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Analyzing Social Issues in Knowledge Organizations

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ABSTRACT

This contribution presents a modeling approach for describing social issues in knowledge organizations. Social issues are one key factor in knowledge organizations for its business success. In the first part, a knowledge organization is described as a socio-technical system with heterarchic structures. Then modes for exploring social structures using Social Network Analysis (SNA) are introduced. Following a brief introduction of SNA applications in knowledge management deficiencies of a pure SNA approach for knowledge organizations are revealed. Finally, a new approach for modeling knowledge organizations is introduced.

Keywords

Knowledge Organizations, Social Structures, Social Network Analysis, Modeling, Conversion Mapping

SOCIAL ISSUES IN KNOWLEDGE ORGANIZATIONS

The business environment is increasingly uncertain and turbulent and as such, existing management and organizational approaches and, consequently, their modeling approaches must be reconsidered. For instance, to ensure the long-term success of a company, employees should not be merely treated as “cost drivers” or resources, but rather as essential contributing factors to its turnover.

A knowledge organization is defined by its capacity to adapt to the changing environment by creating new knowledge, disseminating it effectively and put this knowledge into practice (Nonaka and Takeuchi, 1995). Due to the increasing importance of knowledge, the “industrial paradigm”, which dominated business in the past, is being replaced by the “knowledge paradigm” (Sveiby 1997). This is accompanied by an approach that a rather tayloristic (traditional) influenced picture of a company should be abandoned in favor of an organically structured, flexible, and dynamic (agile) working method.

Increasing Importance of Social Issues

A knowledge organization is a system in which, “distributed knowledge networks convert the work of their participants into added value” (Roehl, 2002). Drucker ((Drucker, 1993) quoted in (Venters, 2002)) asserts, that “the basic economic resource (is) knowledge [...] and [...] knowledge workers will play a central role” because knowledge is bounded to a person. Knowledge workers are highly qualified, educated specialists, who work extremely autonomously (Sveiby, 1997; Drucker, 1999).

Generally speaking, the more crucial people are for the success of an organization, the more important are social issues. This increasing importance of the unifying factor in such organizations is often referred to as the “human value” (Hall, 2000). Values are filters that serve as a basis for personal interaction amongst knowledge workers in an organization. These interactions rely on communication between actors. Normally a greater degree of ownership evolves in social systems, examples of which include the development of an “own” language and meanings, self-determined decisions and awareness about their role in the organization.

There are other approaches besides those that concentrate more on "social structures" of knowledge organizations. These are focus more on the technical design of knowledge organizations. Thiesse defines the development of an knowledge architecture as an aim of knowledge organizations (Thiesse, 2001). This architecture consists of the static structure of knowledge sources and the dynamic aspects of knowledge management processes. These technical systems are the result of a construction and production process. They can be controlled directly or indirectly from the outside and contain deterministic input and output relations. Technical systems are established in specific environments, but these environments depend on the social system. This means, the better the harmonization of social and technical systems, the greater is the success of the employment of technology in the long term.

In the following sections the premises for describing a knowledge organization in a model are introduced. Hence the socio-technical system approach and the concept of heterarchy are presented.

Knowledge Organization as a socio-technical System

The approach of socio-technical systems links a social and a technical system with their structural (organizational), social and technical aspects. An analysis of a socio-technical system is feasible on a micro (individual), meso (group, community) or macro (whole system) level (Wohlgemuth, 1991). Technical and social structures are interdependent. They interact and face the environment conjointly (Herrmann, 2003). In Mumford (Mumford, 2000) the socio-technical approach is described as "an approach that aims to give equal weight to social and technical issues when new work systems are being designed". In a statement for the socio-technical approach (Emery, 1972) an organization is regarded as an open, sustainable system of social actions, which maintains its position in a turbulent environment because of a high level of self-regulation. Socio-technical systems have emergent properties. Therefore a company as a system must be regarded as a whole (Sommerville, 2004).

