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ITJ2930

Toward Improved Community-Supporting Systems Design:
A Study of Professional Community Activity

Malte Geib, University of St. Gallen, Switzerland
Christian Braun, University of St. Gallen, Switzerland
Lutz Kolbe, University of St. Gallen, Switzerland
Walter Brenner, University of St. Gallen, Switzerland

ABSTRACT

In this article, we analyze the design factors of community systems in two real-world professional communities — a learning network and an expert network — that employ a mix of communication modes, that is, face-to-face communication and computer-mediated communication. Our objectives are to determine which design factors influence community activity and therefore community output. We furthermore intend to make recommendations to improve the design of community systems that support professional communities using a mix of communication modes. Our study is exploratory and based on action research given the lack of studies on the design of community-supporting systems in professional communities that employ a mix of communication modes. To illustrate similarities and to enhance the generalizability of our findings, we analyzed two real-world professional communities in-depth, namely, a learning network and an interorganizational expert network. Our study shows that face-to-face communication is the primary mode of communication in these communities; the community systems that they employ only have a supporting function. This leads us to a few design guidelines for the systems that support such communities. Generally, community systems have to support professional communities' work processes and relationship development. Important functions for work-process support are those that support face-to-face meetings (for the preparation and wrap-up of meetings) and that explicitly support specific work processes. Important functions for relationship development are functions that enable or facilitate face-to-face meetings, for example, member profiles.

Keywords: community-supporting system; community system; expert network; learning network; professional community; system design; virtual community

INTRODUCTION

In recent years, it has become normal to support geographically dispersed communities with advanced forms of computer-mediated communication (CMC) systems, usually based on Internet technology. These community-supporting systems (in short, community systems), frequently termed *teamware* (Schulte, 1999) or

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groupware (Bach, Vogler, & Österle, 1999), support the interactive exchange and creation of documents, online discussions, chat rooms, and role-based personalization. Besides communities that rely solely on CMC (frequently termed *virtual communities*; Rheingold, 1998), the majority of professional communities employ a mix of CMC and other communication modes (i.e., telephone, fax, face to face). Much research has been devoted to the analysis of virtual communities (e.g., Bieber et al., 2002a; Bieber et al., 2002b; Godio, 2000; Rheingold) and to the comparison of CMC with other communication modes (e.g., Etzioni & Etzioni, 1999; Wiesenfeld, Raghuram, & Garud, 1999). However, there has been little research on the design of community-supporting systems in professional communities that employ a mix of communication modes.

To address this gap, the objective of our research was to analyze community system design factors in professional communities such as learning and expert networks that employ a mix of communication modes. We addressed the following research questions in detail:

1. Which community system design factors influence community activity and therefore community output?
2. How should community systems supporting professional communities be designed?

Because our research was exploratory, we used an action research (AR) approach (Checkland & Holwell, 1998). Action research is often used in the information-systems domain for the exploratory analysis of systems design in real-world settings (Davison, Martinsons, & Kock, 2004; Mansell, 1991).

Two real-world communities were the object of our in-depth study: a learning network of postgraduate students and an interorganizational expert network consisting of experts from different companies working in the areas of customer-relationship management (CRM) and knowledge management (KM).

In the following section, we describe the research model developed from the literature on computer-mediated communication and virtual communities that which presents the causal relationships discovered in previous research relevant to our research questions. Next, we describe our research methodology. Subsequently, we describe and discuss the results of our research to arrive at propositions for the design of community systems supporting professional communities. Finally, we summarize our findings and discuss further research opportunities.

THEORETICAL BACKGROUND

Professional Communities

The notion of community is a socioscientific collective term for a specific type of social group (Poplin, 1979; Sutton & Munson, 1976). Although there is no generally accepted definition, a community can be defined as a group of socially interacting persons who are mutually tied to one another and regularly meet at a common place (Hillery, 1955). With the diffusion of electronic information and communication systems, communities have increasingly turned to computer-mediated communication.

In respect to their objectives and scope, communities using CMC can be classified into three major types (Markus, 2002). Socially oriented communities form to support the development of social rela-

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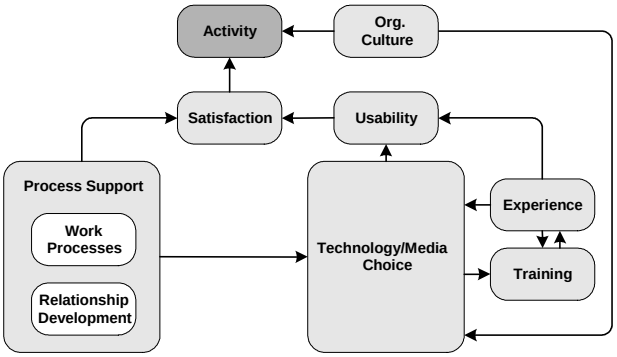
Figure 1. Research model



tionships between individuals and have no economic goal. Commercially oriented communities form to directly support a profit-oriented economic goal (cp Hagel & Armstrong, 1997). Professionally oriented communities (in short, professional communities) consist of companies' employees who communicate and share information to support their professional tasks (Godio, 2000). In this article, we focus on the analysis of professional communities.

