

Exploring Web 2.0 Applications as a Mean of Bolstering up Knowledge Management

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Abstract: Web 2.0 applications aim at improving the interaction between users. Web 2.0 principles overlap with characteristics of knowledge management (KM) or could be applied to reshape KM practices. Applying Web 2.0 applications to KM has the potential to improve the sharing and creation of knowledge. However, little research has been conducted in this area. This research aims at identifying Web 2.0 applications for bolstering up organizations' KM practices. An additional aspect addressed is how Web 2.0 applications for KM can be categorized and how they match different aspects of the KM strategy of an organization. The research examines the suitability of Web 2.0 applications in KM by conducting exploratory case studies in two student-run organizations, which are an interesting research subject because their members are considered most open towards new technologies. The case studies aim at exploring which Web 2.0 applications are in place. Based on the findings we propose a framework for categorizing Web 2.0 applications for KM. The findings indicate that Web 2.0 applications may enhance KM and may even initiate a new era of KM. Moreover, the article provides a discussion of a number of Web 2.0 applications and proposes a way of categorizing these applications. The proposed framework allows assessing the use of Web 2.0 applications for KM and can be used as an orientation for the introduction of Web 2.0 applications in organizational KM. The research contributes to the general understanding of how Web 2.0 applications can be used in KM. The proposed framework for categorizing Web 2.0 applications provides an orientation for organizations that want to use these applications for bolstering up their KM practices.

Keywords: Web 2.0, collective intelligence, user-generated content, social computing, knowledge management, KM 2.0

1. Introduction

Today, an increasing amount of organizations recognize the importance of their workforces' knowledge as assets leveraging competitive advantage. This development gave rise to the emergence of knowledge management (KM). The KM discipline describes how knowledge-intensive organizations can develop a strategy and design an approach to manage the creation, sharing and application of knowledge in order to perform better and reach their overall strategic goals (Dalkir 2005).

With the dot-com crash in 2001, a new era of the World Wide Web began, which is often referred to as Web 2.0 (O'Reilly 2007). Since then organizations have begun to adopt Web 2.0 applications and techniques such as wikis and social networking for leveraging and improving their core processes (Chui et al. 2009). A systematic search on Google Scholar and other literature databases with different combinations of the keywords "Web 2.0" and "knowledge management" and some of their synonyms revealed that little research has been conducted to examine the impact of Web 2.0 on organizational KM practices. This brings us to our research question:

How can organizations use Web 2.0 applications for managing knowledge and which impact do they have on KM?

By conducting explorative case studies the research contributes to the general understanding of how Web 2.0 applications can be used to support or enable KM. The results are captured in a framework of Web 2.0 applications that organizations can use for bolstering up their KM practices.

The paper is structured as follows. Section 2 gives an introduction to the field of KM and Web 2.0. Section 3 presents the findings from the case studies. Section 4 discusses the findings and a KM spectrum for Web 2.0 applications is proposed. Section 5 contains conclusions and indicates areas of further research.

2. Theoretical background

This section elaborates on relevant aspects of KM, Web 2.0 and the implication of Web 2.0 on organizations.

2.1 Knowledge management

KM is a young but relevant field in today's economy. Jashapara defines it as "the effective learning process associated with exploring, exploitation and sharing of human knowledge that use the appropriate technology and cultural environments to enhance an organization's intellectual capital and performance" (Jashapara 2004). In many large organizations, knowledge-management projects have been run, resulting in overall success (Davenport et al. 1999).

However, KM encompasses a variety of different aspects and can be regarded from a number of perspectives. Binney's (2001) KM Spectrum combines various KM theories, tools and techniques discussed in literature in one single framework. The six elements of the KM spectrum are:

- *Transactional KM applications* present knowledge to the user in the course of an interaction with a system.
- *Analytical KM solutions* allow for creating new knowledge from vast amounts of data or information by providing certain interpretations.
- *Asset management* involves the managing of knowledge assets and making them available to people when they are needed.
- *Process-Based KM* deals with the codification and improvement of processes in order to come up with 'engineered assets'. This often involves using methodologies stemming from other disciplines such as Total Quality Management.
- *Developmental KM* aims at improving and developing the competencies or capabilities of an organization's knowledge workers including both tacit and explicit knowledge.
- *Innovation and creation KM* fosters an environment in which knowledge workers, preferably with different backgrounds, can come together to create new knowledge.