Socio-technical systems have a high complexity of their elements and they are not deterministic. Moreover they consist of formal and informal structures. An isolated focus on temporal and spatial relations, which process modeling methods typically have, oversimplifies socio-technical systems. These methods do not include concepts and information on relationships among actors (Wassermann and Faust, 1997). Still, the social dimension "has not been accorded the same degree of attention by IT researchers, even though the creation and maintenance of organizational understanding and commitment may be more problematic than developing IT and business plans in the first place" (Reich and Benbasat, 1998). It is evident that social aspects are often neglected in modeling organizations.

Heterarchical Structures in Knowledge Organizations

In knowledge organizations, knowledge workers perform their tasks parallelly and non-sequentially, rather than in a serial manner. However, the normative function of management is still important. The dominant structural pattern in knowledge organizations is a heterarchic hierarchy. Knowledge workers often operate in a poly-centric structure of a heterarchy that is part of the mono-centric structure of a hierarchy.

Knowledge organizations possess a clear company's center but their processes are decentralized and self-organized. This interplay enables heterarchically structured organizations to adapt changes in the current turbulent environment, because they can reconfigure management and power structures quickly. Heterarchic systems follow the principle of negotiation as a central steering element due to their self-organization, but it must be considered that this self-organization can lead to a slow or even idle state if negotiations are unsuccessful.

As structures in knowledge organizations consist of heterarchical and hierarchical parts, a formal description of a modeling language must consider the characteristics of both. This leads to the high complexity of elements and relations mentioned above. Modeling heterarchic structures can facilitate the analysis of knowledge organizations.

In the following sections, the socio-technical interpretation of knowledge organizations with hybrid structures is used to define an adequate modeling and analysis approach. The Social Network Analysis (SNA) approach is utilized to describe social structures in knowledge organizations. This approach examines whether it is able to understand the complexity of knowledge organizations.

SOCIAL NETWORKS IN KNOWLEDGE ORGANIZATIONS

Knowledge organizations have an organic (organic characteristics in (Tichy, 1981)), predominently network-like structure. This structure is flatter, more flexible, more team-oriented and more dependent on knowledge assets (Cross, Parker and Borgatti, 2002). One success factor in knowledge organizations is the social behavior of knowledge workers. This social behavior is can be described in social structures and Social Network Analysis provides a basis for analyzing these social structures.

Following a short introduction of Social Network Analysis and its methods, applications in knowledge organizations are briefly presented. In the next section, the SNA concept is applied in socio-technical systems. The aim is to analyze structural (organizational), social and technological aspects of a knowledge organization in one model by considering their interdependencies.

Introduction of Social Network Analysis

"[...] [A]n organization cannot be treated as something rational anymore. Instead, limited rationality in decisions should be accepted. Sociological approaches help to focus on the complex coordination constituted by interaction and communication between individuals. The network as a structural paradigm emerges [...]" (Trier, 2005).

Social Network Analysis enables the systematic description and investigation of these network structures and their principles of order in knowledge organizations.

Basically a social network consists of a set of persons and relations that define them (Wassermann et al., 1997). The social environment is described by a pattern among interacting persons (Wassermann et al., 1997). The identified patterns explain individual and collective behavior.

Social relationships of actors constitute the social capital of a knowledge organization. The social capital metaphor states that people, who do better, are somehow better connected (Burt, 2000). "Social capital consists of the stock of active connections among people; the mutual understanding, trust, and shared values and behaviors that bind the members of human networks and communities and make cooperative action possible" (Cohen and Prusak, 2001).

Network analysis offers a range of metrics to analyze social structures. Most of these measures focus on analyzing the same type of actor, e.g. persons, households, organizations (Wassermann et al., 1997). These networks are referred to as one-mode networks. The analysis of different types of actors, different stages and groups is possible as well. Social relations (ties) between actors have different scopes and types, e.g. personal relations (friendship) or biological relations (kinship), transmission of material resources (loans), formal relations (authority), and physical relations (street). Furthermore it is possible to analyze relations between single actors and to compare the dimension and characteristics of different networks (Wassermann et al., 1997; Scott, 2000; Degenne and Forse, 1999).

Essentially an actor's position in a network can be examined with metrics like centrality, prestige, measure for individual roles (e.g. one that isolates or bridges). For example one central concept in SNA is centrality. This metric helps to identify the "most important" actor, meaning the person that is, to a great extent, involved in relationships with other actors in a social network (Wassermann et al., 1997). There are three main approaches to measure centrality: degree, closeness, and betweeness (Chan and Liebowitz, 2006).

