The Information Audit – Analysis and Development of Information Capturing Methods

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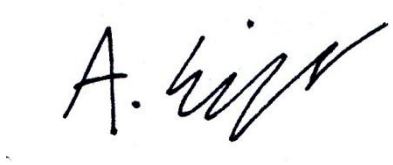

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Abstract

This research examines information audit methodologies and information capturing methods for enterprise social software which are an elementary part of the audit process. Information auditing is lacking of a standardized definition and methodology because the scope of the audit process is diversified and dependent on the organization undertaking the audit. The benefits of information auditing and potential challenges of Enterprise 2.0 the audit can overcome are comprehensive and provide a major incentive for managers to conduct an audit. Information asset registers as a starting point for information auditing are not specifically focusing on social software assets. Therefore this research project combines asset registers from different areas to create a new register suitable for the requirements of Enterprise 2.0. The necessary adaptations caused by the new character of the assets are minor. The case study applying the asset register for the first time however reveals several problematic areas for information auditors completing the register. Rounding up the thesis a template is developed for setting up new work spaces on enterprise social software systems with appropriate metadata taking into account the meaningful metadata discovered in the asset register.

Diese Arbeit beschäftigt sich mit Information Audit Methodologien und Methoden zur Informationserfassung in Enterprise Social Software. Die Erfassung von Informationsressourcen ist ein elementarer Bestandteil des Information Audit. Das Fehlen einer standardisierten Definition und von standardisierten Methodologien für Information Auditing ist begründet durch den weit gefächerten Anwendungsbereich des Information Audit und durch seine notwendige individuelle Anpassbarkeit an die Bedürfnisse der durchführenden Organisationen. Die Vorteile von Information Auditing und die möglichen Herausforderung durch Enterprise 2.0, die mit Hilfe des Audits überwunden werden können, sind weitreichend und stellen einen Anreizpunkt für Manager einen Information Audit durchzuführen. Information Asset Register als Ausgangspunkt für erfolgreiches Information Auditing berücksichtigen noch nicht die besonderen Herausforderungen von Enterprise 2.0. Deshalb spannt dieses Forschungsprojekt einen Bogen von Information Asset Registern aus verschiedenen Einflussbereichen und kombiniert diese, um ein neuartiges Asset Register, welches die besonderen Anforderungen von Enterprise 2.0 berücksichtigt, zu erstellen. Die notwendigen Anpassungen, die durch die neuen Charakteristika der Informationsressourcen verursacht werden, sind von geringem Ausmaß. Das neu entwickelte Asset Register wird im abschließenden Teil der Arbeit in einer Fallstudie angewendet und zeigt mögliche Problembereiche, die beim Zusammenstellen des Registers auftreten können, auf. Als Abschluss der Arbeit wird eine Vorlage entwickelt, welche Nutzern von Enterprise Social Software beim Erstellen von

neuen Arbeitsbereichen behilflich sein wird, diese mit passenden Metadaten, wie sie bereits im Information Asset Register festgehalten werden, zu versehen.

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1 Introduction

This thesis examines the information audit with a focus on methods which are used to capture information resources/assets during the first steps of the information audit. Information capturing is a very important step in every well-known information audit methodology(Buchanan & Gibb, 2008, p. 4). This chapter begins with the problem statement to point out the challenges which have to be dealt with during the process of information auditing. To overcome all these different challenges is a reason why further research is required in the field of information auditing. In the following section the motivation for the research in this topic is stated. Not only the fast growing influence of information as a resource in almost every industry sector is a major reason for dealing with this topic, also the benefits as well as the problems and inefficiencies which can be conquered by the use of information auditing are a motivation for scientists as well as companies for increasing their effort in the field of information auditing (Henczel, 2000, pp. 210). The next paragraph takes the problems identified in previous section and the overall research goal to develop a method for information capturing in enterprise social software as a basis for expounding the research objectives in this paper. These research objectives are used for developing the research questions which will be answered in the main part of this thesis. To conclude the first chapter a summary of the methodical approach for the creation of this thesis is provided. For a better understanding the approach was divided in five main steps which can be easily visualized.

1.1 Problem Statement and Motivation

The key to successful information management is recognizing information as a strategic resource (Burk & Horton, 1988). Conquering this challenge is made more difficult because of today's changes in the information technology sector, the growing importance of Web 2.0 and the Internet in general is leading to a major increase in volumes of information(see figure 1.1) not only for private consumer but also for companies (IDC, 2008, p. 3). Information is important today as it plays a major role as a competitive factor in almost every industry sector. In economic science information is listed together with the classic production factors labor, ground and capital today (Kendall & Scott, 1990, p. 40). As outlined above growing volumes of information, employees lacking skills of how to deal with the requirements of new types of software and information and other issues such as privacy, security or compliance are making the challenge even more complicated. Adjusting the company's information management strategy to the requirements of information created in enterprise social software is a major issue in practitioner literature. Not only the large volumes of information created in enterprise social software, but also adjusting information life-cycle management and records management to the new require-

ments and including this content into the companies enterprise search are challenges which arose through the emergence of Enterprise 2.0 (Williams et al., 2013).

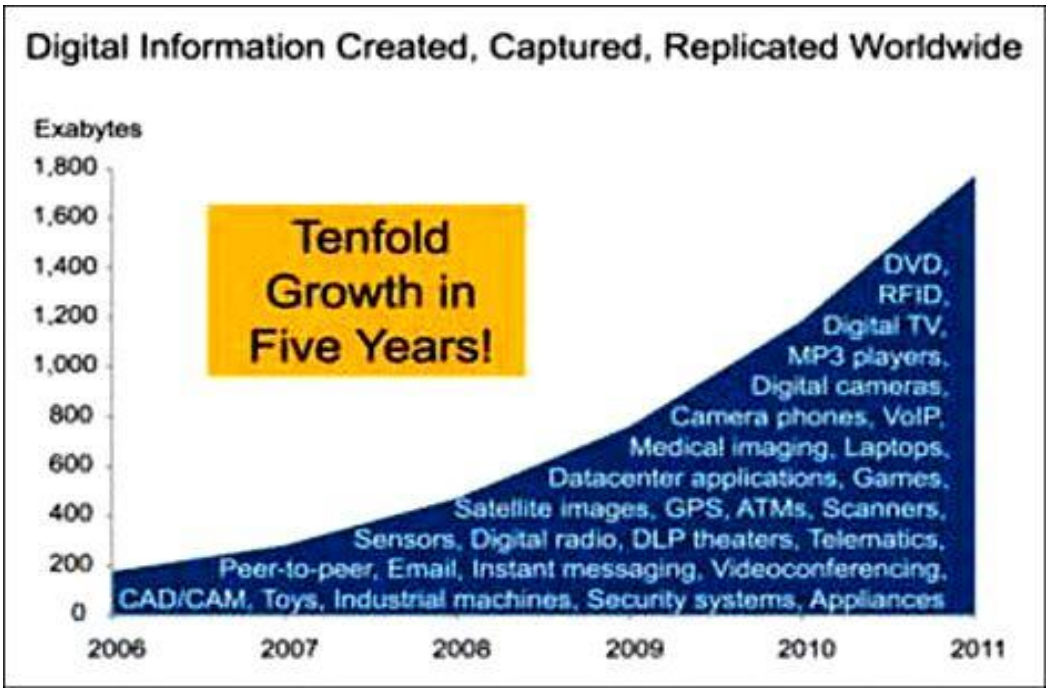

Figure 1.1: Growth of Information Volume (IDC, 2008, p.3)

To conquer these challenges it is necessary to gain a good overview of the content stored in enterprise social software because this overview will form the basis for the development of an adjusted information management strategy. One of the best ways to provide a good overview is an information asset register. Therefore it is important to check existing information asset registers to examine their conformance with new types of information resources in enterprise social software. In contrast to business application data(e.g. data from ERP systems) or legally relevant data like contracts most of the content(images, videos, instant messages) created in enterprise social software as displayed in figure 1.2 is not formally managed at all (Williams et al., 2013). The Enterprise Information Management Survey from Williams et al. also reveals that most companies have the plan to implement systems like DMS, WCMS or CMS to manage that content. If companies are not dealing with that unmanaged content, they risk losing their competitive position in two main areas: conformance and performance. Conformance means that legal obligations like retention periods will not be met by the company and there is a major risk of being sued because of that. Performance on the other hand means e.g. exploiting greater value from their information assets or improving information quality to foster their competitive advantage(Williams et al., 2013).

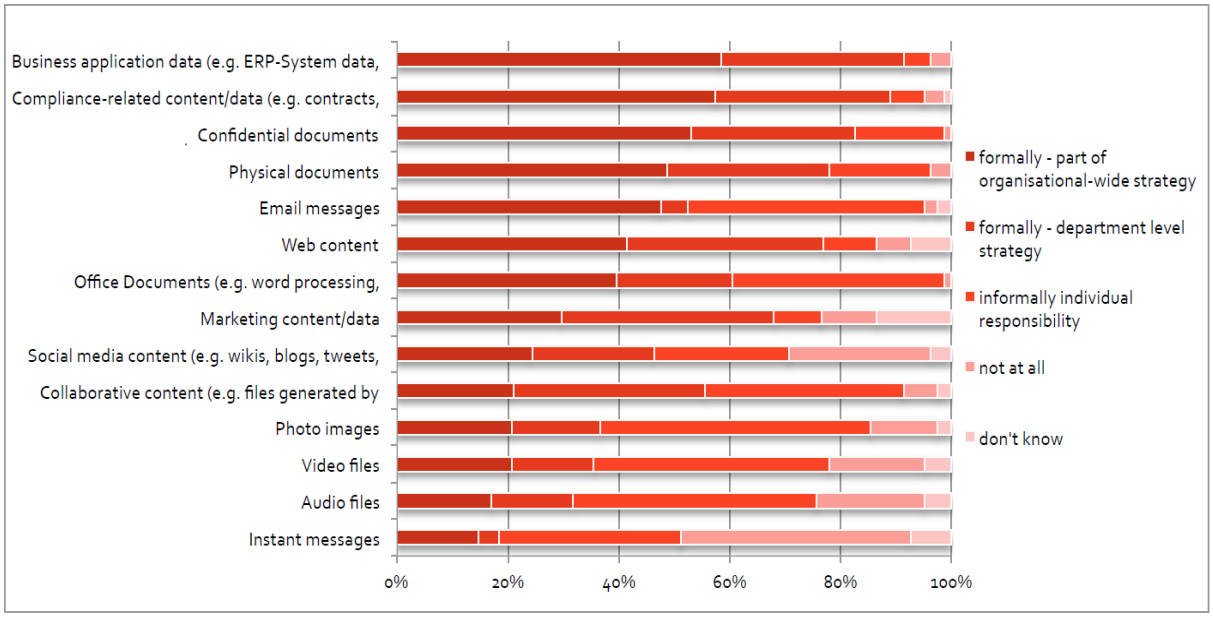

Figure 1.2: Management of Different Content Types (Williams et al., 2013)

The findings from the EIM survey make it clear that there is a need for companies to adjust their information management strategy (if existing) to the requirements of enterprise social software. The information audit and its associated information capturing methods as a fundamental part of the audit form the basis for the development of an information strategy. Therefore it is important that existing information capturing methods are evaluated to check their suitability for the content stored and created in enterprise social software. Another reason why the development of a new capturing method for enterprise social software is necessary is that those types of applications also gathered by the term Enterprise 2.0 have mostly emerged in the last five to ten years. But most of the capturing methods were developed in a time when those types of software were not used in companies. There may be aspects of these new types of software that are not being captured by traditional information audit methods.