In the following we use Binney's framework for analyzing KM in two organizations.

2.2 Web 2.0

A glance at Google's search history shows an increasing interest for the term "Web 2.0" since its emergence in the early 2000s. This shows the term's popularity but what does it actually stand for? In a 2006 report Musser and O'Reilly speak of it as "a set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet". However, some people argue that Web 2.0 is merely a meaningless marketing buzzword (Brodkin 2007). It seems necessary to further illuminate it and its context in order to come up with a definition of the concept.

In 2004, the term gained popularity when O'Reilly Media and MediaLive initiated the first Web 2.0 conference (O'Reilly 2007). O'Reilly and others (Hoegg et al. 2006; McAfee 2006; Vossen & Hagemann 2007) came up with a number of general principles describing the properties of Web 2.0. Knol, Spruit and Scheper (2008) compared the principles proposed by different authors and proposed a generic set of Web 2.0 principles (they refer to them as Social Computing principles) that are depicted by the nine circles in Figure 1.

Knol et al. (2008) point out that the four principles in the bottom of Figure 1 are technically oriented and provide the fundament for the five socially oriented principles in the top. We argue that the phenomenon of Web 2.0, i.e. what you can see about it, can be mainly related to the socially oriented principles that are enabled by a set of Web 2.0 Technologies. Therefore, we propose the following definitions based on the Web 2.0 principles:

Web 2.0 is the reorientation of the Web that promotes unbounded interaction, collaboration and participation of people. It is characterized by the emergence of a large amount of content generated by a collective of Internet users. It harnesses networking effects and leverages the long tail.

Web 2.0 Technologies are technologies that transform the Web into a platform spanning all connected devices. They enable the creation of web-services and applications, constructed from lightweight models, and can be used intuitively.

Some examples of Web 2.0 Technologies are AJAX and lightweight scripting languages like PHP, Perl, Python and Ruby (Andersen 2007).

