

USING ACTOR-NETWORK THEORY TO UNDERSTAND KNOWLEDGE SHARING IN AN ARCHITECTURE FIRM

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This study investigates knowledge sharing in a large Scandinavian architectural firm, ArchFirm. In particular, a knowledge management initiative called the Knowledge Building (KB) is examined. The study is based on a case study consisting of a document review and 12 interviews. Drawing on Actor-Network Theory (ANT) as an analytical lens, KB is conceptualized as a heterogeneous network consisting of several actants, human and non-human. Key aspects of ANT used when analyzing data is; translation, semiotic rationality, punctualization and black-boxing, focal actants and obligatory passage point (OPP). ANT as a theoretical approach created an opportunity to view the intricate nature of knowledge sharing in an architecture firm from a different perspective compared to previous research. This work also opens a window for further research in the area of knowledge sharing as it relates to architectural practice.

Keywords: actor network theory (ANT), knowledge sharing, professional networks, architecture firm, case study.

INTRODUCTION

In their search for competitive advantages the construction industry has adopted a 'rationalization movement' manner from the manufacturing industry meaning that they over the last decade, and in a rather unison way, have searched for and implemented more standardized routines and practices. This has included adaptation, adoption and implementation of various KM tools and methods. Together with the massive entrance of ICT this has led to a concentration of key knowledge and expertise into specific knowledge networks and artifacts, such as ICT models and virtual knowledge networks (Bosch-Sijtsema, 2013; Jaradat *et al*, 2013). This change has led to a reallocation of knowledge, as well as power, from the project settings to centrally organized functions, specialist consultancies and knowledge networks.

Thus, the change towards a knowledge economy has affected traditional logics within the built environment sector; a sector that consists of a wide range of professional actors interconnected in a fragmented and project based production process (Dainty *et al*. 2001). One of the actors that take part in the construction process is the architect, a profession subject to continuous change during the course of its age-old history (Blau 1984; Styhre 2009). In Sweden the architect profession has regressed from having a role of master builder in the 18th century to having a much more limited role in the

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current era (Gustafsson 2007) as contractors have successively overtaken the role of master builder in Sweden. It has been suggested that the establishment of a strong knowledge base is crucial for architecture firms' survival and to the very idea of the architect profession (Holm 2007). Thus, it is necessary that architecture firms have a strong basis rooted in knowledge and expertise of their domain. It is in this context we find the contemporary Swedish architect; in a dynamic environment where the use of specialist professions is of increased importance in practice, where the creation and diffusion of knowledge is essential to sustaining a competitive advantage, but also where contractors have overtaken more of the traditional architecture tasks.

A great deal of research has been conducted on the topic of architects' professional role and practice. Styhre (2009) has for example studied architects' work. He suggests that architecture work is a complex social practice conducted in the intersection between the symbolic and the material. He concludes that architectural work is based on the ability to talk, both within and outside the work, it is also built on peer recognition and credibility on the basis of individual and collective performance. In a related vein of research, Ewenstein and Whyte (2009), in their study of knowledge work in architectural design, highlight the epistemic role of technology objects and show how these roles are in constant flux, changing throughout the project. Blau (1984) explored the inherent contradictions in architecture practice 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. Gluch (2011) has also examined inherent paradoxes and tensions but in her case in relation to the creation of specific 'knowledge'-leaders in an architecture firm. She concluded that standardization of knowledge into expertise areas lead by knowledge leaders conflicts with the social perception of the architect profession itself and that the need to standardize knowledge is a construct driven by self-interest of the knowledge leaders.

Architects are a professional group with a strong focus on creative and aesthetic tasks, combined with strong professional norms, values and identities (Styhre and Gluch 2009). However, although architectural firms are fuelled by creativity, they are also constrained in the boundaries created by their clients. The friction that emerges inbetween is termed the Daedalean risk by Blau (1984: 17); a contradiction which is embodied by the notion that architecture firms strive towards novel solutions in the fulfilment of the profession's ethos whilst pursuing pragmatic solutions more in line with their clients requirements.