As outlined above there are many problems concerning information management in organizations which have to be dealt with. A first step to conquer these problems and to reduce the complexity of the organization's information situation is the information audit. In the last thirty years information auditing became more and more popular in several industries such as banks or pharmaceutical firms because they realized that information is not only a strategic resource but also has financial value like every tangible asset (Orna, 2004, p. 45). Another aspect which motivates companies to undertake an information audit is the risk of losing competitive advantage, if they are not exploiting their information resources efficiently. Effective information management will also open up opportunities for companies e.g. in developing new products (Burk & Horton, 1988). The information audit identifies the

information resources of strategic importance and also the problems, inefficiencies and gaps relating to these resources (Henczel, 2000, pp. 210). These insights are used to formulate recommendations for solutions to the problems and will form a basis for the development of a corporate information strategy/policy in the future.

However, there is no generally accepted framework for the information audit methodology which could be used as a benchmark by companies who are willing to undertake an information audit. Several authors have published information audit methodologies which are excelling in some aspects and are less well developed in other aspects, e.g. Buchanan and Gibb, Henczel or Orna. Much effort is required for companies to identify the best-fitting methodology for their specific needs. Therefore research is required to identify the benefits of each of those methodologies and understand which parts each methodology is excelling in comparison to the others.

The capturing of information resources/assets is a major step in the process of undertaking an information audit because it is used in every generally-known methodology (Buchanan & Gibb, 2008, p. 4). In all of these methodologies the identification of information resources is the step which forms the basis for any further analysis of the information resources (Buchanan & Gibb, 2008, p. 4).

However, there is no generally-accepted information capturing method. Some authors proposed a method like information resource inventory in InfoMap (Burk & Horton, 1988), which is no longer up-to-date for some types of information assets. Other methods are too specific and focus only on a special industry sector e.g. health, education or finance. It is not only the focus and the specification of existing templates that makes the use of those problematic; also the emergence of Web 2.0 technologies used in companies (Enterprise 2.0) necessitates the development of a new template adjusted to these new requirements. The growing influences and expansion of Enterprise 2.0 software in organizations forces scientists as well as practitioners to think about organizing information assets stored in these applications, e.g. in information asset registers (Bughin, 2008, p. 251). Already existing methods are not suitable for the conditions of enterprise social software. Some are just too specific or adjusted to a specific branch like health service; others are too extensive e.g. the number of categories is very sophisticated. Thus a new schema has to be developed using the knowledge gained during the evaluation of the already existing methods.

Therefore research is required to identify, analyze and evaluate already existing methods and combine the knowledge, gained during that process, to develop a method which focuses on the resources stored in enterprise social software. In the end the improved method will lead to better recommendations in the synthesis part of the information audit(Buchanan & Gibb, 2008, p. 4)

1.2 Objectives of the Paper

The overall goal of this thesis is to develop a method for information asset capturing which is drawn on existing methods and combines these methods in a way that an improved method is formed. The resulting method will be specifically designed to meet the requirements of information resources stored in enterprise social software.

For a better overview the overall goal was split into four main objectives, which are worked on sequentially. The objectives are used as the basis for developing the research questions which follow in this section of the thesis.

The first objective is to identify and compare existing information audit methodologies to reflect the current state of science on this topic. There are several methodologies published by scientists which are used quite frequently by companies or other institutions for their individual information audit. Because most of the information audit methodologies are focusing on special industry sectors or excel in just one part in their practical applications, it is indispensable for organizations to understand the practical applicability of the methodology to find out which is the best-fitting for their requirements. This question has not just to be asked by practitioners but also by scientists which are the major force in developing new or adjusted information audit methodologies. The last sub-goal of the identification and comparison of the information audit methodology is understanding the role of information capturing in the information audit process. Information capturing is an important part of the information audit process because it forms the basis for further analysis. Therefore not only the information capturing methods used in the existing information audit methodologies are analyzed. Also methods developed by private companies or other institutions, which did not use them as part of the information audit but to provide a better understanding of their information resources, are used during the understanding process and will also form the basis for the development of a new method.

The second objective is to identify, analyze, compare and evaluate existing information capturing methods; in this case information asset registers. As previously outlined the author combines the capturing methods used in the information audit methodologies with the practically applied information asset registers which are detected by desk research. Looking at those information assets registers the main objective of the analysis and comparison is to understand the strength and weaknesses of each method. The major challenge is the evaluation of the methods because they each focus on needs of a specific industry sector and therefore their focus and granularity will be diverse. Taking the advantages of each method and the combined knowledge to develop a new method is a very difficult task because there is no benchmark method which could be used as a basis for his work.

The third objective is the development of an information capturing method adjusted to the requirements of enterprise social software. As mentioned previously it is difficult to develop such a method because there is no benchmark which could be used as a template. “Older” methods which are focusing on information resources in general or are adjusted to the needs of a specific firm or branch are used as a basis for his work. But the new needs emerging through the new types of information and content stored in enterprise social software are also taken into consideration. Therefore the challenge is to combine the knowledge about social software and its requirements with the generally applicable categories and structure used in the already existing methods to create something which can be used in a company to discover the information resources stored in their enterprise social software system.

The fourth objective is testing the practical applicability of the developed method in an enterprise social software environment as a pilot case study. After the information capturing method has been developed, there is a need for proofing its applicability in the real world. Because there is no scientific evidence e.g. by another case study in which an information capturing method was used in a company’s enterprise social software system, this step is indispensable for showing that the work done during the development process can be successfully used in a real company. The case study is essential for the further development of the capturing method because the knowledge about the method gained during the case study is crucial. The reason for that is the provision of practical evidence which is the basis for further adjustments of the information capturing method in the future.

The fifth objective is developing a template for information practitioners for setting up new communities or work spaces in enterprise social software systems. Today’s social software systems like IBM Connections are lacking of descriptive metadata. Establishing a generally applicable metadata template can be a major benefit for making the communities on the platform comparable and checking them for actuality.

Each research objective is used for the development of the research questions which will be used as guideline throughout the research:

RQ1: Which information audit methodologies exist, what elements do they contain and how do they differ?

RQ2: How is the step of information capturing defined in each of these methodologies?

RQ3: Which types of information asset registers (IAR) are used in companies or other institutions?

RQ4: What are the requirements for information capture and an information asset register for enterprise social software (ESS)?

RQ5: How well do existing methods of information capture meet the requirements of enterprise social software?

The research questions are displayed through the following research steps:

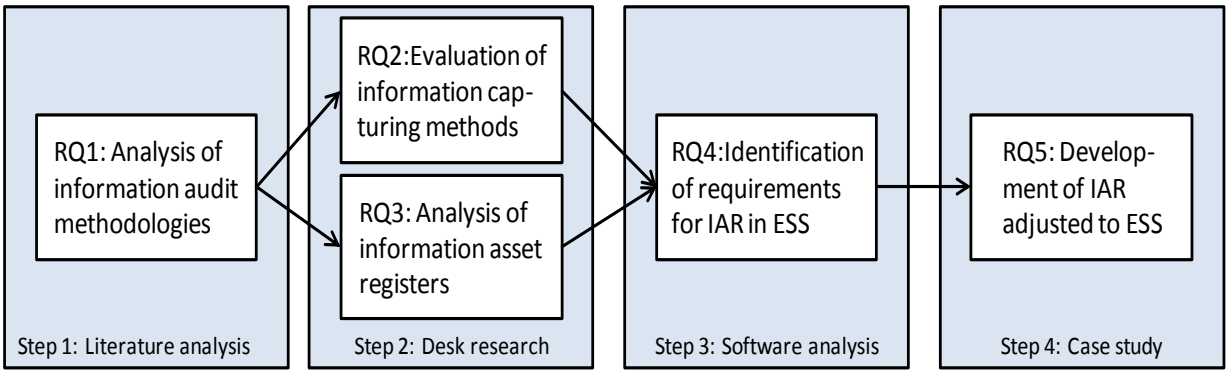

Figure 1.3: Research Steps

1.3 Methodological Approach

The research for this thesis begins with an in-depth literature analysis on the key themes of this thesis. The focus is on information audit literature in general and information audit methodologies specifically as well as the topic of Enterprise 2.0 and enterprise social software. Both topics are widely discussed in scientific literature and therefore the literature discovered during the research has to be reviewed intensively to understand what the major sources for this study are.

The research then focuses on the comparison of information audit methodologies. Therefore analysis and evaluation of the methodologies selected during the literature review is conducted. Furthermore a comparison of the methodologies in a spreadsheet to provide a condensed overview of the advantages and disadvantages of each methodology as well as their major steps and target group is undertaken. Then the research is continued by analyzing the information asset registers which are gathered by desk research. The registers gathered during that process are compared to find out which categories and items are indispensable for the development of an information asset registers for enterprise social software later on. The analysis will not only focus on quantitative aspects but mainly on qualitative aspects because the registers differ widely in their scope and detailing.

The results of this analysis are used for the development of the new information capturing method for enterprise social software. Therefore the author combines the knowledge gained from the analysis performed previously to create a spreadsheet adjusted to the requirements of Enterprise 2.0 systems. The spreadsheet is created in Microsoft Excel because the level of complexity has to be kept as low as possible. This is a prerequisite for this research project since the usability of the spreadsheet is the key success factor for its applicability. The research is completed by a case study which brings the spreadsheet to use in real world Enterprise 2.0 environment. This step is crucial because only practical appli-

cation allows the evaluation of usability and the detection of problems which were not taken into consideration during the development phase. In the last step of the research the information asset register is taken as a basis for developing a metadata template for new enterprise social software work spaces.

2 Theoretical Foundations

In the following paragraphs the basic theoretical terms and definitions are introduced and explained. The two main topics are the information audit and Enterprise 2.0. This chapter begins by defining each of these terms through the introduction of widely known definitions of leading scientist in their area of expertise. Following the definitions both terms are examined broadly by focusing on challenges, benefits and concepts which are relevant for a better understanding of both topics and their development in the recent years. Both topics, especially Enterprise 2.0, are relatively new because they are dependent on the development of information technology and the Internet. Therefore the changes in this area in the last ten years are influencing not only companies that are using Enterprise 2.0 software and information auditing processes but also scientist who have to adjust their methodologies and concepts to these changes. However the basic foundations and concepts for information auditing were established in the 1980s and most of those can still be applied for the development of today's methodologies.

2.1 What is the Information Audit?

Auditing is a widely used management technique which helps executives with understanding and reviewing their current resources and services (Boon & Botha, 2003, p. 23). The information audit however emerged due to the growth of information technology in companies in the 1970s and 1980s (Burk & Horton, 1988). Therefore the key to developing an information audit methodology is understanding general auditing processes focusing on other core areas like financial resources. Those general auditing processes are defined by the American Accounting Associations as:

"*a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those assertions and established criteria and communicating the results to interested users*" (Silvoso, 1972, p. 18)

This definition is really unspecific and does not aim at a particular purpose or key aspect like information, finance or other resources companies have to deal with. The idea of auditing resources in a company originated from the financial and accounting department, which were the first to understand the importance of providing a better overview of how the financial resources are used in a company to improve processes and save cost (Raliphada & Botha, 2006, p. 242). The focus on financial resources was the trigger for the development of auditing processes. This trigger catalyzed the emergence of several new auditing methods like the system audit or management audit (Silvoso, 1972, p. 18). The information audit has the same origin, it took the financial audit as a basis and looked at the auditing process with the perspective of an information manager (Vo-Tran, 2011, p. 271). Today information

volumes are growing at a high rate and companies are not only dealing with paper-based documents but mainly with lots of types of unstructured data like images, transcripts or emails. With the history of the information audit going back to the 1980s, it has become a key concept for effective and efficient information management. It is simply not possible for companies to deal with all of this unstructured information and to create, manage and disseminate these without undertaking an information audit at the first place (Vo-Tran, 2011, p. 271). The purpose of the information audit changed since it was first defined in the 1980s. Burk and Horton (1988), who proposed their information audit methodology in the 1980s, developed one of the first complete information audit methodologies which can be used as a template for companies wanting to undertake an information audit. The focus of their methodology is rather narrow, their guiding idea was the identification of information resources as a strategic and competitive factor in the company to improve management of those resources and understand the value of those resources. The emphasis of their work was on document management rather than taking a wider focus including the organizational culture or structure as later definitions do. Those definitions were proposed by Buchanan and Gibb (2007) and Botha and Boon (2003). They are taking a wider view on the organization and include organizational perspective and a broader spectrum of information resources into their scope (Buchanan & Gibb, 2007, p. 159).

