and such to so that they are participating also. That someone from those networks or sectors, I could say, should join [and] contribute to widening perspectives. (NM of the Construction Technology Network)

Various explanations were mentioned in relation to this, nevertheless they all revolved around two intertwined and embedded concepts in a consultancy firm context; time and money. All the offices of ArchFirm are profit units, hence each office has to pay

for each employee visiting a network activity and subsequently it would be very costly for an office if all the employees were to visit several network gatherings each year. In addition to this, the notion that most interviewees mentioned that they had a large work load also contributed to most of them felt that they could only spare time for one network gathering each year; and the choice of network gathering naturally became the network that the individual felt most affiliated to.

[We] could say the following then; we are a consultancy company with relatively small profit margins. KSN is very active and conducts many activities. It is difficult to get architects to join the 'Project Management Academy', there are so many other activities which they would prefer to attend maybe. (NM of the Project Management Network)

This is always a question regarding time and money and so forth. (Environmental Expert 1)

The notion that all the offices are profit centers seemed to have created a possible source of dismemberment in the KNS; by excluding individuals from offices due to not having adequate resources to send employees to activities.

The smaller offices do not always have the opportunity to join the network gatherings, it costs a bit. (NM of the Urban Development Network)

#### **4.4 The interviewees perception on experts and expertise**

The interviewees indicate that the use of experts is a natural part of the daily activity for most employees. Experts, particularly within the environmental sciences, are employed on a frequent basis. According to the interviewees, the reliance on experts, both internal ArchFirm experts and hired consultants, is an essential aspect of the trade. The interviewees all expressed the notion that one aspect of being an expert is to have extensive knowledge in a certain area or long experience in a certain area. The expert was typically defined in the following terms.

It is (the expert) a specialist within a specific subarea who carries extraordinary skills [and] knowledge. (NM of the Project Management Network)

It is someone who has a relatively long experience but it doesn't have to be this [way], however it is someone who known a topic very well and is well versed in it. (NM of the Urban Development Network)

There seemed to be however some variations in the definitions: one individual noted that an expert do not have to be a older person but could might as well be younger person, that the expert should have knowledge of both national and international trends. Some interviewees also expressed the opinion that the term expert is a relative term; that in some contexts you are an expert and in others you are not an expert.

People can come to me and I can answer most of the questions. If I were to end up in Stockholm's Department for City Planning, then I wouldn't be an expert because then there are so many more that possess that knowledge. (NM of the Urban Development Network)

To add the vagueness of term, the use of the word expert, although defined similarly as shown above, was used to refer to different things. In some cases the term referred to internal ArchFirm experts and in other cases it referred to hired consultants. It may not always have been entirely clear which kind of experts the interviewees were referring to.

#### 4.4.1 Internal ArchFirm experts

There seemed to be a certain degree of vagueness concerning how the interviewees perceived an internal ArchFirm expert. The interviews indicated that there was no clear distinction between who could be considered an internal ArchFirm expert. According to the following interviewee, there were a lot of employees in ArchFirm who he considered to be internal ArchFirm experts.

Yes, that's the whole thing; speak with this person or with that person, speak with the estimator, he is awesome! [...] He's an *expert* in counting money. (Senior Architect 1)

It may also be the case that internal expertise is dependent on demand. If the market demand decreases for a particular set of internal expertise, then the value of that internal expertise may diminish as shown in the following quote.

Then I am sitting there and no one is inquiring about it (my expertise) and then it is all of a sudden not worth anything, or [worth] very little. (Senior Architect 2)

#### 4.4.2 External experts (consultants)

The use of external experts was common as indicated by several interviewees, both NMs and regular employees. There seems to be a distinction between the frequency of using external experts in relation to whether or not the interviewee belonged to a core competence network or a corporate market area network. The following interviewee belonged to a corporate market area and in line with other employees in the corporate market area networks, his experience in using external experts was vast.

I can give as many [examples of using external experts] as possible. [...] For example, we designed a garage and I wanted to make sure that our line of thinking was right, hence we hired a traffic consultant. (NM of the Construction Technology Network)

By involving external hired experts in projects, several interviewees emphasized the acquiring of a type of leverage in negotiations and also a certain transfer of risks. The expert's opinion may have granted a sense of security in that it validates one's own interpretation.

[One] attempts to form their own opinion, then it can be quite nice, if [one] is taking part in negotiating contractors or whatever it might be. Then it is rather nice if [one] has [a person] who is very knowledgeable in [that] area. Then one can be calm and confident in one's own opinion and then [one] performs better in the negotiation. (NM of the Project Management Network)

Several of the interviewees noted that external experts are employed not only based on their level of expertise but also depending on their willingness to understand architecture. The reuse of an external expert is contingent on their performance in past assignments. An external expert who delivers the required results in a fashion typified by cooperation and an understanding for architecture may be more likely to be rehired in the future than those who disregard these issues.

Someone could be knowledgeable in an area but not want to understand the architectural perspective or this task. But if [we] find experts that [we] cooperate very well with, in which it shows very clearly and very quickly, that together we create good and exciting solutions [then we would work with them]. (Former NM of the Environment Network)



Well, I believe that if I am content, then I would want to have the same person. [You] know what they are capable of; it is so extremely heterogeneous, what people deliver and expect to get. (Environmental Expert 2)

## **4.5 The significance of the intranet for knowledge sharing**

The intranet, along with phones and e-mail, constituted the most prevalent form of technological communication tools used in ArchFirm to convey knowledge to others. The content appear to differ much between the networks; some published news, summaries from activities and information about upcoming events; others created a portfolio of reference designs or technical solutions intended to help members find inspiration or solutions for future. The usefulness of this intranet seems to be a contentious topic which spurred a plethora of contrasting views. In general, the perception was that the intranet did help serve a particular function such as offering news of upcoming events such as network gathering, but that it could also be improved.

