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SELaKT - Social Network Analysis as a Method for Expert Localisation and Sustainable Knowledge Transfer

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Abstract: In many organisations, conservation of specialised expertise is picked out as a central theme only after experienced members have already left. The paper presents the *SELaKT* method, a method for *S*ustainable *E*xpert *L*ocalisation *a*nd *K*nowledge *T*ransfer based on social network analysis (SNA). It has been developed during a project co-operation between the Department of Information Science at the Institute for Media and Communication Studies, Free University Berlin, and the Fraunhofer Institute for Production Systems and Design Technology IPK, Berlin. The *SELaKT* method uses recent insights into network analysis and pragmatically adapts SNA to suit organisational practice. Thus it provides a strategic tool to localise experts, to identify knowledge communities and to analyse the structure of knowledge flows within and between organisations. The *SELaKT* method shows its advances and increasing relevance for practical use by integration of specific organisational conditions and requirements into the process of analysis.

Key Words: knowledge networks, collaboration, communities of practice, expert localisation, distributed knowledge management, knowledge sharing, social network analysis, sustainability, strategies, implementation, applied research
Category: A.0, A.1, H.3.0, J.4

1 Introduction

The primary importance of informal communities and networks in knowledge management (KM) has become widely accepted. This shift of focus towards a social perspective as the dominant paradigm in KM studies takes into account that the majority of individual knowledge transfer does not follow formal hierarchies or processes but is instead driven by personal and informal communications. Such a social constructionist view of knowledge exchange (see also [McDermott, 02], [Wersig, 00]) considers single individuals as well as social aggregates and their structural patterns. This demands a set of appropriate tools and methods to analyse personal relationships and flows of informal knowledge exchange. In this paper it is argued that social network analysis (SNA) is a highly effective tool not only for the theoretical conceptualisation of knowledge networks but also for the empirical localisation of informal expertise and facilitation of sustainable knowledge transfer. Thus, the method for *S*ustainable *E*xpert *L*ocalisation *a*nd *K*nowledge *T*ransfer (*SELaKT*) is seen as a valuable contribution to a wider set of practical methods for the implementation of KM.

SNA is a sociological method to undertake empirical analysis of the structural patterns of social relationships in networks (see e.g. [Scott, 91], [Wasserman and Faust, 94], [Wellman and Berkowitz, 88]). It lays the foundation to develop a methodical KM tool to help us identify, visualise, and analyse the informal personal networks that exist within and between organisations (see also [Cross, 02]). Based on SNA, the *SELaKT* method evaluates availability and distribution of critical knowledge and facilitates

- the strategic development of organisational knowledge,
- the transfer and sustainable conservation of implicit knowledge,
- the development of core competencies (like leadership development),
- the creation of opportunities to improve communication processes,
- the identification and support of communities of practice,
- the harmonisation of knowledge networks (for example after mergers and acquisitions),
- the sustainable management of relationships between distributed sites and external partners.

2 The *SELaKT* Method

2.1 Background

A variety of literature examines informal networks and communities and their role in KM and innovation management (see e.g. [Armbrecht et al., 01], [Brown and Duguid, 91], [Collinson and Gregson, 03], [Jain, 90], [Lesser, 01], [Liyanage et al., 99], [Mertins et al., 03], [Nahapiet and Ghoshal, 98], [Nohria and Eccles, 92], [Wenger, 99], [Zanfei, 00]). Discussions of network structures in management literature were strongly influenced by [Drucker, 89] and [Savage, 90]. All of these authors stress the importance of networks for knowledge sharing. Organisations that develop networks both internal and external to their organisation are supposed to be able to deal with knowledge more effectively (see e.g. [Kanter, 01]).

The analysis of networks aims at tracing social relationships wherever they may go (on the boundary specification problem in network analysis see [Laumann et al., 89]). Networks can be distinguished according to their level as between individuals, groups, communities, organisational units (departments), organisations (companies), collectives of organisations or even between societies. Discussions about the role of networks in KM tend to stress the importance of informal networks (as opposed to formalised networks). Often, networks are viewed in the KM context as an activity, that of "networking" (see e.g. [Seufert et al., 99]).