Professional communities can be differentiated into expert networks and learning networks (Markus, 2002). Expert networks are formed by experts focused on a specific topic with the aim of acquiring and developing knowledge through their mutual interactions and discussions as members of the network. An expert network emerges through voluntary association and may be either intra- or interorganizational. A socioscientific explanation of the expert-network phenomenon is given by Wenger (1997), who calls this community type a "community of practice." Wenger, McDermott, and Snyder (2002) offer a pragmatic definition of expert networks as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis." Learning networks are formed by professionals with the objective of joint education, training, or learning (Markus, 2002). Examples of these are virtual corporate universities (Kraemer & Müller, 1999).

Community Systems

With the propagation of the Internet, most CMC systems became based on Internet technology. We use the term community system to describe the Internet-based application system that enables community members to interact with one another.

To structure our analysis of community systems for professional communities, we use a research model that describes the relationships between community system design factors and community activity prevalent in the literature on CMC (see Figure 1).

In the following sections, we define the concepts used in the research model and explain the relationships between them.

Process Support

Communities use community systems to support their communication-based processes (Bieber et al., 2002a; Watson-Manheim & Belanger, 2002). These can be roughly divided into relationship-develop-

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ment processes and work processes (or task-oriented processes). In relationship-development processes, community members establish relational intimacy by exchanging social information (Chidambaram, 1996). In contrast, work processes are executed by community members to solve a problem or to work on a specific task. Examples of work processes are coordination, information gathering, knowledge sharing, conflict resolution, negotiation, and information dissemination (Watson-Manheim & Belanger).

Technology and Media Choice

In the design of community systems, the choice of technology and media depends on the work processes and relationship-development processes that they should support (Stanoevska-Slabeva & Schmid, 2000; Watson-Manheim & Belanger, 2002). Well-established technology is also often chosen on the basis of previous experience with this technology. The choice of technology may therefore depend on the community members' previous technology experience if one assumes that they influence the design process (Chidambaram, 1996; Watson-Manheim & Belanger). The choice of technology may also depend on the organizational culture (Watson-Manheim & Belanger; Wiesenfeld et al., 1999). Subject to their previous experience and choice of technology, community members require training in using the community system to ensure that it is effectively used (Wiesenfeld et al.). A community system's usability determines whether people will find the system easy to use (Bieber et al., 2002a). This is primarily influenced by the choice of a suitable technology and users' experience with the chosen technology.

Satisfaction, Activity, and Performance

Community members' satisfaction with the community system is influenced by the degree of process support offered by the system (Chidambaram, 1996). The system's usability plays an important role in the degree of satisfaction experienced. The community members' activity is defined as the frequency with which community members use the system for communication with one another. Activity is furthermore primarily dependent on the community members' satisfaction with the system and also influenced by organizational culture. For example, Hiltz and Johnson's (1990) study showed that the best predictor of satisfaction with CMC was the (virtual) activity among group members. Experience's (indirect) effect on activity is acknowledged by Chidambaram, who says that "experience with the medium can affect the extent of use…of the medium."

According to McDermott (2002), activity — included in our research model (Figure 1) — is the most basic concept by which we can measure communities' performance. Performance can generally be measured on different levels, each with a different impact on business result (see Figure 2).

Activities comprise, for example, meetings, discussions, and one-to-one contacts. Measuring activities can be helpful in giving some indication of the communities' health. However, these measures do not demonstrate the communities' contribution to its members or organizations. To determine this contribution, it is necessary to measure communities' performance in terms of output and value (McDermott, 2002).

In focusing on the community systems' contribution to the overall performance of communities, we restrict performance measurement to the activity level. This is necessary because the community

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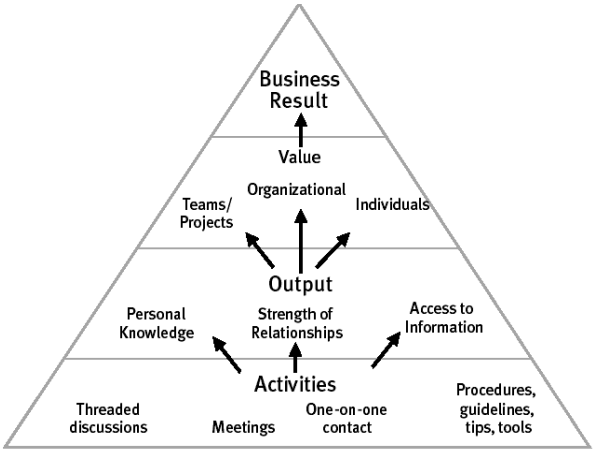
Figure 2. Performance measurement framework for communities (McDermott, 2002)



systems' goal is to facilitate the community members' activities and to make them independent of restrictions imposed by space and time (Bieber et al., 2002a). Community systems' impact is therefore restricted to the activity level as the systems only influence business results by facilitating activities.