Many authors tried to propose a generally applicable definition for information auditing. But as mentioned in the previous paragraphs the scope and focus of the different information audit methodologies is varying to such an extent that it is hard to propose a standard definition which is suitable for every methodology. However the ASLIB Information Resources Management Network introduced a standard definition which describes the information audit as:

> *"A systematic examination of information use, resources and flows, with a verification by reference to both people and existing documents, in order to establish the extent to which they are contributing to an organization's objectives"* (Orna, 2005, p. 160)

This definition combines all aspects from other definitions by notable scholars such as Buchanan and Gibb, Orna or Henczel. Therefore in the following paragraphs different definitions are introduced and compared to provide a better understanding of the standard definition proposed by ASLIB.

A simple and condensed definition of the information is proposed by Dubois (1995). His definition of the information audit describes it as "*a useful information management tool with respect to the identification, costing, development and rationalization of information resources and services"* (Dubois, 1995). In comparison to the standard definition Dubois focuses on resources and services and does not include information flow and use. This limits the scope of the information audit and makes it easier to apply the methodology. But by taking information use and flow into consideration the results can lead to greater improvements after applying the counsels at the end of the information audit. Dubois'

definition is well fitting to the early information audit methodologies like Burk and Horton with their narrow focus.

Buchanan and Gibb broaden the scope of the information with their definition by including information flow. In their definition the information audit is described as "*a process for discovering, monitoring and evaluating an organisation's information flows and resources in order to implement, maintain, or improve the organisation's management of information*" (Buchanan & Gibb, 1998, p. 34). Besides adding information flow to the scope of this information audit, this definition also includes an aim: the improvement of the organization's information management. While Dubois only looks at what has to be done during the audit, Buchanan and Gibbs' definition also considers what has to be done after the audit to convert the results for improving efficiency and effectiveness in information management. Buchanan and Gibb take this into account because organizational success is dependent on how organizations exploit and manage their information resources. However Buchanan and Gibb mention several fundamental problems which influence information management negatively. Information loss, non-compliance, increasing costs for information storing and information overload are a few of the problems companies are facing concerning information management. To overcome these is the goal of Buchanan and Gibb's methodology (Buchanan & Gibb, 1998, p. 29). Thus this definition is closer to the ASLIB definition but there are still important aspects missing.

Botha and Boon's definition broadens the focus of the information audit even further. They describe the information audit with the following definition: "*information audit entails the systematic examination of the information resources, information use, information flows and the management of these in an organisation. It involves the identification of users' information needs and how effectively (or not) these are being met*" (Boon & Botha, 2003, p. 24). They include a new aspect into their definition, which is the use of information in an organization, and how the user's needs are being met. In comparison to Buchanan and Gibbs definition Botha and Boon slightly change the aim of the information audit. Instead of focusing on the improvement of information management in general, they place a special emphasis on the users who are one of the key success factors when it comes to improving information management. Since this thesis also focuses on Enterprise 2.0, which is the use of Web 2.0 technology in a company's environment (see section 2.5), the concept of the user as the center of application (architecture of participation) is one of the characteristics of Web 2.0 (O'Reilly, 2009). Therefore the focus on information use and information user's needs is one of the guiding ideas in this thesis during the development of the information asset registers in chapter four. But in comparison to the standard definition by ASLIB, this definition is lacking focus on the improvement of information management as well as the contribution of effective information management to the company's objectives.

The basis for the ASLIB standard definition was a definition proposed by Booth and Haines, which was tailored to a specific case: the Regional Health Authority. Their definition slightly differs from the ASLIB definition: "*a systematic examination of information use, resources and flows, with verification by reference to both witnesses and documents, in order to establish the extent to which they are contributing to the Regional Health Authority's objectives*" (Booth & Haines, 1993). It includes the complete spectrum considering the scope of the information audit by dealing with the information resources itself, the way information flows through the organization and how the information resources are used by the employees. Furthermore it links the organization's success with the way the employees use the information resources.

	ASLIB (Booth & Haines)	Dubois	Buchanan & Gibb	Botha & Boon
Activities	Systematic examination	Identification, costing, development and rationalization	Discovering, monitoring and evaluating	Systematic examination
Focus	Information use, resources and flows	Information resources and services	Information flows and resources	Information use, resources, flows management, user needs
Aim	Understand how information resources contribute to organization's objectives	-	Implement, maintain or improve information management	Understand if user needs are being met

Figure 2.1: Comparison of Information Audit Definitions

Concluding it can be stated that while the different authors take a specific focus point in the information audit definition, the core idea of each information audit remains the same. Providing an overview of the information resources and understand how the management of those resources can be improved is the guiding concept of each definition. Whereas some authors only focus on information as a resource, which is a position aligning to the classical resources labor, capital and ground, others are highlighting the way those resources support organizational objectives or user needs (Kendall & Scott, 1990, p. 40). The first position is more value-based than the second and aims at pricing information like machines or other classical resources. In contrast the second position is based on effec-

tiveness and efficiency issues and the way value is created by improving information use e.g. by increasing productivity of the employees. In figure 2.1 the conclusion is displayed by summing up the definitions in a spreadsheet. Therefore every definition is split into three basic parts, which are the activities the information audit includes, the aspects it focuses on and the intended aim. The spreadsheet confirms the conclusion above that the definitions are quite similar in their core idea but differ in their details. The table also shows that the authors are sometimes using different words but considering their meaning the words could be replaced synonymously. This fact can lead to misunderstandings when talking about the information audit. Therefore discussion of the popular terms which are used in the field of information auditing is provided in the following paragraph of this chapter.

Since the information audit is an information management tool, on which a lot of professionals cannot agree on the benefits gained through performing it, there are different terms which people in the information technology sector are using interchangeably. The terms information audit, needs assessment, survey and other designations are used synonymously by practitioners (DiMattia & Blumenstein, 2000, p. 178). Although these terms are used interchangeably by practitioners, it is important for researchers to clearly point out the differences between them. The information needs assessment as well as the information inventory are just elements (steps) of the whole information audit methodology and therefore the interchangeable use is not appropriate (Boon & Botha, 2003, p.24). In the information audit far more elements are included. The main steps of the information audit are the identification of the organization's real information needs, the identification of the information users, understanding where people provide themselves with information and finding out in which parts customers get in touch with the organization. Other notable elements are the definition of information resources and services, the determination of the organization's real information needs and the implementation of the results after finishing the audit. In summary the overall goal of the information audit would be increasing the understanding of the information resources and where they are created as well as how users include those information resources in their daily work (Pantry & Griffiths, 2002).

2.2 What Steps Does the Audit Consist of?

In the previous paragraph the main elements of the information audit were already introduced. However, to provide a full understanding of how the information audit process is executed in an organization, there is a need to understand what actions have to be performed during each of these steps to get an acceptable result at the end of the audit. Therefore a summary and introduction to one of the first information audit methodologies proposed is provided: InfoMap by Burk and Horton. The framework is chosen as a basis for this thesis for two reasons. The first reason is that this methodology is compressed and also easy to understand for persons not familiar with the topic of information audit-

ing and the second reason is that, besides the framework is already thirty 30 years old, the elementary parts in each information audit methodology are still the same. Therefore many methodologies, which were proposed after InfoMap, took InfoMap as a basis for their work. From there a good understanding of InfoMap will also help working with the newer methodologies from Buchanan and Gibb, etc.

Basically InfoMap consists of four main steps; it starts with a survey phase, which is continued by the second step with costing and valuing the information resources. After that the results from step one and two are handled in the analysis phase. The results from that step are used for the last step, the synthesis, in which the information resources are evaluated. The four main steps and the key elements of each step are displayed in figure 2.2. Each of the steps is separately explained in the following four paragraphs.

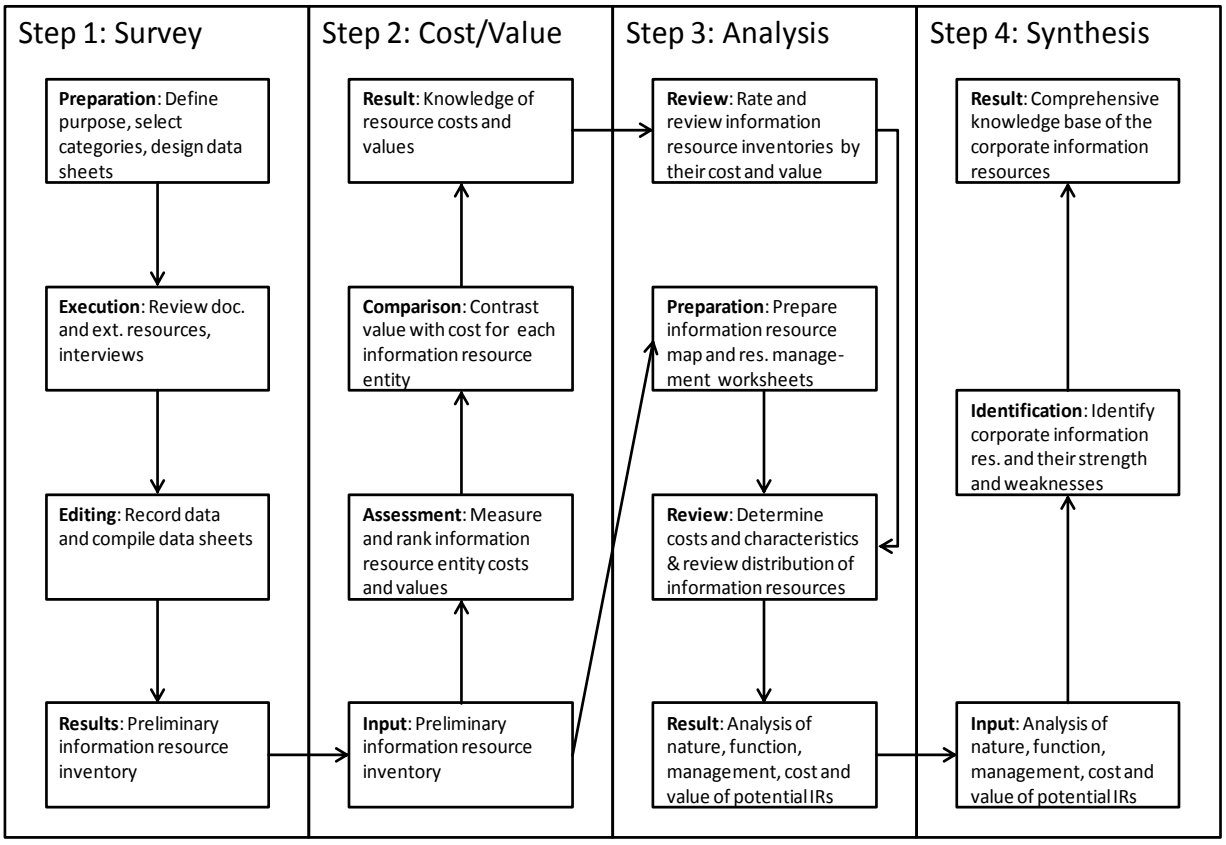

Figure 2.2: Overview of InfoMap (adapted from Burk & Horton, 1988)

2.2.1 Step 1: Survey

The InfoMap methodology starts with provision of a list collecting the information sources, services and systems in the respective organization. This list or table is called preliminary information resource inventory. The list forms the basis for discovering corporate information resources. Because it is so important for the further steps, organizing this list in a way that it is easily understandable and reusable is crucial for the success of the information audit process. Therefore the development of a classifi-

cation scheme for corporate information resource entities is indispensable. An example for a classification scheme, which could be used in practice, is provided in figure 2.3 (Burk & Horton, 1988, p. 173).

