A FEATURE-BASED ANALYSIS OF OPEN SOURCE TOOLS FOR ENTERPRISE 2.0

Open Source Tools for Team Collaboration in SMEs

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Abstract: The marketplace of Enterprise 2.0 tools that support knowledge workers within companies to work together on cognitive tasks and share information and knowledge is diversified and offers commercial systems of varying complexity and functional range as well as open source software. Like commercial systems, open source tools for Enterprise 2.0 provide a broad range of functionality and offer a good alternative for organisations – especially for SMEs. This paper presents a study of the growing market for Enterprise 2.0 systems and focuses entirely on ones that are available under an open source license. We introduce a set of 97 individual features and criteria to assess a representative sample of open source Enterprise 2.0 tools. Our results show that the marketplace of open source tools for Enterprise 2.0 offers technically mature solutions with a broad range of functionality.

1 INTRODUCTION

Enterprise 2.0, the use of emergent social software platforms within companies, or between companies and their partners and customers, has rapidly gained momentum since this term was coined by McAfee in 2006 (McAfee, 2006a). Although Enterprise 2.0 incorporates more aspects than simply applying social software or comprehensive Enterprise 2.0 software systems, the software tools supporting collaboration processes have a great impact on the utilisation of Enterprise 2.0 concepts in enterprises and organisations (Cook, 2008). A lot of vendors – big, well-known market actors as well as small startup companies – offer numerous tools and systems. In addition market analysts, journals and online communities provide market reports and analyses to support potential customers to identify the appropriate Enterprise 2.0 system.

The basic concept of Enterprise 2.0 can be applied to all kinds and sizes of organisations. Small and medium size enterprises (SME) use social software platforms just like large enterprises for sharing information and knowledge among their employees. They need maximum but specific functionality and community support at a reasonable price and workload. Besides small vendors, niche players and big software companies that offer highly flexible but complex and sometimes costly commercial platforms, there are also several Free and Open Source software tools available. Open source Enterprise 2.0 tools (Spath et al., 2007) often provide a good alternative solution especially for SMEs and not-for-profit organisations to support team collaboration in a cost-effective way.

Market reports on Enterprise 2.0 by market analysts typically target large enterprises and therefore rarely cover open source tools (Drakos et al., 2010); (Koplowitz, 2009). Individual reports on specific open source tools often appear in journals and in several channels within the social software, Enterprise 2.0 or open source community. However, substantiated analyses and comparisons of open source tools can hardly be found. In this paper we present a market analysis of the growing market of Enterprise 2.0 systems that focuses entirely on those that are available under an open source license. These Enterprise 2.0 systems have to support and enable communication, coordination, collaboration and connection (Riemer, 2007) and (Cook, 2008). Consequently, only those open source tools that support – at least partially – these four primary

interaction processes of enterprise collaboration are included in our study. We introduce features and criteria that can be applied to assess Enterprise 2.0 systems and present detailed results for five selected open source Enterprise 2.0 systems.

In Section 2 we discuss Enterprise 2.0 and team collaboration and present related work on open source Enterprise 2.0 systems. Section 3 identifies and characterises Enterprise 2.0 software and analyses the Enterprise 2.0 marketplace. Section 4 presents the applied assessment methodology. Section 5 provides detailed results of a number of open source Enterprise 2.0 systems. In section 6, we summarise key findings on open source systems for team collaboration based on the sample of evaluated Enterprise 2.0 systems. Finally, Section 7 concludes this paper.

2 ENTERPRISE 2.0

McAfee first introduced the term *Enterprise 2.0* in his trend-setting paper "Enterprise 2.0: The Dawn of Emergent Collaboration" where he discusses how companies can benefit from Web 2.0 technologies to support knowledge workers (McAfee, 2006a). McAfee (2006b) defines Enterprise 2.0 as "... the use of emergent social software platforms within companies, or between companies and their partners or customers". The utilisation of social media within enterprises and organisations has significantly increased since then. For example, weblogs may be used as project logs or to communicate between the CEO or head of marketing and the company's customers. Knowledge workers of organisations create shared knowledge bases with the help of wikis. Microblogging applications allow for easy communication among team members. Thus, social media help employees and team members to work together on cognitive tasks and share information and knowledge.

2.1 Enterprise 2.0 Systems

All definitions of the term *Enterprise 2.0* have in common that they refer to the use of social software or other web-based technologies to support enterprises and organisations. For example the AIIM, the *Association for Information and Image Management* (also known as the enterprise content management association) defines Enterprise 2.0 as a system of web-based technologies that provide rapid and agile collaboration, information sharing,

emergence and integration capabilities in the extended enterprise (AIIM, n.d.).