METHODOLOGY

Given the lack of studies on the design of community-supporting systems in professional communities that employ a mix of communication modes, our study is exploratory and the research sites are real-world communities. To illustrate the similarities and to enhance the generalizability of our findings, we made an in-depth analysis of two professional communities, namely, a learning network and an interorganizational expert network.

Action research (AR) is an appropriate methodology for the exploratory analysis of systems design in real-world settings (Davison et al., 2004; Mansell, 1991). AR focuses on solving organizational problems through intervention, while at the same time contributing to scholarly knowledge (Davison et al.). In the AR process, the researcher enters a real-world situation and becomes involved as both participant and researcher (Checkland & Holwell, 1998). AR's iterative characteristic implies a cyclic process of intervention, with one or several cycles of activities being conducted (Davison et al.).

Checkland and Holwell (1998) argue that in order for AR results to be valid, the research process has to be recoverable by interested outsiders. It is therefore essential to state the epistemology (the set of ideas and the process in which these ideas are used methodologically) through which outsiders make sense of the research, and thus define what they regard as acquired knowledge (Checkland & Holwell). Figure 3 shows the AR process that we followed for one cycle in respect to each of the two communities.

The organizational problem to be solved in respect to each professional community was improving the community's work and relationship-development processes through the design of a community-supporting system.

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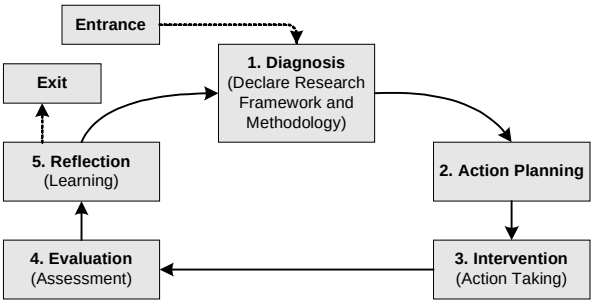
Figure 3. AR process model (Checkland & Holwell, 1998; Davison et al., 2004; Susman & Evered, 1978)



A detailed understanding of the surrounding environment is a prerequisite for the determination of an appropriate intervention, therefore the data-collection techniques employed before, during, and after the action-taking stages should ensure a rich pool of data for subsequent analysis (Davison et al., 2004). Furthermore, a thorough review of the existing literature is useful not only to inform the research's focus and process, but also to help position the research within scholarly knowledge (Davison et al.). We therefore developed a research model from the literature (see Figure 1).

In the diagnosis phase, we started our research with a thorough diagnosis of the community's current situation. This was done through an analysis of the community's documentation and interviews with community members regarding their requirements. Subsequently, we identified the community members, their roles, and their work and relationship-development processes. We also gained insights into the choice of appropriate technologies, media, and functions supporting these processes. Finally, we also acquired information on community members' experience and training, as well as on their general cultural context.

In AR, the diagnosis will directly inform the planning of actions, and planned actions will subsequently be implemented and evaluated. In the action-planning phase, we planned the design of the community system according to the users' requirements as based on their processes. In the intervention phase, we developed and implemented the community system.

In the evaluation phase, we compared the intervention outcomes with the project objectives and expectations. We therefore gathered performance data that were relevant within our research model's context to measure the community system's success. This was done by measuring the community members' activities when using the community system. The starting point of this data collection was the access logs generated by the Web server (Lotus Domino server) that handles the communication between the community members and community applications (Lotus Notes databases, Lotus Team Workplace, and Lotus Sametime). The analysis steps were as follows:

1. We collected the access logs, which recorded page views. A page view is the result of a request for a particular Web page and therefore denotes the requesting person's activity.
2. To eliminate the effects produced by a community system's administration

