# Network Structure and Innovation Outcomes in Real Estate Networks

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*Within the traditional real estate business today there's a growing trend focusing on increased costumer value at office workplaces. Facilitating innovation requires transfer of different kinds of knowledge, which means that the knowledge-bearing actors must meet and interact. In a case study, this paper seeks to improve our understanding of how network structure affects innovation outcomes in real estate innovation networks by analyzing network structure in terms of network size, density and in terms of actor centrality or position. This study shows that it was primarily the customer who was behind the innovative development of the workplace while the supplier had a more network coordinating role.*

## 1. Introduction

Previous studies on real estate companies indicated that business related to residential buildings was considered a pure management task, whereas dealing with commercial buildings involved active work with customers, for example by adapting the premises to customer specifications (Nordin, 2011). Thus, real estate business concerning commercial building largely consisted of marketing activities, as the ambition was to develop the facilities in active cooperation with the customers. This implied focusing on local services as well as on change processes rather than considering the premises as goods to be sold. This was assumed to increase the attractiveness of the real estate companies as landlords, which ultimately was expected to secure long-term contracts with the tenants.

These observations indicate a shift from the past, when real estate business was considered a special case with close connections to non-business spheres such as local and national politics. The new trend is to envisage real estate management becoming an "industry like any other where the focus is on customers, markets, employees, production, and ultimately even the brand" (Lind and Lundström, 2009).

This paradigm shift can be regarded as an innovation and seems to be based both in new business practice and in new views on the role of politics in society. This new innovative approach means that real estate companies develop and produce effective, functional and environmentally correct workplaces in close cooperation with their customers. In other words, the real estate companies try to develop workplaces that increase the involvement of their customers' employees, in turn leading to greater efficiency and productivity. Creating and building functional workplaces are complex processes in which real estate companies, their customers and a large number of different specialists interact, cooperate and exchange resources with one another. The new workplaces are, in other words, a result of these network processes. To enable us to understand the paradigm shift, we need to understand how real estate companies, their customers and specialists pursue innovative network cooperation.

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Social capital plays a significant role in network innovation research. Innovation is usually viewed as the result of interactions and exchanges between actors, and social capital is consequently considered the basis for innovation (Subramaniam and Youndt, 2005; Zheng, 2010). Social capital is the sum of the actual and potential resources (e.g. knowledge) that arise in network relationships (Nahapiet and Ghoshal, 1998). Social capital exists in ties between people and networks, while human capital consists of individuals' knowledge and competence (Zheng, 2010). When people with various kinds of human capital meet and interact with one another, social capital arises. It has become increasingly common in innovation research to analyse, from a social capital perspective, how innovation arises. In such analyses, researchers usually divide social capital into a structural and a relational dimension (sometimes also a cognitive dimension) (Nahapiet and Ghoshal, 1998; Zheng, 2010). The structural dimension is the network configuration in terms of the size of the "ego network," including the number of direct and indirect ties, the number of structural holes, the position and centrality of the ego actor, the strength of the ties, and the tightness or density of the network. The structural dimension is, in other words, impersonal and objective, while the relational dimension is personal and subjective. In the relational dimension, it is the personal relationships of the actors in terms of trust, norms, obligations, commitment, etc., that are in focus and that are determined by their qualitative content through standards and the parties' convictions about the excellence of the relationship (Nahapiet and Ghoshal, 1998; Zheng, 2010).

Earlier studies in this area have examined networks in traditional industry and not real estate networks. As there is a great need to understand how network processes in real estate networks can be used as tools to foster innovation, which in turn leads to more competitive companies, it is important to study the network structure in a real estate context. This paper seeks to improve our understanding of how network structure affects innovation outcomes in real estate innovation networks. The next section reviews the terms network structure and innovations and the relationship between them. This theoretical argument is then illustrated by the case of a Swedish real estate network.

## 2. Literature Review

### Network structure

In this study, we analyse network structure in terms of network size and density and in terms of actor centrality or position. The research literature usually examines network structures from a hub perspective. The problem with this perspective is that it provides a picture only of how networks are structured; a more accurate depiction would incorporate the perspectives of several or all network actors (Roxenhall, 2011). Each network actor has unique connections or ties to other actors in the network; it is as though each actor has his or her private network within the network, a so-called "ego network." These ego networks cumulatively reflect the network structure. Ahuja (2000) defines network structure as existing in three dimensions: the first concerns the number of direct ties a focal actor has to his partners, the second pertains to the number of indirect ties the actor has to the partners of his partners, and the third concerns the ties between the focal actor's partners and the extent to which they are bound to one another (i.e., the ego network's density and structural holes). "Centrality" refers to an actor's position in the network.

