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WEB 2.0 AS APPROACH FOR ENTERPRISE INFORMATION TECHNOLOGY

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LIST OF REPRESENTATIONS

LIST OF ABBREVIATIONS

AARF	Avenue A | Razorfish
AJAX	Asynchronous JavaScript and XML
API	Application Programming Interface
ARPA	Advanced Research Projects Agency
CIO	Chief Information Officer
CMS	Content Management System
DARPA	Defense Advanced Research Projects Agency
DrKW	Dresdner Kleinwort Wasserstein
ERP	Enterprise Resource Planning
FNC	Federal Networking Council
GUI	Graphical User Interface
ISBN	International Standard Book Number
ISP	Internet Service Providers
IT	Information Technology
IWPC	Work Productivity Council
KM	Knowledge Management
MP3	MPEG-1 Audio Layer 3
NSF	National Science Foundation
PDA	Personal Digital Assistant
RSS	Really Simple Syndication
SaaS	Software as a Service
SCM	Supply chain management
TCP	Transmission Control Protocol
WWW	World Wide Web

1   INTRODUCTION

It is not unusual that consumers adopt new technologies before companies. In the context of Web 2.0 technologies McKinsey & Company and Sand Hill Group wrote in their Software 2006 industry report:

> *"As in previous innovation cycles, whenever multiple point capabilities converge – such as wireless, pervasive broadband, and online collaboration - the consumers tend to adopt the new services and products before the enterprise. But in the end the enterprise market is usually far larger and more profitable."* [1]

1.1   Relevance of the Topic

Web 2.0 is a common term in the Internet field nowadays. On the consumer market services like Youtube or MySpace, which stand for the Internet of the second generation, have attracted attention. When Google Inc. bought the video streaming service Youtube on October 9, 2006 for $1.65 billion in a stock-for-stock transaction it became clear how important the Web 2.0 trend had become for the online business.[2] On the consumer market new Web 2.0 applications are launched ever more frequently. The Web 2.0 directory web2null.de (www.web2null.de) alone lists 1042 German Web 2.0 applications and the number is increasing every day.[3] Even though probably not all of these new services will succeed, it can't be disregarded that the face of the Internet is changing. Web 2.0, which is sometimes also called participation web, already motivates millions of people to contribute. The networking portal MySpace alone claims to have more than 70 million members.[4]

The company marked on the other hand has not been strongly influenced by the new trend. But Web 2.0 could also be used to improve enterprise information technology.

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[1] *Berryman, K./ Jones, J./ Manyika, J.,* Software Report, 2006, p. 8.

[2] Cp. *Google Press Center*, Google To Acquire YouTube, 2006.

[3] Source: *web2null.de*, http://www.web2null.de/alle-web-20-applikationen (2007-03-19).

[4] Cp. *News Corporation*, Myspace members, 2006.

Examples are Web 2.0 concepts, which increase the effectiveness of data handling or concepts, which provide new communication methods. Therefore the use of Web 2.0 concepts in an enterprise context seems worth considering. Especially under consideration of the increasing importance of tacit work, Web 2.0 concepts could improve the productivity in companies. The research and consultant house Gartner, Inc. is one company, which is approving the importance of Web 2.0 concepts for enterprises. Annual the company is publishing the so called "Hype Cycle", a forecast model, which provides companies an overview about the importance of current technologies.
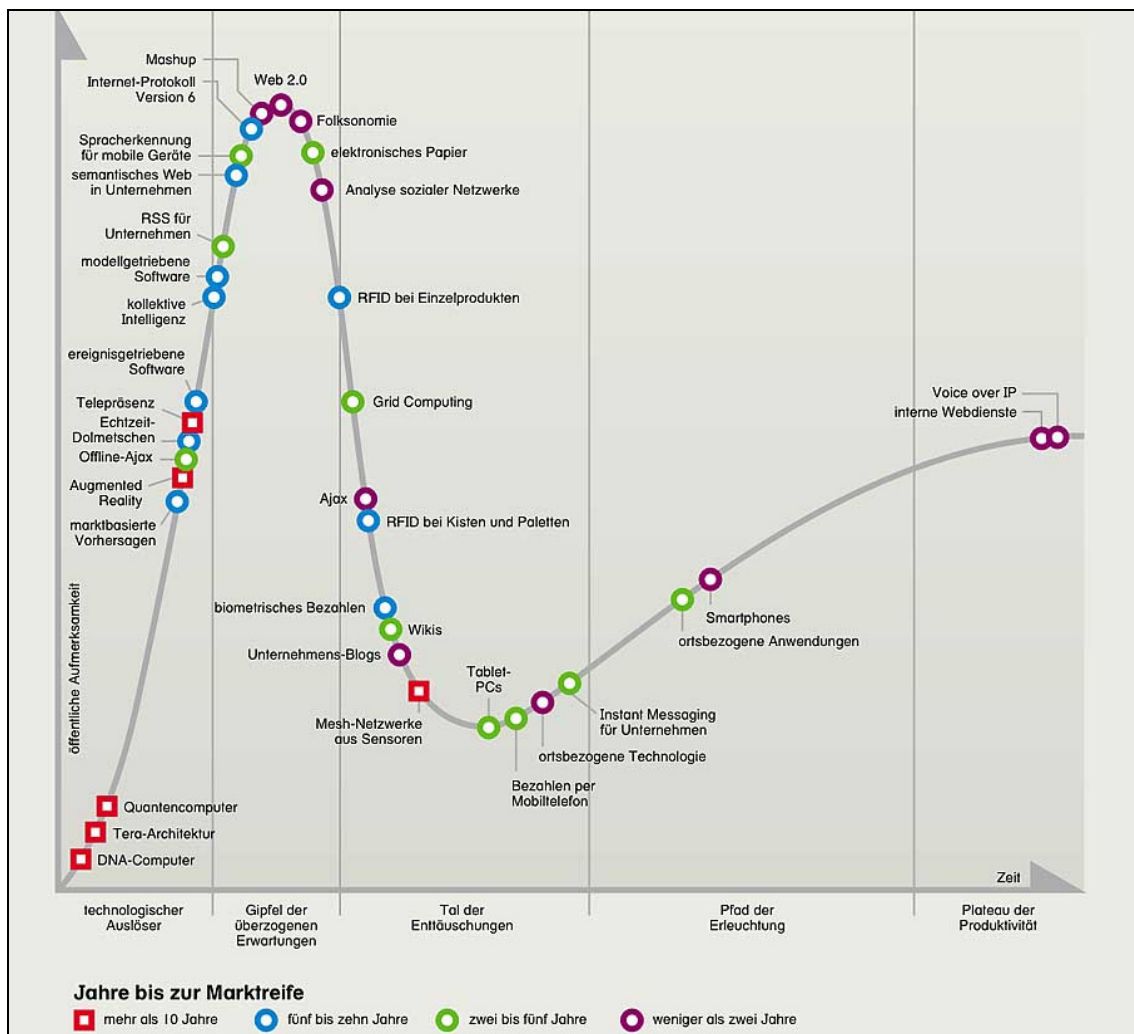

Figure 1: Emerging Technologies Hype Cycle 2006.[5]

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[5] Source: *Honsel Gregor*, Hype Cycle, 2006.

In the 2006 "Emerging Technologies Hype Cycle" Web 2.0 is one of the three identified key technology themes. Under the category Web 2.0, Gartner, Inc abstracts several products and services, which are believed to enable new ways of performing applications that will result in significantly increased revenue and cost savings for enterprises.[6]

1.2   Objective

The objective of this diploma thesis is to answer if the Web 2.0 approach could also be used in an enterprise context and if the adoption of Web 2.0 could be a benefit for companies.

For this objective several fundamental points need to be clarified first. One fundamental point is to define the term Web 2.0 and to introduce the different elements of the Web 2.0 concept. Because even so the term is widely used, the exact meaning is vague. After the essence of Web 2.0 is identified and it has been explored why and how this concept is working, it is possible to deduce the potential of the concept for a use within companies. Therefore it will be investigated which Web 2.0 elements can be used within companies and how they need to be adjusted to be used there. In this context it will also been explained which technologies and applications can be used for the realisation of these adjusted Web 2.0 concepts. The answers to these questions represent the second central point of this thesis.

1.3   Structure of the Report

As already mentioned, the meaning of the term Web 2.0 is vague. The expression became so popular during the last years that it is now strongly used to market all kinds of new Internet applications. Thus the first part of this report will focus on clarifying the meaning of Web 2.0. First a brief overview about the development of Web 2.0 is given (chapter 2.1), then the term Web 2.0 itself will be critically discussed (chapter 2.2). This is followed by the introduction of the concepts which can be summarized under the

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[6] Cp. *Gartner, Inc.*, Gartner Technologies Hype Cycle, 2006.

name Web 2.0 (chapter 2.3). After a clear picture of Web 2.0 is given, the technical and social drivers for the development of Web 2.0 will be addressed.

In the next part of this thesis a Web 2.0 key theory, which has special importance for the use of Web 2.0 in an enterprise context, will be explained (chapter 3). The theory provides also insights about the success and function of different Web 2.0 concepts.

At this point a good foundation for the discussion of the main objective has been laid: whether or not Web 2.0 concepts have potential to improve enterprise information technology. As initially said, this question has not been the object of many studies yet. So far, only few scientists have made deeper and detailed investigations on this topic. In chapter 4 the results of these researchers will be introduced and supplemented by my own findings. First, it will be argued why enterprises should take Web 2.0 concepts in consideration and what the benefits could be. Therefore it will be examined what weaknesses common enterprise information technologies have and if Web 2.0 concepts are capable of eliminating these weaknesses (chapter 4.1 and 4.2). In chapter 4.3 it will be researched which Web 2.0 elements can be used within companies and how they need to be adjusted for their use there. Next it will be shown how these adjusted Web 2.0 concepts can be realised within a company. Different technologies and applications, which can be used for the realisation, will be introduced and compared with the common enterprise information technologies (chapter 4.4). In chapter 4.5 the pros and cons of the use of Web 2.0 concepts in companies will then be discussed. Finally it will be explained what companies need to do in order to integrate Web 2.0 technologies successfully (chapter 4.6).

In the next part a case study will provide a practical insight in the realisation of Web 2.0 concepts within enterprises. The example shows how the investment bank Dresdner Kleinwort Wasserstein supplemented their IT infrastructure with the use of wikis and blogs (chapter 5). This is followed by the conclusion (chapter 6) and the introduction of related questions, which answers could be worth further research (chapter 7).

2   THE MEANING AND DEVELOPMENT OF WEB 2.0

In this chapter the base is built to analyse the importance of Web 2.0 for enterprise information technology. Therefore the development and meaning of the term Web 2.0 will be discussed. Afterwards, by the introduction of the Web 2.0 key elements, it will be defined in detail what the Web 2.0 concept is. It will also been explained what leads to the recent success of Web 2.0 and why the concept is working. Finally the theory of "collective intelligence" will be introduced. The theory provides an explanation for the function of different Web 2.0 elements and technologies and is also important for the discussion of Web 2.0 in companies.

2.1   History of the Internet

In 1969 the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense established the ARPANET. This network is considered to be the first step in the development of the Internet.

The ARPANET started with four knots. It connected time-sharing computers at government supported research sites which were principally universities in the USA. In this way the resources of the connected computers could be shared by many users at different locations, which lead to a more efficient use of expensive processor time. The popularity and importance of the network among the computer science research community in the USA grew fast. New tools and applications were developed - for example the first e-mail program in 1971/1972. ARPANET also employed packet switching,[7] which later led to the development of commercial packet networks. Today's computer communication networks are based on this technology.

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[7] In a packet-switching network the digital data is cut into small pieces called packets. Each of the packages proceeds independently over any available circuit through the network to the target destination, where the pieces are reassembled. If any are lost on the way, they are resent by the originator. Cp. Wikipedia, http://en.wikipedia.org/wiki/Packet-switching (2006-10-08).

An important step towards the Internet as we know it today was made by the effort of the Defense Advanced Research Projects Agency (DARPA), formerly ARPA, to connect various research networks in the United States and Europe. Therefore DARPA set up a program called "Internetting", in which the interconnection of heterogeneous networks was investigated. The research based on the new concept of open architecture networking. In order for the concept to work, a new protocol as well as new system architecture had to be developed. In 1974 *Robert Kahn* and *Vinton Cerf* presented the basic design of such a protocol and system architecture. Namely, the transmission control protocol (TCP), which enabled different types of machines in networks all over the world to route and assemble data packets.

By the 1980s the National Science Foundation (NSF) worked with DARPA to make TCP/IP[8] the standard in all federally supported research networks. In this way the access to the net could be expanded to the entire academic and scientific community. In 1983 ARPANET, and all networks attached to it, officially adopted the TCP/IP networking protocol. From then on, all networks that used TCP/IP are collectively known as the Internet. In the late 1980s the first commercial Internet service providers (ISPs) appeared. Their number was growing rapidly. In 1989 the Federal Networking Council (FNC) gave formal approval for interconnection of commercial and federal networks and in 1993 federal legislation allowed the NSF to open the NSFNET backbone to commercial users. In 1995 the NSF decided that the net infrastructure no longer required their support because commercial providers were now able and willing to meet the needs of the Internet community. So the NSFNET backbone was retired. Where a government sponsored system once existed now a fully commercial system was in place. [9]

From the 1990s on the Internet was experiencing an enormous growth in the number of networks, number of hosts and the volume of traffic.[10] The upcoming World Wide Web

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[8] The TCP/IP protocol suite implements the protocol stack on which today the Internet and most commercial networks run. It consists of the Transmission Control Protocol (TCP) and the Internet Protocol (IP). Cp. *Wikipedia*, http://en.wikipedia.org/wiki/TCP/IP (2006-10-10).

[9] Cp. *Michael, Aaron Dennis*, Internet, 2006.

[10] Cp. *Gray, Matthew K.*, Web Growth, 1996.

(WWW)[11] and the release of Mosaic, the first widespread web browser, in 1993 made the Internet come to general public attention. Mosaic was developed by the University of Illinois and allowed an easy access of the Internet through a "point-and-click" interface. In the end of 1995 there were over 100,000 web sites on the Internet. For most publicly traded companies it became obvious that a public Web presence was desirable. First it was mainly seen as a cheap and quick way to publish information worldwide. But more and more the possibility of direct Web based commerce (e-commerce) came into focus.[12]

The second half of the 1990s initiated the so-called "dot-com boom" or "dot-com revolution". The period was marked by the founding of numerous Internet based companies, commonly referred as dot-coms. Driven by an explosive growth of the Internet - the number of web sites more than doubled annually[13] - a strong believe in the Internet as new groundbreaking business platform arose and new online businesses emerged everywhere. Venture capitalists saw record setting rises in stock valuation of Internet companies and therefore assigned capital open handed. But many entrepreneurs lacked realistic plans and administrative ability. As a result many companies never became profitable. That led to the so called "dot-com bubble". In financial markets a stock market bubble is a sharp rise or boom in share prices without a factual reason, but because prices are expected to be high.[14] In March 2000 the stock prices reached the top. From this date on the prices started to fall with a fast increasing rate. The bubble burst and as a result many companies of the "new market" went out of business.