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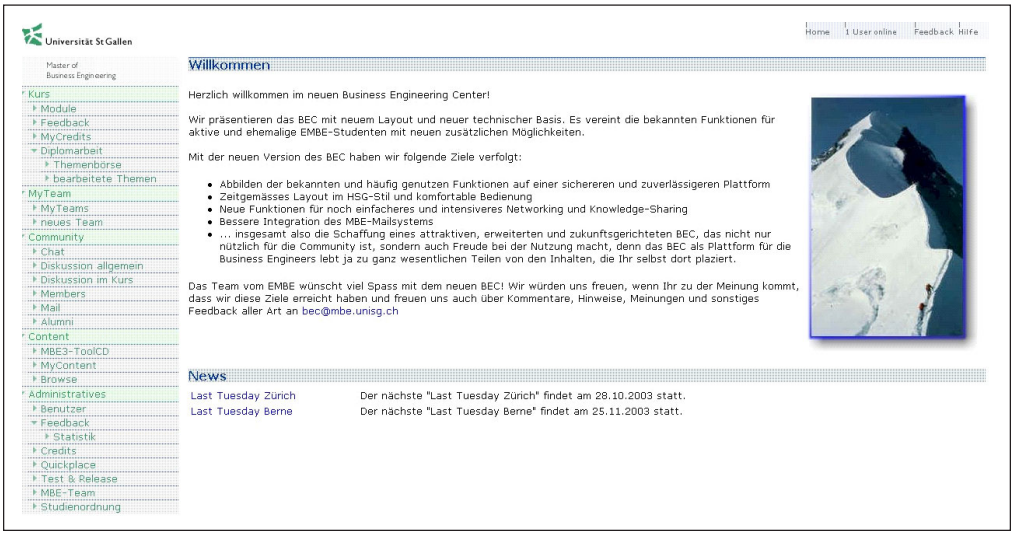
Figure 4. BEC screenshot



(which also generates entries in the access logs), we filtered the entries containing system administrators' user names and Internet protocol (IP) addresses. Consequently, the results of the analysis only reflect the community members' activities.

3. To aggregate results, we grouped the Web pages and forms according to functional areas. We determined the number of page views (the sum of the related Web pages and forms' page views) for each functional area and the percentage of total page views. This percentage is an indicator of how important the specific functional area is for the community members.

To conduct this evaluation, we used the Web-log analysis tool WebTrends, which can cope with the specificities of access logs generated by Lotus application servers.

In the reflection (learning) phase, we analyzed deviations between project outcomes and expectations. The goal was to gather knowledge on the relationships between a community system's design factors and the community members' activity. We discussed the differences between the outcomes and expectations and developed hypotheses to explain them.

RESULTS

The BEC: A Learning Network

Overview

The University of St. Gallen's Executive MBA in Business Engineering (MBE) is a part-time postgraduate course for managers in leading positions. The program is intended to qualify professionals for all aspects of business transformation (Winter, 2002). At present, the MBE HSG has about 90 participants in two courses and approximately 270 alumni.

To support participants during the courses and afterward, the MBE organization decided to implement a community

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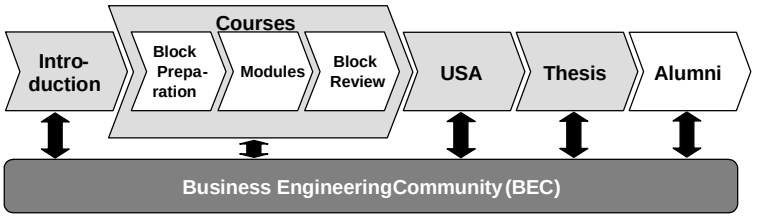
Figure 5. The process of study



system called the Business Engineering Community (BEC) in 1998. By fostering interaction between participants, especially during practice weeks and after the study, the BEC contributes to and maintains community building. Because the system was designed to support interaction and relationship development among the current participants and alumni, we focus on these two groups of community members. The current release of the BEC system was first implemented in February 2002.

The Design of the BEC

The study of the system can be divided into several phases, which are shown in Figure 5. The BEC has to support all the phases from "Introduction" to "Alumni." Additionally, the BEC has to provide functions that support relationship development between participants. In the following section, each phase of the participants' work process is described.

In the introduction phase, the participants acquire information on the program, venues, organization, and contact persons. They edit their own profiles, view other participants' profiles, and get used to the BEC's functions. During courses, participants obtain information on timetables, documents, their credits, and instructors. They have to do (preparatory) exercises in groups, communicate with one another, exchange related documents, and discuss related topics. They thereafter provide feedback on the modules and meetings. The program also contains a four-week stay at a North-American university. Apart from information on the stay and the local companies that they will visit, the work processes in the U.S. are identical to those in the previous phases. The thesis is written in groups of two to four persons. The participants therefore need to build teams, and search for and discuss possible topics. After the completion of the program, the alumni are primarily interested in maintaining the community and in networking. They organize events, search for experts, and exchange knowledge and experiences.

To support the study's different phases and the corresponding processes, the MBE organization decided to implement a community system. The MBE organization thus created the BEC's functional specifications based on experiences with an earlier release, user feedback, and the requirements mentioned above. The new BEC system was implemented by an external service provider and was launched in February 2003. It is currently operated and maintained by the MBE organization.