Software to support communication, cooperation and collaboration within teams of (knowledge) workers has been used for decades under the terms Groupware, Group Support Systems and Computer Supported Cooperative Work (CSCW) (Koch, 2008); (Koch and Gross, 2006). Ellis et al. (1991) define groupware as "computer-based systems that support groups of people engaged in a common task (goal) and that provide an interface to a shared environment".

One of the basic functionalities of Enterprise 2.0 systems is the support of electronic collaboration (short: E-Collaboration) among team members. E-Collaboration systems, i.e. information systems to support collaborative work, are "software for supporting communication, coordination and cooperation between people processes in groups" (Riemer, 2007). Therefore software and tools to support the ideas and concepts of Enterprise 2.0 can be found as Enterprise 2.0 software, groupware, CSCW systems and E-Collaboration systems.

To describe the characteristics of Enterprise 2.0 systems, McAfee (2006a) uses the acronym SLATES, which indicates six key components of Enterprise 2.0 technologies: Search – Links – Authoring – Tags – Extensions – Signals. Hinchcliffe (2007) extends SLATES by four elements: Freeform – Social – Network-oriented – Emergent (resulting in the mnemonic FLATNESSES). While many authors (e.g., Koch, 2008; Ellis et al., 1991) categorise groupware and CSCW according to three basic interaction modes – communication, coordination, cooperation – Cook (2008) modifies and extends this approach to four primary functions of social software and Enterprise 2.0: communication – cooperation – collaboration – connection (4Cs). We will follow this approach based on 4Cs to organise our feature-oriented analysis of Enterprise 2.0 systems.

2.2 Related Work

The market of Enterprise 2.0 tools and E-Collaboration systems offers a large variety of features and configurations. Riemer (2007) presents a study which structures the range of available systems into system classes using cluster analysis. He applies the classification process to a sample of 94 systems that are used to derive four main system classes. Xu et al. (2008) present a survey on asynchronous collaboration tools, i.e., systems with limited functionality. Büchner et al. (2009) analyse

seven commercial and open source Enterprise 2.0 tools based on 51 core Enterprise 2.0 services (in 13 service categories) to examine which concepts and services are supported by these tools. Comparative studies, which analyse open source tools exclusively, can hardly be found (Spath et al., 2007).

Market analysts like Gartner Research (Drakos et al., 2010), Forrester Research (Koplowitz, 2009) or Real Story Group (2010) tend to cover the entire market for collaboration platforms and social software vendors. However, they focus on vendors with strong market presence and diverse functionality. Consequently, small niche players and open source tools (e.g., Koplowitz, 2009 includes one open source tool [MindTouch] in his analysis of eleven vendors) are rarely included. These market reports, for example evaluate the *ability to execute* and the *completeness of vision* to identify niche players, visionaries, challengers and leaders (Drakos et al., 2010). Functionality and features of Enterprise 2.0 tools are represented in these studies only to a subordinate extent.

3 E-COLLABORATION SYSTEMS

This paper discusses Enterprise 2.0 software that supports collaboration among team members. Thus we focus on those software tools that are commonly denoted as E-Collaboration systems and tools that cover the same functional range. From the large variety of available systems, we narrow our analysis to those systems available under an open source license (OSS).

Refining and enhancing Riemer's definition (Riemer, 2007), we define E-Collaboration systems as software for supporting and enabling communication, coordination and collaboration between people in shared projects, processes and teams within organisations and for cross-organisational use. According to Cook's 4Cs model (Cook, 2008), comprehensive E-Collaboration systems should cover all types of social interaction in collaborative team processes – communication, coordination, collaboration and connection.

3.1 E-Collaboration Marketplace

The Enterprise 2.0 and E-Collaboration systems marketplace is highly dynamic and diverse and consists of heterogeneous system classes. It is made up of various tools with different levels of support of Enterprise 2.0 features. In his map of the 2009 Enterprise 2.0 marketplace, Hinchliffe (2009) arranges more than 70 major products along two dimensions *Enterprise Capability* and *Support for Core Enterprise 2.0 Features*. He clusters them into three categories: Established Software Firms & Incumbent Players Territory – Enterprise 2.0 Sweet Spot – Open Source, Startup, Web Co. Territory.

An evaluation report on enterprise collaboration software by the Real Story Group (2010) analyses *Functional Business Services* and *Technology Services* (application services, administrative & system services), *Vendor Intangibles* and *Universal Scenarios* for 27 products. These products are organised into six categories: platform vendors (4), social software suites (7), wikis (5), blogs (3), white-label community services (4) and public networks (4).