Towards 2003 the new market recovered from the crash and the depression that followed. Some of the pioneers of the dot-com era such as eBay (http://www.ebay.com)

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[11] The development of the World Wide Web began in 1989 by Tim Berners-Lee and his colleagues at CERN, an international scientific organization based in Geneva, Switzerland. They created a protocol, HyperText Transfer Protocol (HTTP), which standardized communication between servers and clients. Cp. *Wikipedia*, http://en.wikipedia.org/wiki/Www (2006-10-10).

[12] Cp. *Cerf, Vinton G.*, Internet History, 1997.

[13] Cp. *Gray, Matthew K.*, Web Growth, 1996.

[14] Cp. *Liebowitz, Stan*, The Network Economy, 2002, p. 8.

or Amazon.com (http://amazon.com), which had solid business plans, had survived. Also new companies and applications were again launched more frequently.

In preparation of a conference *Tim O'Reilly*, the founder and CEO of the publishing house O'Reilly Media, Inc., and *Dale Dougherty* discussed if companies that had survived the dot-com crash had something in common. They came to the conclusion, that the dot-com collapse was a turning point for the web. In this context they adopted the expression "Web 2.0". This expression was an allusion to the nomenclature for software upgrades, for what they believe to be the second generation of the Internet.[15] In 2004 *O'Reilly* and a partner started a new annual conference, called Web 2.0, which has become a big event since then. In September 30, 2005 *O'Reilly* wrote the article "What Is Web 2.0" in which the term is explained for the first time.

2.2   The Meaning of Web 2.0

Since *Dougherty* and *O'Reilly* invented the name "Web 2.0" it became a great success, especially in marketing terms. In October 2006 the Google search result for Web 2.0 lists about 499.000.000 hits.

Figure 2: Google trend history on the keyword Web 2.0.[16]

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[15] Cp. *O'Reilly, Tim*, Web 2.0, 2005.

[16] Source: *Google trends*, Web 2.0, http://www.google.de/trends?q=web+2.0 (2006-10-14).

Almost every new Internet page or -service which has been launched recently declares to be Web 2.0. But what Web 2.0 actually stands for is vague. As a result several people see Web 2.0 mainly as a buzzword without real matter. It can be argued that the term Web 2.0 is often overused but it has a meaning: Web 2.0 can be seen as the continual advancement of online applications from the end of the dot-com crash until now. Or as *Tim O'Reilly* put's it:

> *"… the '2.0-ness' is not something new, but rather a fuller realization of the true potential…"* [17]

O'Reilly argues that from the end of the dot-com crash until now large-scale changes took place in a short time. In this process the face of the Internet was so broadly changed, that it now can be called the web of the second generation (Web 2.0). So Web 2.0 is not a new technique, a new programming paradigm or the consideration of social network theories for an online service. It is all of that. It is an effort to capture all new flows under one name. Under this view an online service can be declared Web 2.0, when the relevant new concepts and techniques have been considered in its design.

Still it can be criticised whether the term Web 2.0 is necessary. Especially when arguing that the new flows summarised under the term Web 2.0 do not seem to have so much in common. But the supporters of the term explain that a common thread exists: Web 2.0 captures recent developments which bring the Internet back to what it was meant to be, before it shifted in a different direction in the dot-com era. An example is the concept to foster desktop-like applications in the Internet. This concept is an important element of Web 2.0 but the idea exists already since the very beginning of the Internet. When Java came up in 1996 it was introduced as a new model of software which should challenge desktop applications. The approach was to deliver applications from a server, instead of having them on the local hard disc. But despite the actual approach Java became essentially a generic replacement for the programming language C++. First through recent developments like AJAX (Asynchronous JavaScript and XML) the concept of

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[17] *O'Reilly, Tim*, Web 2.0, 2005, p. 4.

desktop-like applications is starting to succeed.[18] AJAX is a web development technique for creating interactive web applications. The technique will be explained more detailed in chapter 2.4.2.

2.3   Web 2.0 Key Elements

If agreeing to the term Web 2.0 or not, fact is that the new developments labelled as Web 2.0 are broadly changing the face of Internet. The key elements of these developments can be identified through the examination of Web 2.0 applications. When comparing applications which are labeled Web 2.0, it attracts attention that most follow similar ideas and concepts. From these ideas and concepts eight key elements can be deduced for which Web 2.0 can be defined as the generic term. In this chapter these Web 2.0 key elements are explained.

Architecture of participation

To design applications, which encourage user participation has probably brought the most attention in the Web 2.0 discussion. The idea derives from the open source concept, where software is developed by a community of dedicated users. This concept was enhanced by the idea that users could not only help developing the application it self, they could also be encouraged to implicitly add value to an application while they use it. To make this idea work it is necessary to design the application from the start on open for participation. Another requirement is to take social aspects in consideration. Communities, as part of an online application, for example can motivate participation.[19]

By attending these points, several users could be motivated to contribute but the most still would not take the trouble of adding value to an application. Therefore the core of the concept is that the architecture of the application enables an automatic production of value while it is used. The approach is to set inclusive defaults for aggregating user data as a side-effect of their use of the application.[20] An example is the online bookmaking

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[18] Cp. *Graham, Paul*, Web 2.0 The Common Thread, 2005.

[19] Motivations for users to participate in online applications will be explained in detail in chapter 2.4.1.

[20] Cp. *O'Reilly, Tim*, Architecture of Participation, 2004.

service del.icio.us (http://del.icio.us). The service allows it to store bookmarks online, so they can be accessed from wherever an Internet connection is available. But the major attraction of the application is that it is possible to see who else bookmarked a site and what other bookmarks these persons stored. In this way the users of del.icio.us generate collective value as an automatic by-product of pursuing there own "selfish" interests.

Data as the center of an application

The value of online applications lies increasingly in its database. The competitive advantage is a unique, hard to recreate source of data. A good example is Amazon.com in comparison to its competitor Barnesandnoble.com (http://www.barnesandnoble.com). The databases of both companies base on information from the ISBN registry provider R. R. Bowker. But Amazon.com has enhanced the data by adding publisher supplies such as cover images, table of contents and sample material. Beside that, and even more important they designed their portal to encourage users to annotate this data. As a result Amazon.com became the primary source for bibliographic data on books and left Barnesandnoble.com behind.[21]

Comfortable data handling

While applications are increasingly data-driven and the data is increasingly user generated, users need to be offered comfortable ways of handling this data. That means that users should be in control of their allocated data without having another party locking it up. For most Web 2.0 applications, as social networking portals like MySpace (http://www.myspace.com), this is constitutional. In other business models it would be disadvantaging to give the full control over the data to the user. In those cases users will still be comforted to create content freely, but the right on it will go to the owner of the service. At Amazon.com for example users who write online reviews agree to give all rights of usage to Amazon.com.[22]

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[21] Cp. *O'Reilly, Tim*, Web 2.0, 2005, p. 3.

[22] Cp. Amazon.com, Conditions of Use, http://www.amazon.com/exec/obidos/subst/policy (2006-10-05).

When talking about comfortable ways of handling data, the question of how to publish data easily is also of particular importance. The answer is to provide user friendly online interfaces which can be accessed by only using the web browser. In this context new techniques like AJAX come into focus. Other technologies increasingly used to achieve easy data handling are wikis, blogs, RSS (Really Simple Syndication) and tags. These technologies will be explained in detail in chapter 2.4.2

Desktop-like applications

Desktop-like internet applications are typically a combination of a GUI (Graphical User Interface) and multimedia content. The approach is to facilitate rich user experiences through the creation of web based software which offers the user a similar experience to a computer based software program. A key component to realise desktop-like applications is the already mentioned AJAX.

A good example for a desktop-like application is the Google mail service, Gmail (http://mail.google.com). Gmail offers a user interface which is as good as GUIs from desktop mail programs. Beside that, it can be accessed through a web browser from wherever an Internet connection is available and it includes strong search abilities.
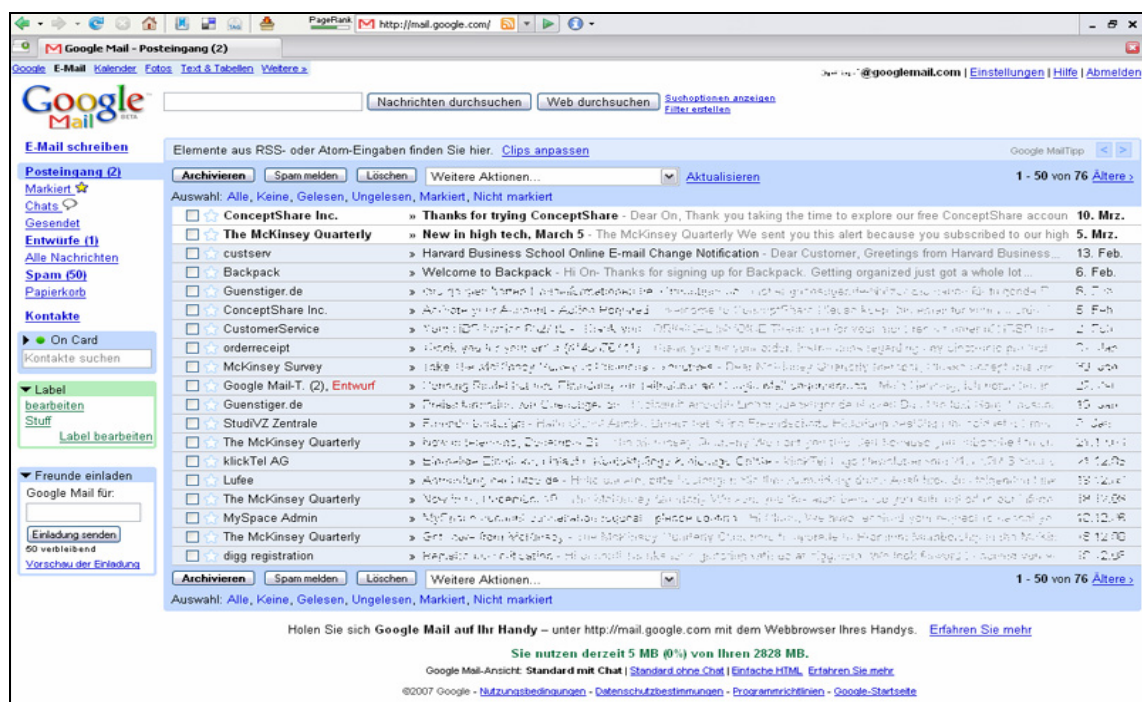

Figure 3: Google Mail, Inbox. Source: Own contribution.

Lightweight programming

Lightweight programming stands for a programming concept where simplicity and ideal usage of the application is central. The application is reduced to what the user needs and offers it service in the way the user wants it. That sounds obvious and one could think that every online application meets these points. But even so usability has always been a considered part of an online application's design, it has not always been the primary aspect. Especially during the dot-com era the focus was more on how to optimise the application on generating income. Users were for example forced to registration even if they did not gain any benefit from it. They were subscribed to e-mail advertisements by default and the applications it self were often loaded with ads.

But the idea of "lightweight programming" goes further than just reducing user obstructions to a minimum. Applications build under the aspect of "lightweight programming" support open standards which makes it easy to re-use the application and mix it content with other online services. This makes it possible to enhance the applications in ways maybe unimagined by its creators. The new service, which results from the recombination of content from other applications, is called "mashup". A good example which shows that online applications can benefit from openness is the online map service Google Maps (http://maps.google.com). Google Maps cannot only be embedded in everyone's own homepage, it also offers a public interface (API)[23] which makes it possible to use Google Maps as foundation for other services. Plazes (http://beta.plazes.com) is for example such a service which combines new information with the Google Maps service and creates a new value out of that: The Plazes mashup automatically detects the location of its users and connects them to people and places nearby. Without being open to re-use, Google Maps would probably not be as popular as it is today.

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[23] An application programming interface (API) is the interface that a computer system, library or application provides in order to allow requests for services to be made of it by other computer programs, and/or to allow data to be exchanged between them. Cp. *Wikipedia*, http://en.wikipedia.org/wiki/API (2006-11-12).

Always beta

"Always beta" stands for applications which are no longer treated as products but as services. Therefore updates are no longer released in fixed cycles. When the application is connected to the Internet, updates can be made permanently. That makes enhancements a normal part of the user experience. Users become real-time testers and feedback about new features will be presented quickly. Only features which are adopted by the users will stay, the others can be removed for further development. That promotes the users to co-developers and makes sure that the application provides precisely what the users want.

Software above the level of a single device

Today most mobile devices as PDAs (Personal Digital Assistant) or cell phones are able to connect to the Internet. As a result Internet based applications are no longer limited to a PC. To ensure comfortable usage of applications from a mobile device, it is necessary to consider this aspect in the architecture of applications from the start on. But the approach can be taken even further when mobile devices are actively integrated into an online service. An example for such a concept is the MySpace partnership with the wireless carrier Helio (http://www.helio.com). Helio offers cell phones which are specially made for the use of a mobile MySpace service. The devices allow it to manage MySpace mail, comments and friend requests and much more while on the go.

The web as a platform

Another phrase often used in the context of Web 2.0 is "the web as a platform". That refers to the possibility of using the web as a foundation upon which to build all kinds of applications. That was of course always possible. But through the increasing use of the Internet, increasing access to broadband connections and new online technologies like AJAX this concept becomes more relevant. Recently the web is changing from a collection of web pages to a platform for applications, similar to desktop applications.

The web as a platform is also often associated with the use of typical Web 2.0 technologies, like wikis and blogs, as platforms.[24]

2.4   The Technical and Social Backbone of Web 2.0

In this chapter the social and technical premises responsible for the development and success of Web 2.0 will be discussed. It can be distinguished between social aspects which drive people to use Web 2.0 applications and technical inventions which enable the development of Web 2.0 services.

2.4.1   Social Motivations for Online Collaboration

One of the most important elements of Web 2.0 is, as explained before, participation. Most Web 2.0 applications base on concepts which first work through contribution of many persons - as for example Flickr[25], YouTube[26] or Wikipedia[27]. Often the aspect of participation is also what makes these applications so popular. The following theories explain what motivates people to participate in online services.