One important aspect of the intranet is that the possibility to publish material is confined to one person in every network, the editor. If someone wants to publish something they have to send the material to the editor who then publishes the material on the intranet. This was perceived as inefficient by several interviewees; one network even went around the intranet and started their own Facebook page where anyone could quickly publish links and materials. Contrasting the negative aspects, one interviewee described the intranet as vital.

All the work takes place via the intranet. That is where you log in on the morning and that is where you get all the news, there is where the links are to everyone in the KSN. It always comes up... Stuff happens all the time. You have access to all templates, documents and the quality system. (NM of the Project Management Network)

In contrast to the more extreme views on the intranet several interviewees showed a similar pattern concerning their usage of the intranet

**Q:** Can you describe the intranet and how often you use it? **A:** Not frequently enough. I log in to the intranet a couple a times each month, mostly to check if something new has come up, regarding the KSN intranet. Sometimes I check the other networks [homepages] to see if there is anything I'm interested of; how does it look at the Housing [Network]? (NM for the Urban Development Network)

## **4.6 The role of group identity in shaping knowledge sharing customs**

Several of the interviewees talked about ArchFirm as a knowledge company and that the conceptualization of ArchFirm as a knowledge company was conveyed and magnified through the KSN.

All of the strategic investments undertaken by ArchFirm in knowledge development outside of projects I think are visible and build ArchFirm as a knowledge company and therein KSN is included as an important investment. (Former NM of the Environment Network)

The majority of the interviewees stated that there were no routines in place at ArchFirm to capture the knowledge gained from experts (internal or external). A certain discontented sentiment could be heard from the manager of the Interior Design

Network who asserted that although it did occur that other members from larger network participated in their events, the opposite was typically the case.

We have to shout out that we exist. The larger (networks), they are busy with their thing. So if a symposium is being planned, it is easy to forget about landscaping or interior design or construction technology (another small network) for example; to forget about these areas when planning for these large events. We have therefore resorted to shouting a few times and sometimes it has worked and sometimes it has been overlooked. It would really be better if all the areas (i.e. networks) were involved in planning these larger events. (NM of the Interior Design Network)

The manager for the construction technology network expressed similar viewpoints while attributing the weaker support felt by the construction technology network as the result of it not being a market area.

Perhaps the most central characteristic of the architect's identity is that of creativity. Therefore, the impact that KSN has on creativity is of the utmost importance. In this regard, some of the NMs insisted that KSN had no significant impact on their creative work whereas others pointed out the indirect effect that has, as demonstrated by this narrative.

KSN creates room for knowledge creation and dissemination of knowledge, this makes it possible to gain benefits from the larger network, ArchFirm. By having this as a baseline, one will have gained a lot and travelled rather far. You do not need to start from square one every time which probably means that you will have time for being creative. Existing knowledge is a prerequisite for creativity; otherwise one would focus on "need to have" instead of "nice to have". (NM of the Project Management Network)

Thus, KSN seems to affect the creativity of the architects by primarily making the process of gaining knowledge easier by facilitating connections between the various employees and thus allowing for more time to reflect on creative designs. Another viewpoint asserts that the main contribution to creativity is the networks ability to provide for inspirations. In this narrative, KSN affects creativity in a direct fashion by providing a databank of creative solutions.

Indeed, it's really important. Inspiration is the alpha and omega. This is a creative profession where you constantly have to come up with solutions. (Former NM of the Healthcare Buildings Network)

The architectural occupation and architect's practice is almost per se creative. It is about structuring the creativity and there KSN plays an important (role as a) strategic knowledge collector so that all the creativity that exists in the projects not only exist there. The housing network for instance has put up a number of reference drawings. It's about structuring creativity is what I would say. – (Former NM of the Urban Development Network)

A common theme identified in nearly all of the NMs narratives was the idea of allowing for flexibility with regards to how each network deals with its knowledge sharing practices. Evidently, these narratives appeared to have stood in agreement with the positive effect of allowing for a large degree of flexibility in these practices. These sentiments were perhaps expressed most vocally by the managers of the smaller networks. Their main assertion being that formalization of these procedures would result in a degradation of the knowledge sharing capabilities in their respective networks.

I would say that we do not use that (i.e. the intranet) very much. There a lot of people in our group who compile things and we should be doing that. However, there are many who are somewhat crass and (say); O, Lord! We could have simply googled this and not spent our time on this and instead searched for new trends and so forth or spent the time reading about exciting seminars and interesting interior design projects. {...} I have been taunted several times about this on these large (network meeting); let's see how many visitors there has been to the interior design (intranet). It doesn't work like that and no one does that. We have therefore dismantled it and agreed on how we spread our knowledge to each other in the best possible way. So what (else) are we supposed to do? (NM of the Interior Design Network)

Although the respondents seemed to be in general agreement in regards to allowing for flexibility, there did exist nonetheless a common understanding that certain networks have been exemplary in their use of the intranet. One such network was referred to time and again for their efficient use of their network's intranet. The notion that they used the intranet on a daily basis and as part of their continuous work was something which other NMs seemed to admire about that network.