The BEC's functions, which support the community members' processes, can be divided into five areas, supplemented by a sixth category for "support functions":

- **Course support:** This area contains information on modules and meetings, with

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relevant documents available for download. Participants can also provide feedback on modules and individual meetings. In addition, participants can access statistics relating to their study credits. To support the participants in their endeavor to find a topic for their thesis, a discussion forum is available in which topics can be suggested and discussed.

- **Teamwork:** In order to support the participants' thesis work, their jointly done exercises, and the organization of joint events, this area enables the building of private and public teams. Within a team area, the system provides functions such as document exchange, collaborative document creation, application sharing, and a common calendar.
- **Communication:** The BEC offers both synchronous and asynchronous communication. Synchronous communication is supported by a chat function or instant messaging, video and audio conferencing, application sharing, and a whiteboard. Asynchronous communication is supported by discussion forums and an integrated e-mail system.
- **Member profiles:** This area contains a list of all member profiles grouped according to the courses the members attended. Each participant can edit his or her own profile and access other participants' profiles.
- **Content:** In this area, related content can be published and categorized. Possible content types are book recommendations, citations, links, attachments, and events.
- **Support functions:** In addition to the functions just mentioned, the BEC provides supporting functions such as user help, a feedback function, and search and news functions.

The MBE's cultural context in respect to technology use is primarily shaped by the different participants. The MBE program is attended by professionals from all disciplines and industries with different backgrounds and affinity for technology. Most participants have no experiences with the community system's technology even though the system's implementation is based on an established and widespread IBM Lotus technology. Consequently, the MBE organization offers a short explanation of the community system's functions during the introduction phase of the program. The functions are furthermore designed to be largely self-explanatory, although online user help is available.

The CKP-Net: An Expert Network

Overview

The Competence Center Customer>Knowledge>Performance (CC CKP) is a knowledge network between the University of St. Gallen's Institute of Information Management (IWI-HSG) and six major Swiss and German financial-services companies that finance the competence center. The aim of this network is the development of knowledge in the areas of customer-relationship management (CRM) and knowledge management with a focus on performance management.

Generally, the CC CKP consists of a core team — a project manager and researchers of the IWI-HSG — and several of the participating companies' employees (participants). The network has a steering committee on which each participating company is represented, and which meets biannually to discuss the network's research alignment.

The core team's task is to develop knowledge that the participants can use within their companies, while the knowl-

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Figure 6. CKP-Net screenshot

edge network as such should support its participants' work and relationship-development processes. To support these processes, a community system, called CKP-Net, had to be established.

The Design of CKP-Net

The CC CKP has five different processes that have to be supported by CKP-Net: workshops, literature research, project work, steering-committee meetings, and relationship building.

Workshops are conducted four times a year and deal with varying topics. During a workshop, the core team members present state-of-the-art concepts and future trends, whereas the participants report on the status of related projects in their companies and the challenges that they currently face. The core team and participants also take part in group work to exchange knowledge on a new area of research. Both the steering-committee members and the participants are involved in the preparation of workshops. Each company's steering-committee member has to select participants to attend such a workshop. The selected participants then have to prepare for the workshop by familiarizing themselves with the workshop's topics. After a workshop, many of the participants and steering-committee members need to access the presentations and results of group work for utilization in their individual work.

Apart from the workshop documents, the participants and steering-committee members often do literature research, for example, for projects that are not carried out in collaboration with the competence center. Consequently, CKP-Net has to support the publication of research documents and a topic-oriented structured search as well.

The core team members also support the participating companies' employees by means of projects within their respective

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companies. Project work that the participants and core team carry out requires an intensive exchange of documents, for example, documents explaining the enterprise environment, project plans, and concepts. CKP-Net therefore has to facilitate the exchange of documents and the collaborative creation of documents.

It must also be possible to publish agendas, presentations, and the results of discussions in steering-committee meetings on CKP-Net to allow the steering-committee members easy access to these.

In order to build relationships within the competence center, it is useful for the core team, participants, and steering committee to communicate with one another at times other than during the workshop meetings. All stakeholders' contact details should therefore be published within CKP-Net.

To support all these processes, the core team decided to implement a community system. Because previous competence centers had already worked with community systems for several years, CKP-Net was designed based on experiences with these systems and the above-mentioned requirements. In January 2003, it was launched and had an expected life span of two years. Its functions, which support the community members' processes, can be divided into the following areas:

- **General Information:** This tab contains documents on project plans, a list of publications, and important links.
- **Team Information:** Two documents provide the contact information of core team members, participants, and steering-committee members, as well as photos of the core team members.
- **Workshops:** This tab includes documents pertaining to planned and conducted workshops (information on location, agenda, workshop presentations, and photos of conducted workshops).
- **Research Topics:** Included under this tab are several academic papers and presentations dealing with research topics that are relevant to the participants and steering-committee members.
- **Project Rooms:** Each of the participating companies has its own collaborative work space that can be accessed via this tab. A work space includes support for the exchange and collaborative creation of documents, as well as discussion forums.
- **Steering Committee:** This tab contains documents about planned and conducted steering-committee meetings (information on location, agenda, presentations, and photos of conducted steering-committee meetings).
- **Archive:** Integrated under this tab are workshop documents and the documentation of previous competence centers' specific research topics.
- **Chat:** By clicking on this button, each CKP-Net user can activate an integrated Lotus Sametime client application for awareness and instant messaging (AIM). This client application also provides opportunities for audio and video meetings, as well as application sharing.
- **Support Functions:** Further support functions include integrated help, a feedback function, and search and news functions.