	Related concepts & theories	Basic assumption / evidence
Intrinsic motivation	Task-involvment	Psychological pleasure derived from the active involvment with a challenging task. (*Csikszentmihalyi, Mihaly* , Psychology of Discovery,1997)
Extrinsic rewards	Social approval: recognition and reputation	Gaining peer reputation as central incentive to make one's work publicly available. (*Raymond, Eric S.* , Open Source, 1999)

(figure continuing on the next page →)

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[24] Cp. *O'Reilly, Tim*, Web 2.0, 2005.

[25] Flickr is an online photo management and sharing application. See http://www.flickr.com/about/.

[26] YouTube is a free online video streaming service that allows users to view and share videos. See: http://www.youtube.com/t/help_center.

[27] Wikipedia is a Web based, free content encyclopedia project, written collaboratively by volunteers. See: http://en.wikipedia.org/wiki/Wikipedia.

	Related concepts & theories	Basic assumption / evidence
Extrinsic rewards	Gaining knowledge	Gaining knowledge by means of information exchange and help provided by expert members of the community. (*Kozinets, Robert V.* , Virtual Communities, 1999)
Meaning of exchange	Expected reciprocity and equity	Cognitive evaluation of the input/output ratio in relation to a referent other. (*Walster, Elaine* , Equity, 1978)
	Moral obligation	Reciprocation based on internalized norm or conviction. (*Etzioni, Amitai* , Analysis of Complex Organizations,1975)
	Gift-giving	The significance of exchange arises from objects and symbols given away. Gifts are not contingent on future reciprocation. (*Stirrat, R. L. / H. Henkel* , Gift-giving, 1997)
Common goals and values	Shared passion	Communities gather around a common interest, communing in a shared passion. (*Kozinets, Robert V.* , Virtual Communities, 1999)
Communal relationships	Group bonds	Intimate communal ties (*Rheingold, Howard* , Communal Relationships, 2000)
	Sense of community	Webs of personal relationships in cyberspace (*Rheingold, Howard* , Communal Relationships, 2000)

Figure 4: Reasons for participation in virtual communities [28]

As shown in the chart the motivation for participation is caused by a mixture of self-serving and group related, altruistic reasons. While reasons in which contributors value the opportunity to benefit others cannot be dismissed, the group of self serving reasons is far bigger. Also the first listed theory of "task involvement" explains participation through the ambition to achieve personal benefits. *Csikszentmihalyi* explains that people feel happier when they are actively involved with a challenging task.[29] A good example is Wikipedia (www.wikipedia.org), the free encyclopaedia, where all articles are written collaboratively by volunteers.

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[28] Cp. *Hemetsberger, Andrea*, Cooperation on the Internet, 2001, p. 12.

[29] Cp. *Csikszentmihalyi, Mihaly*, Psychology of Discovery, 1997.

The theory of "social approval" shows one aspect of how communities can motivate participation. People who contribute in a community and provide value will earn recognition and reputation for the expertise and time invested.[30] When for example at the video broadcasting portal YouTube (www.youtube.com) a video post earns top ratings from many other users this is a high motivation for further contribution.

The theory of "gaining knowledge" names gaining knowledge and the increasing of career prospects as important motivators for participation. This is one explanation for the popularity of online business networks as for example Xing (www.xing.com). Through participating in services like that people gain knowledge about other persons, which can also help finding a job. Another example is Wikipedia, where the contribution of information and discussion in the community expands the knowledge of the contributor.

Participation is in many cases an exchange of knowledge. In the theory of "expected reciprocity" the exchange is motivated by expectations of reward of knowledge resources. Especially in virtual communities power relies on giving away knowledge resources instead of possessing or hoarding them. Another reason for contribution can be that a person feels constrained to return a favour. This is explained in the theory of "moral obligation". If a person had benefited in the past from the work of a community, for example the Wikipedia community, this could motivate to pay back.

In the theory of "gift-giving" contribution is a result of altruistic behaviour in the sense of "doing something good" for others. In this case participation is not based on expecting satisfaction of needs and may even demand the sacrifice of personal pleasure.[31] The more central an object or activity is to a person, the more likely the person will participate in a project or community. This motivation is explained in the theory of "shared passion". *Rheingold* wrote about this issue:

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[30] Cp. *Raymond, Eric S.*, Open Source, 1999.

[31] Cp. *Stirrat, R.L. / H Henkel*, Gift-giving, 1997.

"Communing in a shared passion is the essence of truly communal community."[32]

This applies in the same way for virtual communities. Internet communities usually gather around common interests and shared passions.[33] Feelings of belonging and friendship are also reasons for cooperative behaviour. People who already know each other use online communities to stay in contact. Beside that, also people who did not know each other before often develop social relationships by collaborating in an online community.[34]

2.4.2   Web 2.0 Technologies

After presenting the social motivations for online participation, technologies and infrastructural developments, which enabled and stand for the Web 2.0 concepts, will be described. As addressed in chapter 2.2 many of the Web 2.0 concepts base on ideas which have existed for a longer time already. But still it took until now to realize them. The reason is that technical and infrastructural prerequisites were missing before.

A requirement for the development of Web 2.0 applications is the wide access to fast Internet connections. Especially to give consideration to the concepts of "comfortable data handling" and "desktop-like applications", broadband Internet connections are necessary. From 2003 until 2005 the amount of broadband Internet connections in private households in Germany rose from 9% to 22%. In 2005 62% of German companies were accessing the Internet through broadband connections. This development matches the European standard while the dispersion of broadband connections in the Scandinavian countries is still higher. For example in Finland, in 2005 37% of the private households had broadband connection.[35]

Beside Internet connections, also the performance of personal computers improved. Furthermore the offering of free software (open source software) increased and the costs

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[32] *Rheingold, Howard*, Communal Relationships, 2000.

[33] Cp. *Kozinets, Robert V.*, Virtual Communities, 1999.

[34] Cp. *Rheingold, Howard*, Communal Relationships, 2000.

[35] Cp. *Statistisches Bundesamt*, Information Technology, 2006.

for online storage dropped.[36] All these developments supported the spread of Web 2.0 applications. The decrease in storage costs for example enabled the development of storage intensive applications like Flickr or YouTube.

AJAX

Beside these environmental enhancements, additional technical developments were supporting the realization of Web 2.0. One of the important new technologies is the already often named AJAX. AJAX (Asynchronous JavaScript and XML) is a web development technique for creating interactive web applications, which means that AJAX is not a single programming language, but a combination of different technologies like XHTML, CSS, XML and JavaScript. The main benefit of AJAX is that web pages which are using this programming concept feel more like desktop applications. Classic web pages work in the way of the request-response paradigm in which every user action on a web page is send as a request to the server which is after some processing, returning an HTML page to the client. This can cause waiting time for the user when the server or the Internet connection is slow.

An Ajax application eliminates the start-stop-start-stop nature of interaction on the Web by introducing an intermediary, the AJAX engine. Instead of loading a webpage, at the start of the session the browser loads the Ajax engine which is responsible for both - rendering the interface the user sees and communicating with the server. The Ajax engine allows the user's interaction with the application to happen asynchronously - independent of communication with the server. So the user does not have to wait for the server to respond. The result is none, or at least a reduction, in waiting time, when the server or the internet connection are slow. That leads to an improvement in usability and user experience.[37]

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[36] Cp. *BITKOM*, Open Source Software, 2006, p. 1, *Computerwoche.de*, storage costs, 2006.

[37] Cp. *Garrett, Jesse James*, AJAX, 2005.

Wikis

Another important technology for the Web 2.0, especially under the aspect of collaborative authoring, is the wiki software. Wikis match perfectly with the Web 2.0 concepts and therefore considerably contributed in the spreading of Web 2.0. But wikis are not only a standalone prime example for Web 2.0. Many Web 2.0 applications use wikis as part of their service, for example as a tool for documentation. A wiki is a website that allows the visitors themselves to add, remove, and otherwise edit and change the content of the webpage. The editing is made in a simple mark-up language just using a web browser. Often this is possible without registration and mostly there is no review before modifications are accepted. The result is that edits can be made in real-time and they appear almost instantly online. The name wiki is a short form of "wiki wiki" (weekie, weekie) a word in Hawaiian language for fast.

The fact that anybody can make changes without registration and review can also lead to abuse of the system. That is why some private wiki servers require user authentication. But wikis are generally designed to make it easy to correct mistakes, rather than making it difficult to make them. Wikis provide for example a "recent changes" page: A list of all the edits made within a given timeframe. From this list other functions like showing the previous page versions and highlighting the changes between two revisions are accessible. An authorised editor can use these functions to restore a previous version of the article.[38]

Blogs

Blogs are another important Web 2.0 technology. The term "blog" is a blend of the words web and log (Web log). A blog is a user-generated website where entries are made in journal style and displayed in a reverse chronological order. Blogs often provide commentary or news on a particular subject, such as food, politics, or local news. Others function as more personal online diaries.[39]

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[38] Cp. *Wikipedia*, Wiki, 2006.

[39] Cp. *Wikipedia*, Blog, 2006.

Today's blogs are mostly based on weblog software (also called blog software or blogware). This software is a special kind of Content Management System. With the help of such software even people without programming and HTML knowledge can keep a weblog. Generally only a web browser is needed to create and edit the blog. The weblog application is regularly offered through the developers host for free. These typically includes free of charge hosting service for the published blog itself. An important feature of blogs is the ability for readers to leave comments to the blog entries. The comments can be tipped directly in the web browser and are most times immediately visible. That makes contribution very easy and is one reason for the success of this media.

Permalinks are another important feature. A permalink is an URL that points to a specific blog entry even after the entry has been removed from the front page into the blog archive. Dynamic, database-backed websites, as for example blogs, have the problem that their URLs are often changing. Changing URL can not be bookmarked and they are in general difficult to recover. Because permalinks remain unchanged indefinitely, their use avoids this problem.

Beside permalinks, trackbacks are another special feature of weblogs. They are primarily used to facilitate communication between blogs. If a blogger writes a new entry commenting on, or referring to an entry found at another blog, and both blogging applications support the TrackBack protocol, then the commenting blogger can notify the other blog with a "TrackBack ping". The receiving blog will typically display summaries of, and links to all the commenting entries below the original entry. This allows for conversations spanning several blogs that readers can easily follow. [40] Blogs became recently so popular that even an own terminology was developed. Publishing information at a blog is called blogging, the person contributing the information is called blogger and the entries in the blog are cold posts.

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[40] Cp. *Wikipedia*, Trackback, 2006.

Podcasts

Because blogs make it easy for everybody to broadcast information and ones opinion, they strongly foster the participation idea of Web 2.0. In this cause blogs are related to podcasts. Podcasts are downloadable audio or video (then also called video podcast, vidcast or vodcast) recordings. To publish a podcast the content provider just needs to record an audio file (for example, an MP3[41] file) and make it available on the internet. This is done by posting the file on an own or publicly available web server. To make the podcast available to a wide audience the content provider then usually acknowledges the existence of that file by referencing it at a podcast directory. The initial appeal of podcasts was to allow individuals to distribute their own "radio shows", but the system is also used in a wide variety of other ways, including distribution of school lesions, conference meetings and tours of museums. The term "podcast" is a portmanteau of the name of Apple's portable music player, the iPod, and broadcast.[42]

RSS

RSS is, as in chapter 2.3 already mentioned, a technique increasingly used to realise the Web 2.0 concept of "easy data handling". RSS was already introduced in 1997 but it took until the success of web blogs before RSS became widely popular. It is a technique which allows subscribing to content of specific web pages. Every time when new information is available on a webpage it will be delivered to the subscribers. This is especially helpful when observing many different web pages because it turns the information flow from a pull- into a push paradigm. RSS is a web feed, which is the generic term for a data format used for serving users frequently updated content. Another web feed is the Atom standard, which development was basically an reaction to recognized issues with RSS. [43]

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[41] MP3 is a popular digital audio encoding and compression format, designed to reduce the amount of data required to represent audio. Cp. *Wikipedia*, http://en.wikipedia.org/wiki/Mp3 (2006-10-10).

[42] Cp. *Wikipedia*, Podcast, 2007.

[43] Cp. *Keogh, James*, RSS, 2005, p. 109ff.

Tags

Tags are a further Web 2.0 technology with the goal of easier data managing. The concept is to assign keyword-like one-word descriptors to data, to organize it. In difference to traditional categorizing systems it is not necessary to match the data into preconceived categories. Tags can be chosen informally and personally by the creator, and they do not form a hierarchy. That allows the creator to choose the keywords which are the best for him to categorize the data.

Peer-to-peer networks

Also peer-to-peer (or P2P) computer networks are commonly considered an element of the Web 2.0 technologies. P2P is a technique for sharing files containing music, videos, text or anything in digital format. Also realtime data, such as telephony traffic, is passed using P2P technology. The data can be shared either over the Internet or with a closed set of users. Unlike the traditional methods of storing a file on one machine - which can become a bottleneck if many people try to access it at once - P2P distributes files across many machines, often those of the users themselves. Therefore a peer-to-peer computer network relies primarily on the computing power and bandwidth of the participants in the network rather than on central servers. P2P is a technique which follows the idea of "architecture of participation" because every user of a P2P service automatically helps to build the value of the shared data.[44]

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[44] Cp. *Wikipedia*, Peer-to-peer, 2007, *O'Reilly, Tim*, Web 2.0, 2005, p. 3.

3 COLLECTIVE INTELLIGENCE – WISDOM OF CROWDS

Wikis and tags are considered to be two of the Web 2.0 tools which can be used to improve enterprise information technology. These technologies, but also for example the Google search engine, imply in their concepts the theory of "collective intelligence".[45] This theory explains for example why Wikipedia is working and what the advantages of mass collaboration are. But also what conditions are necessary to make contribution successful and what risks of failure exist. The theory has been described by *James Surowiecki* under the headline "The wisdom of the crowds" and will be described in this chapter.

First in 2004 *Surowiecki* published a book called "The wisdom of the crowds". In this book he describes the theory that groups of people can be smarter than the smartest people within them. He argues that under the right conditions a random group will always make better judgements than single experts. A demonstrative example for *Surowieckis* theory can be found at the TV game show "Who Wants to Be a Millionaire?". In the show a candidate has to answer different questions and at best, when answering all the questions correct, can win one million dollars. If the candidate cannot answer a question he can use different "jokers". One joker is to call a friend for help, another one is to ask the audience. Even so the candidate will choose to call an alleged expert for help, when using the "telephone joker", the audience is more often giving the right answer. In average the audience, a random group of persons, was answering the questions in 91% of the cases right, while the telephone experts were only in 65% of the cases right.[46]

A more scientific example for the wisdom of crowds can be found in a test, the sociologist *Kate H. Gordan* made. She asked two hundred students to rank items by weight and found out that the aggregated estimate of all students was 94% accurate,

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[45] Cp. *O'Reilly, Tim*, Web 2.0, 2005, p. 3.