The housing group has done it one way but we need to do it in a different way. They have created examples of reference drawings but it is not as easy to (do so for us). It is not really translatable to the health (network) but one could use reference examples in another form, at the very least. I think that would be great. (NM of the Healthcare Buildings Network)

They (i.e. housing network) have a tradition. They began early to collect residential reference drawings on their intranet. It has become a very important source for information for those who work with housing. One could imagine that we would have something similar. Had we perhaps begun in another time, we could have built up a database of reference drawings for land use planning, but we don't have that now. Maybe this is something we can engage in depending on what we have resources for but it feels like we're taking the right priorities with the funds we have (currently). (NM of the Landscaping Network)

The use of reference examples, as demonstrated by the housing network, may carry the advantages of both providing for inspirations of best practices whilst promoting active participation in knowledge sharing. Though many of the respondents could identify with the usefulness of building reference examples, the major concern was the lack of resources and/or time to undertake the building of the list itself. This concern seemed to be more vividly emphasized by the smaller networks where resources to fund KSN endeavors were even more limited. Notwithstanding, even some of the larger networks had apparently not undertaken this process despite having sufficient resources to do so.



## 5 Applying Actor-Network Theory as an analytical lens

In this section, an attempt is made to use ANT as an analytical lens to investigate knowledge sharing in an architectural context. This approach is intended to shed light on the intricate complexities that seems to exist in a knowledge sharing network consisting of many different elements. It is further useful in mapping out the different factors that help to facilitate or serve to hamper knowledge sharing in ArchFirm by providing a methodological outlook which makes it possible to acknowledge certain relationships, which in the absence of the ANT analysis, may have gone unnoticed. This is at the heart of the argument made by Doolin & Lowe (2002) stating that the detailed descriptions provided by applying the ANT perspective enables for an analysis of the interrelationship that comprise the actor-network. Drawing on the ANT perspective, ArchFirm is conceptualized as a heterogeneous network consisting of several actants, human and nonhuman. As stated earlier, knowledge does not necessarily have to be conceived as something that exclusively resides inside individual heads but rather as something that in addition to this, resides in practice. Subsequently knowledge is something that happens between human beings. However, through the notion of heterogeneity adopted by ANT the social is conceived as made up of both human and nonhuman actors which suggests that nonhumans are considered being part of the social environment that creates and shapes knowledge. The above line of thought implies that in the case of ArchFirm, architectural knowledge does not only reside in the mind of the architect neither is it exclusive to the social relations between the architects but rather it exists in the heterogeneous network made up of various employees with different backgrounds and identities, the intranet, the KSN and the sub-networks etc. Hence, may ANT serve as a bridge between identified gaps made of the two epistemologies of possession and practice mentioned by Newell et al. (2009).

### 5.1 Translations and punctualized actors

The concept of translations in ANT is defined as the process which generates ordering effects such as devices, agents, institutions or organizations (Law, 1992). KSN in this perspective could be seen as the effect of the process of translations which has transformed the heterogeneous elements, such as the employees, the intranet and other components of ArchFirm, into the punctualized actor KSN. The punctualized actor once stable will be subjected to resistance from various other alternative translations.

There is no such thing as “the social order” (Law, 1992, p.386), rather there are different translations of how a social order can be constructed. This is important in relation to KSN in that it discards the idea of forming the perfect or ideal network. Instead, there are various alternatives to network formations, some of which may be more conducive to the expressed purposes of the KSN. Since the idea of “the social order” is rejected by ANT, social order is continuously contested and there are numerous sources of resistance. The resistance toward social orders may be greater in the case of ArchFirm considering the many different professions that are represented in the firm. Another way in which resistance could be manifested may be through the seemingly dominating position of the architects’ identity.

The process of translations permeates social order; it is also useful in analyzing how expertise is understood within ArchFirm. The different ways in which the term

'expert' was used by the interviewees may be explained by failures in the process of translations.

## **5.2 Obligatory passage point (OPP)**

A successful architectural design, seen in a material semiotic view, is not the result of one great architect but the result of relational effects. In the case of ArchFirm and knowledge sharing the concept of OPP could be viewed through different levels. In the broadest sense, the management of KSN constitutes an OPP in that the management of KSN is the center point upon which the entire system is founded. However, their significance is reduced in regards to the operational part of the KSN. In this aspect, the NMs play a more decisive role in facilitating knowledge sharing through organizing the network gatherings and similar activities. On this secondary level, the OPP is reflected by the individual NMs whose prime function is to coordinate the network which implies that they are placed as the central node of the network. Considering that personal commitment was described as inherently embedded in the role as NM, one might argue that personal commitment could also be considered an OPP.

In a similar fashion, the NMs play a reduced role in regards to the daily knowledge sharing activities between the individual members of the respective networks. Regarding knowledge sharing through the intranet, the OPP is constituted by the editor who controls the flow of information through the intranet. By having an OPP in relation to the intranet, the interaction becomes more limited compared to if the OPP was removed. A removal of the OPP may facilitate increased knowledge sharing by allowing for the employees to publish and spread various types of information (presentations, designs and other publications) unhindered.

## **5.3 Semiotic relationality**

As mentioned in the literature review, the principle of semiotic relationality establishes that the different elements in the actor-network help define and shape each other (Law, 1992). The network is therefore not perceived as a solitary 'thing' but rather as a composition of different elements that shape one another. This viewpoint when applied in the case of ArchFirm might then suggest that KSN could be viewed as a circulating entity in which each element, made up of actants, mutually interact to shape and create meaning. This perspective allows one to take into account the different factors involved in the sharing of knowledge through the KSN by observing how the different actants relate to one another with respect to knowledge sharing. A similar interpretation was made by Goodings (2010) in investigating self, identity and community in a social networking website.

Drawing on several of the interviewees' dissatisfaction with the intranet, their relation with it can be characterized by semiotic relationality. However their interaction with the intranet is reduced since the updating of the intranet is performed by the editor. As described above, the editor can be seen as an OPP through which all the information on the intranet has to pass and subsequently the shaping is asymmetrical. In relative terms, the intranet shapes the employees more than the employees shape the intranet. A possible consequence of this is that the employees may begin to distance themselves from the intranet which could be detrimental with respect to knowledge sharing.