Market analysts like Gartner Research or Forrester Research typically analyse in their reports only vendors with significant market presence. Koplowitz (2009) discusses the collaboration platform products of 11 vendors and organises them into three categories: leaders, strong performers, contenders. In the 2010 version of their *Magic Quadrant for Social Software in the Workplace* Gartner discusses 23 vendors after assessing their market presence and the functional capabilities of the products (Drakos et al., 2010). Based on their evaluation criteria concerning *Ability to Execute* (7 criteria) and *Completeness of Vision* (8 criteria) they identify three leaders, two challengers, seven visionaries and eleven niche players.

Besides these major reports, listings on Enterprise 2.0, E-Collaboration systems and groupware can be found in (online) journals, in Wikipedia and in various Enterprise 2.0 and open source communities.

3.2 OSS Tools for Team Collaboration

A large variety of open source tools for team cooperation and collaboration exists which are referred to as groupware or E-Collaboration systems. According to our definition of E-Collaboration systems, only those tools will be part of a detailed analysis that support all four basic types of social interaction (full support or partial support per interaction process, but all types have to be supported). Applying this limitation, we eliminate the vast number of single function open source tools, e.g. all those wikis, weblogs, chats, video conferencing tools, project management tools, content management tools, tagging or bookmarking solutions, etc., that offer only a limited number of

features according to their system class, but do not cover the entire spectrum of functions for team collaboration.

Based on a detailed market analysis in which we analysed the functional range, we set up a longlist of 15 open source tools to be included in our study:

- Alfresco Share
- dotProject
- EGroupware
- IGSuite
- Liferay Portal / Social Office
- MindTouch Core
- more.groupware
- Novell Open Workgroup Suite
- NullLogic Groupware
- OpenGroupware
- phpGroupWare
- PHProjekt
- Simple Groupware
- TUTOS
- Zimbra Collaboration Suite

Other open source tools that are often labelled as groupware, too – like Kolab, netOffice, Web Collab, Plone or Scalix – have not been included because of their focus on project or content management or simply because their scope of operation does not meet our requirements for E-Collaboration systems.

Due to reasons of presentation in consequence of lack of space in this paper we had to reduce the longlist to a shortlist containing only five E-Collaboration systems:

- Alfresco Share, Community v3.4.0
- EGroupware, v1.4
- Liferay Portal, Community Edition v6.0.5 CE
- Simple Groupware, v0.701
- TUTOS, v1.7

These products have been chosen to represent the major types of collaboration tools on the market including tools focusing on content-based collaboration (Alfresco Share), content sharing (Simple Groupware), and project management (i.e., focus on coordination; TUTOS) as well as connection-oriented tools (Liferay), and groupware style tools (EGroupware). Thus, these five tools fairly represent collaboration solutions on the open source marketplace. Despite this limitation to a representative number of Enterprise 2.0 systems, the presented feature list and evaluation criteria can be easily applied to all tools in the longlist and to new emerging tools.

4 EVALUATION METHODOLOGY

The evaluation methodology used to assess the open source E-Collaboration systems consists of the following three steps (*Author X, 2010 – identity of authors removed due to requirements of "double-blind" paper evaluation*):

1. Selection of E-Collaboration systems
2. Definition of evaluation criteria
3. Assessment

The basis for all three steps of the evaluation are the primary interaction processes for collaboration defined by Riemer (2007) and Cook (2008). Tasks in electronic collaboration can be assigned to one of the following primary interaction processes, which are also called the 4Cs (following Cook, 2008):

- Communication
- Coordination
- Collaboration
- Connection

In the first step of the evaluation process we select a number of E-Collaboration systems for the assessment (see Section 3.2). Due to space limitations results will be presented in Section 5 for members of the shortlist only.

The second step of the evaluation process covers the definition of appropriate evaluation criteria. Functionalities provided by E-Collaboration systems were assigned to each of the categories, which resulted in a feature list grouped into the 4Cs. In addition, two more categories were identified to be important for the evaluation of open source tools: *cross-sectional* features as well as *administration & technology*. These features were selected on the basis of a detailed study of literature on electronic collaboration, CSCW software and groupware (e.g., Riemer, 2007); (Ellis et al., 1991), of related reports and studies such as Büchner et al. (2009), Spath et al. (2007), Drakos et al. (2010) and Koplowitz (2009) which were complemented by the results of a number of interviews with experts (e.g., consultants) in the field of CSCW and electronic collaboration plus personal expertise of the authors. For a detailed description of the respective features, refer to the following sections.