[46] Cp. *Surowiecki, James*, Wisdom of the Crowd, 2006, p.4.

which was better than all but five of the individual guess. Even so the single students were no experts in the task the groups aggregated estimates were almost perfect.

The reason for this phenomenon, *Surowiecki* argues, is under a mathematical point of view quite easy to explain: When a group is participating to solve a certain task everyone has some different knowledge, some experience in the problem but also some errors in their information. When aggregating all the information and different judgements the errors are being cancelled out. The result is a good or even perfect judgement.

The main problem of single experts is that even so they are performing better than the average in a special field they constantly overestimate the likelihood that they are right. A survey on the question of overconfidence by economist *Tarance Odean* found that physicians, nurses, lawyers, engineers, entrepreneurs, and investment bankers all overvalued their knowledge in their area of expertise.[47] Similarly, a recent study of foreign exchange traders found that 70% of the time the traders overestimated the accuracy of their exchange rate predictions.[48] That means that however well informed and sophisticated experts are, they are not impeccable and the risk is high that they will not see it when they make a mistake. To get the most out of experts it is therefore better to pool their advice and predictions with those of others to eliminate the errors. The larger the group, the more reliable its judgment will be. But this is only working under certain conditions, which will be explained next.

3.1 Premises for Wise Crowds

Two basic factors need to be given to make the theory of the wisdom of crowds working: The problem which should be solved needs to be clear, and a right answer for this problem needs to exist. In points of art or creativity for example that limits the wisdom of crowds. Beside that, there are four other conditions which need to be satisfied in order for a crowd to be smart.

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[47] Cp. *Odean, Tarance,* Experts, 1998, p. 53.

[48] Cp. *Surowiecki, James*, Wisdom of the Crowd, 2006, p. 42.

Diversity

Diversity stands for the cognitive diversity of the group, which means diverse perspectives and heuristics. Crowds are more likely to be intelligent if their members use different ways and tools to solve a problem. This is because of two reasons:

- Diversity expands the range of information the group has access to, which helps to make better judgements. Groups that are too much alike are less able to investigate alternatives, because each member is bringing less and less new information to the table. That means that an expert-only-group will most likely underperform a random group because of the expert's homogenous points of view.

  This can be illustrated by an experiment of *Scot Page,* a political scientist at University of Michigan. In his experiment *Page* took computer simulated agents and let them solve a problem. Afterwards he rated how well they were doing. In a second step he put them into groups: One group of the best of the bests and a second random group. Then he let the groups solve the problem. The result was that the best of the best group was doing well but the random group was consistently outperforming the best of the best group.[49] The random group had some less intelligent agents but those agents brought in different information, different perspectives. The result was a higher collective intelligent of the random group - even so their average intelligence was lower.

- Diversity also helps to avoid the fundamental group problems of group thinking and peer pressure. These problems have negative influence on the quality of group decisions. When all persons in a group have the same point of view they have no reason to question their thinking; they could easily miss a mistake in their ideas. But if there are only some differently thinking people within the group it will also motivate the people which share the same opinion to rethink their view.

  Peer pressure is a problem which is often believed to be irrelevant in groups of adult, professional decision makers. In reality this can very well be a barrier as

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[49] Cp. *Page, Scott / Hong, Lu*, Heterogeneous Agents, 2001, p. 63.

experiments, as of psychologist *Solomon Asch*, show. But *Asch* also found out that diversity is an effective way to neutralize peer pressure.[50]

Independence

How wise crowds are is also depending on how independently their members act. Therefore all persons in a group should base their judgement as much as possible on their own knowledge. People should not look so much what the others around them are doing and thinking. To produce a smart group decision all this individual judgements should then be aggregated to one. This is the opposite of trying to find the group's least common denominator. Bad group decisions are often the result of focusing too much on a consensus, which result is often mediocrity.

But especially in small groups it is not easy to ensure that everybody in a group is working as much as possible as an individual. One reason is that people tend to imitate. A popular example therefore is a group of people staring up to an empty sky. If this group is just big enough (about 15 people) most of the passing by persons will also start looking up - even so they do not have any personal evidence that there might be something above them. This is a natural human habit and often helpful, but in connection to group decisions it is destructive. Another reason why independence is hard to provide is because people are afraid of their reputation. People often equalise their point of view to the group's majority perspective because they fear to be in the end the only one with a different, maybe wrong, idea.

Decentralization

To make use of the before explained group diversity and the independence of its members it is necessary that important decisions can be made individually. Power should not fully reside in one central location. Otherwise diversity and independence would be without effect. Important decisions should be made by individuals based on their own local and specific knowledge rather than by a "farseeing" planner.

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[50] Cp. *Asch, Solomon*, Group Pressure and Judgements, 1963.

Aggregation

As mentioned before, an important part to realize wise crowds is to aggregate all individual views to one collective answer. Depending on the task of the group there exists a variety of different tools to do that. An example is Wikipedia, where the content to a certain topic will be modified as long as it represents the point of view of all contributors. If a page finally stays unedited this can be seen as the groups aggregated wisdom.[51]

3.2   Practical Relevance

At the example of Wikipedia the practical relevance of the wisdom of crowds can be quite well illustrated. In Wikipedia, as in any other wiki, everybody can edit the content. The articles are a result of voluntary work of thousands of different persons. Even so these persons are generally no experts the quality of most articles is good. The reason for that is that errors made in the article, if deliberately or not, will most likely be found by one of the other contributors and then be corrected. That this system is working was shown by a comparison made in 2005 of sections of Wikipedia and the Encyclopaedia Britannica. The result of the analysis, performed by the science journal "Nature", was that the two encyclopaedias were close in terms of accuracy.[52]

But even so Wikipedia provides good quality in a large number of articles it cannot be disregarded that some lack neutrality or are even wrong.[53] In these cases often one of the conditions, introduced by *Surowiecki*, had been violated. A possible reason for the violation can be a too self-contained community. Such a community with a very consistent point of view bears the risk that different opinions are too easily rejected. The result is that the requirement of independence cannot be fulfilled. This is a problem which many Web 2.0 applications face, when connecting a concept of collective intelligence with a community. Even so communities are a common part of Web 2.0

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[51] Cp. *Surowiecki, James*, Wisdom of the Crowd, 2006.

[52] Cp. *Glies, Jim*, Comparison of Wikipedia and Encyclopaedia Britannica, 2006.

[53] See for example http://www.answers.com/topic/criticism-of-wikipedia (2007-02-08) for a general overview on the Wikipedia problems.

applications and as explained before are helpful motivators for participation, they constrain independence. In order to maximise the power of crowd wisdom it is better to keep connection random and ties loose. Therefore it is important to distinguish if the goal of an application is communing or to harness collective intelligence. To try to achieve both goals could lead to failure.

This is also important to attend when using Web 2.0 concepts to improve enterprise information technology. The aim needs to be clear. If the company plans to develop the communication in project teams this needs a different approach than if the goal is to improve project results through the use of collective intelligence. In the first case the company could for example introduce tools which allow online discussions, the easy sharing of files and coordination of calendars. If the aim is to improve project results through harnessing collective intelligence the approach could be to set up a prediction system, where everybody in the company – also people not implicitly involved in the project – can anonymously predict factors which are important for the success of the project. For example: How high is the budget necessary to realize the project?[54]

Under consideration of the explained theory of "collective intelligence" it becomes now clearer, why collaboration makes Web 2.0 applications so powerful. The in chapter 2.3 explained concept of "architecture of participation" is the foundation for collective intelligence within Web 2.0 applications. The adoption of the "architecture of participation" concept for the use in an enterprise context could also enable companies to use the power of "collective intelligence". This is a first indication, why Web 2.0 has also importance for enterprises. The next chapters will provide more evidence on the relevance of Web 2.0 for enterprises.

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[54] For more information on the chances and risks of corporate prediction markets see for example: *Ottaviani, Marco / Sørensen, Peter Norman*, Corporate Prediction Markets, 2007.

4   THE ADOPTION OF WEB 2.0 IDEAS FOR ENTERPRISES

After explaining the meaning, elements and important theories of Web 2.0 it is now possible to examine the potential of Web 2.0 for the use in an enterprise context. Therefore it will be discussed which persons at a company would benefit most from the introduction of Web 2.0 concepts and how. The core of this chapter is formed by introducing the concepts which can be deduced from Web 2.0, in order to improve enterprise information technology. It will also be analysed how these concepts can be realised at a company. Afterwards the strengths and weaknesses of Web 2.0 as approach for enterprise information technology will be discussed. Finally it will be examined what companies need to attend to successfully adopt Web 2.0 concepts.

4.1   The Challenge of Tacit Interactions

Today for 25 to 50 percent of the employees, collaborative, complex problem solving is the essence of their work. The "tacit" activities of these knowledge workers[55] involve the exchange of information, the making of judgments and a need to draw on multifaceted forms of knowledge in exchanges with co-workers, customers and suppliers. Knowledge workers are for example responsible for the invention of new products and services, the design of marketing programs and the creation of strategies. Their work is unstructured and they are extremely mobile. Often a company's knowledge workers are dispersed across the organization, and increasingly across the globe. They are typically among the company's highest paid workers and make huge contributions to its competitive prospects in a fast changing global business landscape.[56]

A key to high performance within a company is therefore to enable knowledge workers to work productively, creatively and innovatively. To ensure this work environment, the company has to provide proper ways of communication and knowledge

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[55] A knowledge worker is anyone who deals for a living with information, ideas and expertise. The term was first introduced in 1959 by *Peter Drucker* in his book "Landmarks of Tomorrow". Cp. *Perseus Publishing*, Business Resource, 2002.

[56] Cp. *Bryan, Lowell/ Joyce, Claudia*, 21st-century organization, 2005, p. 25f.

management. Hence knowledge workers are supported with different information technologies (IT) and knowledge management (KM) tools. Based on the definition of *Wainright*, these enterprise information technologies can be described as:

> *"Technology used in companies to utilise, create, capture, manipulate, communicate, exchange, present, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived). Thus, information technology includes computer hardware, software, and communication systems."* [57]

The described special work environment of knowledge workers makes one segment of enterprise information technology especially important for their effectiveness: IT, which supports unstructured and unplanned interactions. In the following the most common components of this IT segment will be introduced and their limitations will be discussed. Generally these technologies are divided into two categories: channels and platforms.

Channels

This media enables anyone to create and distribute digital information. Examples for channels are person-to-person instant messaging and e-mail. E-mail is also the most used information technology of knowledge workers (see Figure 5). The disadvantage of channels is that the degree of commonality of the information is low. An e-mail for example is only viewable by the few people who are part of the thread. A second disadvantage is that channels can only be accessed or searched by the contributing person. Even so the information has importance for other persons it stays invisible and unobtainable for these.

That explains why channels and especially e-mail is seen negatively by many knowledge workers. In a survey of the Work Productivity Council (IWPC) doing research on the topic "personal information and knowledge management" it was found

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[57] Wainright, M. E./Brown, C. V./DeHayes, D. W./Hoffer, J. A., Information Technology, 1999.

that 26% of all knowledge workers feel, that e-mail is overused in their organization, 21% feel overwhelmed by it and 15% fee that it actually diminishes their productivity.[58]
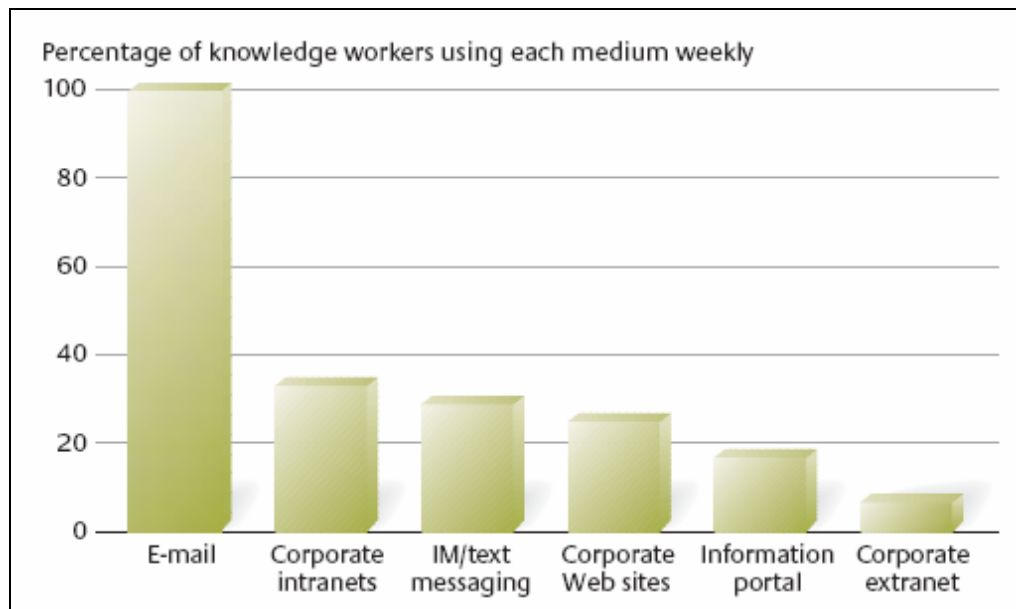

Figure 5: Communication technologies used by knowledge workers.59

Platforms

The content of this media is generated by a small group, but it is widely visible and persistent over time. That makes platforms in a way the opposite of channels - the production is centralized and commonality is high. Platforms are for example intranets and corporate information databases.

In a survey by Foster Research the disadvantages of platforms became visible: Only 44% of the respondents agreed that it was easy to find what they were looking for on the intranet of their company.[60] Furthermore, only a small percentage of employees publish their output and cogitations on a public platform, which makes the actual capturing of knowledge difficult.

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[58] Cp. *Davenport, Thomas H.*, Knowledge Work, 2006, p. 126.

[59] Source: *Davenport, Thomas H.*, Knowledge Work, 2006, p. 124.

[60] Cp. *Morris, Meredith*, How Users Feel About Technology, 2005.

Knowledge Management systems are another important part of corporate IT. They are designed to be a channel as well as a platform. They aim to elicit tacit knowledge, best practices and relevant experience from knowledge workers throughout a company and put this information in a widely available database to provide assistance for tacit work.