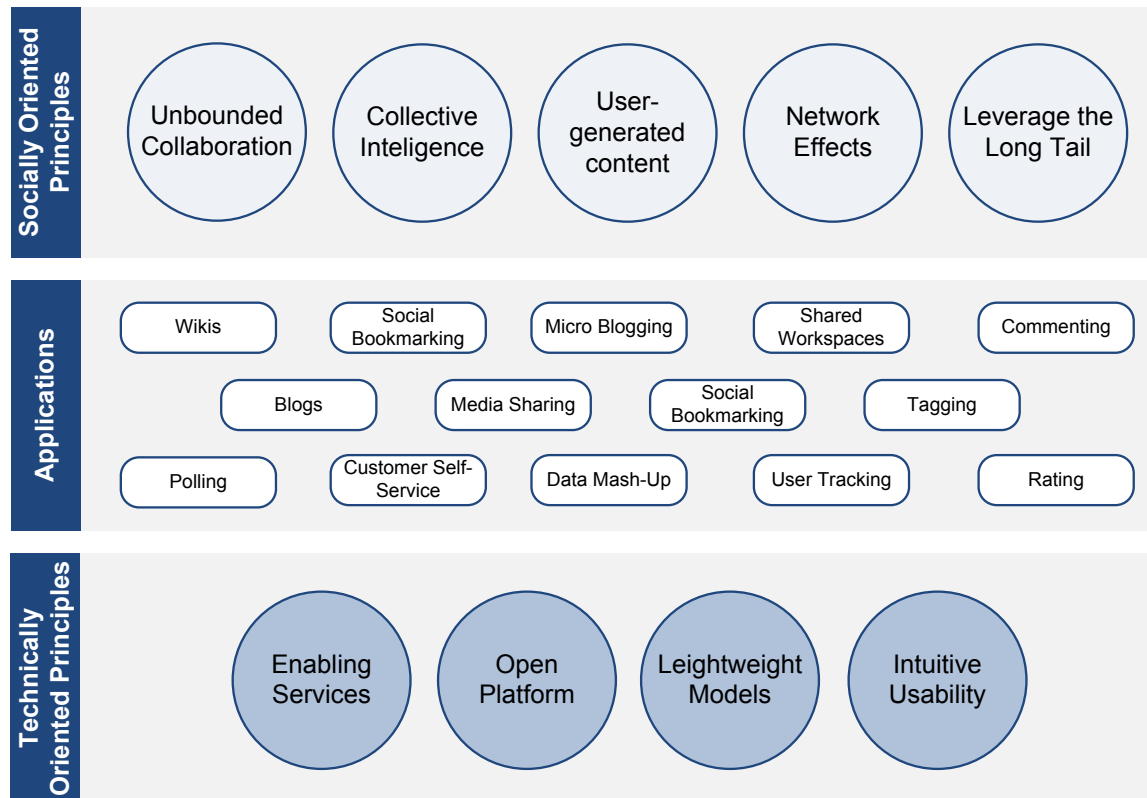


Figure 1: Web 2.0 principles (adopted from Knol et al., 2008) and popular applications

By reviewing literature (Chui et al. 2009; Andersen 2007; Knol 2008) we identified a number of common, but certainly not all, Web 2.0 applications, services and techniques (in the following only referred to as Web 2.0 applications). They are depicted in the middle layer of Figure 1. We added “Micro-Blogging” (e.g. Twitter) as application since we think that this considerably new trend can be valuable for KM as explained later.

2.3 Enterprise 2.0

Applying Web 2.0 principles on companies is widely referred to as Enterprise 2.0 (McAfee 2006; Tredinnick 2006; Levy 2009). Levy reviewed literature dealing with Enterprise 2.0 and proposes a matrix (Figure 2) that structures Enterprise 2.0 according to two dimensions: the type of technology used and the type of user that is being addressed.

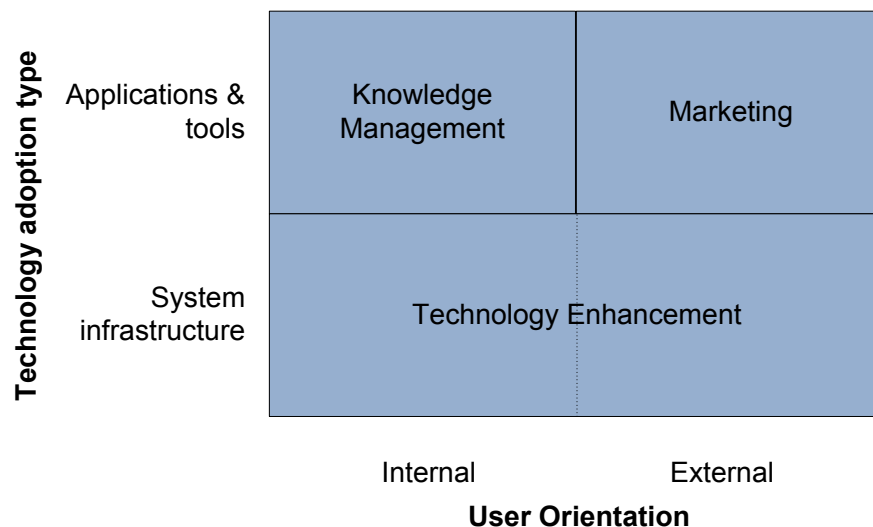


Figure 2: Enterprise 2.0 segments (adapted from Levy, 2009)

The “technology adoption type” dimension distinguishes between two types of adoption: Web 2.0 system infrastructure (developing in lightweight models, using AJAX etc.), which can be related to the technological aspect of Web 2.0 as introduced in the previous section; and secondly Web 2.0 applications and tools (using wikis, blogs, tagging etc.), which stem from the phenomenon aspect of Web 2.0.

