Toward a Community-Oriented Design of Internet Platforms

Katarina Stanoevska-Slabeva

ABSTRACT: Building user communities can contribute significantly to the success of an on-line platform. The literature on establishing on-line communities and on extending existing platforms with functionalities that enable community building emphasizes the social and economic aspects of community building and neglects the technical aspects. On-line communities have two elements: community members and platform. The platform provides a virtual social meeting space and shapes communication with the service it provides. In order to determine what kind of services will enable, stimulate, and foster community building, this paper identifies community modules and proposes a typology of on-line communities and their community-supporting platforms.

KEY WORDS AND PHRASES: Community-supporting platforms, on-line community, typology of on-line communities.

The social aspect is a major factor in the success of the Internet and other new media based on information and communication technology (ICT). These media enable ubiquitous meeting spaces that satisfy the basic human need for communication. As a result, new on-line communication paradigms can be observed. One of these is the on-line community, characterized by strong social relationships between participants, community-specific organizational structure and modes of discourse, a common vocabulary, persistence of common meaning, a shared history, community rituals, continuity of communication, and a common on-line meeting space [4]. Taken together, these elements provide an identity for the community, enable long-lasting relationships between members, and foster strong commitment to community goals, thereby making a significant contribution to the success of commercial digital platforms, such as e-commerce, on-line learning platforms, and knowledge-sharing systems [3, 12, 20, 21].

The growing importance of on-line communities raises the need for targeted organization, initiation, and stimulation of on-line communities and for guidelines on how to establish and manage successful communities. The prevailing guidelines in the literature pertain to the economic, social, and managerial aspects of community development [3, 7, 21], and neglect the technical aspects [15, 40]. This paper argues that information technology in the form of a community-supporting platform is an equally critical success factor for community building. The major prerequisite for community building is the possibility for potential participants to communicate with one other in a community-specific way. A successful platform, therefore, is one that provides such services to the community as enable rich and appropriate communication and social interaction [40].

The first on-line communities arose around simple communication software, such as on-line chats, bulletin boards, and newsgroups. Today, software for the support of on-line communities is available in various forms and lev-

International Journal of Electronic Commerce / Spring 2002, Vol. 6, No. 3, pp. 71–95.

1086-4415/2002 $9.50 + 0.00.

els of complexity—for example, as separate communication tools or as complex software integrating different kinds of communication and content management (for detailed descriptions, see [18, 39]). On what basis should one choose among technologies? What mix of technologies is best for a specific community? Given the importance of communities for existing e-commerce and knowledge-management platforms, how can support for community building be incorporated in platforms already available?

This paper provides the first step toward answering these questions by identifying the functionalities necessary for community support and by proposing a typology of on-line communities and their platforms. The specific requirements for platforms will be deduced by applying the generic media-reference model developed by Schmid [14].

Theoretical Background and Research Approach

Despite the increasing body of literature on the subject, there is still no generally accepted definition of on-line communities (for an overview of the definitions that have been proffered, see [10, 23]). In order to avoid misunderstandings in the discussion that follows, the presentation here will begin with a definition of on-line communities and then will describe the role of the platform in community building.

Definition of On-line Community

For the purposes of this paper, on-line communities are defined through their features as associations of participants who share a common language, world, values, and interests, obey a commonly defined organizational structure, and communicate and cooperate ubiquitously connected by electronic media and possibly represented by avatars [35]. In accordance with this definition, on-line communities exist at the intersection of complex technical and social systems. "Neither technology nor sociality can supplant the need for the other, and the two are conceptually inseparable" [21]. Therefore, on-line communities have two interrelated constitutional elements: the association of community participants, and the enabling digital platform [34].

There is a division of tasks between the two constitutional elements of an on-line community. The members of the community communicate through the electronic platform and thereby generate common content and meaning, a shared history, social relationships, and emotions. Furthermore, they obey a clearly defined organizational structure consisting of possible roles and processes as well as rules for communication and participation [13, 15, 23, 31, 36]. The organizational form can vary from very simple regulation of membership, through a tightly defined hierarchy, all the way to a complex society (the Cybercity community is an example of the latter [www.cybercity.com]). All of these features delimit and distinguish each community from others and define its identity.

The second constitutional component of on-line communities is the enabling power of the electronic medium—in other words, the community-supporting

digital platform. It provides communication services, such as chats or other on-line discussion forums, that allow interaction among participants without barriers of time and space. It performs the task of saving and providing content by administering the community's memory. Its computational capability enables it to take over intelligent tasks, such as searching, bundling, and organizing content, as well as coordinating communication (e.g., the coordination of on-line auctions). Based on rule-enforcing algorithms, the digital platform can do what is needed to foster the community's organizational rules [37]. For example, it can control access to content and communication services according to defined rules, or it can enforce rules against spam by filtering messages containing certain words [6, 37].

In summary, the platform provides both a virtual social space where the community meets and the community's memory. Moreover, it shapes the communications between community members [40]. The available platform services delimit the scope and form of possible interactions and have a significant impact on community building. This can be illustrated with the LetsBuyIt.com community of buyers. LetsBuyIt.com offers buyers the possibility of getting specific products more cheaply by forming buying communities consisting of a defined minimum number of participants. The participants can join a group of users interested in buying one of the offered products. The members of the group are anonymous to one other, and each user knows only the total number of participants who have subscribed to the group. Members of groups cannot comment about why they decided to sign up for a product. Users who might be interested in joining a group but are undecided have no way to contact members who have already joined the group to ask for their advice. Thus, the platform enables the building of groups of anonymous participants with similar interests, but it does not allow direct communication between community members.