But knowledge management systems are often complicated and inflexible. The structure of KM systems is designed in advance and mostly in a top-down process. This architecture is contrary to the unstructured workflows of knowledge workers - especially when the KM system provides no opportunities to alter the structure afterwards. Another problem of KM systems is that they need to be filled actively with information before they provide a benefit. Frequently, this information should be found and contributed by knowledge workers in their spare time. The problem is that the spare time of knowledge workers is usually rare. [61]

Recapitulating it becomes obvious that common information technologies have several weak points. A study by *Susan Feldman* and *Joshua Duhl* highlights the problems. They found out that knowledge workers spent 24% of their work time (in a 40-hour week) on searching and analysing information. They calculated that each task costs more than $14,000 per worker per year (based on average salary of $60,000 per year plus benefits).[62] That points out that the use of common communication- and KM-tools alone cannot lead the way to high performance knowledge workers. But a study by McKinsey (8,000 US companies were researched) shows that there are ways to achieve that goal. In their survey, analysing the importance of knowledge workers, *Beardsley, Johnson,* and *Manyika* found out that some companies manage tacit interactions much more effectively than others:

> *"We found that the performance of companies in relatively tacit-interactive sectors varied far more than that of other companies. ... [That] reflects two things: First, companies have considerable competitive headroom for improving the productivity of those who undertake tacit interactions and less headroom for*

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[61] Cp. *McAfee, Andrew*, The Dawn of Emergent Collaboration, 2006.

[62] Cp. *Feldman, Susan / Duhl, Joshua*, Costs of Information Work, 2005.

improving the productivity of other workers. Second, in some highly tacit sectors, companies in the top quartile understand how to make tacit workers more effective and now have a significant performance lead on rivals. ''[63]

4.2   Web 2.0 as Approach for High Performance Tacit Work

As the McKinsey survey shows, some companies are better in making their knowledge workers effective than others. These companies obviously found ways to support their knowledge workers stronger. The question is what are these companies doing different? In the survey the answer is that the best performing companies found ways to remove communication barriers and foster collaboration. These companies introduced new tools, which made communication, interaction, and data handling easier and encouraged workers to share ideas.[64] These actions clearly bear resemblance to Web 2.0 concepts. Under this point of view it becomes visible that Web 2.0 concepts can be used to develop enterprise information technology in order to make knowledge workers more effective.

When considering the before described weaknesses of common IT infrastructures and the advantages Web 2.0 applications can provide, it is not surprising that some knowledge workers start to adopt Web 2.0 tools independent for their office work. Services like Bloglines[65] (www.bloglines.com), del.icio.us (del.icio.us) and Google Desktop[66] (http://desktop.google.com), which help consumers to generate, share and refine information, can also be useful for knowledge workers. In this way consumer Web 2.0 applications already found their way into many companies.[67]

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[63] *Beardsley, Scott/ Johnson, Bradford/ Manyika, James*, Better interactions, 2006, p. 57.

[64] Cp. *Beardsley, Scott/ Johnson, Bradford/ Manyika, James*, Better interactions, 2006, p. 60f.

[65] Bloglines is a web based personal news aggregator. The service offers searching, subscribing, creating, and sharing of news feeds and blogs.

[66] Google desktop allows full text search of e-mails, web history and files. It can be advanced through many different tools, as e-mail, stock information, personalized news, RSS/Atom feeds.

[67] Cp. *Trotter W.,* Enterprise 2.0, 2006, p. 2.

But making use of consumer Web 2.0 applications can bring a company more risks than advantages. If the software is not officially supported and integrated by the IT-department, the result could be vulnerability. Beside that, to optimise the possible benefits of Web 2.0 tools it is necessary to adjust these services and products to the company's special needs and integrate them with the present IT infrastructure.

4.3   Enterprise 2.0

Web 2.0 concepts modified for the use in enterprises are called Enterprise 2.0 concepts or Enterprise Web 2.0 concepts. The term Enterprise 2.0 is used to describe the introduction and implementation of Web 2.0 ideas within enterprises. The effort of Enterprise 2.0 is to use the Web 2.0 ideas to enhance the support of knowledge workers.

So far the practical realization of Enterprise 2.0 mainly consists in introducing Web 2.0 technologies as wikis, blogs and RSS to a company. But Enterprise 2.0 also stands for the more general approach of realising a new corporate IT concept, deduced from Web 2.0. *Andrew McAfee* of Harvard Business School defines Enterprise 2.0 as:

> *"The use of emergent social software platforms within companies, or between companies and their partners or customers."*[68]

The central term in *MacAfee's* definition is social software. Social software can be defined as software which enables people to rendezvous, connect or collaborate through computer mediated communication.[69] In an enterprise context the term social software is a more general expression for groupware or collaborative software. With emergent *McAfee* means that Enterprise 2.0 software is freeform and that it contains mechanisms to let the patterns and structure inherent in people's interactions become visible over time. Platforms are, as already addressed above, digital environments in which contributions and interactions are globally visible and persistent over time.

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[68] *McAfee Andrew*, Definition of Enterprise 2.0, 2006.

[69] Cp. *Wikipedia,* Social software, 2006.

Other Enterprise 2.0 descriptions such as from *Rangaswami* and *Mirchandani* of Sand Hill Group or *Dion Hinchcliffe* from Hinchcliffe & Company are wider.[70] *Rangaswami* for example includes in his description the aspect of software as a service (SaaS), which is related to the Web 2.0 element "always beta".[71]

So far no final agreement exists on which Web 2.0 elements are part of the Enterprise 2.0 approach. But most descriptions address the same aspects in their core. These common Enterprise 2.0 concepts will be explained in detail next.

Applications as platforms

A fundamental goal of Enterprise 2.0 is to make information widely and perennially available for knowledge workers. It is a known problem that knowledge workers spend much time on finding information like for example: "Who is working on a similar problem right now?", "Does a template already exist for the analyse I want to do?" or "Who were the key people in restructuring our online sales process last year?". All this information exists, but is often hidden in someone's e-mail box or private documents.

By offering knowledge workers applications which are platforms, the contributions and interactions become globally visible and persistent over time. In contrast to KM systems the approach is not to capture knowledge itself but to store the practices and output of knowledge workers. The stored information can then be consulted and searched by everyone with access to the platform. Even if a knowledge worker is retired it is ensured that his or her findings remain in the company and can be in further use.

Also managers can benefit from the use of platforms because the work of their employees becomes more transparent. E-mail as communication medium for example is making it much more difficult to overlook the work progress of a project. The concept of "applications as platforms" deduces from the Web 2.0 element "the web as a platform" and is for example realised in wikis and blogs.

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[70] Compare: D. Hinchclife's blog at http://web2.wsj2.com and SandHill.com, Opinion at www.sandhill.com/opinion/index.php (2007-01-13).

[71] Cp. *Rangaswami, M. R.*, The Birth of Enterprise 2.0, 2006.

Designed for collaboration

This concept is similar to what *McAfee* describes as social software and bases on the Web 2.0 element "architecture of participation". The approach is to introduce the many-to-many paradigm to corporate IT. Many-to-many means that everybody can contribute and everybody can access the information. Channels, as for example e-mail, only allow a "one-to-one" communication. Through this media an individual can communicate with another individual. A corporate intranet most times represents a "one-to-many" communication. Everybody inside the company can view the information, but only one group, the corporate web team, can contribute information.

The many-to-many paradigm can be realized for example through the use of wikis, blogs and tags. If such applications are set up in a company they allow all knowledge workers to view, supplement and modify the published information. Under consideration of security issues, the access to the application could even be expanded to suppliers and customers. That would not only lead to a more effective collaboration of knowledge workers, but also to a better collaboration with the partners outside the company. An advanced collaboration with suppliers, partners and customers allows for example the early integration of their know-how in the design of new products, which can reduce the risk of launch failures.

In the context of collaboration also the concept of collective intelligence is getting into focus. As addressed in chapter 3: If groups contribute on a problem the aggregated judgement of the group will most likely outperform the judgement of the best skilled persons within the group. The prerequisite is that the group is diverse, the people are independent in their decisions and that all information is aggregated to a collective view. The realisation of the many-to-many paradigm provides diverse information. Necessarily a many-to-many application will also include mechanisms to combine all the different information, so that in the end a collective view of all contributors is visible. If the company policy then also allows knowledge workers to be relatively independent all conditions for collective intelligence are fulfilled.

Lightweight workflows

This concept is what *McAfee* describes as "emergent". The approach is that the user can decide how he wants to use an application. The application can be personalised to adjust it perfectly to a user's special needs. That means that the structure of an application is not predetermined, the structure will be developed through using the application. This does not mean that such applications provide less structure, the difference lies in how the structure is developed.

The problem of current corporate IT infrastructure is that once a given business process is mapped into an application it is difficult to readjust the process. But in many cases the best configuration for a process is not always clear in advance. Therefore, the idea of this Enterprise 2.0 concept is to use information technology which allows its users to develop the structure through experimenting and iterating over time. Such technologies are for example wikis or tags. Applications which are not based on a fix structure also have the benefit that information can be unrestrictedly recombined in order to solve new problems. Knowledge workers especially benefit from this ability - which is also known as remix-ability - because their work is highly diverse.

Another aspect of this Enterprise 2.0 concept is to foster simplicity and ideal usage of applications. Partly this is achieved through the fact that people are not confronted with predefined, maybe complicated workflows. Further steps to realize easy and appealing applications are to offer simple interfaces. This can for example be realised through the use of AJAX. The concept of "lightweight workflows" is based on the Web 2.0 element "lightweight programming", while the remix ability of information is inspired by the mash-up concept.

Software as a service and all-embracing access

The delivery model of software as a service is not new but moves in course of the Enterprise 2.0 discussion increasingly into focus. The idea is that companies are not longer buying enterprise software as a product. Instead the application is accessed as a service through the Internet. That makes companies much more flexible in the introduction of new applications, because the usually time consuming and expensive process of buying and integrating enterprise software can be simplified. Also the

operation of the software is getting cheaper with this concept, because expensive infrastructure for operating and maintaining the software is no longer needed. In the same way the risk of system stability is handed over to the service provider.

For knowledge workers the advantage of this approach is that software can be adopted bottom-up. Most times users know themselves best which applications they need. A corporate enterprise committee, making the decision for them is often counterproductive. Besides, that allows the flexibility of SaaS knowledge workers to change to a different application, if the old one is for example not meeting the requirements of a new project. Further more, knowledge workers are better integrated in the development process of the application itself, when using applications which are designed as a service.[72]

If an application is provided as a service or as a product, the accessibility is always better if it is an online application. Online applications allow knowledge workers to use the program from wherever access to the intranet respectively Internet is possible. Because many knowledge workers have to be extremely mobile such applications are a huge benefit. In the context of mobility also the use of handhelds (pocket sized computing devices) is coming into focus. Handhelds generally provide Internet access and can therefore be used as terminal to access software from anywhere. If software is accessed with a handheld it should be secured that it still offers a similar ease to use as if accessed by using a desktop computer. To make this possible, web development techniques like AJAX can be used.

The approach of this Enterprise 2.0 concept is to take all these aspects into consideration, when developing or adopting software. The SaaS aspect of this concept derives from the Web 2.0 elements "always beta", while the accessibility is related to "software above the level of a single device" and "desktop-like applications".

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[72] Cp. chapter 2.3 Web 2.0 Key Elements, always beta.

4.4   Enterprise 2.0 Technologies and Applications

In this chapter technologies and applications will be introduced which allow the realisation of the presented Enterprise 2.0 concepts. It will be shown how these technologies and applications can be used to improve corporate IT.

As the Enterprise 2.0 concepts deduce from the Web 2.0 elements it is not surprising that also the realisation of Enterprise 2.0 can be done through the use of Web 2.0 technologies. The technologies usually used to realize Enterprise 2.0 applications are wikis and blogs in combination with tags, RSS feeds and search functions.[73] But there exist also Enterprise 2.0 applications which do not base on these technologies. So far these applications are still rare. But it is likely that if Enterprise 2.0 will develop to an inherent part of corporate IT, more and more of these applications will be developed. Three of these applications will be introduced at the end of this chapter.

4.4.1 Blogs

The use of blogs in companies is not completely new. More and more enterprises discover the advantages of corporate blogs. But primarily these blogs are used as marketing instrument, to communicate with customers and other stakeholders. The use of blogs as enterprise information technology is still rare.

But blogs are also valuable as internal communication tool: Blogs are platforms, so all contributed information stays permanent and widely accessible. Blogs also allow their readers to comment on the published information. This enables contribution - although it is not a hundred percent realisation of the many-to-many paradigm. Further more, blogs are very easy to use. All needed to access a blog, publish information and comment on posts is a web browser. Another attribute of blogs is that it is possible to set them up very easily and quickly. Blogs also provide an emergent structure through tags, which are regularly an inherent part of blogs. In total the attributes of blogs correspond complete with the Enterprise 2.0 concepts.

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[73] Cp. *McAfee, Andrew*, The Dawn of Emergent Collaboration, 2006.

According to *Ansgar Zerfaß* from the University of Leipzig two main applications of blogs as internal communication technology can be identified: Knowledge blogs and collaboration blogs.[74]

Knowledge blogs describe blogs which are used as knowledge repository. In this way single knowledge workers or teams can keep blogs to publish important information. This can be general branch news, studies or reports for their department. For every different subject, as for example marketing issues or corporate news, different blogs can be set up. Without the use of blogs such information would probably be sent as e-mail or be published on the corporate intranet. But the use of those media bears several weaknesses: Releasing the information on the intranet could be difficult and time-consuming. Depending on the companies CMS[75] and their publishing process it could even be necessary to forward the information to the company's intranet team - if these are the only persons able to publish information. Posting the information on a blog in contrast is possible within minutes.

When the information is spread via e-mail the problem of a time consuming publishing process would be solved. But e-mails could easily be overseen or forgotten when considering all the mail communication knowledge workers are confronted with. Beside that, is the access to information sent by e-mail limited to the recipients. A blog in contrast will have a fix address which can be checked for updates whenever an interested employee finds the time. This is also possible from at home or while on the go. Blogs allow their readers also to discuss the information and complement it with own experiences. This is an important aspect, since only through the participation of many persons a knowledge repository can become valuable.

In the category of knowledge blogs belong also blogs that are used to publish experiences in the form of "lesson learned". Through publishing gained insights on a blog they can be reflected and become more set. It also allows consulting the records again every time a similar problem is appearing. Moreover, becomes the knowledge

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[74] Cp. *Zerfaß, Ansgar*, Corporate Blogs, 2005.

