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ABSTRACT

As small and medium sized enterprises (SMEs) face new challenges in a complex and dynamic competitive environment, they need to cooperate due to their restricted resources and limited capacities. At this, Enterprise 2.0 is seen as a supporting approach. To this date, there is a lack of academic publications concerning recommendations for the application of Web 2.0 artifacts in SME-networks. This paper aims at bridging this gap by suggesting a conceptual base following the design science approach. Based on technical and organizational requirements resulting from exploratory interviews with representatives of SMEs participating in a regional SME-network, we transfer the requirements in a prototypic concept. This developed artifact provides a basis for a field test to evaluate the concept and for further research.

Keywords

Web 2.0, Enterprise 2.0, SME-Networks, Design Science

INTRODUCTION

The idea of building networks between organizations to gather benefits in an enterprises' value creation is not new and can be described through the logics of scales and scopes (Jarillo, 1988). Hence, several economic theories (e.g. resource-based view, transaction cost economics) explain the phenomenon of cooperation (Tatarynowicz, 2008). Thereby cooperation enables businesses to access and operate on an extended resource base (Human and Provan, 1996). This aspect is especially relevant for small and medium sized enterprises (SMEs) as they need to cooperate to compete with new challenges in a complex and dynamic competitive environment with respect to their restricted resources and limited capacity for innovation (Street and Cameron, 2007). Since SMEs represent 90 % of all U.S. Enterprises and 99 % of all European Enterprises, they are of high social and economic importance within the U.S. and Europe (European Commission, 2003). From a technological point of view, Web 2.0 tools as software-oriented Web 2.0 artifacts[1] are seen as adequate tools for SMEs to increase productivity as well as proximity to the market (De Saulles, 2008a; Wyllie, 2008). The advantages of Web 2.0 tools in use of SMEs are beyond dispute, as Web 2.0 artifacts can improve the performance of SMEs in the following three areas:

[1] In the following the term "Web 2.0 artifact" comprises Web 2.0 applications (e.g. blogs) also named Web 2.0 tools as well as Web 2.0 concepts (e.g. tagging).

- internal communications and information/knowledge sharing
- external communications with customers, suppliers and partners
- marketing to prospective customers

Applying Web 2.0 technology in an organizational context is referred to the term of Enterprise 2.0. The term focuses on Web 2.0 platforms that are used "within companies or between companies and their partners and customers" (McAfee, 2006). However, the implementation of Enterprise 2.0 in SMEs is considered useful and necessary (De Saulles, 2008b; Farrell, 2006) but expandable, as the implementation of Web 2.0 artifacts remains exceptional.

From an organizational point of view, SMEs are often aligned in a patriarchal way. Thus, entrepreneurial initiatives are often driven by one or two individuals and decided by the SMEs' owners (Scherer, 1997). Consequently, generally not all employees can participate in innovation processes (Masurel, van Montfort and Lentink, 2003). Hence, by following a traditional organizational structure, innovative potential to solve problems in an enterprise might be unconsidered.

At present, results considering a concept to support the challenges of SME networks by using the Web 2.0 approach including technical and organizational perspectives are not published in the information system research landscape. This paper aims at bridging this gap by presenting actual results of a qualitative research approach. Our work aims at depicting Web 2.0 artifacts that have to be implemented within a network of SMEs by means of an incremental qualitative approach considering organizational and technical perspectives. The paper is structured as follows: Section 2 outlines our research approach. In Section 3, we give an overview of related work. General characteristics of SMEs and Web 2.0, as well as how SMEs are using Web 2.0 in practice are shown in section 4. Thereby we emphasize the need for an integrative consideration of organizational and technical aspects in the software development process of Web 2.0. In section 5, we present a use case starting with depicting the results of expert interviews conducted with SME-managers of the "WirtschaftsForum Neuwied e.V.", a SME-network in consideration. Thereby we gather organizational and technical requirements for the development of the Web 2.0 platform. Based on these results, recommendations for an incremental software development process considering organizational and technical requirements towards an integrative Web 2.0 conceptualization are given. The paper closes with a final section comprising summary and outlook.