The “user orientation” dimension distinguishes between the use of these technologies with an internal (by and for the organization) and an external focus (facing customers, suppliers and other external stakeholders). As suggested by the matrix in Figure 2, KM enabled by Web 2.0 principles is one specific aspect of Enterprise 2.0 that encompasses an internal focus together with adoption of Web 2.0 applications and tools.

This raises the question which Web 2.0 applications have an impact on KM. Are they just an enhancement of KM practices by a number of fancy tools or do they pave the way for of new kind of KM, a KM 2.0? By conducting case studies in two student-run organizations why attempt to answer this question.

3. Cases studies

Due to the exploratory nature of the research question case study research (CSR) was chosen as the principal research method. CSR is a research method that is applicable in situations where a number of variables are to be observed in a real life context and where this observation cannot simply be limited to an analysis of data points (Yin 2008: 18). It can involve both qualitative and quantitative evidence and is especially applicable to real-life situations that are too complex for survey and experimental research (Yin 2008: 19).

In order to explore how Web 2.0 can be used for KM we studied two student organizations. The analysis was divided into three steps:

- 1. Analyze the KM function using Binney’s KM spectrum;
- 2. Determine which technology, especially in regards to Web 2.0, is used to support specific elements of the KM spectrum;
- 3. Provide recommendations regarding the potential of Web 2.0 applications for KM.

A recent study published by Pew Research Institute shows that the largest group of people using the Internet, in fact, consists of people born between 1977 and 1990 (Jones & Fox 2009). In a 2009 article on Web 2.0’s implications on KM, Levy proposes to use the young generation as pioneers of Web 2.0 in organizations to leverage KM practices. Obviously, the generation of today’s students is the most active group of Internet users and thus most familiar with the new technologies of Web 2.0. We therefore think that student-run organizations are an interesting subject for researching the implications of Web 2.0 on KM practices.

The case studies involved a number of semi-structured interviews with key personnel and a review of IS fragments of AIESEC in Germany and MARKET TEAM, which are two of Germany’s largest student-run organizations. Prior to carrying out research we developed a case study protocol that described field procedures and the principal questions to be answered.

Both organizations are non-profit organizations (NPOs) and are run by student volunteers on the local level and students working fulltime on the national level. In general, people change position every year which makes knowledge retention a key challenge. As in the NPO domain in general, knowledge in the two organizations can be classified into accounting / administrative, managerial / organizational, teaching / training, fund raising / public relation management / marketing, operational and miscellaneous knowledge (Lettieri et al. 2004).

Both organizations are at different stages of adopting Web 2.0 technologies to enhance their KM practices. Due to their different size and scope (national vs. international) they also differ considerably in regard to their KM needs as indicated by Hume & Hume (2008).

3.1 MARKET TEAM

MARKET TEAM e.V. (in the following MT), solely operating in Germany, aims at providing students insights into the business world by organizing events like workshops, trainings and symposia with

companies. The organization has around 1000 members in 23 chapters (Market Team 2010). KM aims at supporting day to day operations of the organization, which mainly consist of running various projects on both the local and the national level. In general, KM takes place on the local level. There is no knowledge sharing between different chapters. At the moment the organization runs an initiative that aims at improving knowledge sharing between local chapters to build on synergy effect, i.e. re-use knowledge in different parts of the organization.

We analyzed MT's KM function using Binney's (2001) KM spectrum and identified the aspects shown in the upper part of Figure 3. Below we listed the web applications used to support these KM aspects.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
KM Applications	Help Desk Applications	Customer Relationship Management (CRM)	- Document Management - Knowledge Repositories - Content Management	- Best practises - Quality Management - Process Automation	- Skills Development - Staff Competencies - Learning - Teaching - Training	- Communities - Collaboration - Discussion Forums - Networking - Virtual Teams - Multi-disciplined Teams
Web 2.0 Applications			- Media Wiki - Dropbox			- Media Wiki - StudiVZ - Mindmeister - Google Spreadsheets - Google Docs

Figure 3: KM and Web 2.0 applications used for KM by MT

In the past ten years MT has been using a custom developed web platform for fostering communication between the national board and the chapters, for administering member data, for exchanging information and experiences about completed projects and for storing information about partner companies. Since the platform is mainly designed for unilateral communication from national to local level, the organization is currently evaluating how it can be replaced by a more interactive platform leveraging Web 2.0 technologies.