[75] A content management system (CMS) is software to create and manage internet portals. Key features of a CMS are the use of templates and WYSIWYG editors which ease the publishing of content.

accessible to other members of the company. All employees with access to the blog can benefit from the gained insights of their co-worker and complete it with commenting own experiences. In order to motivate knowledge workers, to take the trouble and publish their experiences it has to be primarily easy to do so. This is the big advantage of blogs compared for example with a knowledge management system.

A further application for blogs is to use them in projects. These blogs are what *Zerfaß* calls collaboration blogs. Especially when the project members are geographically separated a blog can simplify the project work a lot. In this case the blog can for example be used before meetings to collect and discuss information, to brainstorm, or to adjust the meeting agenda. Without the use of a blog this would probably be done via telephone or e-mail. In contrast to these media a blog offers much more transparency. If the meeting agenda is for example developed via e-mail, it would be necessary to always make sure, that everybody is working with the latest version. By using a blog new information is immediately visible for everyone. That makes it possible for different people to work simultaneously on the same problem. Because blogs are easy and quick to set up and use, they are most practical in small projects. For bigger projects blogs lack a sufficient ability to structure information. In this case wikis are the better choice.

Whether blogs are used as knowledge repository or collaboration tool, they also help to improve social interactions within the company. The professional exchange of information will always be only one aspect of blogging. If a knowledge worker is frequently writing about his work experiences his posts will probably also tell something about him as a person and his private life. Colleagues who continually follow the posts and comment on them will establish a social connection to the blogger. Blogs aid the forming of social connections especially because the blogging language is commonly informal. In this way blogs can help to improve the social network inside the company, which is important for collaboration.[76] In the end of chapter 4.4.3 Figure 6 shows a screenshot of how blogs can be integrated in a corporate intranet.

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[76] For more information on social networks and their importance for collaboration in companies see for example: *Kilduff, Martin / Tsai, Wenpin*, Social Networks and Organizations, 2003, p. 6f, 32f, 53-58.

4.4.2 Wikis

A wiki used as corporate information technology is also called enterprise wiki, or enterprise wiki software. As explained in chapter 2.4.2 is a wiki in principle a collaborative website which allows users to create and edit pages. In this context wikis are not so different from content management systems which are widely used in companies to manage web pages. But wikis follow a different approach than a CMS; they are designed for collaboration and flexibility rather than strict control.

The structure of a wiki is developed bottom-up in an ad-hoc way. When new information has to be added to the wiki, the contributor can decide independently how to structure the information. This structure will then develop and change while more information of different publishers is added. In a CMS the structure is traditionally first defined and then the information is fit in as good as possible. Another attribute of wikis is that they do not restrict the publication of information. Everybody with access to the wiki can release information. At a CMS new content usually needs to be approved by a senior editor before it becomes visible. Wikis also make the creation of content easy. They provide a simple mark-up language, the so called wikitext, which makes it uncomplicated to format text and generate hyperlinks. Besides, many wikis offer a WYSIWYG[77] editor which makes the creation of content even easier. Wikis are also platforms and they are usually online accessible. A special strength of wikis is, as already mentioned, the ability to harness collective intelligence. Whenever wikis are introduced at a company they will most likely enable knowledge workers to benefit from their group wisdom, which is of course also valuable for the company. All in all the characteristics of wikis correspondent completely with the Enterprise 2.0 concepts. That makes wikis a capable tool to enhance enterprise information technology.

Among the addressed general attributes, enterprise wikis are often equipped with additional functions. These functions are added so that the wiki meets the special requirements of companies. The enterprise wiki offered by Socialtext Incorporated

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[77] WYSIWYG is an acronym for What You See Is What You Get. It describes a system in which content during editing appears very similar to the final product. Cp. *Oxford English Dictionary*, http://www.oed.com/ (2007-02-13).

(www.socialtext.com) for example provides an extra dashboard which allows every user to monitor recent changes made by his/her team. The dashboard displays which pages have been added or changed and who has made the last changes and when. The same information is provided about pages on a user's personal watch list. A further common extra of enterprise wikis is that every wiki page can be e-mailed and that it is possible to get notified by e-mail if a page is changed. Enterprise wikis offer also expanded revision and rollback functions. These make it possible to compare two versions of a page and get the differences between the versions highlighted. In this way it becomes easy to restore a previous version of a page, if necessary. Beside that, enterprise wikis often allow to restrict the access, so that only people who have been invited by an administrator can publish information.[78]

These general and additional features qualify wikis especially to use them as collaborating tool and knowledge repository. These are the same applications as blogs, but wikis and blogs fulfil quite different tasks in these categories. Compared to blogs, wikis can be used to collaborate in big projects or serve as central communication tool. As knowledge portal wikis are capable to substitute a whole corporate intranet. The ability to structure and restructure information widely enables wikis to hold much more information without getting confusing.

Informative (www.informative.com), a technology enabled marketing service company, for example is using an enterprise wiki as intranet knowledge portal. Their teams are spread across five time zones around the globe which makes it difficult to exchange information in person. Before introducing the wiki the company used a traditional intranet portal with a structured editorial process to aid their knowledge workers. But even so six persons were working fulltime on the portal it was never complete and not much used. The new introduced wiki on the other hand became very quickly the one place to find hints, best practices, sample proposals, and a lot more information. The reason for the success was that the wiki was easy to load with information and that the knowledge workers were able to structure the information the way it suited best for

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[78] Cp. *Socialtext*, product tour, http://www.socialtext.com/products/tour/ (2006-12-23).

them.[79] An example for the integration of a wiki in a corporate intranet is illustrated by Figure 6 in the end of chapter 4.4.3.

As collaboration tool a wiki can be used to post requirements, files and questions, build meeting agendas, track meeting notes, attach relevant documents, provide up-to-date profile pages of departments and employees, collaboratively write on documentations and make all this information widely available. Nokia for example set up a wiki at their US "Insight & Foresight department"[80] to improve the collaboration on technology investment research. The wiki lead to massive time savings and accelerated projects especially because it reduced the e-mail traffic. Much time was wasted before to filter important information out of an increasing amount of occupational spam. The wiki enabled the knowledge workers to scan selective for information.[81]

4.4.3 Search, Tags and RSS

The Nokia example illustrates quite well, that finding the right information quickly is a critical factor for effective knowledge work. That applies in the same way for Enterprise 2.0 applications. Wikis and blogs enable easy publishing, contribution and access to information, but it is obvious, that this information can only be helpful when it can be found easily. Therefore Enterprise 2.0 applications integrate commonly a keyword search function. People are used to keyword search on the web and for most people the use of search engines is today the usual and proven way to find information.

The Enterprise 2.0 aspect in this approach is to use a search engine which bases on the concept of collective intelligence. A prominent example for the use of collective intelligence in searching is the Google search engine. The core of the Google system is the PageRank[82] algorithm, which uses the vast link structure of web pages as indicator

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[79] Cp. *Socialtext*, Informative case study, 2006. *Waxer, Cindy*, wiki at Informative, 2005.

[80] Cp. *Nokia*, Insight & Foresight: http://www.nokia.com/nokia/0,,54516,00.html (2006-12-23).

[81] Cp. *Socialtext*, Nokia case study, 2006.

[82] The PageRank relies on the uniquely democratic nature of the web by using its vast link structure as an indicator of an individual page's value. In essence, Google interprets a link from page A to page B as a vote, by page A, for page B. But, Google looks at more than the sheer volume of votes, or links a page receives; it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important"

for the individual value of a page. Simplified, that means that the most linked pages will be displayed at top of the search results. Through the introduction of the PageRank system Google was able to enhance search results and increased the satisfaction among searchers. A study by the Pew Internet & American Life Project points that out. It was found out that 87% of Internet searchers report to have successful search experiences most of the time.[83]

In contrast Foster Research found out (compare chapter 4.1) that finding information on an intranet is often most difficult. One reason therefore is that on most intranets links can only be created by a small group of persons, for example by a web development team. In this situation the link structure can not represent the opinions of a company's workforce. To take advantage of the information contained in links between web pages, employees must be allowed to create and edit links. Enterprise 2.0 applications enable by nature a wide range of persons to build and edit links (for example through wikis).[84] As a result the use of Enterprise 2.0 applications together with a search engine, basing on collective intelligence, will enhance the quality of search results.

Tags

Also tags make it easier to find information and therefore are a common addition for Enterprise 2.0 applications. As described in chapter 2.4.2 are tags collaboratively generated, open-ended labels that categorize content. Tags clearly correspond with the Enterprise 2.0 idea: They are collaborative, they provide an emergent structure, and they are easy to use. Furthermore they are online accessible and the value of categorisation is persistent over time. The categorisation system that emerges from tagging, which the labelling process is called, is also known as "folksonomy". Folksonomy stands for a categorisation system developed over time by folks.

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weigh more heavily and help to make other pages "important". Cp. *Google Technology*, www.google.com/technology/ (2006-11-13).

[83] Cp. *Fallows, Deborah*, Search Engine Users, 2005, p. 2.

[84] Cp. chapter 4.3, "designed for collaboration".

As a stand-alone application tags are often used for social bookmarking. A social bookmarking system is an intranet or Internet application to store lists of intranet and Internet resources. The listed resources are classified through tags. Other users of the system can see who else tagged a resource, under which name the resource was also tagged and which other resources are stored under a certain tag. A social bookmarking system could for example be used by knowledge workers to keep track of useful intranet and Internet pages they have consulted, and to assign tags to these pages as reminders of content. They also could see which other employees are using the same tags, and what sites they have visited. As a result, patterns and processes in knowledge work would become more visible. [85] Another function of tag categorisation systems is to display so called tag clouds. The cloud visualizes all tags used in a certain system. The more often a tag is used, the bolder its font will be displayed (see Figure 6). In this way a tag cloud, which could for example be a part of an enterprise wiki, provides orientation about the topics which are most recent at a company.

RSS

Even so keyword search and tags make it easier to find content, a user can still feel overwhelmed when new content is added so often that it becomes a full-time job just to check for updates on all sites of interest. The use of RSS can solve this problem and is therefore generally an inherent part of Enterprise 2.0 applications.

As introduced in chapter 2.4.2 is RSS a technology to signal users when new content of interest appears. RSS could for example be used with an enterprise wiki to stay up to date with all information concerning a special project. Therefore a knowledge worker would just have to subscribe to the project page. By using a so called feed reader or aggregator the notifications about new content would then be downloaded and displayed. Usually these notifications consist of a headline that is also a link back to the full content. RSS can also be used in connection with tags, in the way that a notification is send when content of pages with a specific tag is changing. Instead of using RSS

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[85] Cp. *McAfee, Andrew*, The Dawn of Emergent Collaboration, 2006.

feeds, also e-mail could be used to signal changes in content. But these contribute to overloaded inboxes and might be treated like spam.

Avenue A | Razorfish intranet portal:
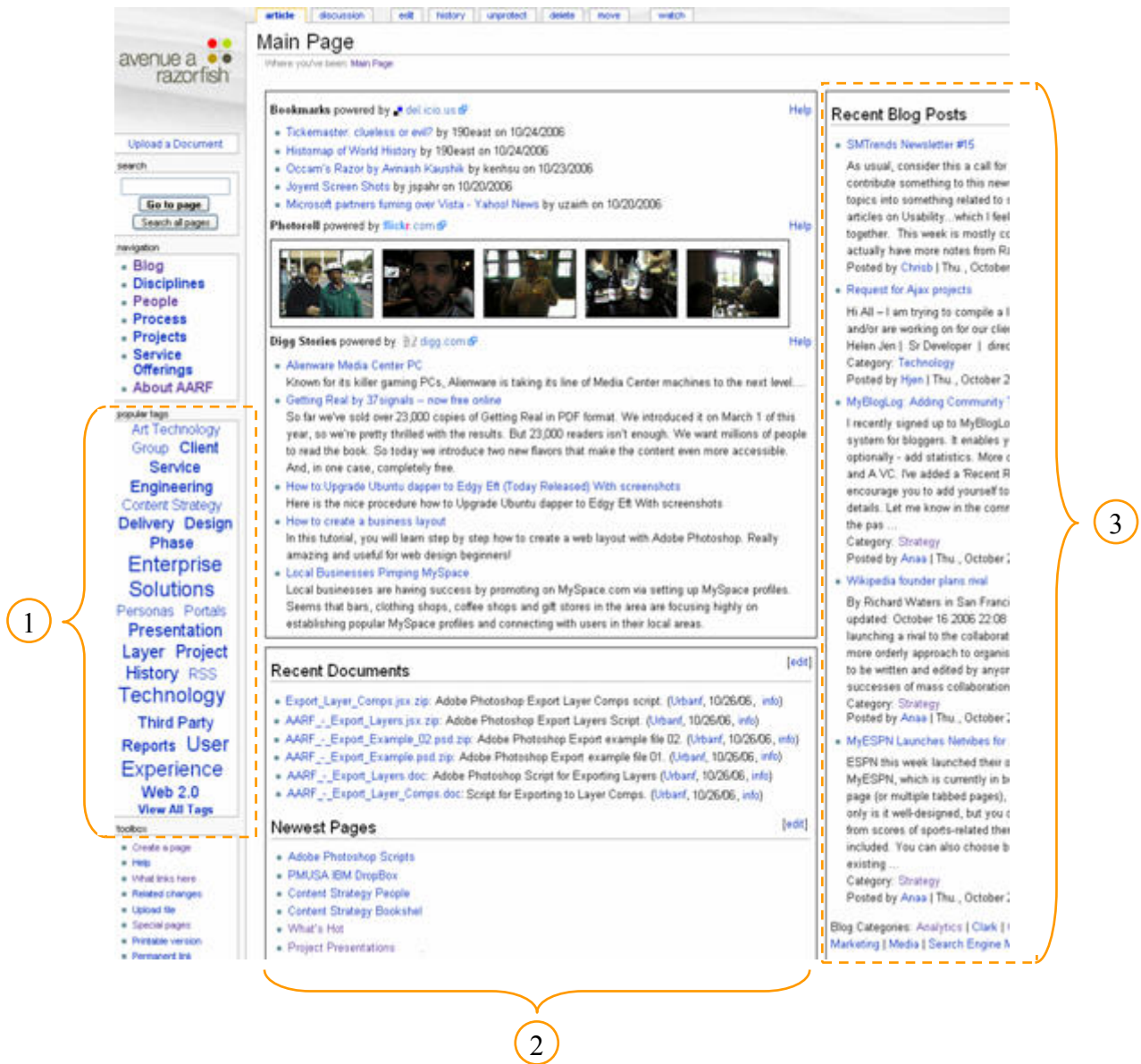
①   Tag cloud displaying the tags most used by the AARF employees in alphabetical order.