Summary of Results

Figure 7 summarizes the previous sections' results, as well as the activity analysis' results (rows labeled "Process-Supporting Functions & Use of Functions by Community Members"). The first column in this row contains the process-sup-

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porting functions and functional areas described in the previous section. The second column ("Page Views") indicates how often a document related to the specific function was viewed. For example, the figure 6,822 in the first row indicates that documents related to information about modules and meetings (e.g., timetables, statistics on own credits, course presentations) were accessed 6,822 times by the community members. The third column shows the percentage of page views in relation to the total number of page views (42,745).

Comparison of the Research Sites

To compare the research sites, we can use Figallo's (1998) classification criteria for communities, which is based on community members' behavior (e.g., degree of personal interactivity, subject scope, cohesion of members), complemented with the research model's criteria, except for usability and satisfaction (because these were not measured but approximated by means of activity measurement).

- **Degree of personal interactivity:** Both communities have a high degree of face-to-face interactivity during personal meetings (courses and workshops). Interaction by means of the community systems is therefore only moderate and confined to the absolutely necessary.
- **Subject scope:** The subject scope in both communities is relatively narrow as both of them deal with a specific subject area. In the BEC's case, this is business engineering, while in CKP-Net's case, this is CRM and KM.
- **Cohesion of members:** In respect to both research sites, the cohesion of members is sustained by a semiformal organization: in the BEC's case, the course organization, and in the CKP-Net's case, the organization of the competence center.
- **General cultural Context:** Both communities are interorganizational and therefore have members from organizations with different cultural contexts and affinities for technology. In the BEC's case, the members' cultural context is highly heterogeneous, whereas in CKP-Net's case, the cultural context is more homogeneous because members come from the same industry and business departments.
- **Work and relationship-development processes:** The two communities' work processes reveal similar characteristics. There are processes for the preparation and wrap-up of person-to-person meetings (courses and workshops), and collaborative processes to create documents or project outcomes (teamwork and project collaboration). Moreover, both communities demonstrate the need for relationship development. However, the MBE community has a greater need for the support of communication processes (discussions) than CC CKP.
- **Technology/media choice:** Both communities employ similar technology for their community systems.
- **Experience and training:** Because community members have no previous experience with the chosen technology, both communities offer their members a short explanation of the system functions in an introductory person-to-person meeting as well as online help within the systems. The systems' functions also have to be widely self-explanatory to avoid the need for extensive training.

In conclusion, both communities show very similar characteristics. This strengthens the generalizability of our findings.

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Figure 7. Summary of results

		BEC			CKP-Net		
Community	**Objective**	Qualify professionals for all aspects of business transformation			Interorganizational knowledge development in the areas of CRM and KM		
	Members	• Current participants of the MBE HSG (ca 90) • Alumni of the MBE HSG (ca 270)			• Steering committee (ca 7) • Participating companies' employees (ca 50) • Core team members (ca 7)		
	General Cultural Context Regarding Technology Use	Professionals from all disciplines and industries with different backgrounds and technology affinity			Financial industry professionals from marketing, sales, service, and IT departments with different backgrounds and technology affinity		
	Work Processes and Relationship Development	*Participants and alumni:* • Access course information • Communicate • Work together • Search for/edit profiles • Exchange information/documents • Organize events/meetings *Participants:* • Access credits • Prepare thesis • Give feedback			*Participants and steering committee:* • Project collaboration • Workshop preparation • Workshop document retrieval • Document search • Communication *Steering committee:* • Steering-committee meeting document retrieval		
Community System	**Goal of the Community System**	Support work processes and relationship development among current participants and among alumni			Support work processes and relationship development among core team members and participants		
	Technology	Integrated solution using Lotus Notes/Domino, Lotus Team Workplace, Lotus Sametime			Integrated solution using Lotus Team Workplace and Lotus Sametime		
	Process-Supporting Functions & Use of Functions by Community Members (activity) [February to May 2003]		**Page Views**	**%**		**Page Views**	**%**
		Course Support					
		Information about modules and meetings	6,822	15.96	General information	36	3.62
		Feedback on modules	1,453	3.40	Member profiles	154	15.48
		Feedback on meetings	150	0.35	Workshop information	620	62.31
		View credits	22	0.05	Research documents	63	6.33
		Thesis topic bourse	4,231	9.90	Project collaboration rooms	40	4.02
		Finished thesis topics	4,726	11.06	Steering committee	36	3.62
		Teamwork			Archive	46	4.62
		Teamwork area	5,968	13.96	Chat	0	0.00
		Communication			Support functions	0	0.00
		Chat	436	1.02			
		General discussion	1,784	4.17			
		Course discussion	5,909	13.82			
		Member Profiles					
		Member profiles	7,022	16.43			
		Content Administration					
		Content	1,317	3.08			
		Browse	2,905	6.80			
		Σ	**42,745**	**100**	**Σ**	**995**	**100**
	Experience	Most members had no experiences with the community system or its technology before using the system.			Most members had no experiences with the community system or its technology before using the system.		
	Training	• Short explanation of functions during introductory phase of the program • Functions are widely self-explanatory • Online user help			• Short explanation of community system's functions during workshops (30 minutes) • Functions are widely self-explanatory • Online user help		