For the assessment of the E-Collaboration systems according to their strengths and weaknesses with respect to the 4C categories, weightings were assigned to the various features representing their relative importance within each category. Since related studies and market reports (e.g., Büchner et

al., 2009); (Spath et al., 2007) often do not provide
weightings, we based ours on the experiences of
experts (e.g. derived from interviews with
consultants) plus personal expertise of the authors
(see Section 5 for details of features and
weightings).

The evaluation was not undertaken for a specific
use case, but for a standard team collaboration
scenario. This scenario covers typical activities of a
team of collaborating knowledge workers, such as
creating knowledge by sharing and structuring ideas,
preserving knowledge by creating and editing
documents together, sharing knowledge by
providing central access to information for all team
members as well as coordinating collaboration
activities with the help of tasks. Of course, in the
case of applying the proposed method to a specific
use case, the weightings of all features have to be
adjusted correspondingly.

Due to the application of a standard team
collaboration scenario all categories were supposed
to be equally important. Thus, we do not compute an
overall sum of all features to get a single rating
number. Each system was evaluated according to
whether it offered a certain feature, which
subsequently increased the total score within each
category. The assessment resulted in a score for each
category with a maximum of 100% per category.

5 ENTERPRISE 2.0 OPEN SOURCE TOOLS PROFILE

In the following subsections the features of the 4C
categories, the category *cross-sectional features* as
well as *administration & technology*, with a special
emphasis on features relevant for choosing an open
source system are presented. The tables show the
features, the assigned weightings for each feature
and scores for the analysed tools in the shortlist (see
Section 3.2). The five E-Collaboration systems got
the according score if the feature was supported (●)
or not (○).

5.1 Communication

This category covers tools for asynchronous and
synchronous communication as well as contact
management and social presence. Among the
asynchronous tools, the functionality of email with
connection to an external email server was
considered to be the most important as email is still
the most widely used means of communication. An

integrated and convenient solution for managing
contacts was also regarded as highly important.
Social presence features, which are often integrated
in instant messaging services, have gained more and
more significance for unified communication as they
allow users to choose the right means for contacting
other team members.

Table 1: Features of category communication.

Category Communication	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	**100,00**	50,00	63,00	85,50	50,50	45,00
Asynchronous	**50,00**					
Internal email	2,50	○	●	●	●	●
Email external email server	17,50	●	●	●	●	●
Discussion forum	7,50	●	○	●	●	○
Weblog	10,00	●	○	●	○	○
Microblogging	2,50	○	○	○	○	○
News	5,00	○	○	●	○	○
Comments	5,00	○	●	●	○	●
Synchronous	**15,00**					
Instant messaging	3,00	○	●	●	●	○
Broadcast	0,75	○	○	○	○	○
Desktop telephone conference	0,75	○	○	○	○	○
Video conference	3,00	○	○	○	○	○
Web conference	2,25	○	○	○	○	○
Telephone (audio)	3,75	○	○	○	○	○
Video telephone	1,50	○	○	○	○	○
Contact management	**20,00**	○	●	●	●	●
Social presence	**15,00**	●	●	●	○	○

In the category communication, Liferay supports
most of the important features. All systems support
email using external email servers. Social presence
showing the status of a team member as well as
his/her availability is supported by Alfresco,
EGroupware and Liferay, thus facilitating unified
communication.

5.2 Coordination

The category coordination comprises features for
task management, project management and
workflows as well as the coordination of
appointments and meetings. A group calendar
providing an overview of the appointments of all
team members was regarded as the most critical
feature for efficient and effective coordination,
followed by the management of tasks. Some systems
provide quite sophisticated functionalities for project
management, depending on whether the system was
designed to support project management or was
developed out of a project management tool and
combined with collaborative features. Simple
workflows are also supported by some E-

Collaboration systems. However, for the full integration of workflows that also allows for designing complex processes, additional software packages are required in most cases.

Table 2: Features of category coordination.