## 5.4 Focal actant

The focal actant (i.e. “token”) in ArchFirm is arguably that of creativity. Through each of the interactions between the different actants within the firm lies this central idea that all work should embody a creative architectural perspective. In clarifying the position of ANT with respect to tokens, Latour (1996) stresses that tokens have the ability to transform the actants they interact with. Moving from one actant to the other, the token is always translated, always moving. With creativity as the token, it becomes vividly clear that its interpretation varies widely within the different networks represented in the KSN. The NM of the urban development network insisted that architectural creativity was no longer defined from her perspective in terms of graphical designs; instead creativity was associated with intelligent solutions. In the landscaping network, creativity was deeply rooted in gaining recognition from others through winning design contests whereas the Healthcare Buildings Network adopted an empirical approach towards the creative by studying causal relationships between design and well being. In each of these cases, the token was reinterpreted in a way which suited the network in question.

## 5.5 Black boxing

A central idea in ANT is the notion of the black box, an actor-network that functions smoothly and is viewed only in relations to inputs and outputs. As long as the black box works, little to no attention is given to *how* it works. It is only when the actor-network either degrades in its functions or when it ceases to function entirely (see 3.5.1) whereby one notices the intricate complexities underlying it. A possible example of such an occurrence in KSN is the relationship towards internal ArchFirm experts. Many of the interviewees in this study argued that knowledge transfer from internal ArchFirm experts was straightforward and part of the status quo in the firm. Most were unaware of the underlying mathematical models or software tools used to produce the desired results. Instead, the process was simplified in terms of inputs (e.g. sending drawings to an environmental expert) and outputs (receiving recommendations on what to change). The process seemed therefore akin to that of a black box. However, from the point of view of the main environmental expert<sup>1</sup>, the process was far from simplified but instead tedious and dependent on many different elements. Furthermore, the constant inquiries that this individual received as a result of being ArchFirm’s central authority on environmental expertise had often interrupted his regular work. From his point of view, the actor-network has broken down and the different parts of the black box have been revealed. With each new request, he envisions the various parts of the black box and the necessary interactions needed to answer that request; the models that need to be created, the algorithms that need to be tweaked, the background research that need to be undertaken, the strains that the request will put on his work and how it will affect his mood for the rest of the day. All of these interconnected parts are apparent to him but hidden to the individuals seeking his assistance. It seems therefore that the expert functions like a black box in ArchFirm when viewed from the perspective of the individual members of ArchFirm but not when viewed from the experts own perception. The notion that an actor-network can be perceived as different things depending on how it is viewed is supported by ANT (Dolwick, 2009). An actor-network may be viewed as an actor from one perspective but as a network from another.

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<sup>1</sup> This individual is referred to in the results as Environmental Expert 2.





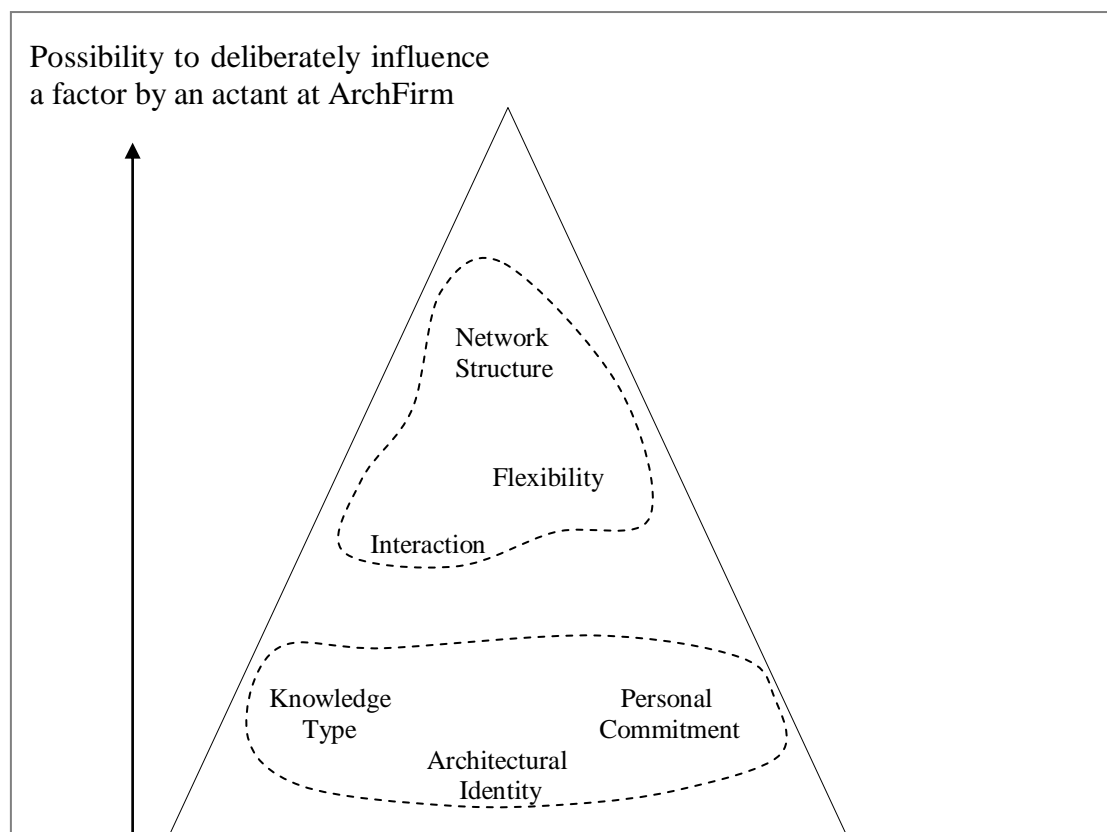
## 6 Discussion

As outlined in the introduction, the main purpose of this report is to illuminate factors influencing knowledge sharing in an architectural firm. Drawing on the identified factors, the authors intend to make suggestions on activities or processes that encourage and facilitate knowledge sharing in an architecture firm.