## Innovations

Innovations are characterized by their uniqueness, and it is common to categorize them as radical or incremental (Abetti, 2000; Koberg et al., 2003; Ojasalo, 2008). Radical innovations create fundamental changes in activities and behaviour in an existing sector, business structure, product, or market. Radical innovations commonly reduce the value of previous knowledge in a particular sector or company. Incremental innovations are smaller changes that instead tend to reinforce previous knowledge in a sector or company.

Innovations are usually further divided into product and service innovations, process innovations, and market innovations (Abetti, 2000; Ojasalo, 2008). Product and service innovations are the types that most obviously generate revenue. Process innovations contribute to ensuring and improving quality and reducing costs. Market innovations concern identifying new and better markets and new and better ways of satisfying these markets' needs. Incremental innovations are in turn regarded as significant or less significant. Incremental product, process, and market innovations are analysed in this study, but not whether they are significant or less significant.

Innovations do not arise in companies but between companies and individuals. An innovation therefore cannot be regarded as the product of a company, but as the product of interaction between two or more actors in a network or networks (Frenz and Ietto-Gillies, 2009; Håkansson, 1985) (cf. Open innovation, (Chesbrough & Crowther, 2006)). New knowledge generally develops where different areas of knowledge intersect. In exchange situations, various types of knowledge that can lead to innovations meet and are combined or confront each other. Technical solutions developed by an actor in a particular area may be usable by another actor in another area. New ideas can thus be developed by combining the experience of various actors. In the special case of exchanges between purchaser and seller, the purchaser's needs confront the seller's knowledge of possible technical solutions in the interaction. Such exchanges present an opportunity for both parties to refine and redefine both the needs and the solutions and to find new ideas and opportunities (Håkansson, 1985).

Innovation, in other words, requires that various forms of knowledge be combined or confronted with one another. Knowledge may be more or less complex, codified or non-codified. Knowledge that is less complex can usually be codified or documented in manuals, books, articles and computer files. In that way, it can be spread and transferred from one actor to another without their meeting. Knowledge that is more complex can rarely be codified or documented. Such non-codified knowledge is tacit knowledge (i.e., knowledge for which we have no words), such as know-how, and is more or less attached to particular actors. Tacit knowledge can only be disseminated or transferred when the actors involved meet and interact, though even in that case, it is still difficult to transfer (Ahuja, 2000; Hansen, 1999; McAdam et al., 2007; Zander and Kogut, 1995).

## Network structure and innovation

Facilitating innovation requires the transfer of codified and non-codified knowledge, which means that the knowledge-bearing actors must meet and interact. In other words, they must have direct mutual ties. Mutual relationships, shared values, trust, commitment and cooperation, which make it easier for non-codified knowledge to be transferred, interpreted, and understood, develop in such ties (Ahuja, 2000; Coleman, 1988;

Granovetter, 1985; Hansen, 1999; Rost, 2011). It has been found that there is correlation at the corporate, organisation, and group levels between the number of direct ties and the number of innovations (Ahuja, 2000; Shan et al., 1994), and between the number of ties and creative and innovative performance (Allen, 1977; Smith et al., 2005). At the individual level, the number of ties has been found to have a marginal effect (Rodan and Galunic, 2004) or no effect whatsoever (Moran, 2005; Obsfeld, 2005) on innovation, although this is attributable to the latter researchers having used a different definition of the term "innovation" (Zheng, 2010). Researchers have also found that the number of indirect ties has a positive effect on innovation (Ahuja, 2000). Studies further identify a nonlinear correlation in which the positive effect appears to diminish once the number of ties becomes too great (McFadyen and Cannella Jr., 2004; Vanhaverbeke et al., 2001). One explanation for this could be that maintaining a large number of relationships simultaneously is complicated and resource-intensive. In sum, large ego networks result in more innovation than do smaller ones, but this positive effect diminishes if the networks become too large.