The example of LetsBuyIt.com shows that on-line communication is shaped and delimited by the available communication services. The on-line communication technologies available on the market shape the communities enabled by them in similar ways. For instance a chat allows a different form of communication and related organizational structure than a Bulletin Board System (BBS). Preece uses the metaphor of houses to explain these interrelationships: "How software is designed affects community development just as the architecture of a house affects those who live in it" [23]. This is particularly true because on-line communication cannot be augmented by the full range of verbal and nonverbal cues that are part of face-to face communication.

The interdependence of the two constitutional components of on-line communities implies that an appropriate supporting platform for an on-line community must enable the necessary communication and coordination forms and offer the storage facilities required by the community.

Research Approach and Design

The aim of this paper is to provide cumulative knowledge (i.e., guidelines) for community-oriented design and enhancement of different kinds of Internet platforms. In order to achieve this, a descriptive and interpretative research

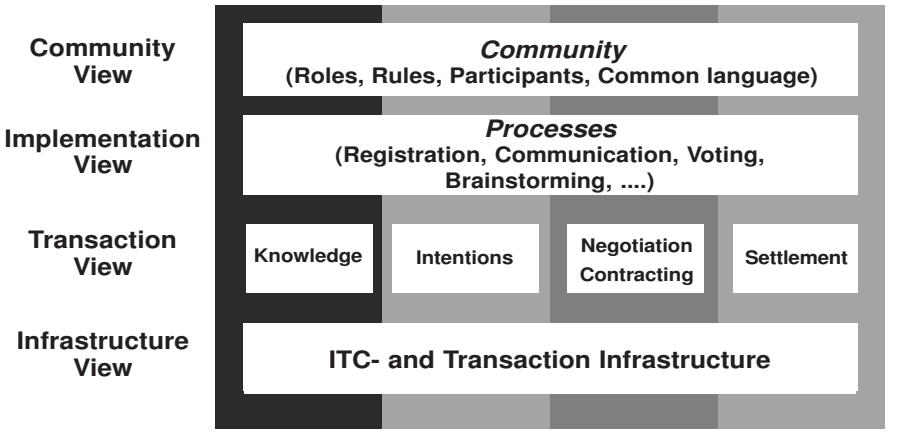

Figure 1. Media Reference Model (MRM)

approach was adopted [4]. In line with this approach, descriptions and case studies of on-line communities in the literature were analyzed, and published findings concerning the functionality of community platforms were summarized. In addition, findings were verified and extended by the author's participation in various on-line communities.

The media reference model (MRM) developed by Schmid was used to structure the necessary functionalities for community-oriented design [31]. As can be seen in Figure 1, the MRM puts communities explicitly in the center of online platform design by providing an abstraction of required services for community support [1, 34].

In its original form Schmid's MRM was designed to structure the functionality and services of e-commerce platforms [18, 19, 31]. However, it has also proven suitable for structuring other kinds of Internet platforms, such as knowledge-management and e-learning platforms [6, 32]. As many on-line communities arise around existing Internet platforms, the MRM is suitable for a simultaneous analysis and structuring of existing platform-specific and possibly community-enabling functionalities.

The MRM shown in Figure 1 distinguishes four layers or views—community, implementation, transaction, and infrastructure—that refer to different aspects of community support [31]. The transaction view comprises four basic communication and coordination services. The views and basic services will be briefly described below as they provide the foundation for the structuring of the functionalities that platforms need for community building.

The *community view* refers to the delimiting and identity-shaping features of a community and to static elements of its organizational structure that can be built into the platform in order to provide as much community-specific support as possible. In particular these are: possible roles in the community, valid rules for communication and access, description of community participants, and the community-specific language (for a model of these features in the Unified Modeling Language (UML), see [5]). These features will be described below in detail and matched to software modules and tools suitable for supporting them.

- *Roles in the community*. Each role is an abstraction of a class of community participants (e.g., moderator, contributor, visitor) and is described in terms of rights and obligations as well as required capabilities as a prerequisite for role performance. When the rules of "legal" actions for a role are implemented on the platform, the platform can support their enforcement.
- *Valid rules for communication*, that is, policies and community governance, which include Netiquette and the rules defined by the community and community organizers [23]. In most communities, rules are published in the form of descriptive text explaining the requirements for joining the community, the style of communication between participants, accepted conduct, and repercussions for nonconformance (for a detailed list of different rules, see [23]). Some of the rules (e.g., filtering of expletives) can be implemented and enforced in the platform. The establishment and enforcement of rules is a basic prerequisite for establishing trust within the community [12, 23].
- *A description of community participants* in terms of personal characteristics (e.g., demographic features, capabilities, needs, desires, beliefs, intentions, and preferences, assumed roles in the community) [12]. The recording and, in particular, visualization of participants' features should help them to build and present an identity in the community [3]. Information about participants is a basic prerequisite for promoting ongoing interaction. Participants must be able to recognize one another and to meet again [14]. In addition they must be able to obtain information about what other members did in the past. In existing communities, tools for participants or user management (e.g., yellow pages, participant databases) are typically used to describe features of community members and to manage links to their contributions to the community.
- *The common language*, as a delimiting feature of the community and foundation for common meaning. The common language can be built into the platform in the form of an ontology, taxonomy, or vocabulary. For example, in a health community an explanatory list of possible treatments for diseases provides a simple model of the domain of discourse and fosters mutual understanding. In transaction communities, this task is performed by electronic product catalogs and product information. Some communities have their own slang consisting of so-called emoticons or their own abbreviations [23]. A list of the applied emoticons and abbreviations will facilitate understanding of the messages exchanged.