Category Coordination	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	100,00	53,50	92,50	48,00	52,50	67,50
Surveys	5,00	○	●	●	●	○
Workflow management	**10,00**					
Modelling of workflows	2,50	○	●	○	○	○
Ad hoc workflows	6,00	●	○	○	○	○
Workflow templates	1,50	○	○	○	○	○
Project management	**20,00**					
Gantt charts	5,00	○	●	○	○	●
Work package coordination	4,00	○	●	○	○	●
Assign work packages to employees	3,00	○	●	○	○	●
Status of work packages	3,00	○	●	●	○	●
Resource mgmt.	4,00	○	●	○	○	●
Multi project mgmt.	1,00	○	●	○	○	●
Task management	**25,00**					
Task coordination	10,00	●	●	●	●	●
Assign tasks to employees	7,50	●	●	●	●	●
Status of tasks	7,50	●	●	○	●	●
Appointment coordination	**30,00**					
Group calendar	18,00	●	●	●	●	●
Personal calendar	4,50	●	●	●	●	●
Search for free dates	7,50	○	●	○	○	○
Meeting coordination	**10,00**					
Coordination of participants	5,00	○	●	○	○	○
Coordination of documents	5,00	○	●	○	○	○

In the category coordination, EGroupware gets the highest score followed by TUTOS. EGroupware provides a fully developed calendar and task management system including features for software development projects such as bug tracking, feature requests and patches as well as timesheets and resource management. EGroupware also supports the management of multiple projects.

TUTOS also supports the management of software development projects including Scrum, invoice, risk management, bug tracking and the administration of installations. Even though these features are not really necessary for standard team collaboration scenarios, the consequence of this emphasis on project management are extensive functionalities for coordination tasks.

5.3 Collaboration

Within the category collaboration, wikis are regarded as a widely used, suitable and thus important means of shared content production. A fully developed administration of shared content is crucial for a system to adequately support team collaboration. Creating documents out of the shared workspace proved to be a significant feature for E-Collaboration systems to be integrated into daily work routines. Workspaces supporting this functionality have got a higher chance of being used like the desktop. On the other hand, E-Collaboration systems that provide only up and downloading of documents risk being used as a repository for documents instead of supporting active collaboration.

Table 3: Features of category collaboration.

Category Collaboration	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	100,00	70,25	58,25	75,50	68,00	18,50
Shared content production	**20,00**					
Wiki	10,00	●	●	●	●	○
Whiteboard	3,00	○	○	○	○	○
Synchronously shared documents	4,00	○	○	●	○	○
Shared ideas / brainstorming	3,00	○	○	○	○	○
Working together on the same objects	**15,00**					
Social tagging	6,75	●	○	●	○	○
Social bookmarking	6,00	●	●	●	●	○
Social cataloguing	2,25	○	○	●	○	○
Administration of shared content	**50,00**					
Document sharing	7,50	●	●	●	●	●
Image sharing	2,00	●	●	●	●	●
Video/audio sharing	2,00	●	●	○	●	●
Restricted access for content	4,00	●	○	●	●	○
Restricted access for folder	2,50	●	●	●	●	○
Check in/check out	5,00	●	○	●	●	○
Up- & download	5,00	●	●	●	●	●
Versioning	4,00	●	●	●	●	●
Archiving	2,50	○	●	●	●	○
Folder / shared folder	7,50	●	●	●	●	○
Content tagging	4,00	●	●	●	○	○
Folder tagging	1,50	●	○	○	○	○
Personal site	2,50	●	○	●	●	○
Creating documents out of the shared workspace	**15,00**					
Text document	5,25	○	●	○	●	○
Spreadsheet	1,50	○	○	○	●	○
Presentation	1,50	○	○	○	○	○
Graphics	0,75	○	○	○	●	○
…using MS Office	6,00	○	○	○	○	○

In the category collaboration, Liferay gets the highest score followed by Alfresco and Simple Groupware. While Liferay supports the collaborative organisation of content and the according meta data with the help of social tagging, bookmarking and cataloguing, Alfresco´s strength is the administration of shared content. Simple Groupware offers several features for dealing with shared content and enables editors to create (wiki) text, spreadsheets and graphics in the workspace, but does not support tagging.

5.4 Connection

The category connection provides the presentation of the user profiles as well as social features. Profiling allows users to present personal expertise and people search supports finding the right person to contact. E-Collaboration systems with an emphasis on connection provide a short profile of the author together with contact details for every piece of content.

Table 4: Features of category connection.

Category Connection	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	**100,00**	**50,00**	**58,00**	**86,00**	**50,00**	**50,00**
People search	25,0	●	●	●	●	●
People profiling	25,0	●	●	●	●	●
People tracking	8,00	○	●	●	○	○
Social networking	20,0	○	○	●	○	○
Visualisation of the network	9,00	○	○	○	○	○
Network analysis	5,00	○	○	○	○	○
People tagging	8,00	○	○	●	○	○

Liferay´s emphasis is on the social connection of team members. The system provides activity tracking on blogs, message boards and wikis with a Facebook-like activity wall. Furthermore the social networking aspect is supported by the possibility to view the friends of a team member as well as their activities together with the team member´s profile. All systems provide user profiles and the possibility to search for people.