Social network analysts use two kinds of tools from mathematics to represent information about patterns of ties among social actors: graphs and matrices (Hannemann and Riddle, 2005).

Applications in Knowledge Management

"There are two distinct communities involved in the knowledge management debate - the one focusing on information and communication technique and other focusing on general management issues" (Raub and Rühling, 2001). In the last five years, socio-scientific approaches, like Social Network Analysis, have become more important in knowledge management. SNA can be applied for analyzing and reorganizing knowledge organizations. There are different perspectives (or views) on networks where social actors interact: hierarchy of decision, information and knowledge transfer, resource transfer, task distribution, and competence. Depending on the required target, SNA is applied in order to initiate changes within the organizational structure, in a special network/ process, in a team, on a personal level or focused on a knowledge process level (according to e.g. (Anklam, 2002; Cross et al., 2002)).

SNA emphasizes social issues in its analysis. As mentioned previously, these social issues are important for the success or failure of knowledge organizations. With SNA, distributed communication and collaboration structures can be examined. Particularly after corporate mergers or acquisitions, existing networks must be harmonized; here SNA can be applied. In addition, knowledge flows in inter-organizational networks can be explored in terms of the amount and type of shared knowledge. SNA enables the identification of structural holes or overlaps in the structure of knowledge organizations. Existing (cross-functional) relations are determined in their strength and intensity. Expertise within networks can be located. For instance, in cases where people with a high level of expertise are not being utilized appropriately by the network participants, the analysis shows that the expert is not integrated properly into the group. In another case, where one employee holds a knowledge broker position within a network, innovation, productivity, and responsiveness can be increased through extending this "know-who" to additional participants.

Organizational subgroups or cliques are visible with SNA. These groups can develop their own subcultures and negative attitudes towards other groups. By implementing adequate integrative measures this situation can be prevented. An evaluation of the average distance between existing networks is also possible. This degree of separation connects all pairs of nodes in a group. Short distances tend to transmit information accurately and in a timely manner. Conversely long distances imply slow and even distorted information transmission (Cross et al., 2002).

On a personal level, a primary focus is placed on the human interactions like social presence. Based on network analysis, people with vital knowledge and connections can be identified and rewarded accordingly for their work. In SNA attention is turned often to a knowledge-based dimension of relationships (Cross et al., 2002). Here knowledge organizations in particular strive to improve knowledge transfer in terms of seeking and sharing interactions. Based on these analyses, existing knowledge management tools and techniques can be applied, for example, to improve the knowledge transfer or the communication.

Need for a socio-technical Method Integration

The structural, social and technical determinants in a knowledge organization must be examined equally and interdependently. Therefore an extension of the SNA approach aspires to cover the complexity of a knowledge organization.

Usually analyzing relations within social networks depends on selective perspectives (views). Each point of view may explain specific coherence between system elements. The focus on only one perspective (e.g. communication, transfer of resources) at a time disregards the interdependencies of perspectives in practical applications. These relations are more important as the socio-technical interpretation of knowledge organizations is used. Therefore the application of a mono-causal explanation models is insufficient.

Another problem is that normally, an analysis of social networks concentrates on small bounded networks with two or three types of links, among one type of nodes and at one point of time. This contradicts the flexible structure of knowledge organizations due to the constantly regenerating heterarchies (cp. section "Heterarchical Structures in Knowledge Organizations").

Therefore a dynamic network description that treats ties as probabilistic must be developed. The theory of social networks should be extended through artificial intelligence planning and learning methods to develop a dynamic network model. However, first of all a modeling method must be specified as base for further considerations. An approach for this modeling method is introduced in the following sections.

REQUIREMENTS FOR A SOCIO-TECHNICAL METHOD INTEGRATION

Methods are logical procedures that are systematically applied to archive defined targets or to solve scientific problems (Hesse, Merbeth and Frölich, 1992). The development of methods is linked to respective guidelines. A specified method is necessary, and must be appropriate for the problem and the user, understandable, communicatable, formally correct and economical (Becker, Hallek and Brelage, 2005).