The elements of the community view define the static aspects of the community's organizational structure and enable mapping of its delimiting elements onto the platform. In the *implementation view*, the dynamic aspects of the community's organizational structure (i.e., community processes) are identified and defined. The community processes are sequences of activities nec-

essary to achieve defined goals and can also be built into the platform [38]. Examples of community processes include the registration process, the process of participation in discussions and events, and the process of gaming in virtual worlds.

The *transaction view* summarizes the fundamental communication and coordination services offered by a platform to support the community's activities [31]. These are (1) knowledge services supporting sharing of information and knowledge as a prerequisite for communication, (2) intention services supporting signaling of intentions as a prerequisite for cooperation, (3) negotiation and contracting services supporting negotiation of mutual obligations as part of coordination, and (4) services for the settlement of obligations (i.e., performance of tasks). The basic communication and coordination services are described below in more detail.

- *Knowledge Services* enable management and use of the knowledge (i.e., content) available through the platform. Two types of knowledge can be distinguished in on-line communities [33]: knowledge created by the community members, and knowledge about the community. The first type of knowledge is usually made available by content- or knowledge-management modules (e.g., search engines, information catalogs, classification tools, document-management tools) that enable the establishment of a common memory and a shared history. Knowledge about the community is created through information provided by the participants, and by user-tracking and data-mining tools. Knowledge about community participants is used by personalization tools to provide personalized service to users.
- *Intention Services* support participants in articulating their intentions and needs, which is the first step toward mutual coordination and cooperation as well as negotiation of tasks necessary for achieving a common goal. Examples of intentions are requests for communication with other community participants, questions addressed to community members, requests for help or for discussion of specific topics. In addition, intention services enable announcements of specific community events and activities. Broad possibilities to articulate intentions and requests foster community building as they are often a starting point for the interaction process.
- *Negotiation and contracting services* support the negotiation of tasks or obligations that may be recorded as contracts. The tools required in this phase offer support for collecting different opinions, managing the negotiation process, engaging in negotiations of different kinds (e.g., auctions, bargaining, calendar matching), and on-line voting, as well as on-line surveys and analysis. If the negotiation is successful, this phase will end with a "contract"—a set of binding obligations among community members.
- *Settlement services* enable participants to perform tasks and activities as part of their obligations and roles in the community. In transac-

	Knowledge	Intention	Negotiation and contracting	Settlement
Chat	X		X	
BBS		X	X	
NewsGroup				(X)
.....				

Figure 2. Matrix of Available and Chosen Technology

tional communities, for example, this means the shipment of goods supported by logistic technology and payment enabled by electronic payment systems. Other examples are communication activities, the preparation and performance of agreed-upon special events in discussion communities, and participation in surveys, online votes, and brainstorming. The actions in this phase are performed according to the defined community rules.

The identified features and services in the first three views of the MRM define the requirements for the specific community-supporting platform. In the *infrastructure view* they are matched to the available software for community support, including basic technologies and integrating middleware. Among the basic technologies for this purpose are chats, BBS, and videoconferencing systems. For example, BBS is suitable for providing intention services, and chats/videoconferences for discussions of articulated intentions. Chats and videoconferences are also suitable for discussing available content and for creating new content. The choice of the available technology results in a matrix like the one presented in Figure 2.

In summary, according to the Media Reference Model, the following aspects of communities have to be built into the platform: the static and dynamic components of the community's organizational structure and the basic communication and coordination services enabling mutual communication and cooperation.

Typology of On-line Communities

Although there is an increasing amount of research about on-line communities, there is still no standard and widely accepted community typology. Lazar and Preece present a summary of the available classifications [17]. The proposed classifications apply different categorization criteria (e.g., the on-line community's degree of connection with physical communities) and reflect the specific point of view and research discipline of the researcher.

The aim of a typology is to abstract from the appearance of a phenomenon into types based on their similarities [2]. The identified types provide a foundation for developing design guidelines that apply to all representatives of a specific type. The aim of this paper is to provide guidelines for community-

oriented designs of different kinds of Internet platforms. This implies a classification based on the similarities in the requirements community members make of the platform. The requirements on the platform result from the needs of community members that are satisfied when they take part in the community. Based on the existing typologies for on-line communities, and with due consideration for the participant needs as classification criteria, the following types of communities can be identified:

- Discussion or conversation communities, satisfying the need for communication [39].
- Task- and goal-oriented communities, satisfying the need for cooperative achievements of goals.
- Virtual worlds, satisfying the need for fantasy and playing.
- Hybrid communities integrating several of the types mentioned above.