5.5 Cross-sectional Features

Cross-sectional features cover all functionalities that do not only belong to a single category, but support some or all of them. Among these features, configurable areas for users were regarded as the most important, as they allow for the designing of a workspace that suits the specific requirements of the team without the need for an administrator to

customise the workspace. Also the "pull" instead of the "push" way of getting informed about news is integrated into this category by the ability to get newsfeeds and set alerts. The "pull" metaphor is one of the essential elements when trying to cope with the information overload that is mainly caused by emails and to filter only relevant information. Equally important for getting the right pieces of information in time are complex search functionalities, which incorporate various sources of content and also people profiles. As knowledge work becomes more and more flexible and location independent, the synchronisation of the E-Collaboration system with mobile devices is regarded as an important aspect for today´s working conditions.

Table 5: Features of category cross-sectional features.

Category Cross-sectional Features	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	**100,00**	**76,00**	**94,00**	**96,00**	**75,00**	**28,00**
Newsfeed	10,0	●	●	●	●	○
Syndication	2,00	○	●	●	○	○
Personalisation	8,00	●	●	●	●	○
Dashboard	5,00	●	●	●	○	○
Configurable areas	15,0	●	●	●	●	○
Mashup	2,00	○	●	●	○	○
Alerts	10,0	●	●	●	○	●
Tracking	3,00	●	●	●	○	●
Rating	3,00	○	○	●	○	○
Ranking	3,00	○	●	●	○	○
Filtering	4,00	○	●	○	●	○
Handheld delivery	10,0	○	●	●	●	○
Documentation	4,00	●	●	●	●	●
(online) Help	6,00	●	●	●	●	●
Search						
Simple search	5,00	●	●	●	●	●
Complex search	10,0	●	●	●	●	●

Liferay and EGroupware almost fully support all cross-sectional functionalities and thus provide high integration of the features of all other categories.

5.6 Administration & Technology

The category administration & technology covers features which are mainly important for the administrator of the E-Collaboration system. With respect to administration the definition of user groups and roles turned out to be highly significant. Furthermore, the smooth integration of the E-Collaboration system into the existing system landscape was regarded as a determining factor. Finally, the possibility to customise the system according to specific user requirements was identified as an important aspect, too.

Additionally, two groups of features especially relevant for open source E-Collaboration systems were identified: *support & extendibility* as well as *installation*. Regarding support & extendibility, the activity of the community serves as an indicator about how actively the system is further developed and how much support can be expected. *Plugins & API* denotes the availability of a collection of extensions and plugins and the existence of an API that allows programming of self-written plugins. Regarding installation, we distinguish between three options: *Repository installation* refers to package installation from the standard repositories of common Linux distributions (checked with Debian/Ubuntu); *Download and config.* refers to installation via download and configuration from a simple config file or web interface (requiring only a running Apache/PHP/MySQL environment). While these options are regarded as rather easy to be installed, the third category *advanced installation* refers to more complex installation procedures, including having to (re-)compile the code from the sources, or being based on specific database configuration or server installation, etc.

Table 6: Features of category administration & technology.

Category Administration & Technology	Weight	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS
Total score	**100,00**	**64,00**	**92,00**	**95,00**	**75,20**	**45,00**
Monitoring	3,50	○	●	○	●	○
Reporting	5,60	○	●	●	○	○
Scalability	5,60	●	●	●	○	○
Configuration	7,00	●	●	●	●	●
Customisation	10,5	●	●	●	●	●
Designer toolkit	5,60	○	○	●	○	○
Integration	10,5	○	●	●	●	●
Backup/recovery	4,20	●	●	●	●	○
User Management	**17,50**					
User groups/roles	14,0	●	●	●	●	○
Directory	3,50	●	●	●	●	●
Support and Extendibility	**18,00**					
Active community	10,0	●	●	●	●	○
Plugins, API	8,00	●	●	●	●	○
Installation	**12,00**					
Repository installation	6,00	○	●	○	○	○
Download and config. installation	4,00	○	●	○	●	●
Advanced installation	2,00	●	○	●	○	○

Liferay and EGroupware provide fully developed administration facilities. Concerning support and extendibility for further developing the system, apart from TUTOS, all systems have got an active and large community and offer a convenient way of extending the existing features. While EGroupware, Simple Groupware and TUTOS can be rather easily

installed with only basic system administration skills, Alfresco and Liferay belong to the category *advanced installation* which implies that a skilled administrator is required to set up the system.