Network density concerns the extent to which network actors have relationships with one another; when such relationships are absent, we find structural holes, i.e. the more structural holes, the lower the network density, and vice versa. Structural holes have been found to have a positive effect on innovations at the individual level (Burt, 2004; Fleming et al., 2007; Moran, 2005; Rodan and Galunic, 2004), while both positive (Florida et al., 2002; Hargadon and Sutton, 1997) and negative effects (Ahuja, 2000) have been observed at the corporate and organisation levels, along with a positive correlation between density and innovation (Obsfeld, 2005). One explanation for the results at the individual level is that the individuals studied had no need to collaborate with other individuals to create innovations, while those at the corporate and organisation levels were interdependent (Zheng, 2010). A network including few direct ties between a focal actor's partners gives the focal actor control over the partners (Brass and Burkhardt, 1992; Cook and Emerson, 1978), while a network including many direct ties between its partners gives the focal actor less control, but the benefit is that trust and cooperation are developed (Ahuja, 2000; Coleman, 1988; Granovetter, 1985; Portes and Sensenbrenner, 1993). Ahuja (2000) found that the quantity of structural holes adversely affects the innovation capacity of networks. We have pointed out that the presence of structural holes adversely affects network actor commitment and that the density of an ego network has a significant bearing on focal actor commitment to the network and on how the network, in turn, influences the innovation outcome (Roxenhall, 2011). We are thinking primarily of the extent to which a focal actor's various partners have ties with one another. It is likely that the greater the degree of actor involvement in cooperative relationships, the greater the possibility of exchange of codified and non-codified knowledge, which in turn leads to positive innovation results. A fundamental point of departure for this paper is that, for strategic reasons, actors want to create direct ties and enter into close, trusting, cooperative relationships with their partners. They also want their partners in turn to have direct ties to one another, assuming that close cooperative relationships effectively foster innovation. However, such relationships are not free but entail high costs and investments over a long period. This may prompt actors to seek what seems on paper to be a more rational path to fostering innovation, namely, creating few direct ties and as many indirect ties as possible. Building many indirect ties may seem an effective way of gaining extensive access to codified knowledge without the cost of resource-intensive direct ties (Burt, 1992). However, the tacit or non-codified knowledge cannot be transferred and transformed through indirect ties, and such knowledge is required to enable innovations to be created. This means that the ego networks that create innovations are of high density and have few structural holes.

Only a few studies have analysed the network position, or centrality, of the actor (Zheng, 2010). Centrally placed actors can control information flows, and they have many contacts with other actors who can contribute both codified and tacit knowledge and other resources (Mehra et al., 2006). Tsai and Ghoshal (1998) found a correlation between centrality and innovations as a result of trust, while Ibarra (1993) found that centrality has a positive effect on administrative innovations, but not on technical ones. Zheng (2010) believes that it is difficult to draw general conclusions from so few studies, and that there is a strong need for more research in this area. Nevertheless, the point of departure for the present paper is that actors involved in innovations tend to occupy more central positions than those who are not.

There are also correlations between the various structural dimensions. Obsfeld (2005), Rodan and Galunic (2004), and Smith et al. (2005) found correlations between network size and structural holes. Large networks comprise numerous ties, and it is difficult and expensive to connect all the actors with one another, resulting in structural holes. Ahuja (2000) found, however, that network size positively affected innovation, while structural holes had a negative effect. These divergent results are presumably attributable to the contexts in which the studied networks exist. Innovations are produced in strategic networks, alliances, and cluster initiatives through close cooperation between actors, while individuals in other types of networks may not be as dependent on cooperation with other actors. In networks in which those involved depend on close cooperation, it is advantageous for the actors to have many direct mutual ties and for the networks to have as few holes as possible, while in networks in which dependence on cooperation is less pronounced, it is not as important to have as many ties, and there will be a higher proportion of structural holes.

## 3. Methodology

To obtain a picture of how the network relationships were structured, minutes of meetings have been analysed. This indicates which actors have attended different meetings and which different constellations they have been part of. The network contained 38 actors who interacted with one another at 45 different meetings. To ascertain how they were related to one another, we conducted a social network analysis, which meant analysing the relationships between the network members (Annen, 2003, (Cross, Borgatti & Parker, 2002, (Sandström, 2008). We constructed a matrix consisting of 38 x 38 cells (one for each network member). In each cell we noted whether a tie existed or not using ones, subsequent meeting between them with twos etc. If the actors never met, the value was 0. The matrix was then exported to the analysis program UCINET 6, where a large number of different processing operations could be performed on network relationships, such as specific processing of the direct and indirect ties of the ego networks, density, structural holes and centrality. The visualisation of the network was then done in the computer program Netdraw. (Borgatti et al, 2002).

## 4. Findings/discussion

The customer’s intention in taking part in the real estate network was to create an attractive workplace for his employees, and the supplier’s was to create an efficient and appealing workplace for the customer. Over a period of 30 months the customer and supplier therefore cooperated during the building process together with a large number of customers (turnkey contractor, architects, builders and their subcontractors) on creating and developing innovative workplaces that matched the customer's specific needs. The

total investment was around 22 million euros and consisted of a total of 11,000 $m^2$ of workplace space.