Discussion Communities

Discussion communities are dedicated to the exchange of information with reference to a defined topic. The following subtypes of discussion communities can be identified:

- *Relationship communities* [7] are targeted at the establishment of social relationships between members and are dedicated to passionate personal topics, such as death and illness (e.g., www.thewell .com). These types of discussion communities are also called social and help alliances [36]. Relationship communities are usually targeted at groups that are clearly delimited demographically or geographically. For example, the SeniorNet (www.seniornet.com) is dedicated to topics and relationship-building among seniors, NetNoir—The Black Network (www.netnoir.com) is targeted at people of African descent, and iVillage—The Woman's Network (www.ivillage.com) is designed to appeal to the issues, interests, and concerns of women.
- *Interest communities* emerge around a defined topic and attract participants interested in it. For example, www.ancient-sites.com is dedicated to the topic of ancient cities, de.alt.fan.fastfood is a German-speaking community dedicated to fast food, www.drkoop. com is one of the most popular health communities, Cycosmos (www.cycosmos.com) is one of the biggest trend and lifestyle communities. Similarly, there are sports communities (e.g., www.soccer.com), ecological communities, and communities dedicated to domestic animals.
- *Communities of practice* are a specific kind of discussion community that is focused on a domain of knowledge. Wenger defines them as "a group of people who share an interest in a domain of human endeavor and engage in a process of collective learning that creates

bonds between them: a tribe, a garage band, a group of engineers working on similar problems" [40]. Communities of practice build a common stock of knowledge, accumulate expertise in their domain, and develop their shared practice by interacting around problems, solutions, and insights. Two types of communities of practice can be distinguished: (1) communities of practice that emerge in organizations around certain topics and know-how across departmental barriers [9, 39], and (2) communities of practice arising around professional associations or among persons pursuing the same profession [1] (e.g., the on-line community of the German construction industry, www.BauNetz.de, or www.agriculture.net, the community of agriculturalists, which provides information and discussion forums on topics relevant for professions in agriculture).

- *Implicit discussion communities* are a special category of discussion communities that are also known as recommendation and reputation communities [25, 26, 30]. They aim at the exchange of knowledge and experience with respect to a specific product or service. The exchange of information is performed among members indirectly by asynchronous writing and reading. Examples of such discussion communities are the Amazon.com and eBay review communities, where reviews for books or traders are posted on the platform and can be read by other participants without direct communication between reviewers and readers. The reviews provide an implicit community feeling. Another example of an indirect community with the same implicit community effect is the recommendation system of Amazon.com based on collaborative filtering, which is, in effect, an attempt to automate word of mouth. Besides being part of transaction platforms like Amazon.com and eBay, recommendation and reputation communities can also be observed as a separate business model for independent platforms (e.g., www.epinion.com, www.dooyoo.com, www.ciao.com).

Task- and Goal-Oriented Communities

In task- and goal-oriented communities the aim is to achieve a common goal through cooperative efforts. Communication between participants during all stages of task achievement results in social relationships and community building. There are several subtypes of task- and goal-oriented communities.

- *Transaction communities* emphasize market transactions and arise around electronic commerce platforms. The best-known example is the eBay community, which comes together to auction and trade private goods. All customer communities that emerge around the e-commerce platforms of different suppliers fall into this category. Customer communities can have different forms and targets, such as support communities (e.g., the support community of Dell [www.dell.com]) and product-discussion communities.

- *Design communities* are aimed at cooperative design of defined products and goods. Well-known examples are the open-source communities (e.g., the Linux community [13, 36], www.linux.org, and the open-source community for development of the Apache Internet server, www.apache.org). Another example is the open directory project (www.dmoz.org), a community dedicated to the creation of a comprehensive index of Web resources. Design communities are also increasingly supported by companies that offer their customers the opportunity to participate in designing future products.

- *On-line learning communities* emerge between teachers and students, as well as among students of on-line education platforms [22, 32]. Learning communities usually emerge around on-line learning platforms offered by universities and other schools. An interesting example of an independent on-line learning community is the German Learnetix community (www.Learnetix.com) organized by the publisher Cornelsen.

Virtual Worlds

Virtual worlds provide virtual settings of complex fantasy worlds or even virtual societies [23, 28]. Examples are the MUDs (multiuser dungeons) and MOOs (object-oriented multiuser dungeons) platforms like www.ultimaonline.com [23] or the virtual city www.cybercity.com. MUDs and MOOs are usually a hybrid between an adventure game and a chat [28]. Currently prevailing versions of MUDs are usually three-dimensional (3-D) virtual worlds where players can assume and create a fantasy character represented by an avatar. Disguised as this character, the player moves through rooms and passages slaying dragons, purchasing goods, and engaging in adventures.

Hybrid Communities

Besides communities dedicated to a specific need, there is a growing number of complex community platforms combining several communication technologies and consisting of different kinds of on-line communities like the ones mentioned above.

An example of a hybrid community would be an on-line store with a 3-D interface simulating a physical store and artificial agents acting as interactive virtual sales clerks. Users can assume the role of window shopper, buyer, or participant in organized games or product-design teams. They can obtain information about products in the electronic catalog, in chats or product forums, and by browsing through the recommendation collection and available customer comments. Users can also visit the chat cafe or some other amusement opportunity. They can choose and order products and pay for them on-line or through a monthly bill. Users may be given the opportunity to provide a shopping list of products they would like to buy in the near future and get recommendations for other interesting products based on collaborative filter-

ing in reply. Such a world presents a mix of discussions, transactions, and virtual world communities related to a common topic. One example of a hybrid community is Cycosmos (www.cycosmos.com), which offers, in addition to discussion forums, a rich entertainment world accessible through avatars. Participants can select and personalize an avatar and can communicate and entertain themselves by choosing from the various communication and entertainment offerings. In addition they can buy products. Other commercial sites that have many elements of hybrid communities are the communities for kids offered by Lego (www.lego.com) and by Mattel for its "Barbie" product (www.Barbie.com).