In the following discussion, the factors influencing knowledge sharing in ArchFirm is presented in Figure 2 where they are loosely categorized in regards to how much they can be influenced by managerial actants such as the management of KSN. Prior to offering a more comprehensive description of how each factor influence knowledge sharing in ArchFirm, a brief overview is presented in order to give the reader a more holistic perspective of these factors.

### 6.1 Factors affecting knowledge sharing in architect firms

The results from the interviews reveal some of the intricate complexities involved in the sharing of knowledge in an architectural setting, particularly one in which several professions work together across geographical boundaries. The findings show that a number of factors (see Figure 2) have the potential to either facilitate or hamper knowledge sharing.



**Figure 2:** An illustration of factors identified as influential in the facilitation of knowledge sharing in the KSN.

The six factors listed above derive from a combination of the interview results, an application of ANT and the literature review. As indicated by the dotted lines in Figure 2, these factors could be differentiated in regards to their visibility as some seem to be more visible than others and subsequently some are more responsive to

influence than others, in this case from the management of KSN. In particular; personal commitment, architectural identity and knowledge type appear to be more hidden whereas flexibility, interaction and network structure seem to be more visible. From an ANT perspective, personal commitment could in this sense be viewed as the OPP, the central feature which is necessary in order to share knowledge in the organization. The complete lack of commitment to share the issues in the organization would most likely result in a hindrance of knowledge sharing. This is in line with the argument presented by Hendriks (1999) showing that successful knowledge sharing practices rest on a foundation made up of individuals who are committed to share knowledge with each other as part of the organization's culture. This further tie in with the notion of architectural identity in as far as the architect identity is typically seen as displaying high levels of commitment (Brown et al., 2010; Cuff, 1991). As a consequence of this identity, the architects may further finds themselves more drawn toward a specific knowledge type most commonly described as generalist (Holm, 2007).

What seems to be the common denominator linking together the three preceding factors is their apparent lack of visibility; neither commitment, identity, nor knowledge type might be described as easily observed. Rather, these factors could be viewed as inherent within the organization's culture. In contrast to this, the level of flexibility allowed within the KSN is more readily observed according to statements made by the interviewees. Flexibility, in turn, seems to be linked with the preceding factors considering that architectural identity in addition to the knowledge types represented in the architect firm; both imply that flexibility is needed in order to accommodate the various viewpoints embodied in the organization. The level of interaction could also be described as visible and easier to influence; it manifests itself through the various network gatherings and other types of meetings that occur in the KSN. The center issue, or the focal actant, in regards to these interactions seems to be that of creativity. Regardless of whether the interaction is between internal ArchFirm employees or with external parties outside of the firm, the core issue at hand is finding new and/or alternative ways to improve the core business which in essence could be described as creativity. Although creativity could be translated differently depending on the professional group, it appears to be nonetheless the key issue in the organization. Architects and interior designers might view it in terms of aesthetical designs and urban planners might look at it in terms of finding balanced solutions whereas engineers, project managers and environment specialists may see it in terms of technical solutions. Finally, the network structure is perhaps the most apparent of these factors. It seems to be closely related to the types of interactions that occur in the KSN. If the interactions are composed of mostly physical meetings, the network structure will most likely reflect this by becoming more closely joint. Conversely, if the interactions are composed by mostly phone, e-mail, the intranet and/or other technological tools, then the network structure could perhaps be better described as less closely joint.

As previously mentioned (see 3.5), ANT has a neutral standpoint in regards to causality. Although it might be possible to state that a certain actant can be considered focal or that a certain node in the system can be viewed as an OPP, it is not possible to say with certainty exactly how each actants affects the other. Drawing on this, the factors listed in this section can be viewed as interacting with each other but it may not always possible to say with certainty how each factor affects the other. Take for instance the seemingly obvious connection between interactions and network

structure. If the level and/or type of interactions change, the corresponding network structure might also change. However, this could also be true in the opposite case. If the network structure is altered, the interactions that occur in that particular network might then change accordingly. For this reason, the researchers have chosen to focus on investigating the factors individually without necessarily describing the causal links between the various factors.

## **6.2 Factors that are less responsive to deliberate influence**

The following three factors (see Figure 2) may not be directly visible in the KSN and are instead integrated in the organization. They may therefore not display the same level of responsiveness to direct influence from the management of the KSN and are perhaps determined more by the core values of the employees and the organization than from directives from management.

### **6.2.1 Personal commitment**

Personal commitment was emphasized by a majority of the interviewees as important to several aspects of the daily activities of the KSN. Personal commitment was mentioned as central to everything in professional life by one senior architect. It seemed to underlie the KSN and could perhaps be described as an OPP (see section 5.2), a prerequisite in order to share knowledge in the organization. Although it could be seen as an integral factor to consider in the sharing of knowledge in this type of firm, it is perhaps not easily observable. As a consequence of this, it may therefore be difficult to influence this factor from a management perspective.