Even so, despite all of the literature that identifies communities and networks as effective environments for the sharing of personal knowledge, there is a lack of systematic methods for practical use to identify knowledge communities and networks, to analyse their structure and to take measures to actively support them. The next sections present basic methods and steps of application of the *SELaKT* method as well as models of interpretations and ways of interventions. It argues that SNA provides a rigorous analytical foundation for the implementation of practical methods in KM to analyse informal communities and networks.

2.2 Method

The *SELaKT* method was developed as part of the BMBF (Federal Ministry of Education and Research) project "Wachstum mit Wissen" (growth with knowledge) at the Fraunhofer Institute for Production Systems and Design Technology IPK, Berlin, in co-operation with the Department of Information Science, Free University Berlin. It provides an adaptation of SNA to suit practical needs as a strategic tool for expert localisation, identification of knowledge communities and analysis of the structure of intra- and inter-organisational knowledge flows. The basic concepts are those of network members and their relationships, clusters, structural holes and cut-points (for a comprehensive introduction to SNA and its analytical concepts see e.g. [Scott, 91] or [Hanneman, 01]).

Network members and relationships: SNA perceives social structure as the pattern organisation of network members and their relationships. Network data are defined by the members of the network and their relationships. Relationships between members of a network are characterised through direction (directed and undirected ties, represented by arrows in figure 1) and intensity (weak and strong ties, indicated by strength of lines).

Cliques and clusters: Sub-sets of members can build dense connections and develop cohesive sub-groups of the network (like for example the members 3, 4, 5 and 6 in figure 1). These are known as cliques and clusters ([Watts and Strogatz, 98]).

Structural holes: In many cases, networks are not only clustered into cohesive sub-groups, but are also split into loosely coupled or independent components (like the members 13, 14 and 15 in figure 1). In this case, not all possible connections are present: there are structural holes ([Burt, 92]).

Cut-points: Persons of pivotal significance in holding components together are called cut-points or bridges: central nodes that provide the only connection

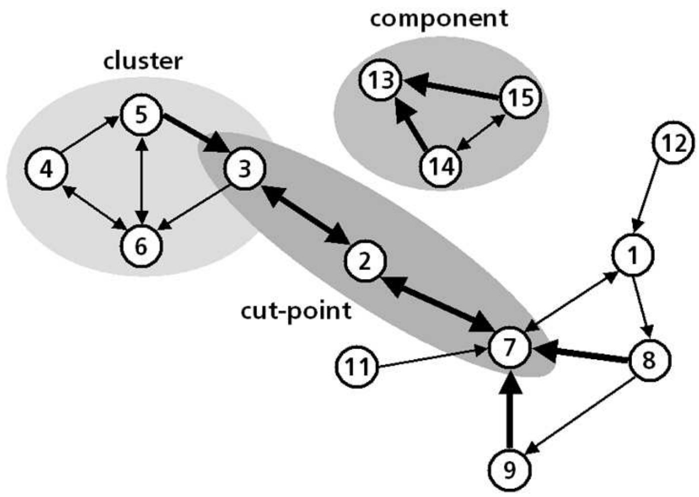

Figure 1: Network members and their relationships

between different parts of the network (like member 2 in figure 1). Cut-points build bridges between sub-groups that would otherwise have been cut-off and split into separate, unconnected components.

Hubs: As networks are clustered, some members are important as simultaneous actors in many clusters. These are known as hubs ([Kleinberg, 99], [Rosen, 00]). As [Barabási, 03] puts it, these persons "have played in very different genres during their careers".

2.3 Application

The primary steps of the application process of the *SELaKT* method include:

1. clarifying objectives and defining the scope of analysis (knowledge domain),
2. developing the survey methodology and designing the questionnaire,
3. identifying the participants,
4. collecting the survey data and gathering further information from other resources,
5. analysing the data through formal methods of SNA,

6. interpreting the results of analysis,
7. taking actions for intervention.

The focus of the *SELaKT* method is put on the successful integration of specific organisational conditions and requirements into the methodological process. To clarify objectives and to define the scope of analysis means to explore the interests, challenges or difficulties found in an organisational setting. Reasons to undertake a SNA include for example:

- strategic considerations by ex ante definition of critical knowledge domains,
- lack of expert knowledge or expertise is not available where it is needed (for example because of lack of transparency or inefficiency of knowledge communication),
- studies of the distribution of personal knowledge along the process chain,
- foundation or facilitation of communities of practice,
- visualisation of networks to foster team development or merger of originally independent departments or business units.