6 REVIEW

Table 7 summarises the scores out of 100% as the total score for each category that the E-Collaboration systems in the shortlist obtained in the categories communication, coordination, collaboration and connection as well as cross sectional features and administration & technology. This table combines the lines "total score" of Table 2 to 6 in a single table including an arithmetic mean in each category. Table 7 does not show an overall score for each of the E-Collaboration systems (e.g. computed as an arithmetic mean or a weighted sum), as the proposed evaluation is based on the standard team collaboration scenario briefly described in Section 4. It should thus provide an overview of the results in the various categories, so that the actual selection by a specific SME can be based on the categories relevant for the use case under consideration.

Table 7: Evaluation of five open source E-Collaboration systems.

	Alfresco Share	EGroup ware	Liferay	Simple Group ware	TUTOS	*Average*
Communication	50 %	63 %	86 %	51 %	45 %	*59 %*
Coordination	54 %	93 %	48 %	51 %	68 %	*63 %*
Collaboration	70 %	58 %	76 %	68 %	19 %	*58 %*
Connection	50 %	58 %	86 %	50 %	50 %	*59 %*
Cross sectional features	76 %	94 %	96 %	75 %	28 %	*74 %*
Administration & Technology	64 %	92 %	95 %	75 %	45 %	*74 %*

Alfresco provides very well supported and integrated document and content management features and thus got the highest scores in the categories collaboration and cross-sectional features. Alfresco belongs to the well known E-Collaboration systems. It is widely used and thus well supported with many reference installations.

EGroupware scores very highly in the category coordination as it supports many project management features and also special functionalities for software development projects. The social aspect is not a strength of EGroupware and the linking between content and people providing the content is not as transparent as in Liferay for example, which puts a special emphasis on the social aspect and thus got the highest score in the category connection.

Even though EGroupware seems to have been developed for collaboration in software development projects, it is easy to use and provides many other collaborative features apart from project management. TUTOS on the other hand also scores highly in the category coordination as it supports the development of software projects from acquisition to installation, but falls short concerning the other categories and thus is not really suited for standard team collaboration.

Although Simple Groupware is developed only by a small company and does not seem to have a big community, it appears technically mature. Simple Groupware scores with its ability for managing content in enterprise, project and personal spaces. Due to limitations in usability and lack of project management capabilities, Simple Groupware is well suited only for small and medium size teams.

The studied systems differ in installability, support, extendibility and maturity, which is typical of open source systems. However, some of them are also supported commercially for those not wanting to hassle with technical issues themselves (in our study: Alfresco, EGroupware, Liferay).

The evaluation of open source E-Collaboration systems among standard closed source systems showed that there are many technically mature open source solutions. As the assessment in this paper shows, a differentiated view on open source E-Collaboration systems is necessary. In addition, many open source systems provide complex functionalities, offer support and training so they can definitely be regarded as a serious alternative to closed source platforms. Market readiness for open source systems is also confirmed by market analysts such as Gartner Research (Drakos et al., 2010) or Forrester Research (Koplowitz, 2009), who list open source systems such as MindTouch together with well-known proprietary solutions.

7 CONCLUSIONS

Small and medium size enterprises as well as small organisations, e.g. not-for-profit organisations, are looking for E-Collaboration systems at a reasonable price and workload to support their needs in communication, collaboration and information sharing among their team members. Open source Enterprise 2.0 tools have shown to offer sufficient functionalities to fulfill these requirements. These tools have strengths in one or more basic interaction processes of electronic collaboration – just like comparable closed source systems have; and like

these systems, they also show weaknesses because they do not support all features we identified to be important for Enterprise 2.0 tools. When choosing an open source E-Collaboration system, special attention should be paid to installation, support and operation options offered by open source systems, especially since many vendors of commercial systems offer easy deployment options like SaaS. However, our analysis of the various installation options provided for open source tools shows that also a number of open source E-Collaboration systems are easy to install and maintain.

This study provides enterprises – especially SMEs – with a comprehensive set of evaluation criteria focussing on communication, coordination, collaboration and connection. In contrast to related studies evaluating open source tools for electronic collaboration, like Spath et al. (2007), our criteria cover the entire spectrum of collaboration features and represent state-of-the-art features of modern Enterprise 2.0 systems. Especially with respect to the category connection our evaluation approach includes features for social networking which are not covered by comparable assessments. In comparison to the evaluation of E-Collaboration systems presented by Büchner et al. (2009), which focus on content-centric collaboration, our report also covers features for communication and coordination. We do not intend to present a market study on all major open source Enterprise 2.0 systems such as attempted by Spath et al. (2007), but to introduce an easy to implement evaluation method. Since other studies and reports like Büchner et al. (2009) include either none or only a small number of open source systems, SMEs will benefit from these results that meet their limited resources.