The NMs were in part chosen due to a personal commitment to issues relating to their network. A reasonable question would then be: why is personal commitment seen as so important in ArchFirm? A starting point would be to look at architecture as a profession and explore the nature of the profession vis-à-vis personal commitment. This starting point would be in line with Brown et al. (2005) and Cuff (1991) where they argue that commitment is indeed important for architects. However, this is not directly applicable to ArchFirm since approximately 50 percent of the employees are not architects and also because the importance of commitment was expressed by non-architect interviewees as well. On the other hand it could be argued that the strong focus on personal commitment from the architects have in a sense shaped the organizational culture at ArchFirm into a culture that premier values aligned with architects values, such as personal commitment. This does not mean that other professions cannot exhibit a high level of commitment but rather that the architect's standards of commitment is typically higher than that of the average profession as indicated by Brown et al. (2005) and Cuff (1991). An indication supporting this notion might lie in the notion that although the services provided by ArchFirm ranges further than mere architectural services, all the interviewees still talked about their work place as an architecture firm.

It could be observed that the level of commitment varied from NMs who were directly involved with the KSN on a daily basis to other NMs where KSN issues were dealt with on a less frequent basis. The same type of discrepancy could be attributed to the commitment shown by ArchFirm's internal experts and senior architects. Some were deeply involved in KSN matters whereas others were less engaged with the KSN.

The perceived time constraint by the employees and the NMs could be a derivative from the very nature of ArchFirm and hence in one aspect related to one of Newell et

al. (2009) points about consultancies: in which the time spent on projects is billed and thus carefully monitored by the client. In an organization where this implicit surveillance is constantly present the risk is that knowledge workers “*often reduce or ultimately fail to spend time searching for, creating or acquiring new knowledge and actively learning*” (Newell et al., 2009, p.39).

### **6.2.2 Architect identity**

The architect’s identity is somewhat intertwined with the notion of commitment as the architect profession typically displays a high level of commitment (Cuff, 1991). Similarly to commitment, the factor of identity seems to be difficult to directly observe and therefore deliberately influence. Instead, identity appears to be more deeply integrated to the core structure of the architect firm. As stated earlier, although ArchFirm considers itself to be an architect firm, it has a large share of non-architects represented in the firm. It seems from the observations of the researchers and from the statements made by the interviewees that the architect identity in a way dominates the other identities. From an ANT perspective, this observation could be explained in terms of a translation which has become dominant and subsequently trumped all other interpretations (Law, 1992). Therefore, the architect identity could be argued to have become the main identity of the firm, not necessarily because of a high proportion of architects (only half of the employees are architects) but perhaps due to the architecture identity becoming the dominant translation.

Group identity played an important factor in shaping the knowledge sharing practices used in the networks. These practices seem to function well when they are in line with the dominant identity in that network. This was exemplified by the Interior Design Network where knowledge sharing was primarily conducted through viewing and orally discussing examples of color schemes and designs. Learning by viewing and discussing design portfolios was considered important in interior design and the knowledge sharing practices reflect that. The focus on oral communication in the Interior Design Network is in line with the way in which knowledge is typically shared in the construction industry, i.e. through personal networks and oral communication (Styhre & Gluch, 2010).

Even though ArchFirm’s employees come from different professional backgrounds, there appears to be a strong unifying culture of architecture dominating the entire organization. Due to this, any external expert who is hired outside of the firm is expected to have a proper understanding of the architectural praxis prior to undertaking any work. It seems that it is not enough to provide for a technical solution which is sufficient to solve the problem. In addition to solving the problem, the hired expert should be able to accommodate the architect’s design perspective in their solutions. The insistence on incorporating the architectural perspective seems to further strengthen the dominant architectural culture in the firm.

### **6.2.3 Knowledge type**

The factor of knowledge type, generalist or specialist, in likeness to the two preceding factors seems to also be difficult to directly observe and influence. As explained in section 4.4, the interviewees had varying depictions of expert knowledge. In this case, no dominant translation seems to have emerged as to who constitutes an expert in the organization. It seemed difficult to differ between the large spectrum of knowledge types: a ‘strict specialist’ on one side of the spectrum, a ‘strict generalist’ on the other

side and a large space in between consisting of individuals who would consider themselves neither specialists nor generalists but somewhere in the middle.

The use of specialized expertise is an indispensable part of consultancy firms' daily operation, perhaps more so in architect firms due to the large number of professions covered under the umbrella of architecture. Even so, this does not necessarily mean that generalists are to be excluded. This argument ties back to the notion, expressed by Holm (2007), that generalist have been preferred in architecture in order to sustain an overview perspective. It would therefore seem sensible that generalists are placed in a coordinating position outside of the individual networks. If so, the generalists will be able to function as mediators between the different networks with the ability to introduce the right person to deal with the appropriate problem. Buchel and Raub (2002) found that coordinating successful knowledge sharing networks is contingent on managing the context, not the details. In this particular light, this could translate to avoiding managing tasks reserved for specialists and instead focus on managing the context in which these experts reside. Therefore, generalists would be of benefit in as far as they are capable to bridge gaps between different expert domains.

### **6.3 Factors that are more responsive to deliberate influence**

The following three factors were found to be more responsive to deliberate influence, having the common denominator that they can be, to a larger extent than the other three factors, influenced by management.

#### **6.3.1 Interaction with internal and external parties**

The interaction between the actants in the KSN is to some extent possible to influence by the management of KSN. However, as made evident by Thompson (2005) interference by management regarding knowledge sharing structures is precarious which was also indicated in the interview results. Knowledge sharing is in essence comprised of different actors and their interdependent interactions. Interactions with coworkers within ArchFirm, in one shape or another is a necessary requirement to be able to share knowledge within the organization, perhaps more so in an architecture firm. Drawing on the previous ANT-analysis, the interactions in ArchFirm can be seen as a representation of how the process of translation continues to change and transform the social order in the firm and consequently also knowledge sharing practices. This perspective provided by ANT emphasizes the importance of exploring the internal and external interaction in relation to the KSN.