At its core, ANT is an application of semiotics, presenting an idea that entities take their form and acquire attributes by their interaction with other entities (Law and Hassard 2005). The theory questions commonly held assumptions about causality and agency. In particular, it stresses the notion of non-human agency in which processes, technological tools and other similar concepts can be viewed as actants (non-human actors) that acquire an identity of their own. Essentially, this implies that the network is not composed of humans alone but also embodies machines, tools, architecture and so forth. As such, ANT emphasizes the role of artifacts in social structures, such as Knowledge Management, and goes as far as claiming that they not only mediate meaningful communication but also help in shaping it. The social interactions that occur in the production and dissemination of knowledge can therefore be seen as a patterned network consisting of heterogeneous material, i.e. various types of actors/actants (human and nonhuman).

By applying the theoretical lens of Actor-Network Theory (ANT) this paper investigates knowledge sharing in a large Scandinavian architectural firm, *ArchFirm*. In particular, a knowledge management initiative, called the *Knowledge Building* (KB), is examined.

ACTOR-NETWORK THEORY

Actor-Network Theory (ANT) as a concept emerged in the 1980's as a way to explain the differences in how something is and how it is perceived (Law 2009). 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 (Law 2009) which has been applied in different contexts. However, few studies have applied ANT into an architectural context. Although not focusing on knowledge sharing, Kjetil (2011) and Stickels (2011) are two exceptions. 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 heart of ANT is the concept of a heterogeneous network, which illustrates that society, organization, agents and machines are effects generated in patterned networks of both human and nonhuman actors (Law 1992). 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. In fact, 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). As Law (2009) argues, it is possible to describe ANT in a somewhat abstract way however in its essence ANT is grounded in empirical case studies.

KEY ASPECTS OF ANT

A central concept in ANT is that of *translations* which is defined as the processes that generates ordering effects, i.e. forms the actor-network, such as devices, agents, institutions or organizations (Law 1992). Seen as a continuous process, it describes the movement of different forms of knowledge, cultural practices, technology and artefacts (Czarniawska and Hernes 2005). In ANT, a translation process is never completed and is bound to fail. Translation involves transformation (Law, 2009), for example, translating two words means making two words equivalent. An interesting example on translation comes from the work of Gherardi and Nicolini (2000). Drawing on a case study of safety knowledge in construction they used ANT to describe how safety knowledge was circulated on a construction site through a process of translation in an actor-network consisting of individual, communities, organizations and institutions. The use of ANT helped them show how nonhuman actors also influence the circulation of knowledge creation and the circulation of safety knowledge. Instead of perceiving the network as a solitary 'thing', it is in ANT rather viewed as a composition of different elements that shape one another. Closely related to translations this principle is termed *semiotic relationality*, which refers to the notion that different elements (e.g. signs and symbols) in an actor-network help define and shape each other (Law 1992). For example, Bruno Latour uses ANT to theorize the discovery of the vaccine for anthrax by Louis Pasteur. Applying ANT he argues that the vaccine, unlike what most people seem to think, was not the result of one great man's intellect (Law 2009). When Latour applies ANT on the event 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.

As mentioned before the term actant is used in ANT to emphasise that an actor in the network can be both human and non-human. The actant that initiates the process of structuring the actor-network can be termed *focal actant* (Onsrud, 2007). The focal actant, in a sense, defines both the identities and the interests of other actants in the network. This idea is also tightly connected with translation, since the focal actant also initiates the process of translation. Callon (1986) offers an example of this. Based on an empirical study of the domestication of scallops, Callon explains that all actants are involved in a process of translation. He uses the example to illustrate how the process of translation is a mechanism of how the social and natural world progressively takes form. The researchers in that study were viewed as the focal actant by initiating the entire process and thereby defining the identities of the remaining actants.

An *Obligatory Passage Point* (OPP) is a concept that is used to denote a single node in an actor-network through which all the actants have to pass at some point (Callon 1986). As an illustrative example, 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 making it possible to create ships and navigation. All these components are translated into a web giving each component a particular shape, which held together for 150 years with Lisbon as the OPP. Another example given by Porsander (2005) is public tendering. She studied how a city could be developed into a cultural capital and found that public tendering was the single passage that needed to be crossed if an actor should become part of this development.