METHODOLOGICAL APPROACH AND RESEARCH DESIGN

Research in Information Systems is widely dominated by two research paradigms: the behavioural science paradigm on the one hand and the design science paradigm on the other hand (Hevner, March, Jinsoo, and Ram, 2004). In our work, we follow the design science approach. Design science "creates and evaluates IT artifacts intended to solve identified organizational problems" (Hevner et al., 2004, p. 77). Our present work within the project KMU 2.0[2] (SME 2.0) is located in the early phase of the design science cycle, as we identify the requirements to create the artifact to solve the relevant problems.

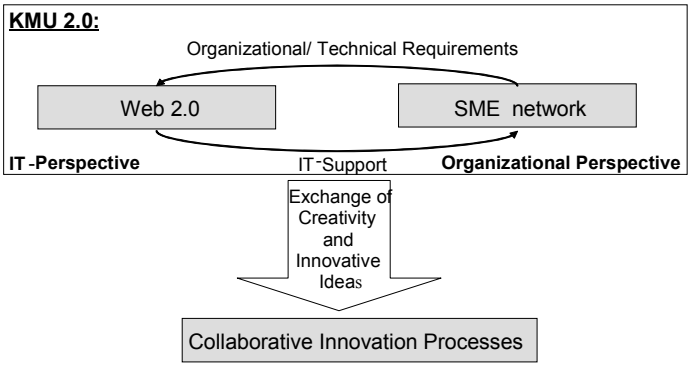

Figure 1. KMU 2.0 Research Framework

[2]KMU 2.0 is funded by the German Federal Ministry of Education and Research (BMBF). For further information see www.kmu20.net.

We could observe that SMEs perceive potentials by using Web 2.0 technology in a cross-organizational context. Thereby Web 2.0 provides possibilities to meet the needs for efficient collaboration as well as to gain economical benefit. In this regard, we introduce the term SME 2.0 to focus on Web 2.0 applications that are targeted at the necessities of SME-networks (Von Kortzfleisch, Mergel, Manouchehri and Schaarschmidt, 2008). Thereby SME 2.0 "can't just to be about a wiki here, a blog there forever" (Hoover, 2007) it rather has to be embedded in the specific context of the particular SME-network (Koch and Richter, 2007).

RELATED WORK

This section summarizes main results of actual studies which are considering the state of the art in practice (CoreMedia and Berlecon Research, 2007; McKinsey and Company, 2008; The Economist Intelligence Unit, 2007). In a nutshell there is a trend that Web 2.0 is becoming familiar within the companies and that all companies plan to spend more on it. Primarily large companies and enterprises that are deriving business value from Web 2.0 are extensively using it. Thereby Web 2.0 tools are integrated into business activities both outside the company to improve customer services and relations and inside the company to optimize internal information and knowledge management. However, not all companies are using Web 2.0. While some companies are dissatisfied with existing Web 2.0 tools and abandon the use of them, for some companies the term Web 2.0 is not known and its benefits are not clear: Web 2.0 comprises a multitude of technologies, applications and services that provide different functionalities and services that are hardly to differentiate. As no common definition of Web 2.0 exists, just a few people really know what it means. Managers do not understand the economical benefit that Web 2.0 can bring to their company and do not encourage the use of it within the enterprise. Besides, some companies suspect a lack of security by using Web 2.0.

WEB 2.0 AND ENTERPRISE 2.0 IN THE CONTEXT OF SMES

In the following section, we depict State-of-the Art in Web 2.0 and in Enterprise 2.0 as well as the challenges of applying Web 2.0 in SMEs.

Web 2.0 and Social Software - State-of-the-Art

Web 2.0 is a phenomenon representing a second-generation approach to the World Wide Web (WWW) which is different from the previous way of passive content consumption by the users. The term was first introduced by O'REILLY and comprises a "business revolution in the computer industry caused by the move to the internet as platform" (O'Reilly, 2006) which allows users to participate in the process of creating and sharing content. Thus internet content of Web 2.0 is not just to be read, listened to or observed. Web 2.0 is created to actively communicate and participate on the Internet (McAfee, 2006a; O'Reilly, 2005). Web 2.0 tools as software-oriented Web 2.0 artifacts are web-based applications afforded by upcoming so called Web 2.0 technologies[3] (Alby, 2007).