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DISCUSSION

In this section, we present the results of the action research process's reflection (learning) phase (Figure 3). We discuss the results of the previous section in order to deduce propositions for an improved design of community systems that support professional communities.

The functional areas of both community systems were designed in accordance with the community members' work and relationship-development processes. However, there are significant differences regarding the community members' activity in respect to the use of the functions. In the following sections, we discuss the implications for the support of work processes and relationship development.

Support of Work Processes

It is apparent that the most frequently visited functional area in CKP-Net was "Workshop Information," and in the BEC's case, this was "Course Support." In contrast, the least visited area in the BEC was "Content Administration," and "Support Functions" and "Chat" in CKP-Net. Generally, we observe that functions related to face-to-face meetings — the preparation for or wrap-up of meetings — such as "Course Support," "Teamwork," and "Workshop Information" are used far more than other functions. This cannot be attributed to a difference in experience or training because these are roughly the same for the different functional areas. Our conclusion is that in these professional communities, interaction by means of face-to-face meetings plays a primary role, whereas interaction by means of the community systems plays a secondary role. These systems are therefore only regarded as supportive tools for face-to-face meetings and not as a primary means of communication as they are in virtual communities.

Moreover, we can see that functions that are directly connected to work processes, for example, information about modules and meetings and "Course Discussion" in the BEC, or "Workshop Information" in CKP-Net, are used much more frequently than general functions like "Archive," "Chat," or "General Information" in CKP-Net.

The functions of community systems supporting professional communities should therefore be designed so that they first support the community members' face-to-face meetings, and second, so that they are directly related to a specific work process. Community members need to know how they can directly benefit from a specific function in their work processes. If a function is not explicitly assigned to a work process, community members do not realize its usefulness.

Support of Relationship Development

An interesting observation was that in both community systems, the "Member Profiles" area was the second most frequently accessed area. Most of the community members meet on a regular basis, either in workshops or in courses, and can therefore engage in relationship building during these events. While research has confirmed that face-to-face communication offers a better means for relationship building than CMC (Chidambaram, 1996), the "Member Profiles" areas are nevertheless extensively used. Relationship-development support therefore seems to be an integral functional part of community systems supporting professional communities.

In respect to the BEC, the "Member Profiles" activity can be partly explained by the fact that the majority of the community members are alumni who do not participate in courses, but are only interested in relation-

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ship development and maintenance. Moreover, participants in different courses — who do not regularly meet one another — may use the system to retrieve additional information about people whom they have met.

In CKP-Net, the "Member Profiles" area seems to complement regular face-to-face communication in workshops very well. Members may use it to retrieve additional information about people whom they have met in workshops, or to retrieve contact details so that they can make telephone contact.

On the other hand, functions that can potentially be used for relationship-development processes, such as discussion forums or chat, are not used very much. This leads us to the conclusion that the "Member Profiles" area is essentially being used by community members to obtain detailed personal information on other community members, for example, information on their companies, job descriptions, and work areas, to extend their knowledge on fellow community members in order to facilitate (or enable) non-computer-based communication.

Besides the functions that support work processes related to face-to-face meetings and relationship development, the others are seldom used. This is particularly true of most synchronous and asynchronous communication functions; for example, the "Chat" function in CKP-Net was never used and the project rooms were rarely used. In the BEC, "Chat" and "General Discussion," too, were rarely used, while "Teamwork Area" and "Course Discussion" were by contrast used quite frequently, mainly for the exchange of documents and the discussion of topics related to courses.

This supports our hypothesis that the primary means of communication between community members is face-to-face meetings. The community systems are only used for interaction among community members if the functions offer support for face-to-face meetings as in the case of "Teamwork Area" and "Course Discussion." Moreover, communication functions are not used for relationship development, but for the support of work processes. Therefore, communication functions that do not directly support work processes, like, for example, the "Chat" functions, are obviously dispensable.