Summary of the Different Types of On-line Communities

The on-line communities described above differ in their goals and in the functionality they require. While discussion communities usually emerge around familiar communication software (e.g., chats, bulletin boards, videoconferences), task- and goal-oriented communities emerge around existing Internet platforms that primarily have other purposes (e.g., e-commerce, e-learning) and can exist without community-building elements. Therefore, discussion communities carry a communicative, social aspect, while for task- and goal-oriented communities the software modules enabling sociability must be integrated into already existing platforms designed for other purposes.

The above typology does not imply clear-cut distinctions between the different types of communities. In fact, an increasing number of communities are developing complex meeting spaces consisting of several types of on-line communities. In such a hybrid community, the basic challenge is to integrate the different community types smoothly and in an attractive manner.

Typology of Functionalities for Community Support

An overview of community-specific functionalities for the different kinds of communities will now be provided. For each type of community, the static and dynamic aspects of the organizational structure as well as the basic services for communication and coordination proposed by the media reference model will be identified and defined.

Functionality of Community-Supporting Platforms for Discussion Communities

A common feature of all discussion communities is the emphasis on communication as well as content generation and exchange related to a clearly defined topic. Participants communicate with one another and contribute to the body of community knowledge and to the use thereof. Depending on the type of discussion community, the emphasis of the platform design can be on communication services or on integrated support for communication and knowledge management. While relation and interest communities emphasize communication design, knowledge and content management is of equal im-

portance for communities of practice and recommendation communities. Nonetheless, all discussion communities have certain features in common, as will be described below.

Organizational Structure

Discussion communities usually have a simple organizational structure with an emphasis on rules for participation and communication. The following *roles* can generally be identified: visitor, novice, regular member [12]. These roles have different rights and obligations and are treated differently on the platform [12]. For example, a visitor can usually access part of the available content and observe ongoing activities for a certain period of time, but is not allowed to participate in the discussions. In many discussion communities, experienced members can advance to leaders and moderators. Leaders and moderators are usually proposed by the community's organizers and approved by the participants (e.g., the selection process for editors in Epinion.com) [25]. They usually have more rights than regular users and are empowered to perform managerial tasks, such as starting and guiding discussions, checking the input provided by regular members, and even punishing regular members who do not obey the community's rules. They may also serve as official editors and moderators. In communities of practice that emerge within organizations, experts or experienced members may perform the special role of mentor [39]. A mentor looks after new employees and new members of the community.

The different roles have to be visible on the platform. For example, colors can be used to mark participants with different roles. In addition, the platform should be able to manage participation with different roles by allowing the roles access to content and communication services according to their defined rights and by supporting the processes of role expiration and role change.

Another important aspect of the organizational structure of on-line communities is the permission for both short-term and long-lasting subcommunities interested in a certain aspect of the domain of discourse as well as of special spaces for private communication [12, 23].

In addition to specific roles, discussion communities usually have clearly defined *rules* governing access to the different community spaces and setting the conditions under which communication takes place and common content can be used and created [12, 13, 15, 23]. For example, in relationship and interest communities, the rules may forbid advertisements, and the platform can enforce this rule by filtering information [37]. In communities of practice, important rules govern knowledge creation in order to ensure the quality of available knowledge and expertise [39].

In all discussion communities *participant management* is a critical success factor, even though there are different requirements in the different types of discussion communities. In relationship communities participants often want to remain anonymous and communicate disguised by nicknames or avatars [2] (e.g., the avatars in cycosmos.com). In interest communities, communities of practice, and recommendation communities, the identity and description of the expertise of the community members is of importance [40]. Participant

management should support the recording of roles taken over by users and links to their community contributions.

Another important delimiting element of discussion communities is the *common language* used by the community. In order to enable fast learning of the special language, it should be clearly defined and its meaning explained (e.g., the rating marks in the recommendation communities epinion.com, ciao.com, or in eBay [27]).

The common *processes* in discussion communities are registration, promotion from one role to another, communication, invitation to and performance of private conversation, and organizing and participating in special events [12, 23, 28]. In addition to these general processes, special processes related to collaborative knowledge creation (e.g., brainstorming, application sharing) are necessary and critical for the success of communities of practice [40].

Basic Communication and Coordination Services

As discussions and creation of content by community members are the main goal of discussion communities, content and knowledge should be well structured and easy to find and sort. Content storage should be long-lasting so that new participants can take advantage of already existing content and lengthy discussions can be easily referred to. For "simple" discussion communities requiring only a common space for conversation, chats and BBS provide sufficient support for content management. Communities of practice require more sophisticated document management and search tools as well as taxonomies representing special phrases. In addition, they require sophisticated management of different types of knowledge (e.g., stories, manuals, case studies of applied problem solutions, lessons learned, descriptions of best and worst practices [40]) as well as a distinction between approved community knowledge and fluid knowledge under discussion and creation.

Collecting *knowledge about the community* is relevant in all types of discussion communities. On the one hand, it is a valuable asset for the community's organizers. On the other, it is the foundation for individual services for the participants. In particular, recommendation communities require technology for collaborative filtering and for management of customer reviews and contributions.

Of great importance for discussion communities are possibilities to *articulate and manage intentions* of the participants. Most commonly, intentions appear in the form of requests for information or conversation, questions, and requests for guidance and mentoring.