Although this interaction is important, it should also be noted that the level of interactions undertaken in an expert context should perhaps be evaluated with respect to the current work load. In an architectural establishment such as ArchFirm, this was manifested by the notion that certain networks within the firm worked with KM issues to varying degrees depending on the quantity of work they had at that present time. This is in accordance to Forcada et al. (2013) who state that the main obstacles to implementing KM are workload, stress, time pressure and long working hours. These three factors are recognized as inherit in the architectural practice by Brown et al (2005). A consequence of this may be that certain networks develop better knowledge sharing practices and also that it may create rifts between the different networks.

Interaction through yearly network gatherings is appreciated by nearly all of the interviewees although its effect on knowledge sharing is more difficult to discern. The

effect could perhaps be described as indirect; the network gatherings serve as a type of social platform where employees meet and interact with individuals from other offices and consequently build stronger professional relationships. These relations seems to benefit the employees at ArchFirm in several ways in their practice: they have a better knowledge of who knows what in the offices, they also said that it was easier to make contacts with a person they had meet in a prior engagement.

However this is not to say that employees do not share any knowledge at all at the network gatherings, they do present projects and have seminars but the effects of these are difficult to describe since very few could retell what they learned at a network gathering nor give a narrative of an especially memorable occasion at a network gathering. In contrast, it could be argued that they do learn at the network gatherings but that the nature of the acquired knowledge could be described as tacit (Newell et al., 2009) and by its nature, it is hard or even impossible to articulate such knowledge in a meaningful way.

All organizations are subject to influences from external sources. Interaction with stakeholders outside of the firm may allow for external sources of creativity which in term constitutes one of the most important elements in architecture. Although this interaction can be deliberately influenced, the difficulty in managing the level of interaction that should be had outside of the firm lies primarily in determining how much external influence should be introduced to what is essentially an internal system for handling knowledge sharing (Styhre, 2009). In this case study, this is further complicated by ArchFirm's expressed desire to increase the NMs' external interactions with customers and stakeholders.

The question concerning interaction with external stakeholders is present during the network gatherings where a number of the networks choose to invite external guests. There seems to be an intricate balance concerning how much external influence the members of a network thinks is acceptable in order to feel comfortable to share knowledge with each other. This seems to be further complicated by the notion that the different networks each establish their own balance as to how much external influence they deem necessary. External stakeholders' presence at a network gathering could arguably affect the employees' willingness to share knowledge (depending on what type of external stakeholder is present at the network gathering). This could be explained by the notion presented by Winch (2010) in which the construction sector is regarded as a competitive collaboration where actors within the industry compete over influence of the whole sector. For example, having external parties such as contractors present on a network gathering runs the risk of transforming the network gathering into an exhibition of strengths and in refraining from taking up sensitive issues that could be perceived as a weakness but might indeed help the present employees to share their knowledge about that particular issue through open discussion. Thus, showing signs of weakness with external parties present may result in a weakening of ArchFirm's position. On the other hand, external stakeholders could serve to introduce new perspectives, help break the notion of some networks as closed social clubs, as one interviewee mentioned, and also to help the employees to build networks that range outside the boundaries of ArchFirm.

External interaction occurs in the various network activities, but it seems also to occur in the daily practice of ArchFirm through interactions with clients and other stakeholders. For most of the interviewees the use of and contact with external experts was a daily activity but there were no routines in place to facilitate knowledge diffusion of the knowledge brought in by external experts. However, it could be

argued that external expert knowledge is integrated in the projects and when the projects are presented, for example, during a network gathering, the expert knowledge is diffused. In other words, the expertise of hired consultants may not directly shared in ArchFirm because there are no routines for explicitly sharing external expert knowledge. However, it becomes integrated in the projects and thus diffused when the projects are presented at a later occasion.

### **6.3.2 The structure of the network**

The results of the interviews indicate that the structure and thus also the size of the various networks can have an effect on knowledge sharing. This might be one of the factors of knowledge sharing that management can deliberately influence and manage, for example by directly determining the number of members in one network or how many networks there should be. The structure then seems to be a decisive factor in how the concept of semiotic relationality (see 3.5.3) will be enacted between the different networks and hence how it affects knowledge sharing.

One aspect in which the size of the network affects knowledge sharing practices was that it framed how the members interacted with each other during for example the network gatherings. The Interior Design Network appeared to be a socially tight group of individuals and their network activities were quite intimate. This is in contrast to the Environmental Network which is a larger network with a wider range of different professionals whose activities appeared to be more fragmented in the sense that they were less coherent as a group, which was reflected in their network gatherings. Drawing on the above, the Interior Design Network could perhaps be described as a community of practice (Wenger, 2000) since they exhibit the attributes identified in communities of practice, such as sense of joint enterprise, relationships of mutuality and a shared repertoire. On the other hand, the environmental network appears not to display these qualities to the same extent. This difference between the networks could be explained by the notion that the knowledge which circulates in the networks is of a different nature. As explained by Holm (2006) and Styhre (2009), architectural knowledge is typically described as tacit whereas the knowledge circulating in the Environmental Network could be argued as more explicit.

The interviews further revealed that the contributions of smaller networks were often overlooked at the expense of the larger networks. Although it was often common for the members of a smaller network to take part in the knowledge building activities of the larger networks, the opposite was rarely the case. This indicates a rift in how the different networks perceive the value of another network.