Since SNA focuses on inter-personal relationships, it is of critical importance to take into consideration the fact that involved participants always anticipate certain results during the process already. This is a very controversial issue. For example, from an organisational perspective it seems reasonable to achieve as much transparency as possible on competencies and expertise of the organisation's members. But measures to increase transparency are paralleled by general concerns about violations of privacy for example. This makes it necessary to clearly define objectives and communicate the benefits with all involved persons (see also [Mei et al., 04]). It is very helpful if everybody who is involved sees his or her own benefits straightforwardly.

The factors outlined above have to be considered in the methodical process and are met by means of internal communication and motivation for participation as integral parts of the *SELaKT* method. Internal communication between involved persons and involved departments and third parties in an early stage of the process is highly important to reach successful results.

2.4 Interpretation

Since results of a SNA are of a descriptive nature, knowledge about the specific organisational background is needed for their interpretation. To illustrate interpretation by a concrete example, an organisation chart will provide the organisational background information here (see figure 2). The SNA undertaken in a research and service organisation aimed at localising persons who are experts with regard to funding of new research projects from the European Union. Some of the most important results are visualised in figure 2 and could be interpreted as follows:

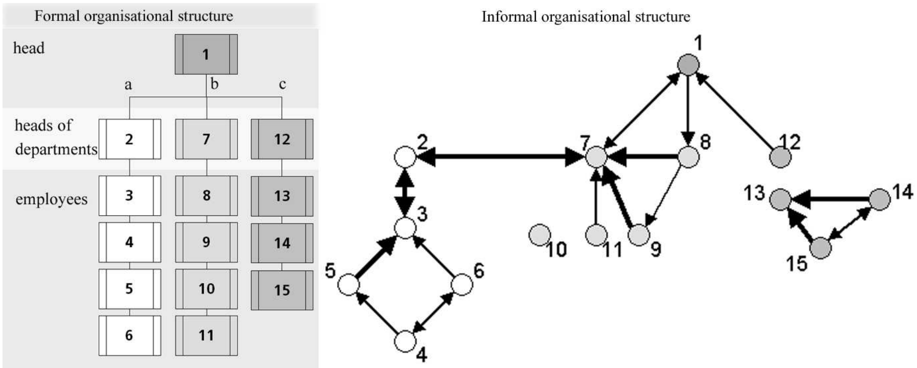

Figure 2: Formal Versus Expert Structure in a Research Organisation

Clusters and components: the members of department c build dense connections and develop a cohesive sub-group independent of the rest of the network since all of its members are connected. Clusters are of special interest to network analysts as they are important for understanding the behaviour of the whole network. For example, organisational clusters or components can develop their own "sub"-cultures and attitudes toward other groups (see [Cross, 02]). They can also gain influence on the overall network.

Expert networkers: Network member 7, head of department b, is a contact person with high expertise for his colleagues. This is indicated by degree centrality, a measure of the incoming and outgoing connections held by an individual network member. Incoming connections (in-degree) define the popularity of a member; those with many ties are members who are considered as having high levels of expertise. On the other hand, excessive linkages might indicate the stress and overload of member 7.

Experts and agents: Results of the analysis indicate that member 2, head of department a, is considered as an expert; nonetheless, he is not a popular contact person with regard to his expertise. Instead of member 2, network member 3 internally communicates the knowledge of member 2 within the department (with members 4, 5 and 6); he is the "agent" of member 2.

Silent experts: Expertise of member 13 is received only by his direct colleagues. This probably results from the fact that his expert knowledge is not transparent throughout the organisation. Insufficient links mean that these members are not well integrated into knowledge flows. They might indicate the potential resources of network members that are not used.

Experts of highly specialised knowledge: Member 8 gives an example for a network actor that has an relationship across formal hierarchies with member 1 (compare with organisation chart). This relationship may indicate highly specialised expertise of member 8.

Bottlenecks and knowledge gaps: In the example, a majority of expert communication is centred around the heads of departments. For example, if member 7 leaves the organisation, there would be excessive lack of expertise and, moreover, he would create a structural hole so that parts of the network would split into unconnected independent components. Cut-points represent the network's bottlenecks and are critical to the knowledge flow of a network. On the other hand, too many links can lead to inefficiency of knowledge exchange. Generally speaking, links between sub-groups (for example, between members of different departments) must be coordinated effectively and efficiently.