Some local chapters use wiki platforms based on MediaWiki for facilitating project management. In general, information and experience report from previous projects and manuals how to run a project are retrieved from the national web platform and the local platform is used mainly for facilitating communication and collaboration between the members of project teams. In addition they may guide project teams through the process of running a project.

Besides physical meetings, communication mainly takes place through emails but also through StudiVZ, a large German social networking platform. These channels are therefore the main mean of exchange ideas and contributing to innovation.

Skill development and training solely takes place in physical meetings and apart from providing manuals and explicit information on the national web platform, no specific web technology is used for this aspect of KM.

Following the general trend, members have started using free Web 2.0 tools for collaborating and sharing files with each other. Dropbox is mainly used for sharing and storing documents online. Google Docs and Spreadsheets and Mindmeister, an online mind map tool, are used for collaboration and idea generation. These tools were not specifically introduced by the organization, but just appeared to be useful and very often already known by members from personal use.

3.2 AIESEC Germany

AIESEC has over 45,000 members globally (AIESEC International 2009), whereof more than 2,500 are from 47 chapters in Germany. The organization aims at developing tomorrow's socially responsible leaders by running an integrated leadership development program and providing coordinating internships at its partner companies around the world (AIESEC International 2009). Due to its size and international scope AIESEC's KM is directed at leveraging economies of scale by providing one single web platform connecting members from around the world. In accordance with Hume and Hume (2008) KM in general

can be considered operationally and strategically mature and KM structures try to capture both explicit and tacit knowledge. A key challenge of AIESEC's KM is to find the best KM approach that fits all the different cultures and national branches' needs (size differs significantly reaching from a few dozen to thousands of members in some countries). Therefore, KM programs are mainly run on the national level, although making it available to the global network is also a concern.

In 2007, the national executive board of AIESEC Germany decided to foster the vision of a "member driven organization", i.e. a bottom-up organization that benefits from the contribution of every single member. In order to achieve this from a KM perspective steps have been taken to adopt Web 2.0 applications such as wikis to enable every member to contribute to the organizational knowledge base. Since then the organization has adopted a number of Web 2.0 applications to improve collaboration and knowledge sharing between its members. The upper part of Figure 4 provides an overview of different KM aspects in AIESEC Germany and the bottom part shows Web 2.0 applications used for supporting these aspects.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
KM Applications	Help Desk Applications	- Customer Relationship Management (CRM) - Business Intelligence	- Document Management - Knowledge Repositories - Content Management	- Best practises - Quality Management - Process Automation	- Skills Development - Staff Competencies - Learning - Teaching - Training	- Communities - Collaboration - Discussion Forums - Networking - Virtual Teams - Multi-disciplined Teams
Web 2.0 Applications		- Google Analytics - Google Forms - Tagging	- Web Portal - OpenCMS - Google Video - Youtube - Flickr - Wikis	Brandkore	- Google Presentation - Slide Share - Google Video - WizIQ - Teamviewer - Meetgreen	- Google Spreadsheet - Google Docs - Google Calendar - Mind42 - Goggle Mail - Google Talk - Skype - Facebook - Blogspot - Twitter - Wikis

Figure 4: KM and Web 2.0 applications used for KM by AIESEC Germany

AIESEC's global web platform contains a wiki module in which every user can create wiki pages. Two years ago, AIESEC Germany has switched from a Lotus Domino powered knowledge base to providing knowledge assets in these wiki pages. Information in AIESEC's global web platform is searchable through an advanced search function based on tags and elaborated filters. These wikis are used for storing information such as manuals, contain processes documentations and are used for collaborative idea generation (e.g. virtual brainstorming sessions). Even though wikis should enable everybody to contribute content or enrich other people's contributions, only a limited number of members have actually been doing it and most of them are nationally active. Since there were some problems with the usability of the platform when it was launched, an interviewee supposed that the problem might be related to that.

