

**Position Paper for the 2nd International Conference
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**Workshop I:
Collaboration, cooperation, transaction in various communities:
exploring differences and commonalities**

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**Studying regional networks
among small and medium-sized enterprises
of the German software branch**

An ethnographic field study

Introduction

The state-of-the-Art of software design is discussed within the field of Software Engineering (SE). One major mistake when developing (software) systems is to rely on the intuitions of developers instead of empirically detecting real problems and practices in the application field. This can, for example, be proofed by the Standish Chaos Reports (2004) which show that one of the main reasons for the failure of software developing projects is an insufficient orientation towards the software users.

Lacking inclusion of users, therefore, is a particular problem in the development of educational systems, as they often too little address the problems and learning cultures of the anticipated learners. Ethnographic studies (Scacchi 2004) can play a crucial role in software design, as most modelling of support for practical cooperation remains too much restricted to formal organisation and lacks understanding of implicit knowledge practices, routines, and other specifics of the given organisational culture. The paper describes empirical activities undertaken to study regional networks dedicated to support the promotion of SE knowledge in small and medium-sized enterprises (SME). As the networks examined in this study were established in a top-down manner by the ViSEK/VSEK project, indicators had to be elicited that could point out sustainability. Therefore, communication structures, relational knowledge and interaction between the network members were used as indicators.

The context of the project

With the ViSEK/VSEK project existing research know-how in SE was bundled and made available under www.software-kompetenz.de, a knowledge portal also offering supporting services. On the portal, the user can retrieve descriptions, know-how and experiences on SE deposited as “knowledge modules” in a database. The portal also informs about new technologies, methods and tools. Besides this the project organises conferences, workshops and other activities and the database is being supplemented through research studies.

The ViSEK project was promoted by the German Ministry for Education and Research (BMBF) from 2001 to 2003 and the follow-up project VSEK from 2004 to 2005. New activities centre on the creation of a German SE community. SMEs should be supported with more practical SE knowledge. Target users thus were the some 20.000 (BMBF 2000) enterprises in Germany, which develop or adapt software. Out of these 20.000, 11.000 belong to the so called primary business sector, where software is being sold as an independent product (data services, companies with data processing devices...), while another 9.000 belong to the secondary business sector, where software is embedded in products or services presenting an important input factor (car industry, telecommunication, financial services ...).

The primary business sector is characterized by a lot of SMEs, in comparison to the secondary business sector, where the companies generally are larger. Employees of SMEs in the software business seem to feel different from those of larger enterprises. This could be of importance especially for SE and related qualification demands and activities.

Didactical conceptions for the promotion of learning in SMEs of the software branch

Some of our former studies (Nett & Wulf 2005) indicate that in SMEs of the software branch a lot of cooperation and knowledge processes remain informal. Instead of well-defined routines and processes, self-organization plays an important role within SMEs, offering a higher degree of freedom, but also demanding a stronger commitment from employees in SMEs (Pröll & Ertl 2004).

The implementation of many established SE processes and methods could mean a waste of resources within SMEs, and many CASE-tools simply are too expensive for them. Therefore, SMEs develop specific techniques to tackle the problems – techniques, which are given too little awareness within established SE.

Because of such and other reasons, many employees in SMEs regard the offers of the “software-kompetenz.de” portal as alien and “too academic” for them. The instructionist design of the portal has been based on the (implicit) assumption that abstract knowledge can be stored and recalled from a database “on demand” without anticipating the embedding of the portal in usage scenarios (cf. Hofmann & Wulf 2003). As a result, there has not been a thorough identification of learning cultures (Nett 2003).

Constructivist learning theories point at the active elements of learning, with which the learners embed their learning in their worlds of signification. Instead of a mere individual consumption of cognition, learning thus is conceived as an ongoing construction and situation of knowledge within specific contexts of practice (Suchman 1987, Lave & Wenger 1991, Wenger 1998).

A related widening of the didactical conception of the ViSEK/VSEK project, therefore, requires restructuring processes. Learning processes may no more be developed as a one-way transfer from academia to economy, but have to be designed as a two-way exchange, where both sides can learn about the construction of the worlds of the other (De Paula et al. 1999). Therefore, it was important to see, if and how the regional activities of the ViSEK/VSEK project contributed to the aim of exchanging knowledge between academia and industry.

A heuristic research model

In the majority of cases, reflections on Social Network Analysis centre around the mathematical graph theory (cf. Diaz-Bone 2004, Jansen 2003, Weyer & Abel 2000). Thus, the exploration of nodes and links appears as a typical object of quantitative research. But a quantitative analysis of nodes and links takes the pre-understanding for granted how to define and to understand nodes and links in a social network. However, this pre-understanding is in no way self-evident (cf. Schnegg & Lang 2002).