Identification Number (ID) :	Category:	Type:	Resource Name:
Location:	Organizational Unit:	Resource Manager:	Operating Contact:
Concise Statement of Goals/Missions/Purposes Supported:			
Description of Contents, Operations and Uses:			
Comments and Observations:			
Evaluation:			
Primary Inputs:	Primary Outputs:	Holdings/Storage Media:	
Prepared by/Date:	Reviewed by/Date:	Approved by/Date:	

Figure 2.3: Inventory Data Form (Burk & Horton, 1988, p. 57)

The major finding of this step will probably be the quantity and diversity of the discovered information resource entities. The main reason for that is that many resources are hidden and organizations are losing track of the information resources their employees are using for their everyday work. The preliminary information resource inventory provides more questions than answers. It is the goal of the further steps of this methodology to provide answers to those questions. The company wants to understand how they can rate their resources in relation to their importance for the employees and as a result of that rating which of the resources they can dispose. Another major question is how the information resource entities foster the organization's economic success (Burk & Horton, 1988, p. 173).

2.2.2 Step 2: Cost/Value

The second step begins with the selection of measuring methods for costs and values of the information resource. The aim is to assign every information resource entity from the preliminary information resource inventory a suitable value. After finishing that step, it is possible to compare the val-

ue of every entity with its cost and to define cost/value ratio to rank every entity by its contribution to the organization's economic success (Burk & Horton, 1988, p. 173).

In this step the organization applying InfoMap will probably find out for the first time in its history what the total costs of its information resources are and understand which entities need further investments or cause high operating costs. These discoveries will foster its economic success because deficiencies are detected, which prevent the organization from fully exploiting its information resource entities. The second major discovery is the assignment of a monetary value for each information resource entity. Thinking about how to measure the values of each entity and how the management could probably be improved to create greater value will foster its understanding of its information resources in general (Burk & Horton, 1988, p. 173p).

2.2.3 Step 3: Analysis

Organizational Units / Information Resource Types	Unit A	Unit B	Unit C	etc.	TOTALS
SOURCES Type A Type B Type C etc.					
SERVICES Type A Type B Type C etc.					
SYSTEMS Type A Type B Type C etc.					
TOTALS					

Figure 2.4: Information Resource Worksheet (Burk & Horton, 1988, p. 120)

Step three starts with discovering how the organization's information resource entities are distributed throughout the organization. One key method to display the distribution is the information resource worksheet (see figure 2.4). In the information resource worksheet each information resource is assigned to a category whether it is a system, service or source. After the categorization they are related to the organizational unit/department, where they are located (Burk & Horton, 1988, p. 174).

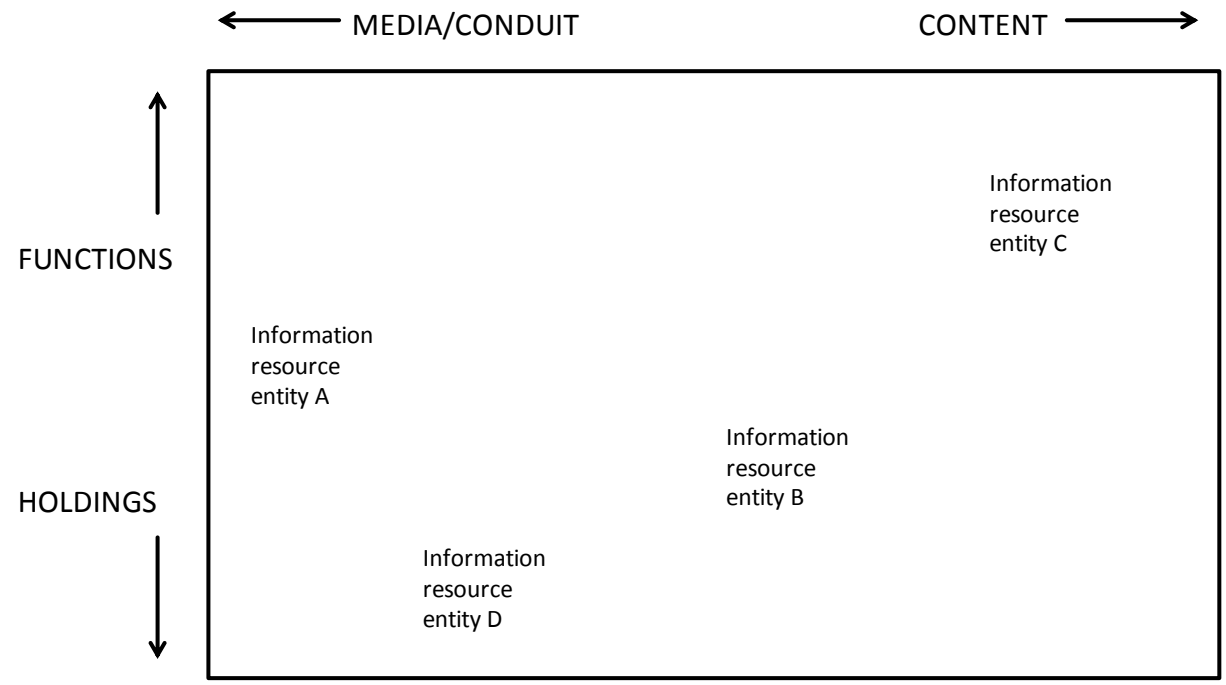

Figure 2.5: Information Resource Map (Burk & Horton, 1988, p. 139)

Another method which is essential for the organization's understanding of its information resources is the information resource map (see figure 2.5). It highlights the characteristics of its information resource entity by displaying them in terms of two spectra. The first one is the holding/function spectrum which rates if the entity is more a static like a database or more dynamic like a news feed. The second spectrum evaluates each entity by deciding if it is more content-based like a business report or media-based like a promotional video. However there are many entities which stand between the lines and therefore find themselves in the middle of the map. After finishing those two mapping techniques the analysis is completed by checking how/if the information resource entities are part of the organization's chart of accounts and if the company's financial controls are considering them while doing their work (Burk & Horton, 1988, p. 174).

The construction of those maps and charts will lead to a multitude of findings. Dealing with these entities too such an extent as it is required for the analysis step will increase the understanding of each of them because most companies have never dealt with their information resources so intensively. The discoveries from that step comprise a broad spectrum. The organization will learn how and which employees are using a specific information service. Furthermore it will increase its understanding of how the management of the information systems in use is organized between the different departments (Burk & Horton, 1988, p. 174).

With the help of the information resource map the auditors can easily visualize how the organization's information resource entities are naturally grouped. This grouping does not cause any further effort

because the information resource map is part of the analysis process. By putting them into groups and/or clusters the management of the information resources will be facilitated because the similarity of information resource entities can be exploited by using the same management principals/methods on each group. Furthermore auditors can discover how and if the respective information resource entities are represented in the company's financial accounting. If it is not possible to detect its information resource entities in the company's balance sheet, its information costs cannot be calculated or just estimated (Burk & Horton, 1988, p. 174).

2.2.4 Step 4: Synthesis

In the last step of the methodology the data collected during the previous steps is merged to improve understanding of what the organization's real information resources are and what strategic value they have for the company. Furthermore the performance of each entity can be evaluated by its effectiveness and efficiency. Recognizing the organization's strategic information resources out of its preliminary information resource inventory begins with the definition of information resource criteria which are applied to each information resource entity during this process. After the recognition the synthesis process is continued by evaluating the strengths and weaknesses of each information resource. For a better understanding those resources are compared not only against criteria statements but also against each other or resources from competitors. This supplement will improve the auditor's evaluation because strength and weaknesses are often not measurable in absolute numbers but they can be evaluated in relation to each other (Burk & Horton, 1988, p. 174p).

A further discovery during the identification process of the organization's information resources is management problems concerning these resources. Solving those issues is crucial because the systems, services and sources, which are recognized as its information resources, are the ones on which the organization's economic success is dependent on. Some of those need to be addressed directly because they endanger the company's success; others are less threatening and can be dealt with over time (Burk & Horton, 1988, p. 175).

After finishing the entire four steps the methodology provides a broad overview over the organization's information resources for the first time. It is possible to identify the corporate information resources, where they are located in the company and what they contribute to the company's success. This overview is easy to understand even for people outside of the subject area because it is provided by simple tools for visualization (Burk & Horton, 1988, p. 175).

2.3 Why Should it be Applied?

DiMattia and Blumenstein (2000, p. 178) argue in their paper that there are many researchers as well as practitioners who question the benefits of using an information audit. Some authors state that there is not enough practical evidence because only view information audits were conducted and documented in a way that the benefits would come out. Others argue that the reason the results of the information audit are not useful for organizations is the lack of a clear definition, which makes the results of different audits not comparable.

But the lack of a clear definition must not be a drawback. It is also the strength of the different existing methodologies that they focus on different purposes. Some are more focused on the costs and values of the information resources; others are putting their spotlight on the alignment of information resources with the corporate strategy and objectives. However, there is one goal, which all information audit methodologies have in common: identifying the organization's information resources and requirements is so basic for every methodology, that it can be commonly agreed on (Buchanan & Gibb, 1998, p. 34).

2.3.1 The Six Categories of Benefits

Different authors have carved out a multitude of benefits that result from applying an information audit. In the following paragraph these benefits are grouped and overviewed by the frequency of their appearance. For a better overview the benefits are divided into six basic categories. In the first category all benefits concerning the employees and what could be improved in their information handling. The second one focuses on law and rules, which means that meeting the local legislation and development of framework/templates for dealing with information are the main areas. Furthermore the third category summarizes all benefits for information strategy, meaning that it deals with how the information audit can help in strategy development. In the fourth category all benefits for the management/executives are gathered. While getting the management's support is one of the key starting points to the information audit, there are many further benefits which could persuade the management of undertaking an information audit. In addition the fifth category deals with purposes for undertaking the information concerning the information itself. The focus is on the problems with information, which the company is dealing with at the moment and how they can be overcome by the information audit process. The last category is higher-level or future aims. Benefits gathered under this category are those which could be initiated through the information audit. But they only take the audit as a starting point and need further elaboration. In the table (see figure 2.6) below those six categories are visualized. For a better understanding more detailed elaboration on these benefits is provided in the following paragraph.