②   Top box: Internet content bookmarked by the AARF employees with the tag "AARF".

      Bottom box: Most recent intranet content uploaded to the AARF wiki.

③   Most recent blog posts.

Figure 6: Screenshot of the Avenue A | Razorfish (AARF) intranet.
Source: *McAfee, Andrew*, Enterprise 2.0 Intranet at AARF, 2006.

4.4.4 Applications

Below three applications are introduced which realise the Enterprise 2.0 approach without the use of the common Enterprise 2.0 - respectively Web 2.0 technologies.

Conceptshare (http://www.conceptshare.com/)

Conceptshare is a Flash based online application that designers and their participants can use to engage in synchronous or asynchronous conversations about and around visual designs. The approach of the application is to include the feedback of involved persons (as clients, consultants, and co-workers) in the design process from the beginning on. The application offers an online platform where the designs can be uploaded, organised, discussed, and developed. People who had been invited into a design project (also called: workspace) do not have to be online at the same time to contribute. Members can log in anytime to any workspace in which they are a member. If members do happen to be in a workspace at the same time they can collaborate with real-time chat and real-time comment- and concept updates.
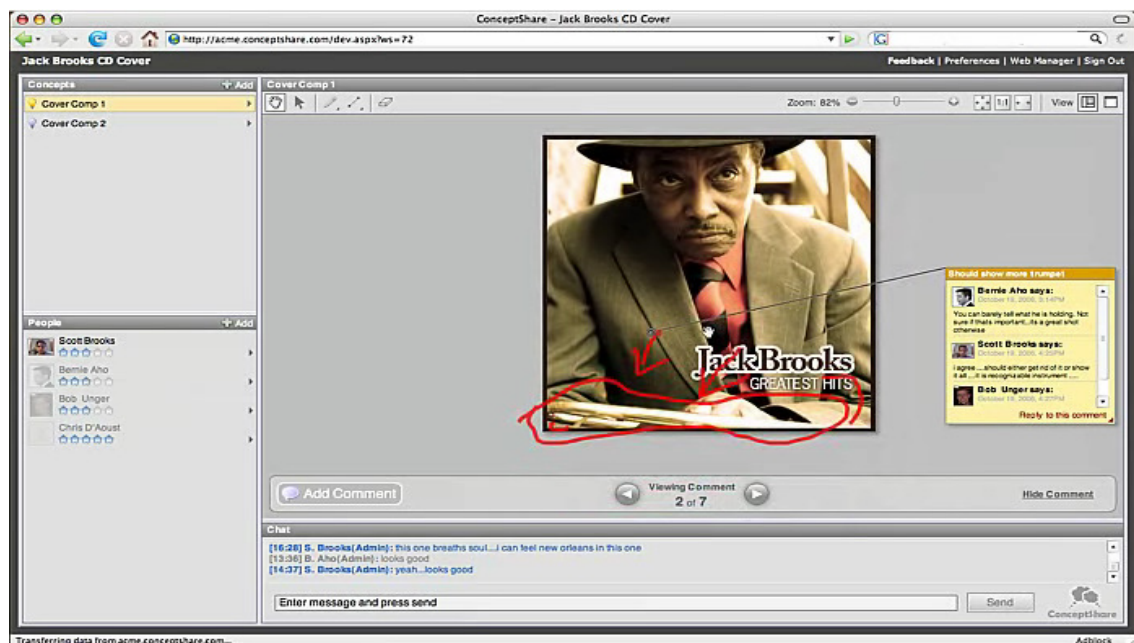

Figure 7: Conceptshare example workspace: CD-Cover design with comments.[86]

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[86] Source: Screenshot of the Conceptshare video tour, http://www.conceptshare.com/tour/ (2007-02-07).

Designs can be discussed through adding comments. Each comment layer can contain drawings or mark-ups directly on the image. Participants can also reply to comment threads in order to answer a question. When enough feedback is collected to update the design, this new design can be added to the workspace. In this way the workspace illustrates also the whole development process, from the first draft to the final layout.[87]

Conceptshare is an online platform which makes design concepts widely available and stores them. The platform is focused on contribution and allows anybody who has been invited to a design project to view and comment on the introduced layouts. Design projects can be categorised through tags which allows a freeform structure. The whole portal is online accessible and only a browser is necessary to use the application. In total Conceptshare implies all four Enterprise 2.0 concepts.

CollectiveX (http://www.collectivex.com/)

CollectiveX is a web based service that enables members of organized groups to privately and securely communicate and network. Everyone registered to the online platform can create different groups and then invite persons to join the groups. The members of every group can then use the platform to communicate and network. Therefore CollectiveX offers different services. The key services are: member profiles, a group calendar, discussion and e-mail functions, and a file cabinet.

The member profiles allow to provide information on professional expertise, personal affiliations, key connections and objectives. A person's profile page includes a real-time bio builder which enables to create comprehensive profiles with a few simple entries. The profile can be viewed only by the other members of the group. The group Calendar allows the sharing of dates to facilitate the coordination of events and meetings. The calendar can be used to track group activities as well as private dates and calendar events and can be exported to Outlook and iCal.

For group conversations a forum can be used which allows the group members to set up discussions. Group members can choose to be notified by e-mail or RSS feed about new

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[87] Cp. *ConceptShare*, tour: http://www.conceptshare.com/tour/ (2007-02-07).

discussions. Another communication possibility is e-mail blasts, which enable the broadcast of e-mails to all group members. The file cabinet allows members to share documents and files. Files are easy to upload and available to all group members.[88]

Figure 8: Screenshot of the summary screen of a CollectiveX sample group.[89]

All information on the CollectiveX platform, as profiles, discussions, files or calendar entries are persistent over time and always available to the group members. Every person in a group can view and contribute information. The structure of the application is emergent and even the biography of each profile can be customised. CollectiveX is an online service and needs only an Internet browser to be used. One of the prime goals of

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[88] Cp. CollectiveX, Product Overview, 2006.

[89] Source: CollectiveX, media inquiries: Screenshot of Summary Screen, www.collectivex.com/media (2007-02-06).

the application is to offer easy usage, which is achieved through an uncomplicated interface. In total CollectiveX correspond complete with the Enterprise 2.0 concepts.

Basecamp (http://www.basecamphq.com/index)

Basecamp is an online project management application. The platform offers a range of tools made to improve the communication between people working together on a project. The key tools are: A dashboard, a to-do list, a file sharing section, a message section, a milestone section and a time tracking tool.

The dashboard (see Figure 9) lists all projects a person is involved in, gives an overview about recent activities in those projects and shows all tasks which have been assigned to the dashboard owner. The to-do list can be used to remember and organise tasks. To-do's can be assigned and categorised in varied categories.

The file sharing section allows the up- and download of files to share them with colleges and clients. Uploaded files can be organised in various categories and by file version. Project members can be notified via e-mail if new files are uploaded. The message section is the place to communicate with the team. The messages can be structured through the use of categories and tags. Files can be attached to the messages as well as comments. Persons can get notified about new messages by e-mail. The milestones section is made to keep track of all tasks which have to be done until a specific date. The section shows an overview about all done and upcoming milestones. From here milestones can also be synchronised with a desktop calendar. The time tracking tool allows keeping track of the hours spent on a task or a complete project. This tool works together with the to-do lists. It is displayed who spend how much time on which project. The information can also be exported.[90]

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[90] Cp. Basecamp, tour: Tour of Basecamp, http://www.basecamphq.com/tour (2006-02-07).

① Tasks assigned to the dashboard owner.   ② Calendar displaying open tasks within the next 14 days.

③ List of the latest activities across projects involved in.   ④ List of all projects involved in.

Figure 9: Basecamp dashboard screenshot.[91]

All information published on the Basecamp portal is always available to the project members and it is persistent over time. Persons collaborating on a project through the Basecamp service can view, as well as contribute information. The structuring possibilities of data, as messages, files or to-do's are not predetermined. Tags and categories for example can be defined on a user's own needs. The application can be accessed online by using a web browser. That makes it possible to access the service also while on the go. Recapitulating Basecamp corresponds perfectly with the Enterprise 2.0 concepts.

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[91] Source: Basecamp, tour: The Dashboard, http://www.basecamphq.com/tour (2006-02-07).

4.5   Enterprise 2.0 Valuation

Through the introduction of the Enterprise 2.0 concepts, -technologies and -applications many opportunities and strengths of the Enterprise 2.0 approach have already been presented. In the following these strengths and opportunities are summarised and compared with the weaknesses and threats of Enterprise 2.0.

SWOT-Analysis about Enterprise 2.0

STRENGTHS	WEAKNESSES
• Direct advantages from the realisation of the four Enterprise 2.0 concepts • Cheap and easy realisation of Enterprise 2.0 applications • Introduction requires less user training as introduction of traditional IT	• Not yet established • Lose of control over information • Difficult to ensure the security of information
OPPORTUNITIES	THREATS
• More effective knowledge workers and competitive advantage • Facilitates integration and collaboration with partners and customers	• Technology could not be used • Unstable quality of information

Figure 10: SWOT-Analysis about Enterprise 2.0, source: own contribution.

Strengths

The strengths of Enterprise 2.0 are mainly based upon the realisation of the four Enterprise 2.0 concepts, addressed in chapter 4.3: The realisation of the concept "applications as platforms" leads to widely accessible information which is persistent over time. The realisation of the concept "design for collaboration" enables enfolding collaboration. The concept "lightweight workflows" ensures an emergent structure and easy usage. The concept "software as a service and all-embracing access" enables the application to be delivered as service and granites wide access.

The Enterprise 2.0 concept "software as a service and all-embracing access" is also partly responsible for the comparatively cheap and easy implementation possibility of Enterprise 2.0 applications, which is a further strength of Enterprise 2.0. Opposite to software products which need to be bought, can a software service be subscripted and paid monthly.[92] Another aspect why Enterprise 2.0 applications are cheap to implement is that many Enterprise 2.0 technologies, as for example wikis or blogs are available open source and are therefore free of licence fees.

A further strength is that the introduction of Enterprise 2.0 applications needs less user training than if traditional enterprise information technology would be introduced. The introduction of new IT always requires user training, but in the case of Enterprise 2.0 it is likely that some employees have already private experiences with for example blogs or wikis.[93] These employees would be able to adopt new Enterprise 2.0 software quicker and easier. Another aspect which reduces the need of user training is that Enterprise 2.0 applications are by design made for easy usage (see chapter 4.3, "lightweight workflows").

Opportunities

As shown in chapter 4, Enterprise 2.0 applications aim to offer knowledge workers better support for their work. This will make knowledge workers more effective and provide competitive advantage to the company.[94]

A further opportunity is that the use of Enterprise 2.0 applications facilitates collaboration with partners and customers. This is enabled through the realisation of the Enterprise 2.0 element "designed for collaboration". Good collaboration with customers results for example in improved speed of delivery on customer related issues, from

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[92] The other characteristics of software as a service, which lead to further saving possibilities, can be found in chapter 4.3.

[93] According to a survey of the PEW Internet & American Life Project, from July 2006, are 8% of the American Internet users keeping a blog and 39% read blogs. Cp. *Lenhart, Amanda / Fox, Susannah*, Blogging in America, 2006.

[94] For a deeper insight into the importance of knowledge workers for the performance of companies see for example: *Beardsley, Scott/ Johnson, Bradford/ Manyika, James*, Better interactions, 2006.

product sales to customer service issues, and will increase customer satisfaction. Also the sharing of information is advanced through tight collaboration, which can lead to the development of new business initiatives.[95]

Weaknesses

A weakness of the Enterprise 2.0 concepts and therewith connected the use of Enterprise 2.0 technologies and applications is that they are not yet established. That makes it difficult for companies, which think about the adoption of those concepts, to evaluate the risks and chances. The companies can base their valuation only on related Web 2.0 experiences from the consumer market. When companies on the other hand plan to adopt common enterprise information technology they can consult a variety of field reports to evaluate the technology.

A major critic point on Enterprise 2.0 is that the introduction will change the hierarchical order in companies. The realisation of the Enterprise 2.0 concept "designed for collaboration" gives every employee inside the company a voice and audience. Also a small employee has the ability to widely spread information and his opinion. This will reduce the power of the management to control information. But on the other hand it will lead to more transparent, democratic and consensus based decision making. If the management is not willing or able to deal with these changes it will not be possible to successfully introduce the Enterprise 2.0 approach. The full potential of Enterprise 2.0 can only be realized if companies manage the cultural, behavioural and social aspects which arise with the introduction of the concepts. That means most of all that the management of a company must be willing to hand over some power to the employees and needs to trusts them.

While the openness of Enterprise 2.0 applications offers many advantages, it becomes more difficult to ensure the security of confidential information. The approach of Enterprise 2.0 is to establish wide access to information, which can include also partners

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[95] For further information on how companies can benefit from the integration with partners and customers see for example: *Beckett-Camarata, E.J. / Camarata, M.R. / Barker R.T.*, Integrating internal and external customers, 1998.

outside the company and the access from mobile devices.[96] That can make complex access concepts necessary to grantee that secret information stays secret, which can lead to high IT expenses. In some industries, as for example in health care, were the keeping of patient secrets is critical, this will be a bigger issue than in other industries.

Threats

A threat of Enterprise 2.0 is that introduced technologies and applications may not be used. A possible reason for that is that users feel uncomfortable about the strong openness of information stored with Enterprise 2.0 information technology. They could find it frightening that their private notes concerning some project should suddenly become openly accessible through publishing them on a blog. This problem can only be solved through proper training and a company policy which fosters openness and transparency.

A further threat is that through the explained lose of control about information also the quality of the information can become unstable. In a traditional publishing process, using for example a CMS or KM system, information is generally reviewed before it is published. By using Enterprise 2.0 technologies this control instance is knowingly abolished. An aspect which puts this into a less threatening perspective is "collective intelligence". As already addressed, this theory represents an important element of the Enterprise 2.0 concept "designed for collaboration". The right realisation of the theory will lead to information of high quality. A good example is Wikipedia (see chapter 3).

4.6   Implementation of Enterprise 2.0 Services

Simply making Enterprise 2.0 applications available behind the firewall will not lead to a successful realisation of the Enterprise 2.0 approach. Active steps are necessary to motivate people to start using the new tools. This is not surprising, considering that also on the Internet the number of people who are contributing content - as opposed to passively consuming it - is a small percentage of web users.[97] When new IT is

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[96] Cp. chapter 4.3, "designed for collaboration" and "software as a service and all-embracing access".

