Web 2.0 artifacts in SME-networks – A qualitative approach towards an integrative conceptualization considering organizational and technical perspectives

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

1 Introduction

Since small- and medium sized enterprises (SMEs) represent 99 % of all European Enterprises, they are of high social and economic importance within Europe [EC03]. With respect to their restricted resources and limited capacity for innovation, SMEs need to cooperate to compete with new challenges in a complex and dynamic competitive environment. Thereby cooperation enables SMEs to access and operate on an extended resource base [HP96; SC07].

From the technical 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 [Wy08]. The advantages of Web 2.0 tools in internal use of enterprises are beyond dispute. However, the implementation of Web 2.0 artifacts in SMEs is considered useful and necessary [Al09; Fa06] but expandable, as the implementation of Web 2.0 artifacts remains exceptional [CB07]. From an organizational point of view, SMEs are often aligned in a patriarchic way. Thus, entrepreneurial initiatives are often driven by one or two individuals [Sc97]. Consequently, generally not all employees can participate in the development of new ideas [TH96].

At present, results considering a concept to support the challenges of SME-networks by using the Web 2.0 approach considering 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. Following the design science approach [He04] our work aims at depicting Web 2.0 tools 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 followed: Chapter 2 outlines general characteristics of SMEs and Web 2.0 as well as how SMEs are using Web 2.0 in practice. Thereby we emphasize the need for an integrative consideration of organizational and technical aspects in the software development process of Web 2.0. Chapter 3 presents results of expert interviews conducted with SME-managers of the "WirtschaftsForum Neuwied e.V.", a SME-network in consideration. Thereby we gathered 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. Chapter 4 concludes with further research questions and next steps within the project.

2 Background: Web 2.0 in the Context of SMEs

Web 2.0 is a term which has a high popularity and is widely disputed within the literature. It provides new possibilities for companies to organize their business in an innovative way. This chapter aims to introduce Web 2.0 in an organizational context. Therefore it outlines results of actual studies that analyze how enterprises, especially SMEs are using Web 2.0 in practice and which challenges they are facing by using it. On the basis of these findings we derive an incremental research approach to develop a Web 2.0 platform within a specific SME-network.

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[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).

2.1 Web 2.0 and Enterprise 2.0

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" [OR06] 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 [McA06; OR05].These concepts are supported by different Web 2.0 tools often also named as social software [SGL06]. Web 2.0 tools as software-oriented Web 2.0 artifacts are web-based applications afforded by upcoming so called Web 2.0 technologies[2] [Al07]. Moreover, widely and 24/7 available broadband internet access and decreasing internet costs supported the development of Web 2.0 artifacts. To categorize the Web 2.0 artifacts, a framework considering the different functions of the tools is reasonable. According to PLEIL, Web 2.0 functions are [Pl06]: Authoring, Sharing, Collaboration, Networking and Scoring. Figure 1 gives a brief overview on current Web 2.0 tools and principles, a brief description of the artifact and the according functionalities.

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 1: Web 2.0 artifacts (own creation referring to [KE06] und [Du07])

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

Applying Web 2.0 technology in an organizational context is referred to the term of Enterprise 2.0. The term was coined by MCAFEE to focus on those Web 2.0 platforms that are used "within companies, or between companies and their partners and customers" [McA06]. While Web 2.0 is stated to be a business revolution and a milestone in the WWW it is also criticized just to be hype or a "dotcom bubble". Thus, the section below sketches major results of actual studies analyzing the question of how companies are using Web 2.0 technologies in practice.

2.2 Enterprise 2.0 in Practice: State of the Art

This section summarizes main results of actual studies which are considering the state of the art of Enterprise 2.0 in practice [CB07; McK08; TEI07]: 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. While SMEs are companies with less than 250 employees [EC03] the section below states further challenges of applying Web 2.0 in SMEs' practice.

2.3 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 [LP05]. 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 [BG06; LP05]: A real small firm has two arms, two legs and a giant ego" [Bu01]. The strategic horizon tends to be short with focus on a survival strategy and a reactive decision style due to limited resources [LP05].