When the translation process results in a single-point actant, those are said to be punctualized or black-boxed. *Punctualization* refers to the event when a network acts like a singular unit, thereby allowing it to 'disappear' and be replaced by the action itself and the seemingly simple creator of that action (Law 1992). Punctualization thus refers to the concept that the whole network is greater than the sum of its constituent parts. For example when a person drives a car or uses a computer, as long as the car or computer runs smoothly, both are perceived 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 work. The actors in an ANT-network are themselves made up of networks and this is how simplification works. So if we find a stable network we can punctualize it and consider it a single actor. When we change an actor we also change the network that this actor simplifies. To simplify a network can also be called to *black box* the network. Black boxes may always be reopened. Since networks are consistently unreliable and can become unstable, the contents and the complexity of the black box may become visible (Tatnall and Gilding 1999). Moreover, according to Callon, a simplified network is a black box, which in turn may consist of a network of other black boxes (Tatnall and Gilding 1999).

Research 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. According to ANT, nothing is purely social or

technical and consequently a relation that is either purely social or purely technical is impossible (Tatnall and 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) compare 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. As such it helps researchers to develop a holistic narrative that builds on this common register (for humans and nonhumans) which provides the analytical inputs from all aspects of the common register, social, technological as well as political (Tatnall and Gilding 1999).

RESEARCH SETTING

ArchFirm is one of the largest architecture firms in Scandinavia and works in a wide variety of areas, including housing, health care buildings, schools, landscape design and architecture, furniture design, and interior design.

ArchFirm has established a systematic knowledge-sharing initiative, which they refer to as the *Knowledge Building* (KB). The KB is, in the words of top management, a strategic R&D investment and consists of extensive knowledge management areas and affiliated social networks active throughout the whole company. It is described as “*a network based academy*” intended to be an important meeting place with no geographic boundaries. KB is divided into 11 expertise (knowledge) areas. An expertise area is either related to a specific market segment, eg hospital buildings, or a core competence, eg project management.

Although its utilization varies, there is a standardized set of activities that should be carried out within each field of expertise. These activities can be conducted internally or together with clients and partners in order to highlight relevant topics. A core activity of the KB is the social network events in which every sub-group arranges at least one a year. In addition, activities, such as education, seminars, workshops, network meetings and study visits are arranged within the frame of KB as well as providing an online discussion forum.

Although open for all employees, each expertise area is managed by a *knowledge leader* (KL). The KLs primary task is to act as facilitators of knowledge, within the firm but also with external stakeholders. KLs’ tasks include an overall responsibility for coordinating and arranging the annual social network meetings as well as establishing contacts with internal and external experts within and related to the expertise area. Besides leading an assigned field of expertise within KB, they are also responsible for maintaining the corporate intranet. Thus, they are intended to constitute a central connection point in each knowledge area. As such they are in a position to establish an agenda and set the discourse for what is to be considered as most emergent within a specific knowledge area, for example they decide what type of information is published on the intranet. A common perception of the role as KL was that it had large degrees of freedom and flexibility where each KL could construct their network in a manner of their choice. Therefore KLs were expected to have great networking skills but they were also expected to be good at sensing and analysing industrial trends, have an established reputation as highly competent among the employees, be ambitious but most of all they were expected to show a strong commitment to the knowledge area in hand.

METHOD

Focusing on KB, a study was conducted in 2013. In order to investigate knowledge sharing in an architectural context, an interpretive case study strategy was adopted due to its argued ability to accommodate the complexity of social phenomenon (Remenyi *et al.* 1998). By adopting a case study strategy, the research offers a more in-depth perspective on the topic of knowledge sharing in an architecture firm. Twelve interviews were conducted. Initially, the interviewees were selected based on a list of recommendations from the director of KB. The list consisted of the names of six current KLS, two former KLS, two senior architects and two specialists. The one-hour interviews were held in the interviewees' offices. The interviews were structured around a set of 30 questions encompassing; the purpose of the KB; its relation vis-à-vis their professional role in ArchFirm; the use of the KB including the intranet; how they perceived the various activities; and their opinions on experts and knowledge. The interviews were recorded and transcribed in verbatim. The analysis consisted of reviewing and examining official documents provided by ArchFirm as well as interview transcripts and field notes. Using ANT as an analytical lens the data was further interpreted and coded.