[97] *Mangelsdorf Martha*, Beyond Enterprise 2.0, 2007, p. 52.

introduced in a company training and promotion are always necessary, but in case of Enterprise 2.0 these steps are especially important. Because Enterprise 2.0 applications base strongly on participation they can only work properly when many people use them. Therefore several important elements for a successful introduction of Enterprise 2.0 applications are introduced in this chapter.

To realise the integration of new IT, a company's management can generally follow two strategies: A bottom-up or a top-down introduction. The introduction of Enterprise 2.0 exclusively bottom-up could lead to a very slow adoption. An introduction of Enterprise 2.0 where the management is strongly ordering the use of the new tools could on the other hand intimidate employees. Because a lot of the value of Enterprise 2.0 arises through the dedicated contribution of employees, such a top-down approach would be counterproductive.[98] Therefore a middle course appears to be most promising.

In course of a successful introduction the company should furthermore attend several general points: It is necessary to figure out which Enterprise 2.0 applications are most useful for a specific company. The applications need to be aligned to the task in which they should been used. As already mentioned in chapter 4.4 exist for example differences between wikis and blogs which makes each tool applicable to solve different problems. The company should also reflect the threats, introduced in chapter 4.5, to develop an up-front concept for their avoidance. This means for instance the development of a guideline, on how and what to post on a blog.[99] It is also beneficial to think in advance about a reward system to encourage employees to strongly participate. If these steps are accomplished, the new tools can be made available inside the company. In this context it needs to be secured that the new applications get usefully integrated with the already existing IT. Enterprise 2.0 applications will not be very benefiting if they are standing unconnected to the rest of the corporate IT.

The company can now start with the actual integration of the new software. This can be done by providing first some initial education for the new tools. This training should

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[98] Cp. chapter 4.3 and 4.4.

[99] This could help to prevent the threat of unstable information quality, as explained in chapter 4.5.

introduce the usage of the new applications and illustrate how they concretely can ease the work of the employees. In this case it can be meaningful to identify a project or project team which is working on a task which solution can strongly benefit from the new tools. In cooperation with the project team the introducing IT team could then develop a case study for the possible use of the new applications. This case study could then be used as an example in the initial education. After the software is introduced and known in the company it should be continually promoted, until it is widely adopted. The first persons adopting the new tools will probably be recent graduates, who have entered the workforce last, and technology affine persons. Therefore the further promotion should focus on eliminating the concerns of the persons who did not adopt the new tools so far. These persons could be worried about the technical complicity of the software or the free access of published information.[100] Overall it is helpful to provide additional support for the software in every stage of the integration. People appreciate to know that they are not left alone with new tools and can get help when ever problems show up.[101]

These steps should be accompanied by different actions in the context of a top-down integration: Managers and team leaders should lead by example. Themselves should start to use the tools. They should also choose some good sample task and state that this task should from now on be solved using the new tools. They could for example decide that in future all meetings are documented with the new corporate wiki.

5   ENTERPRISE 2.0 CASE STUDY

In 2003 the investment bank Dresdner Kleinwort Wasserstein (DrKW) started to integrate blogs and wikis into their corporate IT infrastructure. The reason for this step was the desire to offer better tools to diffuse news, opinions, and knowledge. A further goal was to improve the collaboration within the bank and especially between the

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[100] Cp. chapter 4.5, threats.

[101] Cp. *Suarez, Luis*, Steps towards Adopting Web 2.0 within the Enterprise, 2006.

geographically separated departments. The following case study provides practical examples on how the integration of the Enterprise 2.0 tools lead to the realisation of the described goals.

Dresdner Kleinwort Wasserstein is the international investment banking arm of Dresdner Bank. Based in Europe, but with a global reach, DrKW provides a range of capital markets and advisory services, including: mergers and acquisitions assistance; listing companies that wish to go to market; providing structured finance for the funding of large scale projects; treasury and capital markets transactions; and risk management solutions. With approximately 6,000 employees, DrKW is headquartered in London and Frankfurt, and has offices in New York, Paris, Luxembourg, Tokyo, Singapore and Hong Kong.[102]

5.1   Blogs at Dresdner Kleinwort Wasserstein

Investment banks like DrKW operate under strict regulation and supervision. It is critical to prevent the abuse of confidential information. The blogging technology solution chosen by the IT department of DrKW is therefore an internally hosted open-source blogging platform, called B2Evolution (http://b2evolution.net/). All blogs, as well as the wikis, are hosted on the bank's servers, protected behind its firewalls, and only viewable by its employees.

The implementation of the blogging infrastructure started in 2003. After testing the solution in a small group of users, blogging were made widely available at DrKW. People were encouraged to use the blogs to share ideas, requests, and criticisms and to consider them as a forum for people to venture their professional opinions. In the first 15 month about 30 blogs with about 100 postings a month developed. The IT department frequently updated the blog creation software and revised its integration with the other IT, in order to make it easier to use and boost its popularity. In this way for example a blog icon was added to the entries of the intranet telephone list. If a person keeps a personal blog the telephone list is displaying a link to the blog next to

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[102] Cp. *McAfee, Andrew / Sjöman, Andreas*, Blogs at Dresdner Kleinwort Wasserstein, 2006.

the person's telephone number and e-mail address. In the fourth quarter of 2004 a tipping point was reached and blogging started to grew heavily up to 300 blogs with about 180 postings a month and over 350 comments. The majority of the blogs were still kept by people within the IT department, but also other groups increasingly started using the blogs. *Rangaswami*, the chief information officer (CIO) of the investment bank, said about the introduction of blogs at the investment bank:[103]

> *"While it is early days yet, there is growing anecdotal evidence that people have become more productive as a result: we're seeing lower e-mail traffic, more effective communication, quicker time to market with ideas, and faster solutions to problems."[104]*

5.2   Wikis at Dresdner Kleinwort Wasserstein

In 2005 DrKW implemented also an enterprise wiki solution from Socialtext (www.socialtext.com). The wiki was introduced in addition to the already existing communication tools like instant messenger, blogs, e-mail and the corporate intranet. The aim was to allow users to swap between different modes of communication, depending on which is most appropriate. DrKW took a low-key strategy to adoption, allowing usage to grow slowly and organically. They staged the rollout, introducing the wiki first to the IT department, then letting usage grow through word of mouth.

One of the most enthusiastic user groups became Digital Markets, the business division responsible for developing, deploying and operating DrKW's online products and services. Digital Markets combines front office, support and IT specialists in one unit and so has a wide cross-section of users. The use of the wiki technology facilitated it to bring the different user groups on the same knowledge level. *Dipen Jobanputra*, from Digital Markets, said about the use of wikis in his departments that the most important benefit for him is that everyone can exchange ideas and have a voice. He also gives a real life example of how the wiki made his work easier:

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[103] Cp. *McAfee, Andrew / Sjöman, Andreas*, Blogs at Dresdner Kleinwort Wasserstein, 2006.

[104] *McAfee, Andrew / Sjöman, Andreas*, Blogs at Dresdner Kleinwort Wasserstein, 2006, p. 8.

"For about six months, I talked to the head of our business unit, Sean Park, via the wiki, blogs or instant messages… When I did finally get to meet him, it was a friendly meeting. ...I felt a lot more comfortable walking in and asking for a lot of money based on a piece of paper, and getting him to sign off on it very quickly, because we'd already built up a rapport."[105]

The Wikis at DrKW are also heavily used to assist the managing of meetings. Before meeting agendas were kept on paper or sent by e-mail. In some teams also Excel spreadsheets were used to create meeting agendas. The use of these media had the disadvantage that meeting agendas were edited local and than e-mailed or handed to the other participations of a meeting. That led often to the problem that people in a meeting had different versions of the agenda. The use of the wiki technology eliminated the problem of different versions. Meeting agendas at DrKW are now kept on a wiki page, were everybody participating in the meeting can make changes. The changes are visible in real time, regardless to the location, and people do not have to wait for anybody to update their information.

The use of wikis enhanced also the effectiveness of telephone conferences. Previously, in these meetings lots of time was wasted to inform people about the week's events. With the help of wikis people are now able to update their selves. The time of telephone conferences can now be used to generate ideas, being innovative and talking about problems. *Nigel Verdon* of Digital Markets is one of the persons how is frequently using the wiki to run meetings:

"Writing agendas, collecting materials for meetings, it's all a chore when you're doing it over e-mail. Prior to the wiki, we used to use PowerPoint presentations, which were a pain to put together because everybody had to email me their agenda items, and if I was not around they could not add it themselves."[106]

Verdon also finds the wiki useful for brainstorming and collating ideas. In this sense he intends to use the wiki to develop new brochures for Digital Markets products.

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[105] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 6.

[106] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 12.

"The original brochure was more like a catalogue of products, so for the new ones we'll put the content on the wiki, develop the ideas, pull it all together, edit it and publish the final version, so that the marketing guys take that and get it into print. Beforehand it would have been emails going round, with different versions cluttering up your inbox. For developing ideas, the wiki is much more effective."[107]

As well as getting things into print, *Verdon* and his team are also using the wiki to publish and distribute all relevant information about their products and department. For example, *Verdon* publishes all his cost centre information so that when he is asked to provide a cost centre code, he can direct people to the wiki. He points out, that publishing all data also reduces operational risk when staff leaves. The Digital Markets team finds the wiki also very useful for putting together presentations, as *Stuart Berwick* explains.

"My boss Sean had to give a senior management presentation in New York, and needed to put together very quickly a set of slides collating information from the management team, covering status and plans for 2006. Previously that would have been a huge email exercise, with number of meetings to co-ordinate it and lots of drafts, in PowerPoint."

"Instead one person co-ordinated it, setting up an agenda page and individual pages for each of the main slides so that everyone - asynchronously, in their own time and in parallel - could write the presentation. Within about three of four hours, a presentation evolved that would have taken days and been a much more frustrating process had it been through email and PowerPoint attachments."[108]

The wiki technology helped also at the London office of DrKW to improve communication. There the wiki is mainly used to collect resources within teams and to make these resources also available to other teams. In course of the use of the wiki many old intranet pages - some of which were three years out of date - were replaced by new wiki-pages. The wiki became the primary tool for intra-team communication and is

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[107] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 13.

[108] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 14.

heavily used. But it took some time until people started to use the new medium effectively. At fist, when information was added to a wiki page, such as an issues list, and people were ask to update the list, their first instinct was often to e-mail the information back rather than edit the page. *Niall Hammond*, Head of the London office, says about the wiki:

> *"We have a product called Quartz, and it went from being a product under development to one that was released and being promoted, so we had to provide a new set of information. It progressed from being relevant to just a few people, the developers, to being introduced to the business, IT, and support teams in London and Frankfurt. Until the wiki came along, there was no adequate way to distribute that new information, so we used it as an experiment to see how the wiki might work. And it let us publish higher quality."[109]*

Until summer 2005 approximately 2,500 employees at DrKW started to use wikis. Summarising, the main improvements resulting from the use of the new technology are: That meetings run more smoothly and are more productive; unnecessary barriers between teams are being broken down; the quality of product specifications and documentation is improving; presentations are being written faster and more effectively; and the risks posed by staff leaving is reduced.

But more than that, the wiki is helping people to form business relationships with people that they would otherwise never have met. The use of wikis is strengthening existing relationships, and providing a forum for high quality conversation and exchange of ideas. *Myrto Lazopoulou*, Director of User Experience, said:[110]

> *"The wiki has allowed us to improve collaboration, communication and publication. We can cross time zones, improve the way teams works, reduce email and increase transparency."[111]*

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[109] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 10.

[110] Cp. *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006.

[111] *Socialtext*, Dresdner Kleinwort Wasserstein Case Study, 2006, p. 17.

6   CONCLUSION

The Internet is today a driving force for the development of new information technologies. The Web 2.0 discussion points that out: The technologies and concepts, summarized as Web 2.0 brought the Internet users a wide range of new possibilities - and were thereby developed in a relatively short time.

It appears reasonable for companies to participate in these new IT developments. As shown in this thesis, several of the Web 2.0 ideas have the potential to be used in an enterprise context and provide benefits to the organization. By considering these new ideas the company makes sure to keep their corporate IT state of the art, and as quoted in the introduction: It is not unusual that new concepts and technologies are first established on the consumer market. But in the end enterprises can often benefit much more from the new developments.

But the use of Web 2.0 technologies, respectively Enterprise 2.0 technologies in companies should also not be overestimated. At the moment it is a further development of IT, but certainly not the last one. Some voices are already talking about a Web 3.0. Beside that, Enterprise 2.0 will not change everything about corporate IT. As pointed out in this thesis: The Enterprise 2.0 approach is most capable to improve the support of unstructured interactions. These tasks are so far commonly aid through the use of e-mail, instant messaging and the corporate intranet. In this IT segment, Enterprise 2.0 will probably lead to improvements. In other IT segments, where the focus of the technology lays on supporting structured interactions, like business processes, Enterprise 2.0 will not be very relevant. Those tasks will also in future be best supported through the use of ERP[112] systems, SCM[113] and e-procurement[114].

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[112] Enterprise Resource Planning systems (ERP's) integrate (or attempt to integrate) all data and processes of an organization into a unified system.

[113] Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain.

[114] E-procurement (Electronic Procurement) describes the use of different information technologies and especially the Internet to realize an effective and cost efficient handling of the procurement process.

An important aspect in the Enterprise 2.0 discussion is to attend the cultural, behavioural and social changes, released through the adoption of Enterprise 2.0. Especially the collaboration aspect of Enterprise 2.0 requires a management and corporate culture which allows a partly redistribution of power and capabilities. Therefore companies with a strict, more traditional hierarchical structure will not be able to implement Enterprise 2.0 concepts. This could constrict the wide adoption of Enterprise 2.0, because the management style of these companies will probably not change over night. Companies with a management willing to empower employees, on the other hand, could right away participate and benefit from the Enterprise 2.0 approach. This could lead to a separation of companies released through differences in their management style. If Enterprise 2.0 is developing to an important part of corporate IT these differences in management could then lead to a competitive disadvantage for the more traditional managed companies.

7   FURTHER RESEARCH

Some questions, which were brought up during this thesis, would need further research. These questions could not been answered here because they would have lead the discussion to far from the topic of this report.

Further research would be necessary to make a clear statement about the impact of a company's culture on the adoption of Enterprise 2.0 concepts. A related question is how in detail hierarchies will shape and be shaped by the introduction of Enterprise 2.0.

The introduction of Enterprise 2.0 is also raising the question how the expected benefits of the approach could be measured. As with collaboration technologies in general, it will be difficult to calculate the revenue.

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