Employees	Strategy	Compliance/ Rules	Management	Information	Higher-level
- train employees to improve understanding of information - identify **training needs** for better information exploitation - create **awareness** for the value and benefits of information resources - identify external and hidden resources and include them into information resource management - evaluate information use and how effectively information inputs are processed - increases understanding of information systems	- information audit forms the basis for **information strategy** development - discover information as a **strategic resource** - align IT investments with information strategy	- verify the **provenance** of information to protect intellectual property (copyright) - establish proper access right to foster information security - develop a **framework** with common standards and procedures - monitor and evaluate **conformance** with legislation and policy guidelines	- create **awareness** for information management - detect true costs and value of information resources - improve information management systems - include information into corporate **accounting** - use information for **competitive advantage** - identify **responsibilities** for each information resource - recognize needs for additional information - identify centers of expertise	- identify duplicate information - discover **gaps** in information provision - detect information overload and support conquering it - discover **strength and weaknesses** of concerning information	- use information resources for new product development - adapt **organizational structure** to the strategic information resources - design **information architecture** which relates the business model to the information resources - develop **budgeting standards** for corporate information resources to support future investments in information technology

Figure 2.6: Benefits of the Information Audit

2.3.1.1 Employees

The first two areas of benefits introduced are the employee and management category. Both categories are people-related categories. As outlined beforehand the information audit's main goal is identifying the corporate information resources. In today's economic environment more and more companies are using information systems which include features of Enterprise 2.0. There is a change from classical electronic data stored e.g. in databases to data which is created and stored in the companies enterprise social software(Williams et al., 2013). While in the 1980s or 1990s the machines itself and the people operating them were the main factor, today's systems are socio-technical systems, which means, that the user is in the center of attention and user participation is the key factor for the success of those systems (O'Reilly, 2009). Therefore not only the thematic focus of this thesis, also the general development on the market for information systems dictates to put the people dealing with the system in the spotlight.

For both, the managers as well as the employees the term awareness plays a major role, when dealing with benefits of the information audit. On the one hand the audit creates awareness of the importance of information resource management on the executive level (Buchanan & Gibb, 2007, p. 160), on the other hand it sensitizes the employees for the benefits and values of the information resources, they are using for their daily work (Boon & Botha, 2003, p. 25). Furthermore the employees are trained in information management during the auditing process as a free side effect process because they are included into the process by the auditors (Boon & Botha, 2003, p. 25). Another secondary effect of including the employees into the process is the identification of missing skills in information management. This lack of skills can be converted into training needs, which will help the staff to effectively exploit their information resources (Pantry & Griffiths, 2002, p. 44). Furthermore the employees are using hidden or external information resources in their daily work, which are not recorded in a register or totally unknown to the companies. Discovering this resources and including them into information resource management will foster their exploitation (Pantry & Griffiths, 2002, p. 44). But there are not only benefits in exploiting hidden resources, also already recognized resources have to be analyzed, if employees are using them too their fullest capabilities. Therefore the information audit looks at information inputs and how the employees process these inputs into the correspondent output. This can lead to a major increase in productivity (Boon & Botha, 2003, p. 25). The last benefit concerning the employees is that the employees are able to better understand the information systems in use after the process. During the process they are sensitized for the wasted opportunities through not using the system with its full functionality. The employees themselves seeing the information system as a supporting factor to their work is probably the most significant benefits in this area (Pantry & Griffiths, 2002, p. 44).

2.3.1.2 Management

While getting the support of top managements is one of the major challenges starting an information audit, the benefits elaborated on in this paragraph help persuading the managers to undertake an information audit (Boon & Botha, 2003, p. 35). The first benefits for the management is that probably for the first time they will get a holistic overview of their true information costs and values. In comparison to the classical resources valuing and costing information is a way more difficult task. Therefore the information audit methodologies hand over some helpful method for this task. However there is no method for perfectly valuing corporate information resources exactly on the cent. As a result of that fact information valuing is a research field, which will become even more important in the future (Pantry & Griffiths, 2002, p. 44). Putting a number on each information resource for costing and valuing them is also in the interest of the company's accounting department. Representing information resources in the balance sheet of each company is a complicated task. In today's economic environment,

in which for some companies, especially in the information technology sector, information is the most important resource. Therefore the work done during the information audit will be highly appreciated by the accountants (Burk & Horton, 1988, p. 176). Another aspect is the detection of problems and inefficiencies concerning the corporate information system. This will help in improving the current use of the system or even further lead to the recognition that the problems could not be overcome and a new system has to be implemented (Pantry & Griffiths, 2002, p. 44). On a higher level the information audit will even help in developing new products. Especially when the company is resident in the information technology sector, increasing the understanding of corporate information resources and this insights could be used for improving the company's products to excel its main competitors (Buchanan & Gibb, 2007, p. 160). Furthermore the management and especially the chief information officer are interested in how the responsibilities for each resource are assigned to the employees. If there is no clear assignment for each resource, the efficiency in using this resource can be decreased. Therefore after performing the information audit the company probably for the first time gets a full overview and can identify problems in the management of each resource and overcome them by assigning clear responsibilities (Booth & Haines, 1993, p. 231). The following aspect concerning the management's perspective is that the information audit will provide hints where employees or whole departments need additional information to improve their working processes. Because the information also includes looking at what data the employees need to do their work, gaps in information provision can be easily identified and overcome by acquiring additional information (Pantry & Griffiths, 2002, p. 44). The last benefit is the identification of centers of expertise in the company. These insights will be a great help for the management, because they now get an overview of the key players in information management in the organization. They can now help the responsible employees to disseminate their knowledge in their area of expertise which could be beneficial for the company because now the employees can profit from this expertise and use it to increase their productivity. This will be a first step to change the organizational structure from isles of knowledge to a knowledge basis which is available for the company's employees (Griffiths, 2011, p. 216).

2.3.1.3 Strategy

The next category for grouping the benefits is strategy. The term strategy in this case includes information strategy as well as the company's strategy as a whole. If the company has already an information strategy in place, the audit will help to adjust the strategy to the findings from the information audit. Otherwise the information audit forms the first step for information strategy development. With the help of the overview about the current information situation, the audit is a perfect starting point because the individual information about the organization's information resources can be merged with the well-known frameworks for information strategy to create a result well-fitting to the

companies needs (Buchanan & Gibb, 2007, p. 160). A more fundamental benefit is the discovery of the status of information as a strategic resource. The strategic resource management is a key success factor for companies. With the increasing importance of information as a resource (as outlined in the motivation) applying principles and frameworks of resource management is crucial for the company's success. Therefore the evaluation of the resource management status of the corporate information resources is an elementary benefit of the audit (Boon & Botha, 2003, p. 25). Another higher-level benefit is the integration of information technology investments with business strategy. When the management has to decide whether it should buy a new or adapt the old information systems to the needs of the employees, it can take the analysis and evaluation part of the information audit as a basis and purchase this systems by aligning the acquirement to the respective business strategy. This is a major benefit of the information audit because it will provide valid criteria for the new information system's buying decision. A lot of the first steps during the introduction stage can be abbreviated or facilitated with the help of the information audit report.

2.3.1.4 Compliance and Rules

Another category summarizes the benefits concerning rules and compliance issues with information as well as general business rules or frameworks which could be applied in information management. A major problem referring to this topic as well as in the information age in general are copyright issues and intellectual property. Especially when the employees are using external resources for their daily work, they have to be careful to not violate copyright laws and if they are using this information, e.g. for the publishing a brochure, they have to mark the provenance of this material to avoid being sued by the owner of the information resource. These compliance risks mostly appear in companies with meanly developed information management. As the information audit will definitely improve information management, the risk of being sued will be decreased (Griffiths, 2012, p. 41). Other up-to-date topics are information security and privacy issues. In many company's today access rights for information are not properly defined. Companies are taking a major risk by not controlling the access to information resources. Employees deleting or modifying relevant business information as well as giving them access to confidential material can negatively influence the company's business objectives. A more advanced risk is corrupt employees, if those have access to confidential data, losing the competitive advantage over the organization's rivals or even its trade secret which can be a risk to the continuance of the company are major threats. Therefore the identification of the access rights with the help of the information audit is the basis for avoiding this risk. The second aspects are privacy issues, the customer's or employee's personal data has to be protected from foreign access. Since privacy is a topic of increasing importance, because of recent events like the theft of customer data through hackers at big companies like MasterCard or Sony, many companies have to consider if there information

security standards are sophisticated enough to stand up to current threats. The information audit supports them in that decision by evaluating those security standards and identifying where they have to be improved to decrease the risk of losing confidential customer data (Griffiths, 2012, p. 41). All of these law-related aspects can be summarized under the term conformance. This means that the company after performing the information audit will have a much better understanding of how they are meeting information-related standards like industry standards. Especially within the exchange of data with customers or suppliers, the use of commonly applied data formats can be beneficial to avoid spending extra money on converters. But conformance not only relates to standards, it also means meeting general law like the Bundesdatenschutzgesetz (BDSG) or Telemediengesetz(TMG) and other aspects like policy guidelines, if the company has an information management policy in use (Buchanan & Gibb, 2007, p. 160). Another aspect which is more headed in the future of the company is the development of a framework with information management standards and procedures. After finishing the information audit the company can use the results to understand where the implementation of procedures would foster the effectiveness and efficiency of the employee's workflows. Therefore the company could use commonly known information management frameworks like COBIT or the like and adapt them to the needs of the organization identified during the information audit (Booth & Haines, 1993, p. 231).

2.3.1.5 Information

The fifth category gathers benefits dealing with the information or information resources itself. They are the most fundamental benefits and will be the first and easily achievable improvements from the information audit. One of the first results of the information audit is the identification of gaps and duplications in information provision. Every company performing an audit will identify those problems because they are very common on the one hand because of the growing information volumes (IDC, 2008), on the other hand because of the growing complexity of information systems and software. The employees which are lacking skills in dealing with those problems will highly benefit from these outcomes because the responsible information manager can close these gaps and offer proper instruction for the information system (Booth & Haines, 1993, p. 231; Pantry & Griffiths, 2002, p. 44). A further aspect concerning the information resources themselves is the analysis of strength and weaknesses of each resource. By looking at every resource in detail with the help of tools like the information asset registers, every resource will be evaluated by multiple criteria. And the comparison between different resources supports identifying strong and weak points for each of them. As a result the strong points of a resource can be used and adapted to other resources to overcome the weaknesses (Boon & Botha, 2003, p. 25).

2.3.1.6 Higher-level

In the last category the higher-level benefits of the information audit are summarized. In this case higher-level means that the benefits are not directly visible like most of the others mentioned in the previous paragraphs. After establishing the suggested recommendations from the information audit, it will take a probably several month or years until the intended objectives are noticeable. Furthermore benefits which are concerning a broader spectrum than information management and for example positively influence the organizational structure or strategy are also included in that category. One of these benefits is the usage of the newly discovered strategic information resources for new product development. After establishing information resource management in the company information resources could be exploited a much greater extent. Using the findings from the information audit and including the newly discovered information in new products will improve the products and probably create greater customer satisfaction which will lead to higher sales quantity (Burk & Horton, 1988, p. 176). A further aspect is the opportunity to adapt the organizational structure to the needs of corporate information resources. The existing organizational structure will probably focus on the classic resources like human or finance and therefore not be appropriate for the challenges and opportunities information brings up. For a better exploitation of the chances the information audit provides guidelines and recommendations to adjust the organization's structure and take into account how information contributes to organizational objectives (Burk & Horton, 1988, p. 176). Another benefit is that the information audit offers the opportunity to design an information architecture which improves the way information resources are handled. The information architecture relates corporate information resources and flows with the current business model. Therefore the employees will be able to use the information resources more effectively (Burk & Horton, 1988, p. 176). The last aspect is in the area of budgeting and accounting. As already outlined in the management category valuing is a crucial organizational factor which is a major struggle for every company today. The topic of information valuing is not fully discovered and therefore representing information in the company's chart of accounts is an almost irresolvable task. To facilitate that task most information audit methodologies provide accounting standards and procedures which support the accountants in costing and valuing the corporate information resources. This will not only help in understanding where money is spent on information as well as which resources are the most important regarding their value. It will also support the decision where money is spent on when investments in information infrastructure are necessary in the future (Burk & Horton, 1988, p. 176).