Enterprises and organisations planning to implement Enterprise 2.0 software will find a market analysis of relevant open source tools and an evaluation method that will help them to identify an appropriate collaboration tool. The systematic evaluation approach including a set of nearly 100 individual features in six distinct categories can be applied to various types of Enterprise 2.0 and E-Collaboration systems to provide a sound assessment.

Detailed results on all open source tools included in the longlist will be available in an online version of the market study on Enterprise 2.0 tools. The online version will also include commercial platforms to allow for a comparison of open source software and commercial tools. An even more detailed analysis of selected collaboration tools will rate individual features not in a binary mode –

supported ● or not supported ○, but will apply performance ratings on an appropriate scale.

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REFERENCES

AIIM (n.d.). What is Enterprise 2.0? Retrieved from http://www.aiim.org/What-is-Enterprise-20-E20 on May 1, 2011.

Büchner, T., Matthes, F., Neubert, C., 2009. A Concept and Service Based Analysis of Commercial and Open Source Enterprise 2.0 Tools. In: *Proceedings International Conference on Knowledge Management and Information Sharing*, Madeira, Portugal. pp. 37-45.

Cook, N., 2008. *Enterprise 2.0 - How Social Software Will Change the Future of Work*, Gower. Aldershot.

Drakos, N., Mann, J., Rozwell, C., 2010. Magic Quadrant for Social Software in the Workplace. Gartner. Retrieved from http://www.gartner.com/Display Document?id=1456713 respectively http://www.jivesoftware.com/resources/analyst-coverage/access-gartner-mq-workforce-2010 on May 1, 2011.

Ellis, C.A., Gibbs, S.J., Rein, G.L., 1991. Groupware - Some Issues and Experiences. *Communications of the ACM*, 34(1). pp. 38-58.

Hinchcliffe, D., 2007. The state of Enterprise 2.0, *Enterprise 2.0 Web Blog, ZDNet*. Retrieved from http://blogs.zdnet.com/Hinchcliffe/?p=143 on May 1, 2011.

Hinchcliffe, D., 2009. Assessing the Enterprise 2.0 marketplace in 2009: Robust and crowded. *Enterprise 2.0 Web Blog, ZDNet*. Retrieved from http://blogs.zdnet.com/Hinchcliffe/?p=598 on May 1, 2011.

Koch, M., 2008. CSCW and Enterprise 2.0 - towards an integrated perspective. In: *Proceedings 21st Bled eConference eCollaboration*, Bled, Slovenia. pp 416-427.

Koch, M., Gross, T., 2006. Computer-Supported Cooperative Work – Concepts and Trends. In: *Proceedings 11th Conference of the Association Information and Management (AIM)*, June 2006, Luxembourg.

Koplowitz, R., 2009. *The Forrester Wave™: Collaboration Platforms, Q3 2009*, Forrester Research Inc.

McAfee, A., 2006a. Enterprise 2.0: The Dawn of Emergent Collaboration. In: *MIT Sloan Management Review*, 47(3). pp. 21–28. Retrieved from http://sloanreview.mit.edu/the-magazine/articles/2006/spring/47306/enterprise-the-dawn-of-emergent-collaboration/ on May 1, 2011.

McAfee, A., 2006b. Enterprise 2.0, version 2.0. In *Andrew McAfee's Blog - The Business Impact of IT* (May 27, 2006). Retrieved from http://andrewmcafee.org/2006/05/enterprise_20_version_20/ on May 1, 2011.

Real Story Group, 2010. The Enterprise Collaboration & Community Software Management Evaluation Report. Retrieved from http://www.realstorygroup.com/ on May 1, 2011.

Riemer, K., 2007. The Market for E-Collaboration Systems - Identification of System Classes Using Cluster Analysis. In: Österle, H., Schelp, J., Winter, R. (eds.). *Proceedings of the Fifteenth European Conference on Information Systems*. pp. 346-357.

Spath, D. (ed.), Schimpf, S., Kugler, A., 2007. *Webbasierte Open Source-Kollaborationsplattformen*, Fraunhofer IRB Verlag. Stuttgart.

Xu, J., Zhang, J., Harvey, T., Young, J., 2008. A Survey of Asynchronous Collaboration Tools. *Information Technology Journal*, 7(8). pp.1182-1187.