In discussion communities *negotiation* is basically related to negotiation of dates and synchronization of calendars, as well as negotiation of roles. Important negotiations are those related to common community matters, such as questions related to changes in the organizational structure of the community. It is critical to have support for on-line surveys and voting in order to support collaborative negotiation. This kind of negotiation support enables the community's process of self-organizing [12].

Settlement, in the context of discussion communities, refers to providing communication channels for exchanges of information. Discussion communi-

ties should provide a wide spectrum of communication possibilities (e.g., chats, private chats, videoconferences, bulletin boards, writing and commenting of reviews and recommendations) [15, 23]. In addition, communities of practice require support for collaborative creation of knowledge (e.g., application sharing, brainstorming facilities) [40].

Functionality of Community Supporting Platforms for Task- and Goal-Oriented Communities

In task- and goal-oriented communities, the driving force for participation is the achievement of a specific common goal. As mentioned above, task- and goal-oriented platforms can exist without supporting community building. For example, transaction platforms offer services enabling market transactions, and learning communities provide support for distance learning. What is important is that the basic services necessary for achieving the goal of the community must be extended with specific functionalities supporting social contacts and enabling community building. As a result, there are two kinds of basic services: those necessary for coordination to achieve the common task, and additional services for community building that accompany the goal-oriented services.

Community-fostering elements map the community's delimiting features and organizational structure on the platform as well as communication services enabling interaction among participants. They differ for the subtypes of task- and goal-oriented communities and are described in more detail below.

Transaction Communities

Transaction communities emerge around e-commerce platforms providing services necessary for supporting market transactions. E-commerce platforms are meeting spaces where buyers and sellers meet to agree on the price of goods and services and to exchange information and goods [31, 36]. Extending e-commerce platforms with community elements has become a critical design option. A market organized according to the community paradigm can take advantage of the self-organizing power of the suppliers' and buyers' communities [7].

In the literature the term "transactional community" has a different meaning. This is partly because of a different understanding of "on-line community," but also because e-commerce platforms can be a focal point for different kinds of on-line communities.

- Communities of interest and communities of practice among suppliers of a marketplace or of business-to-business (B2B) platforms have features similar to those discussed above for discussion communities.
- Product-discussion and -support communities emerge among customers of one particular supplier.
- Transactional communities emerge along the basic market activities

among customers and suppliers as well as among customers (e.g., eBay [36], buying communities like LetsBuyIt.com).

The first two types of communities can be designed by following the principles described in the preceding section. The last type has specific features that are described below.

Organizational Structure

Transaction communities usually include the familiar market-participant roles: supplier, customer, intermediary, or community organizer providing the meeting platform. Each of these roles can be differentiated into subroles (e.g., business and private customers). Further important organizational components are the subcommunities forming around certain products and auctions.

The rules of behavior are closely related to the chosen market-coordination mechanism. For example, there can be different kinds of auctions or matchings of supply and demand. Rules concerning interactions between community members are similar to those of discussion communities.

Another important element of transactional communities is the common language used in terms of possible review values and a vocabulary of allowed market actions. The processes of transaction communities also depend on the applied market-coordination mechanism, and consist basically of the four market transactions described by Schmid: information, intention, negotiation, and settlement [31]. Special community-building processes are the registration process, writing of reviews, communication with other participants, and participating in discussions.

An additional important element of transaction communities is the management of participants, their roles and links to past actions and contributions to the community. In order to create a trustworthy environment, participants are often subject to reviews. As a result, in addition to basic functionality, participant management should enable review and recommendation management.

Basic Communication and Coordination Services

The only transaction platforms that have a chance of creating community feeling are the ones that offer support for communication between customers in each phase of the market transaction. A detailed list of required services and possible modules for stimulation will be found in Table 1 and in the discussion by Stanoevska-Slabeva and Schmid [34].

Table 1 shows that there is a broad spectrum of possible ways to improve e-commerce platforms with community-building functionality. The possibilities are a mixture of elements from discussion and recommendation communities as well as market-specific coordination functionality.

Design Communities

In design communities the basic aim is the common design and development of a product or a service. Examples are the open-source communities [36] and

Knowledge	Intention	Negotiation and contracting	Settlement
Product information	Offer	Auctions	Logistics
Product taxonomies	Acceptance	Matching	On-line delivery (download)
Knowledge about transaction partners	Counteroffer	Bargaining	On-line payment
Knowledge about customer	Electronic product catalog	On-line contracting	After-sales support
	Request		
	Customer shopping lists		
Community support			
Community-created knowledge in form of customer reviews	Individual recommendations and offers based on collaborative filtering	Exchange of complementary products between users	Customer-support community
Comments on products and new ideas for product enhancement provided by customers	Customer-specific requests for products and services	Participant's reviews of parties involved in negotiation	Customer feedback
Avatars representing virtual salespersons with options for interaction (e.g., through a chat)	Bundling of customer requests and offers		Interactive support by supplier by way of chats and other communication channels
Technology for customer tracking and evaluation of customer information	Avatars representing virtual salespersons and explaining products and services on offer		User games related to products or their application
	Collaborative filtering		Section with FAQs concerning use of product

Table 1. Functionalities for Community Support in Transaction Communities.

communities dedicated to collaborative design of products and services (e.g., www.dmoz.org). Task- and goal-oriented communities of this type can also exist without community-building elements. As a result, many existing services for collaborative design have to be enhanced with community-enabling functionality.