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 [LP05; SC07].

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 exception. 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 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) [DS08a; DS08b; ECH08; SCN08].

3 A Concept for Cooperation Support of SMEs by Web 2.0 artifacts

Within the project KMU 2.0[3] (SME 2.0) 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 from it. 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 [vK08]. Thereby SME 2.0 "can't just to be about a wiki here, a blog there forever" [Ho07] it rather has to be embedded in the specific context of the particular SME-network [KR07].

3.1 Use Case and Research Design

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.

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

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. Figure 2 shows the dependencies of the different research aspects and perspectives.
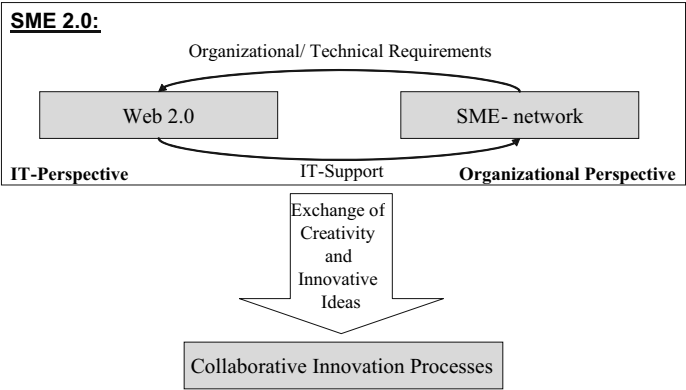

Figure 2: KMU 2.0 - Research Framework (own creation)

The project is based on field research within a specific network, the "WirtschaftsForum Neuwied e.V.". 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 chapter 2 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. Therefore the interviews 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.

3.2 Results

In total 83 requirements (partly with sub-requirements) were extracted from the interviews. Figure 3, presents selected requirements. The denotation of the columns is described in chapter 3.3.

dimension	requirement	category	focus	aim (of the require-ments)	Web 2.0 functionalities				
					Authoring	Sharing	Collaborat	Networkin	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			
	Establishing contacts	A	hybrid	indivi-dual				X	
	Increasing involvement of staff in WirtschaftsForum-activities: WirtschaftsForum-platform for chief executive managers and staff	0	orga-niza-tional	SME		X	X	X	
	Illustration of goals and utility of platform	0	orga-niza-tional	indivi-dual	X	X	X	X	X
	Web 2.0 platform for a closed area	A	hybrid	SME; indivi-dual			X		
"Design"	Easy handling	A	hybrid	indivi-dual	X	X	X	X	X
	Registration with few personal data (data efficiency)	A	tech-nical	indivi-dual					
"Data security"	Avoid circulating of untruth and false information (resilience of information)	A	hybrid	SME; indivi-dual	X	X	X	X	X
	Differentiation of sensitive/ non-sensitive information	B	hybrid	SME; indivi-dual	X	X			X

dimension	requirement	category	focus	aim (of the require-ments)	Web 2.0 functionalities				
					Authoring	Sharing	Collaborat	Networkin	Scoring
"Enhancements"	Information on topics concerning current problems, e.g. energy consulting	B	hybrid	SME; indivi-dual		X			
	Platform for generating, accumulating and communicating ideas	B	hybrid	SME; indivi-dual		X	X		
"Behavioural"	No suppression of negative comments	0	hybrid	SME; indivi-dual					X
	Knowledge transfer	0	hybrid	indivi-dual		X	X		

Figure 3: Selected Requirements

3.3 Discussion

In general, the interview results confirm the actual use of Web 2.0 in SMEs' practice as outlined in chapter 2.3. 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. 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.
- Design: Configuration, design and usability aspects.
- Data security: Meeting the high security needs of SMEs.
- 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, 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 (according to www.wer-kennt-wen.de). Thereby we follow the principle of spare use of applications implying that the use of different applications with same or similar functions is avoided.

3.4. 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 "playgroud" 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 (cp. Figure 3), 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.".

4 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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