CONCLUSION AND OUTLOOK

Our goal was to analyze which design factors of community systems influence community activity, and how community systems supporting professional communities should therefore be designed. Based on the findings of a study of two real-world professional communities — a learning network and an expert network — we drew a few conclusions (Figure 8) that are valid for the communities analyzed. These conclusions may help in the design of community systems for professional communities. However, a study with a statistically relevant sample must be performed before our conclusions can be assumed as generally valid for all professional communities.

In communities that employ a mix of communication modes of CMC, telephone, and face-to-face communication, the competition between the different media has to be considered in supporting community systems' design in addition to other factors relevant to the design of community systems (Figure 8). Our study shows that face-to-face communication is the primary mode of communication; community systems only have a supporting function. This leads us to deduce some design guidelines for systems supporting such communities.

Generally, community systems have to support professional communities' work

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Figure 8. Design guidelines for community-supporting systems in professional communities

		Important Functions	Unimportant Functions
Process support	**Relationship Development**	Functions that enable or facilitate face-to-face meetings, for example: • Member profiles to retrieve further information on the company, job description, work areas, contact details, and so forth, of community members	Functions for general computer-mediated communication, for example: • Chat and • General discussion
	Work Processes	Functions that: • Support face-to-face meetings (preparation, wrap-up) and • Are directly assigned to work processes	Functions that: • Do not support face-to-face meetings or • Are not directly assigned to work processes (such as general computer-mediated communication)

processes and relationship-development processes. Important functions for work-process support are functions that support face-to-face meetings (for the preparation for and wrap-up of meetings) and that explicitly support specific work processes. In contrast, functions that do not support face-to-face meetings or are not explicitly assigned to work processes are dispensable and should not be implemented. Important functions for relationship development are functions that enable or facilitate face-to-face meetings, for example, member profiles that enable members to retrieve further information on other community members' companies, job descriptions, work areas, contact details, and so forth. On the other hand, functions for general computer-mediated communication, for example, chat or general discussion areas, are dispensable.

Critically reviewing our work, it was possible to draw conclusions for improved community-supporting systems design, but further empirical research, for example, by carrying out qualitative interviews with community members, is necessary to interpret our findings and to learn what motivates the community members' virtual activity.

One important question remaining to be answered is what influence the design of the functions in a community system has on a professional community's overall performance. To answer this question, we have to analyze and combine measurement results from different performance levels (activities, output, and value; see Figure 2). Currently, we are working on metrics to measure performance in terms of output and value in the analyzed communities. Our research objective is to show the link between the technology application and business results of a professional community.

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Malte Geib has been a researcher and PhD student at the Institute of Information Management, University of St. Gallen, Switzerland since 2001. His research focuses on customer relationship management and customer knowledge transfer in networked enterprises, especially in the financial services industry. He is currently (2005) a visiting researcher at the Center for Digital Strategies, Tuck School of Business at Dartmouth College, USA. He earned a master's of science in information systems from the University of Muenster, Germany, and has studied at the Queensland University of Technology, Australia. He has worked as a software engineer for IBM Germany and as a consultant for several Swiss and German companies, including Deutsche Telekom AG, Credit Suisse, and PostFinance.

Christian Braun has been a researcher and PhD student at the Institute of Information Management, University of St. Gallen, Switzerland since 2002. His research interests are method engineering, reference modeling, outsourcing, and object-oriented software development, as well as the design of information systems, especially in the financial services industry. From 1997 to 2002, he studied computer science and business administration at the University of Munich, Germany. He received a diploma in computer science in 2002. He is currently jointly responsible for the execution of an executive MBA program at the University of St. Gallen.

Lutz Kolbe has headed the Competence Center Customer Knowledge Performance (CC CKP) and taught at AACSB-accredited University of St. Gallen, Switzerland since July 2002. His research interests are customer relationship management, security management, and advanced technologies in the residential environment. After having worked as a financial consultant, he studied information management at Brunswick Technical University, Germany, where he received his master's. He continued working on his dissertation at Freiberg Technical University, Germany, and the University of Rhode Island, USA and received his PhD in 1997. After that he worked at Deutsche Bank in Frankfurt and New York where he became managing director in 2001.

Prof. Dr. oec. Walter Brenner is professor of information systems at the University of St. Gallen and managing director of the Institute of Information Management. After earning his graduate and doctorate degrees and his venia legendi from the University of St. Gallen, he worked several years for the Alusuisse-Lonza AG based in Basel, Switzerland as the head of application development, among other positions. From 1993 until 1999 he was professor for business administration and information management at the TU Bergakademie Freiberg, Germany and subsequently professor for information management and business administration at the University of Essen, Germany. His research focus is on integrated information management, customer relationship management, and innovative technologies.

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