Organizational Structure

The roles of design communities are defined in accordance with the specific design process. The general roles that can be observed in design communities are contributor and group leader. In the design community dmoz.com, for example, the role of editor for specific categories of Web sites is offered to participants.

The rules of behavior in design communities regulate the use of the common products as well as the process of further development and usage. The

Knowledge	Intention	Negotiation and contracting	Settlement
Product information Versions of designed products Knowledge about design process	Request for design Offer of design component Counteroffer Electronic catalog of available versions Request for resources Request for information	Matching of requests and offers Bargaining Management of task lists Calendar synchronization	Tools for collaborative design Tools for consistency check
Community support			
Community-created knowledge (e.g., ideas for further enhancement) Discussions of existing solutions and versions Reviews of provided solutions	Request for certain features of products Request for design partners	Reviews of negotiating parties and their earlier participation in design groups	Discussion forums Support for members Lists of FAQs about product Discussion forums concerning usage of product

Table 2. Overview of Functionalities for Community Support in Design Communities.

common vocabulary is related to the common product and the applied development approaches. Participants in design communities have complementary qualifications and know-how. In order to organize the process of common development, a detailed list of participants with a description of their qualifications is important. Processes include the necessary steps for performing tasks and achieving the common goal.

Basic Communication and Coordination Services

Important modules for community support are reviews of the solutions provided, bug reports and discussion, discussion forums, and support forums for members. A detailed list of possible functionalities for each service will be found in Table 2.

On-line Learning Communities

On-line learning communities are dedicated to collaborative on-line learning. Their basic aim is the establishment of a learning space for a certain subject, where participants can receive both defined degrees or knowledge and support for continuous lifelong learning [16, 23, 41].

Organizational Structure

This type of community usually includes the roles appearing in off-line learning: teacher, tutor, and student [41]. The possibility of setting up subcommunities is important. The most common subcommunities emerging around e-learning platforms are (1) class communities consisting of participants of one class, (2) campus communities related to students and faculty on a specific campus, (3) communities of students working on group assignments, and (4) communities related to various other campus activities organized by students and faculty. The rules of behavior depend on the applied learning paradigm (e.g., case studies, self-study). The rules for mutual interaction are similar to the rules of discussion communities. A common vocabulary or glossary related to the learning subject is of great importance for creating common understanding.

Another important element in this type of community is participant management, which stores and provides information about faculty and students. An important feature of learning communities in comparison to the other types of task-oriented communities is the greater degree of personal passion and support. An important factor for community building between students is the ability to support one another during learning and preparation of exams [8]. As a consequence, a critical success factor for on-line learning communities is the availability of communication channels for interaction among students.

Basic Communication and Coordination Services

The basic communication and coordination services for community support accompany the basic services enabling on-line learning and teaching (*see Table 3*). Knowledge services refer to the provision of teaching materials and resources. Community-building elements can be added by allowing students to review, comment on, and discuss the offered literature on-line. Further interesting knowledge provided by students to one another could be recommendations on how to use the suggested resources during preparation for exams, where to find them, which have already been included on exams, and so on.

Intention services should allow students to articulate questions and requests for help as well as to search for other students interested in participating in group projects.

Table 3 summarizes the possible functionalities for the support of learning communities.

Community-Supporting Platforms for Virtual Worlds

Virtual worlds are on-line communities built around virtual worlds and games. They can provide a map of a real setting or a fantasy world (e.g., www.Cybercity.com).

Organizational Structure

The basic roles in virtual worlds are participant and wizard. Wizards are the system administrators who manage the community and have special rights

Knowledge	Intention	Negotiation and contracting	Settlement
Syllabus and literature for courses Taxonomy Links and resources Papers written by students Knowledge about participants	Request for students Offer of courses Request for courses and self-study subjects (thesis, case study, etc.)	Matching of requests and offers for tasks related to learning Management of accepted learning tasks (e.g., Ph.D. thesis.)	Course delivery (video conference, multimedia, etc.) Exams Evaluation of exams Feedback for community
Community support			
Evaluation of teaching material by students Evaluation of lecturers Recommendations for additional literature and links from students for students Tips and recommendations on how to prepare for exam from students to students and possibly solutions for old exams Alumni clubs and their comments	Request for help on a certain subject or administrative procedure Request for partners for a certain learning task or group work Access to lists of class participants Recommendation of courses by students and teachers	Access to recommendations for students and lecturers Calendar synchronization	Discussion forums Q&A sessions Whispering function for students listening to a lecture together [8] Lists of those who attend an on-line lecture Q&A sessions with lecturer after the class Feedback on provided results by classmates and lecturers Lists of on-line participants

Table 3. Overview of Functionalities for Community Support in Learning Communities.

[24]. Participants take on different roles and visualize themselves through avatars. The roles of the participants depend upon the context in which the game is designed. For example, they may be warriors with different degrees or dragons. In the virtual town Cybercity the available roles include mayor, council member, municipal officials, neighbors, and other roles similar to those that can be observed in real-life cities. In addition there is usually a hierarchy of roles and clear rules on how to advance from one hierarchical level to the next.

In this type of community there are two types of rules: rules depending on the game scenario and rules for mutual interaction. Processes are usually dependent on the game scenario.

In order to enable movement and action within the multiuser dungeon, all MUDS usually provide lists of commands that each participant must learn, because these represent the common language and build the foundation for interaction. The commands are usually explained in a dictionary [23].