2.3.2 Summary

In the following paragraph a condensed statement of the benefits elaborated on in the previous sections is introduced. The final outcome of an information audit is the information audit report which summarizes the steps taken and insights occurred during the process. The most important part of that report is the recommendations for future actions because they are the reason why the management has approved of undertaking an information audit in the first place. The implementation of those recommendations in day-to-day work practices at the company is probably the last challenge of the information audit; however with including the employees and the management in the audit process in the first place, this challenge will be facilitated a lot. The second outcome of the information audit is a proposal for a new information strategy. The purpose of implementing such a strategy taking the audit results as a basis is putting the organization's information management in relation with its mission and objectives (Buchanan & Gibb, 1998, p. 46; Buchanan & Gibb, 2007, p. 160). The primary goal and benefit of the information audit is fostering effective information management (Raliphada & Botha, 2006, p. 242) and improving the quality of information service (DiMattia & Blumenstein, 2000, p. 178) in order to exploit information for competitive advantage (Boon & Botha, 2003, p. 24).

2.4 What Challenges Have to be Faced during the Information Auditing Process?

In the previous chapter the benefits of applying in an information audit in an organization are broadly outlined. The information audit is such a multi-functional and comprehensive tool that it affects wide areas of the company. And while it can bring many different benefits concerning almost every department at the company, the challenges arising before, during and after performing the information audit will be just as numerous. Understanding those challenges beforehand, managing them during the audit and overcoming them after finishing the process are major tasks to information practitioners. Not only the numerous areas it affects but also the set of skills needed for performing is a major challenge. The information audit team cannot only be composed of information professionals, expertise from other areas like accounting, project management and human resource is needed to perform the audit to a satisfying degree. The challenges arising because of that are mainly triggered by the high complexity of the audit.

However, as already outlined in the motivation, the lack of consensus on the information audit methodology and missing practical advice because only a few information audits performed were documented in a detailed case study, are the most commonly mentioned ones in literature. As Buchanan and Gibb (2007, p. 161) stated the lack of a "standard, agreed methodological approach" is a challenge every practitioner can agree on. The IT professionals performing the audit are facing multiple methods and techniques for information auditing. Some are very extensive, other are just frameworks which

only provide the silhouette of the audit but no concrete and applicable methods. Because of that the practitioner has to find the methods, he needs for performing the audit on his own, which is comprehensive task before starting the information audit. Some argue that there is no standard approach needed because the methodology has to be adjusted to the specific needs of the company. But the lack of evidence e.g. by case studies is a major problem because the methodologies are not evaluated by their usability (Buchanan & Gibb, 2007, p. 161).

Employees	Management	Standardization	Complexity	Methodology
-The staff is lacking skills concerning information techno-logy - Information is power and employees are limiting access to their resource because of that - Employees look at the audit as an instrument for blaming someone for the problems of the company	-It is hard to define value of information in general - Defining the contribution of information to the organizational objectives is a difficult task - Gaining support from top management for the IA is crucial - The management has to establish a culture of participation in the organization	-There is a lack of consensus on the topic IA - There are no standardized methodologies - Many methodologies are lacking practical evidence - There is limited empirical guidance on information auditing(e.g. case studies) - Important literature is missing(e.g. no digitalization)	-Information auditing is very time-consuming - Information auditing can be very costly - Information auditing is a multi-disciplinary approach requiring skills from different professions	-The implementation of the results is not well described in most methodologies - Methodologies are not suitable for small companies - It is hard to tailor the IA to the company's circumstances - The methodologies are not performed as a cycling process - The synthesis of the results between the different stages can be very difficult

Figure 2.7: Challenges for the Information Audit

Not only the lack of a standard methodology is a challenge, there is also a lot of literature and practical evidence missing or not accessible. Those barriers are delaying the agreement on common standards even more. This is caused by several circumstances. Some elementary literature especially from the beginning of information auditing is just missing because it was not digitalized after it was published on paper and is therefore not accessible. Some of the material was not published or a just limited to internal access until today because the papers including case studies with insightful facts were performed by students for their master theses or they are containing confidential material. Furthermore there are many authors from different countries who published their work in their native language. This problem can be solved with the help of translation but it still limits the circle of addresses because

literature databases for the topic information audit are not including papers published in not so widely-read languages. To fully understand the whole scope of literature in information auditing the equivalent terms and key words have to be translated into English and transferred into those databases (Griffiths, 2012, p. 47p).

Furthermore the high complexity of the information audit leads to another huge challenge. Not only that performing the audit can be very time-consuming which is acceptable for some companies if the amount of time consumed leads to great benefits in information management. But in most cases a high amount of time spent on information auditing also causes high costs. On the one hand the information professionals performing the information audit have to be paid for their working time, on the other hand the employees will be detained from work because they are included in the auditing process and their expertise and knowledge is needed to make the audit beneficial. Because there is still little practical guidance on information auditing and knowledge on how to adjust the audit to the individual objectives and circumstances of the organization, the tailoring of the methodology will be not only a difficult but sometimes a irresolvable task (Buchanan & Gibb, 2007, p. 161).

One of the key success factors of the information audit is also a major challenge. The support from top management is a starting point for a successful information audit (Boon & Botha, 2003, p. 35). But it is hard to persuade the managers of the need to undertake an information audit because as already outlined in this paragraph the audit can be very costly and time-consuming. The benefits and purposes outlined in section 2.3 can probably excel those costs but they are not that easily measurable because putting value on information is complicated and a task which researchers are still heavily working on today. While there is still more research needed on determining the economic value of information (Boon & Botha, 2003, p. 36), Swash (1997) outlines that tracing the full contribution of an information resource to the achieving the companies objectives is probably not measurable at all. Therefore overcoming that challenge will be a difficult task and needs auditors who are highly persuasive.

Another challenge is that the information is always described as a routine task, which has to be repeated frequently to be fully successful. Although many authors are stating this as an indispensable fact, most case studies and practical experiences are not taking that into account (Boon & Botha, 2003, p. 37). However, companies are performing the audit and do not continue with it after the initial auditing has been performed. This will limit the success of the audit because the quickly changing information resources in today's information environment require continuous evaluation. The information auditors should ask for advice in other auditing professions like financial auditing because those audits are performed regularly (Boon & Botha, 2003, p. 37). Furthermore many authors are just looking straight at the methodologies and how the audit itself could be performed. They are missing out on looking at the results of the information audit and the changes and recommendations which

have to be implemented after the audit. Without making this implementation a successful undertaking, the results of the audit will be useless. However, advice is missing on how this can be achieved properly (Griffiths, 2012, p. 49).

Another problem is overcoming the staff's fear of information auditing. Many employees look at the information audit as an instrument for laying blame and finding out who is responsible for the problems concerning information. Therefore communicating the benefits and the positive changes the audit can achieve for the organization and its employees have to be outlined to overcome the prejudice of the employees. The auditors have to change their image to make effective collaboration possible. Instead of looking at them as their enemies and a threat to their jobs, the auditors have to be seen as supporters which help the employees facilitating their daily work. This negative preoccupancy leads organization to change the name of the information audit when they are conducting it and label it with a less negatively perceived term. This renaming increases the already outlined problem with the several terms used instead of the information audit but meaning the same (Griffiths, 2012, p. 44).

As outlined in the previous paragraphs the attitude of the employees towards the information audit is one of the key success factors for the auditing process. Changing that attitude positively at the beginning of the audit process is a starting point for every information audit. Not only changing the image of the information audit to something beneficial is a huge challenge. Also opening up the employees to prosperous participation is a barrier auditors have to overcome. There are several reasons for the employees for not supporting the auditors during their work. One of the reasons is that having the right information means power. The departments and employees holding access to important information resources are not keen to share this access because they risk losing their power in the organization and lowering their influence. Establishing a culture of participation and information sharing is a goal which goes far beyond the objectives of the information audit. However the audit is a beginning for starting that change process. Another reason which prevents the employees from collaborating with the auditors is their lack of information technology skills. As already outlined in the section about benefits of the information audit recognizing those training needs will improve the effectiveness and efficiency of the employees working with the corporate information system. However during the audit it can be a barrier for the collaboration of the auditors with the employees. Testing how well employees understand the information systems can be a drawback (Pantry & Griffiths, 2002, p. 45).

Buchanan and Gibb (1998, p. 98p) identify further barriers considering the high complexity of most information audit methodologies. The first is scope and resource requirements. Undertaking the audit in a small or medium enterprise could be unrealizable because they are lacking of money, staff time and skills to make the audit a successful endeavor. Therefore only a condensed version of the information audit is practical for those organizations. However it is questionable if there is a possibility of only

partly applying an information audit and at the same time reaching useful results. A further barrier is the existing diversity between the stages of the audit methodology. The information audit is a multi-disciplinary approach which reflects in each of the different stages. Synthesizing the results and insights from each stage is a very difficult task because there is a lack of frameworks and templates for combining the methods of the different disciplines. Furthermore it is a problem to understand how each of the focal points influence each other because the audit is aiming at many different areas. The business objectives, the workflows and the information resources are all related to each other. And because of that it is hard to turn the right screws as some of those interrelationships are concurrent.

In conclusion it can be outlined that the challenges of undertaking an information audit are its complexity leading to a lot of time and money invested and skill needed. Furthermore the lack of consensus and practical evidence for the methodologies can be a major barrier. However the key challenge is persuading the people in the organization. On the one hand the management which needs to support the audit for a successful undertaking, on the other hand the employees which have to be trained in information technology as well as their fear of the audit has to be reduced and changed into participation. In figure 2.7 the challenges and problems outlined in this paragraph are summarized. For a better overview and understanding of the challenges they are categorized with five keywords. The first two categories are equal to the ones used in the section about benefits and purposes, which are the employees and the management category. Furthermore there are three more categories: complexity, standardization and problems with the methodology itself.

2.5 What is Enterprise 2.0?

The term Enterprise 2.0 was initially introduced by Andrew McAfee in 2006. According to his definition Enterprise 2.0 is about the use of social software to support cooperation between employees in an organization (McAfee, 2006b, p. 23). However Enterprise 2.0 does not only include communication between the employees, the external communication “between companies and their partners or customers” is also a major part of the new technologies (McAfee, 2006a). To understand how the technologies gathered under the term Web 2.0 are confined from those labeled with Enterprise 2.0 McAfee (2006b, p. 23) states that Enterprise 2.0 platforms are those which are only accessible by the employees in order to retain their knowledge on the platform. For a better understanding he also defined the SLATES acronym which represents six main features of Enterprise 2.0 technologies (McAfee, 2006b, p. 23pp.):

Search: The users of the platform must easily be able to find the information they need for their work practice. This is not only facilitated by better structuring the design and navigation of the tools but also the users demand search function to avoid using the navigation. However one would think that it is

easier to search in closed corporate platforms than in the Internet. But surveys confirm that employees have a way better search experience searching the web than searching e.g. the corporate intranet.

Links: Google rapidly increased the quality of Internet search with their PageRank algorithm. They took advantage of the link structure in the Internet and assumed that those web pages are the most popular which are most frequently linked by others. However this works pretty well on the Internet with millions of web pages. But on the corporate intranet with a limited number of pages it is harder to implement such an algorithm. Therefore the organization is dependent on the participation of the employees which should be able to create as many meaningful links as possible.