The intention of field studies is not to define an embracing model of abstract network characteristics in order to prove interferences of its features. Field studies must elicit singular networking effects and unintended, emergent structures instead (cf. Sydow 2003) in a qualitative manner. Hence, for software designers field studies are an adequate technique in the fluid array of learning- support systems design.

Sustainability and success of learning communities is based upon strong relations of trust between individuals in a community. The establishment and utilisation of social capital plays a decisive role in transition processes into autonomous networks. Since social capital doesn't represent a personal private resource as other capital forms that may be acquired and utilised independently. It is always embedded in personal relations (cf. Bourdieu 1992; Coleman 1988).

Therefore, we developed a heuristic model, where focal actors' activities meet in an autonomous network. Regional networks as frames of focal actors' activities compete with, combine with or separate from other network structures, especially associations and entrepreneurial nets (e.g. bidding consortiums). Communicative or commercial relationships, for which a regional network has been an initial frame or motivation, were interpreted as indicators of its potential sustainability, without the relations being defined more closely *a priori*.

Based upon this model, hypotheses were developed relating to organisational, products and appropriation forms. A half-standardized questionnaire was set up intended to motivate a strong influence of the persons interviewed upon the interview (cf. Meuser & Nagel 2002). Interviewees' emphasis diverging from the hypotheses was accepted.

Field research

In the following, two regional initiatives of ViSEK/VSEK, FUN (Förderverein Usability Network) and SFBB (Software Forum Berlin- Brandenburg) were examined according to their potential of supporting sustainable learning structures. Both are two rather different institutions, who nevertheless involve related network functions.

The hypotheses posed a first access to the field. They documented the initial point of the research process, and both the interviewees' and researchers' processes of reflection. The hypotheses were completed iteratively and validated in ongoing adjustment by means of the analysis of collected empirical data.

The interview process was arranged by exploratory talks to colleagues in Berlin, Cottbus and St. Augustin. Starting from document analysis (member lists ect.) the interviews were organised, accomplished and recorded (if permitted). The Interviewees were agents of regional business development, officials of concurring networks, and focal actors. Furthermore visitors of the regional events were interviewed, principles of choice being the frequency of attendance.

The interviews were transcribed in paraphrases, conserving argumentation patterns. Thereafter transcripts were compressed anew, and combined with meta-codes by means of the program "MAXqda2".

The qualitative data interpretation was carried out using a combination of methods: As a first step codes in response to the questionnaire were identified on the basis of the paraphrased transcripts, and relocated to the hypotheses. In the context of the data interpretation, this procedure displayed a “level 1”, since it didn’t exceed the former hypotheses, but took them as interpretation patterns. Questions act here as meta-codes that parts of the transcription may be recurred to according to the free interview guidance.

In contrast, ongoing research elicited “level 2”- problem areas that occurred in the talks but not having been addressed in the questionnaire. Moreover, “level 3” contained semantic conspicuities uncovered in the interviewees’ responses and narratives. To recognise both individual and cultural strategies of learning and cooperation in a wider perspective, and to map them as realistic as possible, singular phenomena of “level 3” were assembled to hermeneutic units together with correlating codes and code complexes.

Thus, answers to questions like condition of action and action context, and individual strategies as reaction and resulting consequences display a view of a (nearly) everyday life context of learning and cooperation processes. This methodology conforms in its main features to the proceeding on the basis of the “paradigmatic model” according to Strauss and Corbin (1990), and was in our case combined to a classical interview-based hypotheses-testing procedure.

Conclusion

Empirically-based domain knowledge can contribute to the development of software applied to complex socio-cultural contexts (Crabtree & Rodden 2001). In particular for the development of innovative technologies to support collaborative, cooperative and transactive human interaction, this is of crucial importance, as lack of related knowledge leads to under-complex modelling or lacking consideration of context-specific interaction and communication practices – with their related significance for situated competences.

The discussion of related research results can not only be used for design decisions, but also for the initialization of a discourse with anticipated users, allowing for their integration into the very design process. Such design discourses can transform design ideas to more practice-oriented product visions. For example, in the presented case, the isolated presentation of abstract knowledge in a database proofed as a little practice-oriented form of supporting SE among SMEs.

In this context, the central role of identities in learning processes became apparent for the acceptance and use of educational offers. Therefore, identities and learning cultures play a crucial role for their sustainability. The identities and communicative and collaborative practices of users have to be addressed by educational offers, having impact on content, interaction and representation forms, but on the embedding of learning in social worlds, as well. However, the identities of the focal actors which develop and maintain the educational offers have to be taken into account, as well.

For related research, the methods described in this paper proofed to be adequate and reasonable. They already led to some preliminary results regarding the technologies used on the software-kompetenz.de platform, which (among others) allowed for new features to be developed. However, the main focus of the research was on the regional networks to form a nucleus of a German SE community. The comparative research into these regional activities has not been completed yet. Therefore, this paper concentrates on the description of the methods used for the empirically-based development and socio-technical restructuring of a competence centre to support SE in German SMEs.

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