The results presented in this paper are to large degree context dependent and are therefore not suitable as a basis for broad generalizations. However, the results may have applicability in cases similar to the one studied and they may also serve as a foundation for a quantitative study comprising a larger sample size of architecture firms. Moreover the discussion on ANT's applicability in similar contexts is of interest for a broader audience.

FINDINGS AND DISCUSSION

Drawing on ANT, the KB was in this study conceptualized as a heterogeneous network consisting of several actants, both human and nonhuman. This suggests that also nonhuman actors were considered as part of the social environment that creates and shapes knowledge. It also implies that in the case of ArchFirm, architecture knowledge does not only reside in the mind of individuals, neither is it exclusive to the social relations between individuals, rather it exists in the heterogeneous network made up of various employees with different backgrounds and identities, the intranet, the KB and the sub-networks etc. Hence, KB as a nonhuman actant serve as a bridge between identified gaps made of the two epistemologies of possessional knowledge and practice (cf. Newell *et al.*, 2009).

OPPs and translation processes of 'good architecture knowledge'

In the case of ArchFirm and knowledge sharing the concept of obligatory passage point (OPP) could be viewed through different levels.

In the broadest sense, the management of KB constitutes an OPP in that the management of KB is the centre point upon which the entire system is founded. KB in the perspective of providing a process that generates ordering may be seen as an effect of several processes of translations, transforming heterogeneous elements, such as the employees, the intranet and other components of ArchFirm, into a punctualized actor, the KB. Once stable the punctualized actor will be challenged by various other alternative translations because there is no such thing as "*the social order*" (Law 1992: 386). Rather there are different translations of how a social order can be constructed. In line with the idea of semiotic relationality (Law 1992), the network is not viewed 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 suggest that KB could be viewed as a circulating entity in which each element, made up of actants, mutually interact to shape and create meaning. Although we sensed that the identity of KB differ between employees, from being that of a databank to being more like a living organism that changes over time, the KB served a unifying role regarding what good architecture knowledge is, thereby providing a reference point for the employees. For example, one of the interviewees said that within the KB: *“we become conscious about what we do and what we see, placing wordings on our aesthetic preferences.”* Another said that; that taking part in KB forces her to *“step outside my regular role and think: ‘What do we want to do?’ Where are we going?’ ”* Thus, seen in a material semiotic view good architecture and successful architectural design is not the result of one great architect but the result of relational effects.

On an operational level, however, the assigned knowledge leaders (KLs) play an influential role in facilitating knowledge sharing through the means of organizing the network gatherings and similar activities. In addition, being editors of the intranet they controls the flow of information through the intranet and are in position to choose what is relevant information and what is not. As a consequence the shaping of the actor-network becomes asymmetrical. On this level, the OPP is reflected by the individual KL whose prime function is to coordinate a specific area of knowledge, 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 KL, one might also argue that personal commitment could be considered an OPP.

Although the interviewees present a rather unified view of KB's primary goal, that of facilitating shared knowledge between individuals and groupings, their perception of its role varies. Some say it primary have a social role connecting people, although some perceive it as closed social clubs of people that know each other and other as open social spaces that invites for new co-operations. Others forward KB as a confidence provider in discussions with clients, others talk of its role in recruitment and when introducing new employees, additionally others talk of KB as symbolic, showing the rest of the world that ArchFirm take seriously on knowledge sharing issues. Thus, KB could be seen as a manifestation of the conceptualized picture of ArchFirm as a knowledge company. As such it was rooted in a general idea of an interrelation between knowledge and creativity.