The term Social Software describes developments and applications that are associated to Web 2.0 (Szugat, Gewehr and Lochmann, 2006). Social Software is not a synonym to Web 2.0 but a subsection of Web 2.0. It covers software systems that support human communication, interaction and collaboration in networks. With the efficient sharing of knowledge and information the security aspects increases in importance. Artifacts such as weblogs, wikis, Social Tagging or Social Networking visualize relationships, persons and information (Burg and Pircher, 2006). To categorize Social Software artifacts, a framework considering the different functions of the tools is reasonable. According to PLEIL, Web 2.0 functions are (Pleil, 2006): Authoring, Sharing, Collaboration, Networking and Scoring. Figure 2 gives a brief overview on current Web 2.0 tools and principles, a brief description of the artifact and the according functionalities.

[3] Examples for Web 2.0 technologies are: Asynchronous JavaScript and XML (AJAX), Really Simple Syndication (RSS) or ATOM Syndicat Format (ASF) [AL07].

Artifact	Description	Function(s)
Weblog	Web-based communication medium, that is determined by the following characteristics: • chronology (time stamp for entries) • actuality (reference to actual events and subjects) • interaction (comment-function for readers) internet-relation (links to continuative information, links to other blogs, "trackbacks")	Authoring, Sharing
Wiki	Collection of websites, that can be edited by every user	Authoring, Sharing, Collaboration
Social Tagging	Collective indexing or tagging of existing context to ease the indexing of content	Sharing, Scoring
Social Networking	Maintenance and building of contacts	Networking
Podcast	Broadcast or broadcast series of audio or video content	Sharing

Figure 2. Web 2.0 artifacts (own creation referring to (Kolo and Eichner, 2006; Duschinsky, 2007)

Enterprise 2.0 - State-of-the-Art

MCAFEE describes how Social Software can be used in the context of an enterprise to enhance the collaboration among employees and to uncover tacit knowledge as well as common practices among employees. After publishing this report MCAFEE defined Enterprise 2.0 as the "use of emergent Social Software platforms within companies, or between companies and their partners or customers" (McAfee, 2006a) and describes the six components of Enterprise 2.0 with the acronym SLATES (search, links, authoring, tags, extensions, signals).

- Search: Search refers to the easy retrieval of information on the internet.
- Links: Links are an indicator for important information. Users are supposed to publish and link content on the internet.
- Authoring: Employees publish content with authoring tools such as wikis or blogs.
- Tags: Employees place tags on content, thereby categorizing the information on the internet.
- Extensions: Extensions describe the recommendation or proposal of similar articles or contributions that may be relevant for the user.
- Signals: To automatically inform users about new content using syndication methods is called signals (McAfee, 2006b)

Social Software applications may not be forced into given structures. The structures are the result of the publication and linking of content as well as the assignment of tags. With Web 2.0 the knowledge is available through the internet. Within the enterprise, the knowledge is contained in wikis and blogs and available for all employees.

The Challenge of applying Web 2.0 in SMEs

Even though companies perceive an increasing benefit by using Web 2.0, its adoption is affiliated with primarily non-technical barriers and challenges. Applying Web 2.0 in SMEs thus requires considering the specific characteristics of SMEs to gain an understanding of how Web 2.0 is actually used in SMEs practice. In general, the SME sector is very dynamic. While many new enterprises start up every year only forty percent of them survive for ten years (Levy and Powell, 2005). This is caused by the specific management structure of these companies: SMEs are considerably influenced by the personality of the company's owners and their attitude to do business (Masurel et al., 2003; Levy and Powell, 2005): "A real small firm has two arms, two legs and a giant ego" (Burns, 2001). The strategic horizon tends to be short with focus on a survival strategy and a reactive decision style due to limited resources (Levy and Powell, 2005).

Thus, planning and implementing Information Technology (IT) tends to take a short-term perspective. IT is used to manage day-to-day operations rather than to support management activities. As SMEs mostly have no IT department or expertise, the SME's owner is the only person with authority and (limited) knowledge to identify IT-opportunities and to adopt them. Implementing IT often occurs in an ad hoc fashion and highly depends on the owner's personality, experience and skills (Levy and Powell, 2005; Street and Cameron, 2007).