Authoring: The Web 2.0 technologies open up opportunities for many people to contribute their knowledge, expertise or anything else they have to offer to a knowledge base on the Internet. The wisdom of the crowd sharing its knowledge with the whole environment can also be exploited by companies if they are encouraging their employees to participate in company's wikis or blogs for example. The advantage of authoring on these platforms is the constant change of the content. It is updated, improved and linked with the help of the employees. This increases the quality of the data; however the organization still needs an authority which occasionally reviews the content.

Tags: With growing information volumes on the corporate platforms it is indispensable to introduce a categorization system to increase clarity of content. A way to simplify the categorization is including the users by giving them the opportunity to tag content with self-compiled, single word descriptions. The idea of tagging is wide-spread over the Internet and can be a major gain for companies when implemented. The categorization system developed is a folksonomy, which is taxonomy created by the folks. Folksonomies have some advantages and disadvantages in comparison to taxonomies. The overriding advantage of folksonomies is that they represent how the employees are actually using information systems and not how a higher instance constrained them to do.

Extensions: Extensions are omnipresent in today's web environment. Extension algorithm use pattern matching and the knowledge from tagging to present the users content which is similar to the content they are currently looking at. This is commonly known from Amazon's "Customers who bought his item also bought". The like-button from Facebook is another example for a useful extension. Using such a button in a company environment will easily find out the user's preferences and because of that they are automatically provided with their preferred content.

Signals: The main problem with the comprehensive functionality of the Enterprise 2.0 systems is that it can easily lead to information overload for the users, which prevents them from effectively using the system. To overcome that problem signals are a major element. They filter the content for the users and only alarm them when new content of their individual interest emerges. Typical examples for signals are e-mail-notifications and push messages.

For the implementation of the SLATES components software developers are following two important ground rules. The first one is: “Keep it simple.” As already outlined the users are the key to successful introduction of Web 2.0 features in a company. Without the user’s participation the money spent on this software would be useless. Therefore usability is the main requirement for software developers. Current tools just need a web browser and limited IT skills to be effectively operated. However with most users already using the Web 2.0 tools in their private environment, the developers of enterprise social software have to adapt from commonly known tools like Facebook, Twitter or Wikipedia. The second rule is: “Give the users their space.” This means that the users should not be limited in their freedom by the software. The software itself should provide as less structure and suggested categorization as possible. Instead it should be developed by the users when they are working with the tools and emerge over time. In this way the structure will be self-explanatory for the users and accordingly increase usability. This is an elementary change in comparison to platforms developed before the emergence of Web 2.0 (McAfee, 2006b, p. 27).

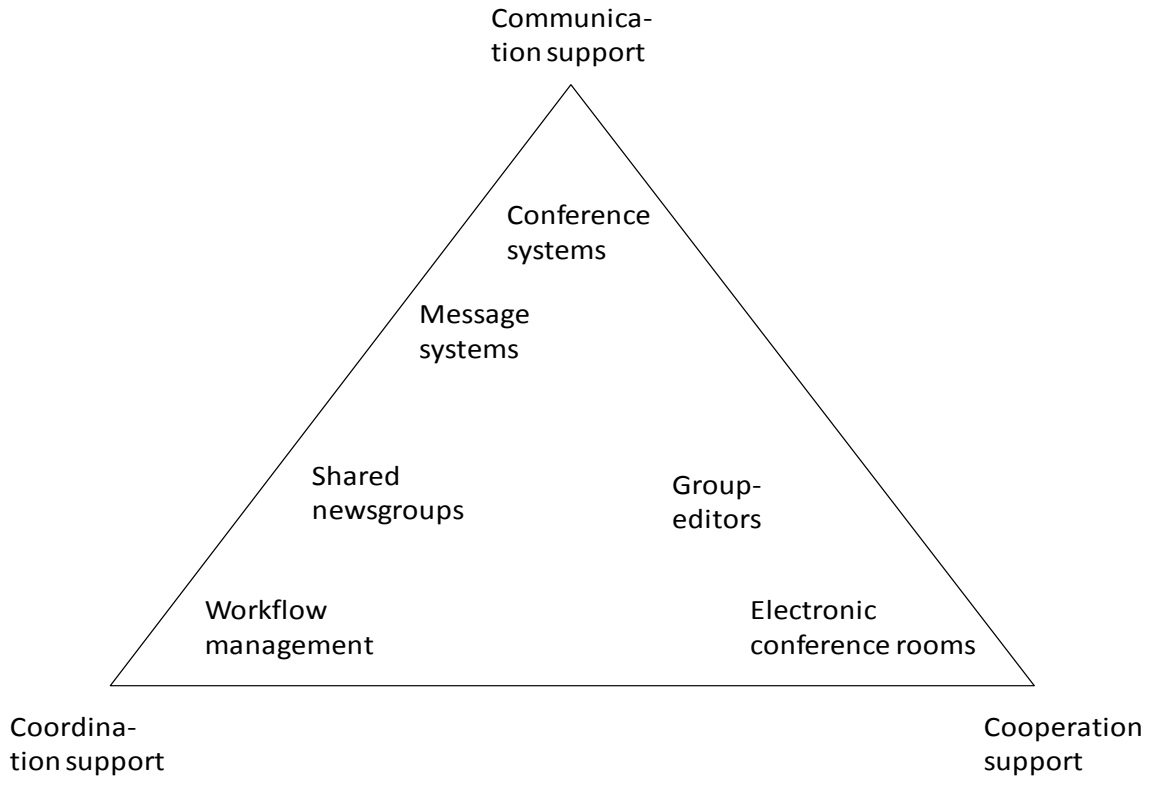

Figure 2.8: Classification of Groupware (Koch & Richter, 2007, p. 18)

The use of enterprise social software in organizations was initiated by the employees themselves because they started using blogs and wikis to communicate informally during a project (Koch & Richter, 2006, 15). However using enterprise social software to communicate in an organization is not a phe-

nomenon initiated by the upcoming of Enterprise 2.0 applications. Organizations are already using similar applications for cooperative work, however these applications are gathered under the name groupware; there is a whole field of research considering those types of applications called computer supported cooperative work (CSCW) (Koch & Richter, 2007, p. 16). CSCW is a research field combining influences from different disciplines like social or computer science. The core idea of this research field is supporting practitioners in development, analysis and evaluation of technical systems, which foster any kind of social interaction between employees (Gross & Koch, 2007, p. 10).

Figure 2.8 shows a condensed overview of a groupware system's main components. The figure confirms a core problem of CSCW research: the differentiation between the terms groupware and enterprise social software is a very difficult task because the features of both kinds of systems are coinciding. Therefore it would not attract attention if the caption for figure 2.8 would be "Classification of Social Software" because it is still suitable.

2.6 What Challenges are Companies Facing in Information Management because of Enterprise 2.0?

There are several threats and problems which have to be faced when implementing Enterprise 2.0 tools in an organization's IT environment. But even if the implementation is successful the operation of these systems represents a major challenge for information managers. As multiply outlined in this thesis the users are always the starting-point when it comes to challenges as well as benefits. Since the tools are dependent on user participation, employees who are not using the tools are a big threat. Although most people are using Web 2.0 tools at home, the participation rate when it comes to blogs, wikis or tagging is relatively low (McAfee, 2006b, p. 27). Therefore the managers have to foster participation to form the employees from simple users to contributors. However it is a difficult task to encourage users to frequently participate in Enterprise 2.0 tools. Several companies tried to conquer that task by offering the employees financial or other materialistic gratification when they are making a meaningful contribution. However rewarding employees with money was not a great success. Intrinsic gratification shows way better results proven by case studies like XEROX Eureka. At first XEROX tried to foster knowledge sharing with financial incentives. This experiment has not been successful. They found out that getting their colleagues appreciation was a greater encouragement for the employees to participate in the knowledge sharing system. Every solution published on the platform is directly linked to the employee and therefore the colleagues will know who came up with this helpful piece of advice. The following praise of the colleagues is the best reward an employee could receive (Moore, 1999). However the bottom-up culture of Web 2.0 with the principles of self-organization and participation which are the key success factors to Web 2.0 conflicts with the way most firms, especially

small and medium organizations, are organized. Therefore a process of change management is necessary to establish such a culture in an organization and foster collaboration and creativity of the employees (von Kortzfleisch, Jung, & Nüttgens, 2011, p. 61p.).

The first threat is about the users not participating. However it could also be a threat if the users are participating. But not in the way the management wanted them to do. Most Web 2.0 platforms are focused on the users exchanging their opinions which can lead to conflicts between the employees themselves or between the employees and the management. In many organizations this new and open discussion culture will not be welcomed by the management. The question is how the management reacts to these new communication channels on the corporate intranet. Will they accept negative comments and critics or employees pointing out that a project cannot possibly be finished in the scheduled time frame. The problem is that in comparison to the Internet, the management has the power to suppress discussion on the intranet. If they want Enterprise 2.0 to be a success in their organization, they have to use that power well-considered (McAfee, 2006b, p. 28).

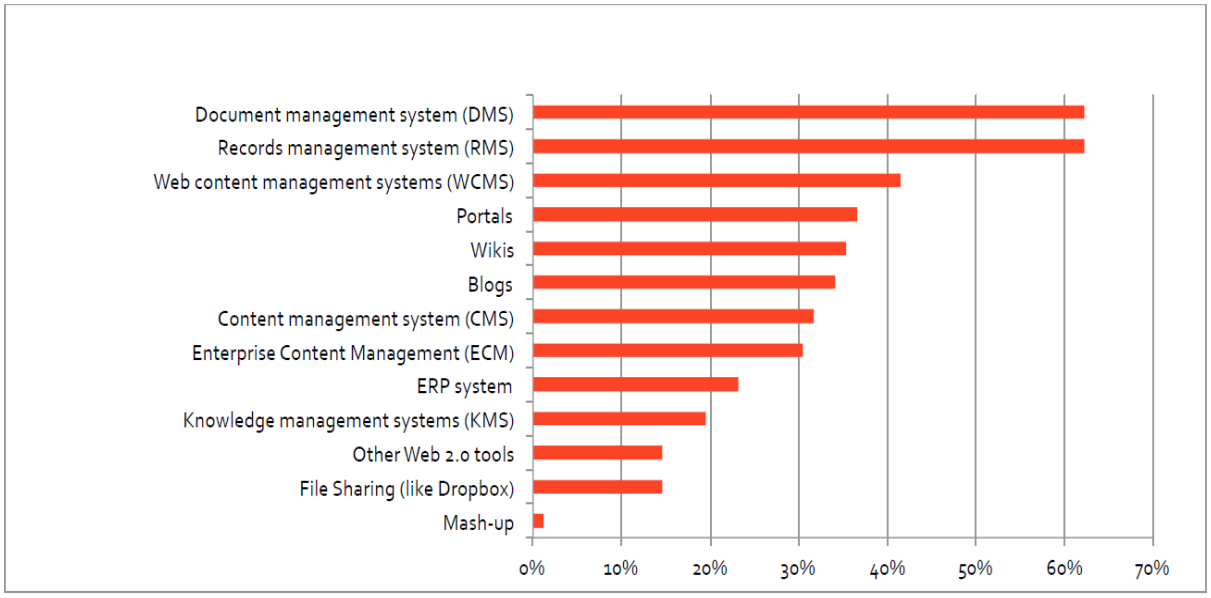

Figure 2.9: Technologies for Information Management in Use (Williams et al., 2013, p. 16)

Figure 2.9 shows the responses of organizations on which information management technologies they are currently using. It is easily recognizable that the traditional document and records management systems are most popular. However the number of Web 2.0 tools like portals, wikis and blogs is increasing (Williams et al., 2013, p. 16). Companies are still concerned with choosing the right tool for their organization and understanding how the functionality of the software can benefit their business objectives. To foster the growth as well as improving the exploitation of the functionality of enterprise social software companies still have to take several further steps. Furthermore IT security is a major

challenge concerning those technologies. With their permanent connection and exchange with the Internet, protecting intellectual property, securing customer data or preventing the system from unwanted access are elementary threats for organizations (Williams et al., 2013, p. 259). Many companies, especially small and medium ones, are threatened by these issues because on the one hand they do not have the expertise in the area of IT security. They are lacking of experts and knowledge in this area. On the other hand especially for not manufacturing companies information and content is probably their most important asset, which should not appear on the Internet. To avoid publishing confidential content on a Web 2.0 platform it is essential for companies to define clear borders between inside and outside the company. The features which are intended for internal use should only be accessible via the intranet (Koch & Richter, 2007, p. 174p.). Another aspect is privacy. Especially companies who are dealing with their customers via a Web 2.0 interface have to be careful with the protection and access of the entire customer data collected on the platform. The company has to deal with the national privacy legislation to avoid getting sued for inappropriate use of personal data. Therefore in German legislation it is required to get the customers consent in a written or electronic form to avoid violating significant clauses like §4 BDSG (Koch & Richter, 2007, p. 176pp.).