AIESEC recently started using Google Apps, a bundle of collaborative web applications. Its word processing module and its spreadsheets module are mainly used for documentation (e.g. minutes) and idea generation (e.g. brainstorming). The presentation module is used for virtual education and the video module is used to distribute education videos. A module that allows for creating forms that is used for creating surveys amongst members. In addition, for improving interaction and information exchange between the members a webmail application and a built-in instant messaging client that is identical with Google's consumer product Gmail is used. According to an interviewee the acceptance of Google Apps was significantly facilitated by its intuitive interface and the fact that users already knew the applications from personal use.

In order to streamline their marketing material creation, which needs to be customized for each chapter, AIESEC uses Brandkore, a web-based marketing automation tool. Consequently, members do not need to be familiar with using complicated graphic suits anymore

In order to facilitate the development and learning of its members AIESEC uses a number of e-learning applications such as the platform WizIQ and Teamviewer in combination with web-controlled telephone conferencing tools such as Meetgreen. The organization is currently evaluating the use of web-based video conferencing tools such as Netviewer that allow multiple users to see and interact with each other. In order to keep members up to date a news module and a classifieds module in the global web platform of AIESEC are used. In addition, a public Google Calendar is used to inform members about upcoming events. Although some communication channels such as Facebook and Twitter are intended for communication with external stakeholders, members have started using them for internal communications and collaboration amongst each other as well.

4. Discussion

The two case studies show that Web 2.0 applications can be used for KM. When we look at Binney's KM spectrum and the Web 2.0 applications matched with the respective elements (see Figure 3 and 4), we notice that apparently not all elements of the spectrum are associated with Web 2.0 applications.

We used the findings from the case studies to derive a number of generic Web 2.0 applications (as those in Figure 1) and mapped them to the KM spectrum. The result is shown in Figure 5.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Web 2.0 Applications		▪ Polling ▪ Tagging ▪ <i>Social Networking</i> ▪ <i>Ratings</i> ▪ <i>Social Bookmarking</i>	▪ Wikis ▪ Media Sharing ▪ Blogging		▪ Social Networking ▪ Shared Workspaces ▪ Media Sharing ▪ Podcasts	▪ Wikis ▪ Micro blogging ▪ Blogs ▪ Social Networking ▪ Shared Workspaces
Supporting Principles		Collective Intelligence			Unbounded Collaboration	
		Network Effects				Network Effects
			User Generated Content			User Generated Content
		Leverage the Long Tail				Leverage the Long Tail

Figure 5: Web 2.0 principles mapped to the KM spectrum

We added some applications (italic font type in Figure 5) to the ones that we found in the case studies since we found some evidence in literature that they can be used for KM. Hideo and Shinichi (2007) describe how communication data generated from Web 2.0 applications such as social networking platforms can be used to create new knowledge. Chui et al. (2009) note that data from social bookmarking and ratings can be used for creating additional information. Anderson (2007) describes how podcasts can be used for educational purposes. We did not derive a generic Web 2.0 application from Brandkore that we identified in the AIESEC case because we think that is an applications that mainly builds on the technological enhancement aspect of Web 2.0 and cannot be related to any socially oriented Web 2.0 principle.

In a second step we used the mapping of Web 2.0 applications to associate the socially oriented Web 2.0 principles with the elements of the KM spectrum.

"Collective Intelligence" refers to the fact that a large collective can create more content than a small number of experts (Knol et al. 2008) and that intelligence can be derived from data created by a large number of users (Anderson 2007: 41). This applies to analytical KM and asset management. Analytical KM applications may create information from large amounts of user data such as social bookmarking and ratings. Wikis, as an asset management tool, also rely on this principle because their content may be created by large numbers of users whereof everyone just contributes a small amount.

"Network Effects" refer to services that get better, the more people use them (Knol et al. 2008). This applies to basically all analytical KM applications that we identified. Also the content of wikis and other asset management applications benefits from network effects. Finally, also network effects are also relevant to social networking and micro blogging that are related to innovation and creation KM.