Given this context, the adoption of Web 2.0 in SMEs practice differs in some points from the study results outlined previously. While an intensive SMEs' usage of the internet can be observed, the utilization of Web 2.0 remains exceptional. Internet is mainly used for e-mail communication with customers and suppliers as well as collecting information. However there is an increasing use of complex online applications for customer service and purchase. In the next two years rising internet activities for customer communication are expected. Contrary to this, Web 2.0 has no direct business relevance for some SMEs. Although they perceive improvements in customer relations or an optimization in gathering information, SMEs consider the potential of success of Web 2.0 with skepticism. A SMEs' minority believe that Web 2.0 will impact their business since they are not able to evaluate its potential. Additionally a SMEs' majority perceives risks by using Web 2.0 within their company (e.g. legal risks, risks of abuse) (DeSaulles, 2008a; DeSaulles, 2008b, Social Computing News Desk, 2007).

TOWARDS A CONCEPT TO SUPPORT SME NETWORKS IN COOPERATION – A USE CASE

Use Case Background

The project KMU 2.0 is based on field research within a specific network, the "WirtschaftsForum Neuwied e.V.". The research project KMU 2.0 explores new management strategies for collaboration in SME-networks enabled by Web 2.0 applications and referring to innovative and cooperative solutions for daily work life problems (e.g. worker's health protection or work-life balance issues). This comprises an analysis of concepts and models of self-organization and information technology (IT) in the context of Web 2.0, assuming

- An employee's confidence in using Web 2.0 applications in private life and thus a motivation to participate on a Web 2.0 platform in work life.
- A high potential for creativity and innovation offered by heterogeneous groups.

Given this context, we examine the capability of Web 2.0 applications to integrate employees from different SMEs participating in a cross-organizational network in order to profit from their collaborative creativity. The project raises the question whether the use of specific Web 2.0 applications foster the exchange of creativity and innovative ideas within a network of SMEs. Thereby we focus on the generation of new forms of innovation processes among the cooperating participants enabled by Web 2.0. This requires an incremental research approach gathering organizational and technical requirements for Web 2.0-based cooperation in order to develop and implement a Web 2.0 platform within a network of SMEs.

The "WirtschaftsForum Neuwied e.V." was founded in 2002 and is a regional network of SMEs in the north of Rhineland-Palatinate, Germany. It consists of roughly 100 SMEs primarily from the industry and business sector employing about 8,000 individuals. With regard to its members who vary in enterprise sizes, represent different branches and offer diverse products and services, the "WirtschaftsForum Neuwied e.V." is heterogeneous in structure. It thus focuses on non-competitive activities (e.g. daily work life problems) and aims at fostering knowledge transfer between its members and enhancing collaboration and business relations. To gather first requirements for the development of a Web 2.0 platform, which will be implemented into the "WirtschaftsForum Neuwied e.V.", explorative interviews have been conducted with six executives of the cooperating SMEs. These companies represent the six project's value partner who act as lead users, test the Web 2.0 platform and distribute it among the members. With regard to the results of our State-of-the Art analysis, the interviews were directed at collecting organizational and technical requirements for the development of a Web 2.0 platform that meets the specific needs of cooperating SMEs. Since this qualitative research design is an accepted approach to gather first requirements in the software development process (Pohl, 2008), we first focus on exploratory interviews to gain a broad overview and first insights in our subject area (Corbin and Strauss, 2008). Therefore the explorative interviews describe general facts and relations to generate hypothesis that have to be validated in further empirical studies. Within our research project they thus provide general information about the SMEs and their collaboration with the "WirtschaftsForum Neuwied e.V." as well as requirements, benefits and objectives of using Web 2.0 in this context.