Another such rift may exist between the networks which ArchFirm has labeled as market areas and those categorized as core competencies. A network belonging to the former category (e.g. Housing and Healthcare Buildings) work closer to fulfil market needs and as a result of this seem to enjoy preferential treatment over the core competencies networks (e.g. Landscaping and Interior Design). This may in part be explained by the notion that managers tend to preference knowledge sharing networks in which tangible results are readily available in favor of networks wherein tangible results are not as easily observable in the short term. The apparent inability to produce short term tangible results should perhaps not be regarded as a sign of its ineffectiveness since the network may be conducive in improving the firm in terms of customer satisfaction (Buchel & Raub, 2002). This is also in line with the proposition made by Koch (2002), which states that the mere sharing of knowledge in and of itself serves to strengthen the organization's competitive advantage.

### **6.3.3 Flexibility**

The last factor deemed to be possible for the management of KSN to deliberately influence in some extent is flexibility; in terms of allowing the different networks to function as they please with few constraints. Flexibility was something that was universally appreciated by the various NMs. It could be argued, by allowing for a high degree of flexibility, the management of KSN avoid deteriorating successful knowledge sharing practices. In other words, by having a flexible approach, one supports the facilitation of knowledge sharing rather than directly managing it (Thompson, 2005). Instead, the NMs work more independently. This would then seem to put a greater emphasis on finding NMs who are apt to carry that responsibility. Drawing on the notion of the NM as an OPP which might obstruct certain aspects of knowledge sharing, a more flexible NM might be able to reduce the effect of being an OPP.



## 7 Conclusions

The primary goal of this thesis was to investigate the factors involved in facilitating knowledge sharing in an architectural context. In particular, the focus was placed on deconstructing and mapping the use of a knowledge sharing network (KSN) in an architectural firm. The case study along with the subsequent discussion resulted in the identification of six factors (see Table 2) influencing knowledge sharing in an architect firm.

**Table 2:** A list of possible courses of action to facilitate knowledge through factors identified as influential in knowledge sharing in an architect firm.

#	Factor	Responsive to deliberate influence	Possible facilitative action
1	Architectural Identity	No	Manage the proportion of architects in the firm.
2	Flexibility	Yes	Create a flexible environment.
3	Interactions	Yes	Manage the number of network gatherings. Manage the interactions that occur on the intranet; make it more accessible.
4	Knowledge Type	No	Allow for generalists to coordinate the knowledge sharing networks.
5	Network Structure	Yes	Manage the membership of a network; facilitate participation in networks other than one's own.
6	Personal Commitment	No	Create an environment where commitment is appreciated. Consider in the early hiring stages.

The results support the overall conclusions made by Styhre (2009) that there is no single unifying theory or method in regards to KM in the construction industry. Granted that architecture in general and ArchFirm in particular contain many professions, it is not possible to treat all the professions represented in the firm identically. The way by which knowledge disseminates in the different networks represented by the KSN differs depending on the discipline of each of the respective networks. A recommendation then is that these differences should be incorporated within the framework for knowledge sharing at the firm, otherwise the risk exist that certain groups within the organization will diverge away from using the tools created to facilitate knowledge sharing in the firm as illustrated by the Interior Design Network and their use of Facebook instead of the intranet. This diversion may increase over time and potentially result in a form of isolation. For this reason, it is important to treat any incompatibility that one network might face towards the tools to disseminate knowledge as a sign that the tools need to be revised and not necessarily the network itself. In the case of ArchFirm, the intranet was perceived by many of the interviewees as inflexible which caused several of the members of the firm to distance themselves from it. A possible course of action is to restructure the intranet by enabling for a higher degree of flexibility in terms of allowing the employees to publish their own information. It is further important that a culture of sharing

knowledge is promoted in the organization since successful tools to share knowledge are contingent on the existence of such a culture (Hendriks, 1999).

It seems to be the case that the factors depicted in Table 2 affecting knowledge sharing practices are plentiful in number. This makes it more difficult to assess how each individual factor affect the remaining factors. Notwithstanding, it is possible to state that certain factors do seem to interact. This seems to be the case for the factor of interaction which helps to determine how much of an effect the others factors will play. If, for instance, the level of interactions in the KSN increases (e.g. through organizing more network gatherings), more individuals will be able participate in knowledge sharing activities and this will in turn reshape the structure and the size of the network. Likewise, architectural identity and personal commitment may be considered intertwined to a certain extent in as far as architect's tendency to display a high degree of commitment to their work as part of what it means to be an architect (Brown, et al, 2005). Architectural identity may also be tied to factor of knowledge type since traditionally architects have identified themselves as generalists. Drawing on the above, it seems reasonable to conclude that the sheer number of factors involved in the facilitation of knowledge sharing in an architect firm makes it difficult to establish how each factor interacts with the other. However, one of the contributions of this study is the identification of factors (see Table 2) which are more responsive to deliberate influence.

This study was conceived to address issues relating to knowledge sharing in an architectural firm based on the specific settings found in that particular firm. As such, the findings are perhaps most relevant in that specific context. Additionally, the findings may have some degree of applicability in other architect firms who employ similar knowledge sharing procedures.

As for ANT, a noteworthy aspect of this study has been the large amount of abstract concepts (e.g. identity, expertise, commitment, creativity etc) which seems to underlie much of the architect profession. These abstract ideas have in this study been viewed through the ANT perspective although ANT has typically been applied in empirical studies where the actants are played by tangible objects, such as scallops in Callon's study or people and tools in Latour's study (see section 3.5.6). A possible conclusion that could be made is therefore that ANT studies that deal with knowledge sharing in architecture may need to consider abstract ideas to a larger extent than what is done in empirical ANT studies.

## **Further research**

As mentioned previously, ANT has not been applied in a similar organizational setting before and hence this attempt made by the authors should be considered as a first step. Further research is needed in order to create a more comprehensive view of knowledge sharing in architectural firms and in this respect, ANT may prove beneficial.

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