"User Generated Content" refers to the large amount of content that is generated by users (Knol et al. 2008). This content may be stored in asset management applications such as wikis, blogs or media sharing platforms. The fact that users generate content also leads to an increased creation of ideas and innovation. However, it should be noted that quality of content might become an issue in comparison with traditional KM approaches where content is mainly generated by a small number of experts. Apart from

that there might be a risk of a low user participation in content creation (Tredinnick 2006). This issue is clearly linked to organizational culture. Consequently, only certain types of organizations may benefit from user generated content. Tredinnick (2006) suggests that especially dynamic organization in a fast changing environment and built on a high degree of innovation may benefit from this aspect of Web 2.0.

“Leverage the long tail”, i.e. the exploration of niches (Knol et al. 2008), applied to micro blogging and social networking services may be beneficial for knowledge creation in such a way that users may exchange snippets of information that they would otherwise not have known about. These micro messages may lead to creation of new ideas and innovations. In addition, we think that analytical KM might also benefit from the long tail in such a way that the interaction of users can be used as an additional source for data mining as suggested by Hideo and Shinichi (2007).

“Unbounded collaboration” refers to a form of collaboration that is independent from place and time, i.e. time differences and different locations do not matter anymore. It enables creativity processes that were not possible before. Furthermore, this novel kind of collaboration might also lead to cost and time savings because travel might be reduced. This also has an impact on training and education because e-learning and virtual conferencing applications may be used.

This discussion shows that Web 2.0 applications may be beneficial to four elements of Binney’s (2001) KM spectrum, i.e. analytical KM, asset management, developmental KM and innovation and creation. Although transactional and process-oriented KM does not seem to benefit from Web 2.0 applications, it may benefit from enhancing technology by adopting technical principles. For instance, the AIESEC case suggests that intuitiveness is a key enabler for the acceptance of a new technology.

In the case of AIESEC we have also found out that there does not seem to be such a clear differentiation between internal and external use of Web 2.0 applications as proposed by Levy (2009) (see Figure 2) because organizational members communicate about internal subjects in open channels, e.g. social networking sites. This overlap of internal and external communication might become a real problem for the organization by decreasing the attractiveness of public relation campaigns and by making confidential information available to public. We assume that one possible reason for this blend of communication could be that organizational members do not find the communication channels that they desire to use inside the organizations. By introducing and fostering internal social networking platforms organizations may mitigate this issue.

5. Conclusions

The research question, as proposed in section 1, states:

How can organizations use Web 2.0 applications for managing knowledge and which impact do they have on KM?

We conducted exploratory case study research in two study-run organizations to explore in how they use Web 2.0 applications for different aspects of their KM strategy. Based on the findings we were able to identify which aspects of KM, as described in Binney’s (2001) KM spectrum, benefit from Web 2.0 applications. As a last step we created a generic KM spectrum for Web 2.0 applications.

The research suggests that analytical KM, asset management, developmental KM and innovation & creation may benefit from the adoption of Web 2.0 applications. Depending on the organizational culture these applications may even lead to a novel kind of KM. This new approach to KM would not just benefit from a technology enhancement of the existing applications, but also lead to a new understanding of KM that is based on user contributions, a novel way of unbounded collaboration and leveraging the long tail of user interaction data. In our opinion, it would therefore be appropriate to refer to this as KM 2.0.

The findings in this research are based on two case studies. To expand external validity of the findings research should be extended by replicating the case study in different types of organizations. It would be interesting to have a look at other types of non-profit organizations and for-profit organizations and examine if there are considerable differences in term of KM and the impact of Web 2.0 applications. The framework proposed in Figure 6 can be used for providing recommendations to organizations that intent adopting Web 2.0 applications for bolstering up KM. Therefore, the applicability as a tool for providing recommendations should also be tested.

As we observed a low participation in wikis in one of the cases (AIESEC) and no knowledge sharing between different chapters of the other organization (MT), we suppose that organizational culture and structure have a major effect on the effectiveness of adopting Web 2.0 applications for KM. Further research should therefore investigate the influence of organizational culture and other factors on the effectiveness of adopting Web 2.0 applications for KM.

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