Requirements of a regional SME network towards Web 2.0 artifacts

In general, the interview results confirm the actual use of Web 2.0 in SMEs' practice. However, we could observe that Web 2.0 is perceived as instrument to optimize cooperation within the "WirtschaftsForum Neuwied e.V.". The companies' expectations to join the network are not entirely met at present. All interviewees express a high need to obtain general information on the WirtschaftsForum members. As a general survey of the member structure, which comprises information about branches, business areas and services provided, is not available yet, the enterprises perceive a lack of possibilities to represent their company and to exchange services within the network. In this regard we decided to focus on the development

of a closed Web 2.0 platform first that fulfills these needs and will be refined during our project. Further requirements highly depend on the company's own strategy and thus have to be analyzed within the course of our project.

In total, 83 requirements were extracted from the interviews. While analyzing the interview content, we could identify five dimensions of requirements, which allowed us to structure the requirements according to:

- Who-is-doing-what: The platform that gives a general overview about the member structure of the SME-network (cp. Figure 3).
- Design: Configuration, design and usability aspects.
- Data security: Meeting the high security needs of SMEs (cp. Figure 4)
- Extensions: Options to extend the platform.
- Behavioral: Aspects comprising rules and ethical code that constitute the overall behaviour of the platform participants.

These requirements aim partly on technical aspects of the prototype (e.g. ease of use), partly on organizational aspects (e.g. gaining economical benefit) and partly on hybrid aspects. We identified hybrid aspects as organizational requirements, which can be supported by technology (e.g. initiation of contacts). By assigning the Web 2.0 functionalities (Authoring, Sharing, Collaboration, Networking, and Scoring) to the particular requirements and dimensions, we could schematically identify the Web 2.0 tool that fulfils these requirements.

The requirements can be categorized according to the aim of their use. Either they aim at supporting individual use, the SMEs' use or both. Furthermore we categorized the requirements according to importance A (must have within the first prototype) and B (further implementation). As a result we could identify the relevant requirements for each iterative phase of our incremental development process. Requirements that cannot be realized by technical means are categorized by "0". These requirements are thus important for the organizational management of the SME-network. Analyzing the dimensions, we summarized that a social network tool is the Web 2.0 tool fulfilling most of the A-requirements and providing the most technical possibilities to expand the platform. Thereby we follow the principle of spare use of applications implying that the use of different applications with same or similar functions is avoided.

					Web 2.0 functionalities				
dimension	**requirement**	**category**	**focus**	**aim** (of the require-ments)	**Authoring**	**Sharing**	**Collaboration**	**Networking**	**Scoring**
"Who- is – doing what"	Overview on structure of Wirtschafts-Forum members: Who is part of the WirtschaftsForum? Who are the particular contacts?	A	hybrid	SME; indivi-dual		X			
	Information about the particular companies: What do the companies do? What services do they offer?	A	hybrid	SME; indivi-dual		X			
	Profile of the companies	A	hybrid	SME	X	X			
	Structural presentation of member-companies	A	hybrid	SME	X	X			
	Platform for bundling local services (of WirtschaftsForum)	A	hybrid	SME	X	X	X	X	
	Search for business partners	A	hybrid	SME	X	X	X	X	
	Directory service for WirtschaftsForum	A	hybrid	SME; indivi-dual		X			

Figure 3. Requirement Dimension "Who-is-doing-what" (extract).

					Web 2.0 functionalities				
dimension	**requirement**	**category**	**focus**	**aim** (of the require-ments)	**Authoring**	**Sharing**	**Collaboration**	**Networking**	**Scoring**
"Data security"	Avoid circulating of untruth and false information (resilience of information)	A	hybrid	SME; indivi-dual	~~X~~				
	Avoid disclosing too much personal data	A	hybrid	SME; indivi-dual	~~X~~				
	Avoid unintentional dependency concerning data management	A	techni cal	SME; indivi-dual				~~X~~	
	Securing the validity of information	A	hybrid	SME; indivi-dual		~~X~~			
	Reducing unauthorized manipulation of information	A	hybrid	SME; indivi-dual		~~X~~			
	Data security/ data protection	A	techni cal	SME; indivi-dual	X	X	X	X	X
	Login complying to aspects of data security and data protection	A	techni cal	SME; indivi-dual	X	X	X	X	X
	Differentiation between sensitive/ nonsensitive information	B	hybrid	SME; indivi-dual					X
	Management of measures and constraints, e.g. through an impartial administrator as a supervisor concerning users' behaviour	A	hybrid	SME; indivi-dual	X	X			X