The KB as black boxed expertise knowledge

A central idea in ANT is the notion of the punctualization and black-box. As long as a 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 whereby one notices the intricate complexities underlying it. A possible example of such an occurrence in KB is the relationship between internal ArchFirm experts and staff. Most interviewees were unaware of the complexity of the work behind expert advice, e.g. the mathematical modelling or the software tools used. Instead, the process was simplified in terms of inputs (e.g. sending drawings to an environmental expert) and outputs (receiving recommendations). The process seemed therefore akin to that of a black box. The consequence of viewing expert knowledge as a

punctualized actant is that experts are constantly interrupted with sometimes trivial questions, i.e. lack of respect for their limited time. From the expert's point of view, the actor-network has broken down and the different parts of the black box have been revealed. With each new request, the expert visualises 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 other work and how it will affect the mood for the rest of the day. All of these interconnected parts are apparent to the expert but hidden to the individuals seeking his or her 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.

KB as a black boxed place and space for creativity

One of the interviewees said: *"KB creates room for knowledge creation and dissemination of knowledge... Existing knowledge is a prerequisite for creativity..."* Here KB, in an ideal world, is expected to provide space, place and time for framing, as well as challenging, reference objects, and as the above quote exemplifies, KB is seen as a base for creativity. An idea very much rooted in architecture practice. However, the interpretation of creativity varies within the different areas in the KB. One KL claimed that architectural creativity was framed by intelligent solutions. In another area, creativity was deeply rooted in gaining recognition from others through winning design contests whereas the area of Healthcare Buildings adopted an empirical approach towards the creative by studying causal relationships between design and wellbeing. In each of these cases, creativity was reinterpreted in a way that suited the area in question. The focal actant in ArchFirm is thus 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 architecture practice. In clarifying the position of ANT with respect to focal actants, Latour (1996) stresses that focal actants have the ability to transform the actants they interact with. Moving from one actant to the other, the focal actant is always translated, always moving. With creativity as a focal actant, it becomes evident that its interpretation varies widely within the different networks represented in the KB.

Opening the black box – revealing knowledge (and power) asymmetry

Based on personal and/or professional interest the employees were free to choose area(s) to join. They could also decide to not participate. The size of each area in terms of members therefore differ, some very large and other, often within a specific niche eg interior design, being smaller. In addition, although a mix of professional backgrounds was said to be preferred, some areas seem to attract more architects and others more engineers. This creates knowledge asymmetry within KB. It also separates professional discourses rather than uniting them. Moreover, as top management of ArchFirm assigned higher priority to some areas perceived as important market segments, those areas got higher priority in terms of allocated resources leading to increased attraction by employees. These prioritized areas had in common that they were dominated by an architectural logic and discourse, which indirectly side-lined areas with a more engineering perspective, thus creating a knowledge (as well as power) asymmetry within ArchFirm.

Important in relation to KB is that it discards the idea of forming the ideal knowledge arena. Instead, there are various alternatives to social formations, some of which may be more close to top management's 'official' objective of the KB. Thus, social order is

continuously contested and there are numerous sources of resistance through the various perception of KB's role. Considering the different professional groupings, opposing professional discourses and epistemological views represented in the firm, the resistance toward social orders may be greater in the case of ArchFirm. Another way in which resistance could be manifested may be through the seemingly dominating position of the architects in ArchFirm. That the architecture logics and discourse has become dominating is not necessarily because of a high proportion of architect (about half of the employees are architects) but more due to the architecture identity becoming the dominant translation.

CONCLUDING REMARKS

An attempt has been 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 arena consisting of many different elements. Through its methodological approach and focus on sociotechnical processes, ANT has been useful in mapping different interrelated factors that either facilitate or hamper knowledge sharing in ArchFirm, factors which may have gone unnoticed using a more conventional analytical frame. This is at the heart of the argument made by Doolin and 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. Though the ANT approach might be perceived as esoteric, it nonetheless provides a framework to better understand the complex interactions that occur between both human and non-human actors. In that sense, its applicability with regards to construction in general and architecture in particular becomes evident. The long range of intricacies embodied in architectural work necessitates an explanatory model capable of capturing complex interactions and conveying them in a coherent manner. This study has attempted to show that ANT could constitute one such explanatory model with both the scope and the depth to adequately portray the inner workings of knowledge sharing in architecture firms.

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