The necessity for method integration has already been identified in the area of social networks and knowledge management above. Following the explanation of the function of a modeling method, the requirements for defining it are introduced in the next sections.

The Function of a Modeling Method

Models are "applied and used, to solve a specific task. A manipulation of the original using direct operations is initially or is not realizable or too extensive because of given conditions" (Klaus and Buhr, 1976). A model is able to assume the function of understanding, explanation and demonstration, indication, variation and optimization, verification, projection, steering or compensation (Klaus and Buhr, 1976).

Therefore a substitute model is necessary to apply interdisciplinary methods for analyzing social networks in the context of knowledge management. The purpose is to replace a real system with a formalized model system. This formalized model system can be (automatically) converted into specific models for applying different analysis methods. From a method perspective, this formalized model system is original. Methods can meaningfully interact in spite of different model premises. Interaction between models is only a problem if methods are based on different paradigms (Schwinn, 2004).

Only in case of a pure cooperation, the capacity for method interoperability must be investigated. Interoperability generally signifies the ability to collaborate in different systems, techniques or organizations. The main focus of interoperability is to exchange and use information (IEEE, 1990). Here the basis is shared standards. In this interaction model, a shared standard is defined by the formalized substitute models.

Methods do not work together directly. Findings are realized in the substitute model (not in the original). Therefore, these findings are available for other methods. The user decides which findings should be transferred to the substitute model and which findings from the substitute model should be transferred to the original.

Requirements for a Modeling Method

Requirements are statements about qualitative and quantitative characteristics of an object. The meta-model of a modeling method describes the modeling language. A modeling method aims to create models with a substitute function. Therefore it is necessary to construct an adequate number of elements and concepts behind them available to the modeler. So he/she is able to cover the relevant circumstances of reality and the model, respectively. The number of these elements should be neither over-dimensioned thereby acting as a complexity driver, nor under-dimensioned, thereby delimiting the necessary meaning.

Requirement for fine granularity:

Models should not be restricted in their level of detail; they must be derivable from the substitute model. Therefore the level of detail must be at least the same as any other method-specific meta-model. Here, the concept of a common conversion as the smallest generic part is used, in order to relate objects of various kinds. The concept of conversion is introduced in a following section.

Requirement for exclusive substitute function:

As mentioned before, generated models have a substitute function. They should not use specific explanatory approaches because each explanatory approach again serves a specific paradigm. The potential for paradigm conflicts is deeply-rooted if a paradigm has been built into the foundation of a meta-model. Incompatibility based on the paradigm cannot be avoided by a (comprehensive) combination of paradigms on the stage of meta-models (Schwinn, 2004). In any case the development of different paradigms is founded in their differences. The development of analysis methods, which works directly with this language, is, of course, not recommended. Such methods and their basic models are treated as external models.

Requirement for visualization:

The visualization of modeling objects is the second envisaged function of the model. Method-specific models contain an internal and formal model representation. This is necessary to automatically derive the method specific models from a substitute model. Specific users share a common graphical visualization of a modeling object. Therefore the existence of graphical notation is a requirement for problem adequacy.

Requirements for abstraction continuum:

An abstraction continuum allows for both a continuous abstraction and the concretization of models. This continuum must be in place between an instance and a scheme. The analysis method can work with abstract or/ and with concrete data. Schemes are structures, in which experiences are generalized (Schmid and Kindsmüller, 1996; Ajideh, 2003). Schemes typically represent expected situations or expected correlations of a certain reality. A continuum is necessary in order to gather incomplete knowledge of a captured original.

Requirements for basic constructs:

The possibility to combine generic constructs is necessary to allow a user to define new basic constructs. Method-specific information should not be reserved to an amount of generic elements. Method-specific constructs constitute a necessary foundation for an automated conversion in method-specific models. A method-specific construct is the smallest semantic unit in a method-specific view on a substitute model.

Requirements for scheme calculus:

The syntax of a modeling method must provide a scheme calculus. The findings, which are extracted from specific analysis methods, are converted into design measures for a realization model. Then these measures are transferred in formal operations using the scheme calculus. In essence, a scheme calculus defines operations on schemes, as negation, addition or refinement. The user of a model is responsible for a non-deterministic selection of analysis findings and a derivation of a design measure. A realization of design measures in a formal realization must be deterministic.