**Innovation**
The supplier proposed an innovative concept that meant that the workplaces would be created according to the working practice required for the customer to be able to carry out his assignments. The supplier wanted to take account of the customer's culture and values and help in establishing processes and routines. The supplier additionally proposed that the workplaces should be designed, coloured and shaped so that they conveyed the customer's brand. There was also a wish to create a functional and flexible environment with functional furniture, portable telephones and computers that would make it easier for personnel to change workplaces without needing to refurnish in the event of new projects or changes of personnel. Correct air quality, acoustic environment and lighting were other important factors to enable to the employees to feel content and well. Ergonomically designed desks and chairs would also improve job satisfaction and productivity. The supplier also suggested that the customer could be helped with the whole process, from analysis of tasks and working practices to the planning of the design of the workplace and moving in. An offer was also made to help the customer with organisational issues, analysis and implementation of new working practices and change processes. The idea behind the concept was for the customer's new workplaces to be a good investment that yielded a direct return in the form of better communication and spreading of knowledge, more efficient flows and a stronger sense of being part of a team and greater productivity.

However, the customer did not buy the whole concept. The customer decided early on to designate a person to work full-time on planning and moving to the new workplaces. This person was also responsible for planning with regard to furniture, photocopying rooms and mail handling. The supplier suggested that for the move to be as smooth as possible, the customer should, in addition to the person already designated, also engage a process manager, and suggested a consultant they had worked with previously. The customer thought that this was a good idea but engaged a different process manager than the one recommended by the supplier.

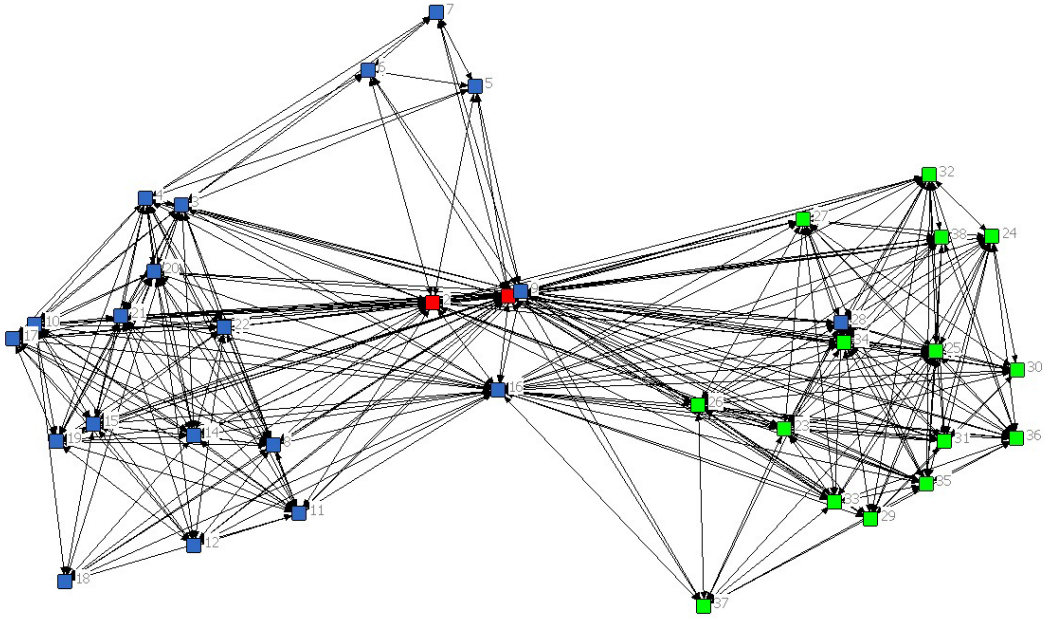
On the other hand, the concept with very high flexibility appealed to the customer. The supplier suggested various types of workplace designs, but the customer had decided early on in favour of a particular design solution with reference to their form of organisation. They were an organisation with many employees, which meant that an open-plan office was seen as the only possible solution as this had been found to work well at one of their previous workplaces. The employees would be easily able to change workplaces with one another by taking their personal belongings with them instead of the customer, as previously, needing to have a full-time employee who solely dealt with workplace moving. The customer visited several of the supplier's reference objects to obtain further inspiration and opted for the solution the supplier had chosen in his own premises. As the customer had his own resources, the supplier saw it as his task rather to remind the customer about things the latter needed to take into account further on in his planning, for example moving telephone switchboards. They were also responsible for providing information about how the building work was developing at several of the customer's internal meetings.

The innovative result can be regarded as going from a traditional focus on the renting of office space to increased integration between customer and supplier.