Enablers: As a complementary concept to bottlenecks, hubs are enablers of knowledge sharing between different clusters. They can effectively link different sub-groups of the network and can facilitate knowledge flows between different departments or to external organisations. (The example illustrated here does not include hubs since the study was focused on one business unit with a small number of members.)

It should be noted that the *SELaKT* method is focused on a clearly defined objective within a clearly defined scope of analysis (knowledge domain). As a consequence, network structures, network positions and relationships are results within the defined scope. This implies that network members who have a prominent network position with regard to a certain domain of knowledge may have a less prominent position with regard to a different subject of analysis.

2.5 Intervention

Based upon the results of the *SELaKT* method and their interpretation, interventions are recommended to improve knowledge flows, to foster knowledge communication, and to strengthen relationships within the network, to built relationships to other networks, and to develop strategies for the creation of flourishing knowledge environments and for sustainable knowledge transfer. This section gives examples of very effective ways for interventions. Since every network shows its individual strength and weakness, they are relevant for the given example only and cannot be treated as general recommendations.

Development of personal competencies and expertise: With the exception of department c, identified expertise is focused on the heads of the departments. The question is if this is the appropriate position for experts with regard to the studied domain of knowledge; perhaps, people in other hierarchical positions should also become experts. Member 2, head of a department as well, has chosen a different approach: he provides his expertise to member 3 who is the contact person for other people. Thus, member 2 is able to keep his expertise up-to-date, while in return member 3 gets the knowledge from member 2 and becomes an expert himself. This is an example of sustainable knowledge transfer which proves to be very successful.

Integration of hidden expertise: Isolated components (like the members of department c) should be integrated into the knowledge network. A very basic, but nevertheless very effective measure for intervention is "[s]imply asking people to spend five minutes [. . .] to identify what they 'see' in the map, the structural issues impeding or facilitating group effectiveness, and the performance implications for the group" ([Cross, 02]). But isolated components can be quite resistant to change. This makes it necessary to precisely communicate the benefits of knowledge transfer for all participants and to create an environment for open knowledge exchange.

Promotion of cross-departmental knowledge transfer: As illustrated in the example, knowledge is primarily communicated within the individual departments. Knowledge transfer between the departments is mediated by their heads (with the exception of the direct relationship between member 1 and 8). Knowledge exchange without the heads of departments as bottlenecks could be organised more efficiently through means of cross-departmental meetings or facilitation of communities of practice.

In a final discussion round about the results of the network example given above, it was mentioned that there exists high inefficiency of the project acquisition process because of a lack of transparency. This inefficiency could be met by popular KM solutions like IT based tracking systems, knowledge navigators and yellow pages to avoid multiple project applications at the same time or to avoid "project cannibalism", to provide an overview over finished and ongoing projects and to easily find experts.

3 Conclusion

As introduced in this paper, SNA has practical application beyond a narrow theoretical perspective. By focusing on the social aspects of KM in a methodically rigorous manner, the *SELaKT* method has much potential. Nevertheless, the use of SNA in KM may be limited in environments characterised by high social complexity and a large variety of organisational constraints. The creation of an environment suitable for SNA is an integral part of the *SELaKT* method. Therefore, it cannot be mentioned too often that the integration of all involved persons during an early stage of the process is of critical importance. This includes the identification of potential conflicts and problems on the one hand, and on the other hand a gain of commitment of all responsible persons; commitment of the management level, commitment of other leading persons and experts within the domain of knowledge, and last but not least of workers's representatives (like the German "Betriebsrat") are necessary preconditions. To gain commitment of these key persons as well as of the survey participants themselves include to promote the advantage of a SNA and also to point to its limits. Concerns about undertaking a network analysis and objections against it must be taken seriously and taken into account of the process planning.

Further adoption of the *SELaKT* method will depend on evidence provided by future research, case studies and practical implementation in organisational business strategies in the various fields of application. Foci of further research include (1) application of network analysis not only as a snap-shot but undertaken as a continuing activity (longitudinal study), (2) research on methods for interpretations and different ways of interventions to improve knowledge sharing through further case studies and (3) comparative studies into the cultural factors that influence network structure and performance (between different industries as well as studies on an international level). Then, insights from the application of the *SELaKT* method could provide the basis to develop measures for assessing the contribution of informal networks, communities of practice and other social aggregates within organisations to overall organisational performance and innovation.

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