Concept of Conversion

In the context of knowledge management Nonaka und Takeuchi (Nonaka and Takeuchi, 1995) utilize the term conversion to describe different interaction forms of knowledge. Knowledge is created and extended only by an interaction of tacit and explicit knowledge. This interaction is referred to as knowledge conversion. There are four types of knowledge conversion: socialization, externalization, combination, and internalization.

The modeling language KMDL® (Knowledge Modeling and Description Language) utilizes this knowledge-specific conversion term as central concept (Gronau et al., 2004, 2005). Based on modeling knowledge-intensive business processes, the four types of knowledge conversion are visualized and enriched by information that is created and used and knowledge objects. The concept of conversion is derived from the KMDL approach. The term conversion is used here more generally to enable the aimed method combination.

The introduced approach uses the concept of conversion as the common basis for different theories, which are based on e.g. communication and/or on rational, social, emotional activities. These existing theories are both concentrated on the semantic value of an object and not in its substance (material level). With the concept of conversion the modeler concentrates on the object’s substance.

A conversion changes an object's format, but keeps its semantic value unchanged. For instance, a house and an architectural blueprint represent the same description of an architect's vision. Both the generation of this vision in an architectural blueprint and the generation of the blueprint in a real house are conversions. Each conversion should be an isomorphic mapping, but the semantic content of an object can not completely reproduced. At least in the area of knowledge modeling in an organization, the modeling of complex content is not economically justifiable. It is almost impossible to convert the implicit know-how of an architect in its entirety (Nonaka, 1991; Goguen, 1997). The whole knowledge content can not be completely codified in a model of a conversion system.

Each conversion object is related to an actor and each conversion has a direction. Using particular conversion methods, certain further conversion objects are applied as method-specific premises. The actors sending and receiving have different premises, which represent content of any kind (e.g. expert knowledge, norms, emotion). A model which is consisting of such conversions is called Conversion Map.

A conversion needs at least two (actor-bound) objects, one source and one drain object. During the modeling of each object a term is selected as an easy, intellectual description of the captured artifact.

Two terms are identical if they describe the same artifact. They are innerly identical, if they describe the same artifact with the same characteristics. They are objectively identical, if they characterize the same artifact with different characteristics. Two terms are innerly different, if their semantic content is different. Two terms are objectively different, if they specify objects with different substance (or formats).

The complement to a conversion is a transformation. A transformation changes the format of an object depending on respective rules, but the original substance remains the same. A transformation does not consider the (semantic) content of an object. A transformation always takes place between (at least) two innerly different but objective identical objects. In contrast, a conversion only converts the representation form of an object. The content is ideally unchanged and the substance is not considered. A conversion always takes place between (at least) two innerly identical but objectively different objects.

Therefore a conversion-based model is better suited to capture information content and flows of a system. This model focuses on the value and development of object's content and semantic meaning. This is in contrast to transformation-based models and modeling methods, which concentrate on the substance of information carriers. These other models only describe the syntactical and material development of a product and not the development of content.

SUMMARY AND OUTLOOK

This contribution has presented basic considerations for introducing a new approach for modeling knowledge organizations based on social relations. Knowledge organizations can be interpreted as socio-technical systems with decentralized decision-making processes. Sound-functioning social relations are directly related to a company’s success, for example in terms of innovation. Therefore an understanding of the existing social structure is a very important starting point for analysis. Here the concept of conversion is introduced to enable opportunities to combine different approaches for analyzing organizations using aspects of informatics, sociology and psychology. A general conversion represents the class of scheme. Determining factors of the general system framework are defined by abstract or partly instantiated schemes, which define for example, communicational behavior, role behavior, sequence of activities and methods.

Conversion Mapping enables the visualization of social structures and social behavior in a company. Here SNA offers metrics to analyze and evaluate these structures. Due to the socio-technical character of a knowledge organization, this approach must be extended to include additional analysis methods. From this, the basic advantage of Conversion Mapping is clear; its character is very general, yet it also allows for the technical aspects of an organization to be considered.

Currently, the research in this area is focused on a further specification of the modeling method as well as a more in-depth investigation of SNA to analyze social issues.

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