Figure 4. Requirement Dimension "Data Security"

Recommendations

As most of the members of the "WirtschaftsForum Neuwied e.V." are not familiar with Web 2.0 concepts or Web 2.0 tools, the academic project partners decided to conceptualize a prototypic Web 2.0 platform in an early stage of the project. This decision was made, so that the Forum members have a "playground" to try out and to learn the Web 2.0 concepts by using them. The information and requirements we obtained from the interviews showed that a prototype fulfilling all requirements at once is neither realizable nor reasonable. As most of the interviewed persons are not common with Web 2.0 concepts or Web 2.0 tools, they probably change their requirements during testing the prototype and identify more requirements during the testing phase.

By analyzing the interview recordings we could identify three groups of requirements: technical requirements, organizational requirements and hybrid requirements concerning inseparable technical and organizational perspectives. Hence, to transfer these requirements into an integrated conceptualization considering all groups of requirements, an iterative proceeding is

necessary. In such a manner, Web 2.0 artifacts can be implemented in sustainable way into the SME-network. Towards an integrated conceptualization, we recommend the following steps:

1. Requirements survey: information gathering by structured interviews to obtain first user requirements, extracting the requirements of the interviews by analyzing the quintessence

2. Classification of the requirements: To structure the requirements, we recommend several dimensions, to classify the requirements. The recommended dimensions are:

    - A) Main content requirements (in the given case "Who-is-doing-what")
    - B) Design
    - C) Data security
    - D) Extensions
    - E) Behavioral.

    After having allocated a requirement, we recommend to identify the associated Web 2.0 functionalities as well as the requirement group (technical, organizational, hybrid). The web 2.0 functionalities provide a basis for prioritizing the technical requirements:

3. Prioritization of the (technical) requirements to obtain a first set of requirements for the first prototype (A: first prototype, B: further implementation).

4. Implementation of A-requirements in a first prototype according to the identified Web 2.0 tool.

5. Train the users for basic functionalities. Thereby present the economical benefits the companies have by participating on the platform

6. Testing the prototype in a two-tier procedure: First, the lead users (in our case: a heterogeneous group of 6 so called-value partners) test the prototype. Then, the entire Forum will test the prototype. Accompanying, the lead users act as opinion formers

7. Requirements survey: In a second round, further requirements are surveyed, that result from the testing stage.

8. Implementation of B-requirements and after-testing requirements

9. Testing the extended prototype and monitoring of the user behaviour (e.g. clicking paths).

With this set of recommendations we aim at suggesting a sustainable concept to implement Web 2.0 in a SME-network. The concept is going to be evaluated in cooperation with "WirtschaftsForum Neuwied e.V.".

SUMMARY AND OUTLOOK

Small and medium sized enterprises (SMEs) face new challenges in a complex and dynamic competitive environment. To compete with these challenges, SMEs need to cooperate due to their restricted resources and limited capacities. Enterprise 2.0 is seen as an approach to solve the current problems that SMEs have to solve.

As there is a lack of academic publications concerning recommendations for the application of Web 2.0 artifacts in SME-networks, we presented a conceptual base following the design science approach. The approach bases on technical and organizational requirements resulting from interviews with representatives of SMEs participating in a regional SME-network. With the aid of several analyzing dimensions, we identified technical, organizational as well as hybrid requirements and transferred them in a prototypic iterative concept. We will apply this concept and evaluate it in cooperation with the "WirtschaftsForum Neuwied e.V.".

This leads us to further research questions: can Web 2.0 newbies in the SMEs handle the prototype? Is sustain "learning" of Web 2.0 artifacts possible? How do individuals accept or decline the Web 2.0 artifacts? Do the users apply the prototypic Web 2.0 platform to solve their work life problems? Is this concept unchanged portable to other SME-networks? After having implemented the first prototype, the next step is to train the users and evaluate the acceptance of the prototype. Furthermore, according to the recommended concept, further requirements are going to be surveyed.

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