With respect to basic communication and cooperation services, it is diffi-

cult to make general recommendations for virtual worlds, as they are very dependent on the game context. In any case, it is important to make possibilities for communication available during the game in the form of chats or asynchronous communication. For example, in Cybercity, the virtual town community, chat and discussion forums are available for different topics and in different settings (e.g., café, city hall).

Functionality of Community-Supporting Platforms for Hybrid On-line Communities

Hybrid communities are made up of several interrelated communities with common members who can be a part of several communities. This type of community is of growing importance, especially in complex settings like the task- and goal-oriented communities mentioned above.

One of the key success factors of hybrid communities is a design that allows for seamless integration of the different community types as well as the technologies for their support. The following succession of steps comprises one possible approach in designing hybrid communities: In the first step, each community is designed independently of the others. In the second step, common elements with reference to basic services are extracted. For example, a customer database storing information about participants in transactional communities can also be used for a discussion forum by revealing only part of the information (e.g., only the nickname). The same holds true for the content created by the community and about the community. In a virtual store, the relevant information about a product for a buyer includes the information in the catalog, as well as additional information from the recommendation database and from customer and support discussion forums. Therefore, this content should be interlinked. The same with intentions: Some modules can store and manage these in a standardized manner. The interlinkage of different community solutions as described above might require additional mediators between available off-the-shelf products applied to the support of the participating individual communities.

After the consolidation step, the common elements should be standardized in order to serve every participant in all the communities involved. Finally, the knowledge created about the community must be spread to include the interlinked knowledge over several communities.

Matching of Required Community Support to Available Software for Community Support

The preceding section summarized the possible functionalities for enabling community-oriented designs of different kinds of Internet platforms. The summaries can be used as guides for a requirement analysis of specific communities.

Communication facilities between participants, the creation, management, and accessibility of common content, and the provision of a virtual social and meeting place are the prerequisites for community building. In order to enable this, community-supporting software has to provide the following modules:

- Content management to support the creation of common knowledge and enable management of content and knowledge created by the community in a community-specific manner.
- Participant management to enable a mapping of the community's organizational structure in terms of roles and their hierarchy as well as rich representation of participants allowing for building of identities and for personalized services.
- Communication facilities to enable interaction among participants in various ways, such as synchronous and asynchronous communication, private communication, brainstorming, and on-line voting.
- Management modules to track participants, manage mailing lists, create controlling information, and so on.

There is also a need for middleware enabling the integration and visualization of the modules mentioned above into a community-specific meeting and social space.

Software that enables community building is available in different forms [1]:

- As commercial or open-source modules that support on-line communication (e.g., chats, bulletin boards, other forms of on-line communication) [34].
- As special community platforms that integrate several forms of communication software with content and participant management (e.g., ArsDigita (www.arsdigita.com), Blaxxun Interactive, offering support for avatars and 3D-Chats (www.blaxxun.de), Cassiopea (www.cassiopea)), and
- as hosting platforms for communities offered by application service providers (e.g., see Virtual Communities—www.vcix.com or Tribal Voice—www.tribal.com).

Besides the generic community software mentioned above, there is also special technology, available for specific types of Internet platforms, that can integrate elements for community support. Examples include various knowledge-management systems that can be used to support communities of practice (for a detailed overview, see [40]) as well as specific systems for e-learning and e-commerce.

The many software options for community support make it difficult to select software for the support of a specific community. In addition, the available software does not usually provide all the necessary functionality, and in many cases has to be extended and adapted. In building a community from scratch, therefore, it is advisable to choose the available integrated software for community support that best matches the community's requirements and to extend it with additional functionalities.

When community support has to be integrated into an existing Internet platform, such as e-commerce or an e-learning platform, there are two possi-

bilities. Depending on how much community support functionality is needed, separate individual modules (e.g., chats or bulletin boards) integrated with the existing platform might be satisfactory, or it might be better to choose an integrated community system. In the latter case, the participant and content-management modules of the existing platform and of the community-supporting system would have to be synchronized in order to provide an integrated solution. The approach described above in "Functionality of Community-Support Platforms for Hybrid Communities" might be helpful for this task.

Conclusion

This paper defined on-line communities and, based on a media reference model, identified the community-specific modules of Internet platforms: that is, the modules that map the community-delimiting features and organizational structure on the platform as well as community-specific basic communication and coordination services. All these modules should be mapped, that is, implemented into the platform, in a flexible way, so that it can be adapted to changing community needs.

Second, a typology of on-line communities was proposed. And third, for each of the identified community types, possible functionalities for community support were identified. The summaries of community-enabling functionality can be applied as guidance during the requirements analysis and for initial identification of the software components suitable for a specific community.

In the next step in this investigation, the author intends to explore how mobile technologies influence community building. The provided summaries will be extended with functionality-enabling mobile communities [29].

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KATARINA STANOEVSKA-SLABEVA (Katarina.Stanoevska@unisg.ch) is a senior lecturer at the University of St. Gallen and a coleader of the Competence Center on Electronic Markets (CCEM) at the Institute for Media and Communications Management. She received her Ph.D. from the University of St. Gallen, after studying business administration at the University of Skopje in Macedonia, and information systems at the University of Belgrade in Yugoslavia. Dr. Stanoevska-Slabeva is responsible for several projects concerning engineering of media platforms, on-line communities, and multivendor electronic product catalogs. She has co-organized several minitracks and tracks on on-line communities and has published several articles about platforms for these communities. Her research interests include on-line and mobile communities, interoperability of Internet platforms, and engineering of new media platforms and organizational networks.