**Network Structure**

The network consisted of two actors from the supplier, 15 from the purchaser and 21 from other actors (see Table 1). Central positions in the network were occupied by the supplier, the external project manager and the architect, with around 30 ties each (see Figure 1). Based on the number of direct and indirect ties and a central position (eigenvector of 0.31), it is shown that the supplier acted as network coordinator or hub between different network clusters to gain control over the various sub-processes. But despite the supplier's large number of ties and central position, the latter's clustered ego network had the lowest density (47.6%) and consequently a large proportion of structural holes. As strong and direct ties are required for transfer of non-codified knowledge, it can be said that the supplier experienced the converse of Burt's (1992) ideas.

Figure 1: Network structure



Ego networks with many direct ties and high density are instead found in other network clusters within the network. Unlike the supplier, the customer (actors coloured green in Figure 1) show a high density (90.6%), lower number of direct ties and a peripheral position in the whole network but a central one within his cluster. The high density in the customer's ego network points, however, to the possibility of transfer of tacit knowledge and consequently an increasing innovative capability. The number of ties to other clusters, on the other hand, was low.

This means that an actor in a central position has control over the network, but this need not mean that this actor has control over, or is involved in, the development and innovation work.

Table 1: Network structure divided into different groups of actors

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| | Supplier | Buyer | Other actors |
|---|---|---|---|
| Number of egos | 2 | 15 | 21 |
| Number of direct ties | 33.0 | 14.9 | 17.3 |
| Number of indirect ties | 499.5 | 188.9 | 251.4 |
| Density of ego networks in % | 47.6 | 90.6 | 88.6 |
| Centrality (Eigenvector) | 0.31 | 0.13 | 0.09 |

**Network structure and innovations**

Innovation creation requires transfer of different types of knowledge, and innovations arise in interaction and exchange of non-codified knowledge between individuals and companies. The network's central actor, the supplier, did not meet with a positive response for the innovative concept they proposed to the customer, who instead chose other solutions. The supplier used a large proportion of other actors, who are little involved in customer integration. For transfer of knowledge within the network, this means that strong ties have not been fully enabled to arise, which is evidenced in the network as network clusters instead of a high consistent density. Structurally, the distance between supplier and customer is large, which as far as the supplier is concerned means limited transfer of non-codified knowledge despite the latter's central position and high number of ties. The possibility of innovation was outside the supplier's control, in the network clusters.

In line with the paradigm shift there was an ambition of increased customer involvement, but in terms of network structure, previously identified success factors for innovative networking were not present.

## 5. Summary and Conclusions

The innovative work was created by 38 actors cooperating in the network. This study shows that it was primarily the customer who was behind the innovative development of the workplace while the supplier had a more network coordinating role. The other actors contributed with advice and technical expertise, they were not involved in the innovative process. For innovations to arise, network actors need direct ties with one another, so that the two types of knowledge—codified and uncodified—can be united or combined. It is therefore assumed that the size of the ego network or the number of direct ties in an actor's ego network affects the innovation outcome; in other words, ego networks with many ties have a greater ability to generate innovations. This assumption cannot be confirmed in this study. This study shows rather the opposite. The actors who had the largest ego network in terms of the number of direct and indirect ties were least involved in the innovative processes, while the actors who had the smallest ego network were most involved in the innovative process. Previous studies show that there is a correlation between network size and innovation performance. One possible explanation for the present study points to an opposite result is related to that in this case is about much

larger number of direct and indirect relationships in comparison with, for example Roxenhalls (2011) study.

Those members who took part in the innovation had significantly higher density ego networks with fewer structural holes than those who did not take part. Strong and trusting ties facilitate the mediation and transformation of both types of knowledge. High density means that the focal ego actor does not have full oversight of his partners (Brass and Burkhardt, 1992; Cook and Emerson, 1978), as they have their own direct mutual ties, but the interactions, knowledge exchanges, and innovative ideas that arise among them nevertheless benefit the ego actor. Ahuja's (2000) finding that structural holes negatively affect innovation and Obsfeld's (2005) finding that high density positively affects innovation also apply to this case.

It is further assumed that actors participating in innovation development occupy a more central position in their network than do non-participants. In this study, the supplier has the most central position in the network. However, this is because the supplier has the role to coordinate different skills and information in the network. It would seem logical to assume that centrally placed actors with numerous ties to other network actors enjoy more alternative ways to access the resources needed to coordinate the network. Centrally placed actors are also less dependent on other network actors than those who are those positioned peripherally in the networks. The customer has a relatively central position in a part of the network and it should further be noted that centrally positioned actors with high-density ego networks have a greater ability to produce innovations than do those who are more peripherally positioned with low-density networks (Roxenhall, 2011).

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