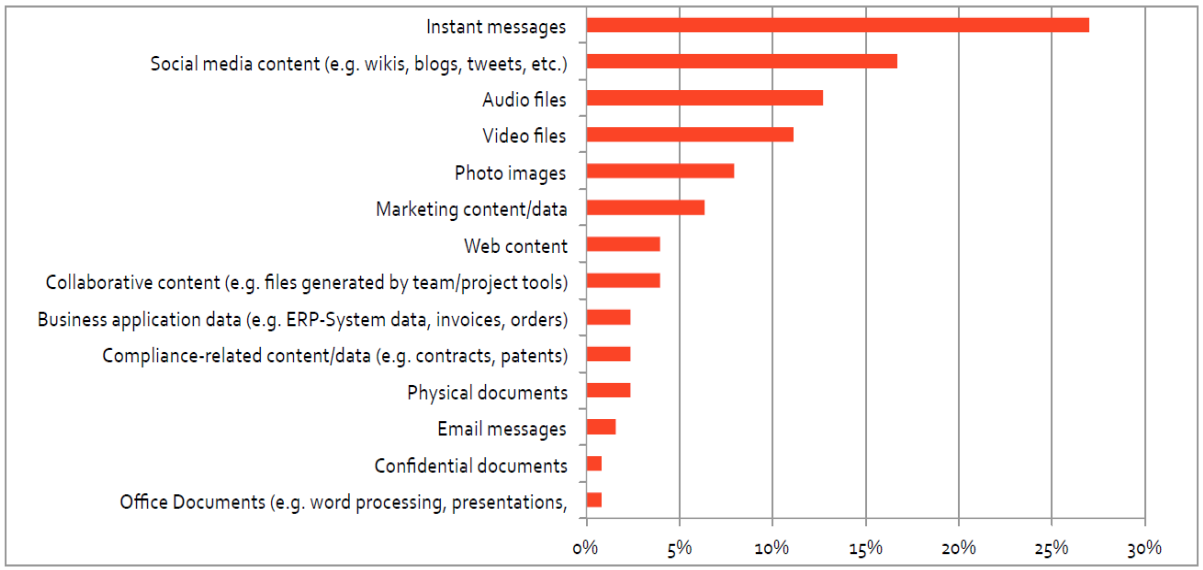

Figure 2.10: Different Types of Unmanaged Content (Williams et al., 2013, p. 15)

As already outlined in the motivation traditional documents like bills or contracts are usually more formally managed than social media content which is sometimes not managed at all. Figure 2.10 displays the types of content which are currently lacking attention in information management. Especially instant messages and everything captured in the in social software tools are not integrated into corporate information management (Williams et al., 2013, p. 15). With the growing influence of enterprise social software practitioners are more and more driven to deal with the management of data

produced in those systems. However the large volumes of data created in these systems is major concern because it is not comparable to limited extent of data created in 30 or 40 years ago. Therefore management techniques which were suitable back then will probably not be appropriate now. Like every other content social media content has to be managed throughout its whole life-cycle, creation, dissemination and disposition have to be regulated. However the application of rules for life-cycle management which were suitable for traditional content could probably not be suitable for social media content any more. Especially the question of disposal is difficult to answer because the pure number of content created complicates the decision which content is critical for the business and has to be kept. Furthermore there are several other minor or major problems concerning information management of Enterprise 2.0 content. Integrating existing enterprise search with social content could be a challenging task. The users are used to key word search from the social platforms they are using in their private environment. However it could be very challenging to include social content and its correspondent algorithm into the enterprise's search engine especially if this engine is out-dated. Besides the retention requirements which are also dependent on applicable legislation have to be adjusted to integrate them with social content. The large volume of content created makes storing the content in corporate archives expensive even with decreasing costs for disk space. Furthermore structuring those archives will be a way more difficult task than beforehand. The decision if social content has to be kept as a business record is a further challenge. On the hand a company has to decide about the value of the content and if it is important enough to be stored in an archive which could be a difficult task because companies are lacking experience in valuing social content. On the other hand legal requirements sometimes force companies to keep that content. However the organization needs experts in that topic to avoid being sued because the deleted content had legal relevance (Williams et al., 2013, p. 259).

3 Information Asset Registers

The following chapter is divided into two main sections. The first section deals with two information audit methodologies and firstly describing and then comparing and evaluating the role of information capturing in these methodologies. The methodologies of Henczel (2001) and Buchanan and Gibb (1998) are chosen. Furthermore the methodology of Burk and Horton is taken into account, which is already briefly summarized in chapter two. The second section focuses on information asset registers from information practitioners. Again three examples are chosen and the author undertakes the same steps with firstly describing them and followed by comparison and brief evaluation. This chapter's content forms the basis for the tool development in the next chapter, which is based on the comparison and evaluation part.

3.1 Which Role does Information Capturing Play in Information Audit Methodologies?

Information capturing is an elementary part of every information audit methodology. However the suggested methods and level of detail vary widely. To provide a basic understanding two commonly accepted methodologies by well known researchers are chosen.

3.1.1 Description

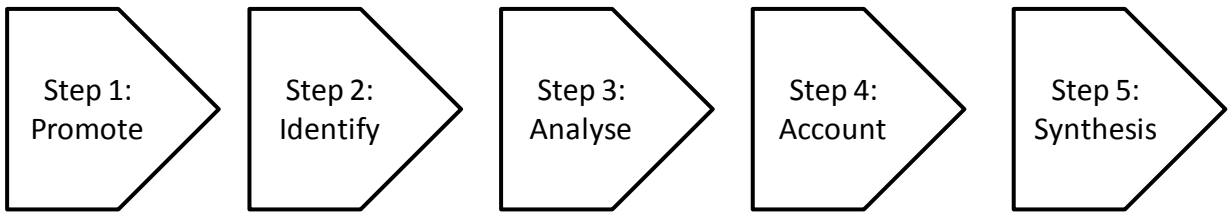

Figure 3.1: Buchanan and Gibb's Methodology (Buchanan & Gibb, 1998, p. 41)

Buchanan and Gibb (1998): Buchanan and Gibb took Orna's and Burk and Horton's methodology as a basis and proposed their own five stage methodology (see figure 3.1). The auditing process begins with the **promotion** phase, where the auditors communicate the benefits of the information audit to the employees and the management and try to foster cooperation for better results. This step is finished with a preliminary survey to understand the level of the current information management practices at the company. The second step is **identification**. The identification stage includes further analysis of the organization's culture, mission, structure and environment. It is finished with the identification of information resources and flows. The next stage is the **analysis** phase. This phase begins with the evaluation of information resources regarding to their strategic importance, utility and problems.

Then it is illustrated how the information flows through the organization in detailed information flow diagrams. After that a preliminary report is produced conducting the first results. The analysis stage is finished with the formulation of action plans to solve problematic situations. The fourth stage is **accounting** and valuing the information resources. For it the authors recommend several methods like activity based costing (ABC), output based specification (OBS) and Glazier's model. After its completion this step will have identified the costs of every information resource. The methodology is finished with the "**synthesize**" stage. This stage includes two steps: the information audit report, which summarizes the results and recommendations of the previously undertaken steps and the information strategy, which takes the results to a higher level by linking them with the organization's goals and mission. Buchanan and Gibb's methodology was proposed in a journal article. Therefore it lacks of detailed elaboration, however it is a useful framework combining the advantages of several other methodologies(Buchanan & Gibb, 1998, p. 41-46; Buchanan & Gibb, 2008, p. 4).

With the focus of this chapter on information auditing the spotlight is put on the "identify" stage, which includes information capturing. However, Buchanan and Gibb start this stage with a strategic analysis, which is a basis for linking information resources with business mission and objectives. In the last two steps of this stage they focus on information capturing by beginning with the identification of information flows supported by Orna's method. The information flow analysis increases the understanding of where information is processed, by whom and how the users are dealing with the information resources. It looks at responsibilities and lacks in information provision. During the flow analysis a good idea of the existent information resources at the organization is provided. In this step the information inventory is compiled supported by interviews of key employees which provide an in-depth image of the corporate resources. At the end of this stage a database is conducted which contains all relevant information about the information resources. The resources are also linked with the organization's strategy, which provides a rich picture of how the information resources support achieving the organization' goals and mission. This information is obtained by the interviews with the key employees (Buchanan & Gibb, 1998, p. 41-46; Buchanan & Gibb, 2008, p. 4).

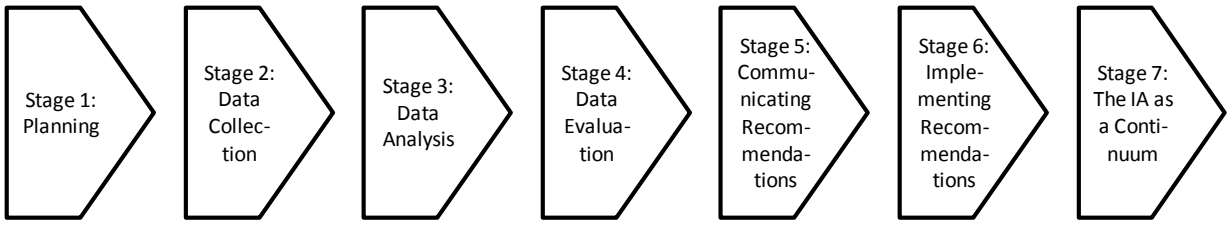

Figure 3.2: Henczel's Methodology (Henczel, 2001, p. 174)

Henczel (2001): Henczel combined the methodologies of Orna and Buchanan and Gibb and proposed her own seven stage methodology (see figure 3.2), which combines the advantages of both by includ-

ing organizational analysis as well as tools and methods for conducting an information inventory and understanding information flow. The first stage of the methodology is **planning**. Planning begins with the development of clear objectives, which state the reasons for the undertaking. After that the scope is determined deciding which parts of the organization or which types of information the audit should include. Furthermore it is made sure that the required resources for the project are available. Then an appropriate methodology is chosen for the organization, a communication strategy is developed and the management's support is enlisted.

The next stages deals with **data collection**, which will be elaborated on comprehensively at the end of this chapter. The data collection stage includes developing a questionnaire, undertaking focus group interviews and is finished by personal interviews for a more detailed view of the corporate information resources.

In stage three the data collected in the previous stage is **analyzed**. This stage is also consists of several steps beginning with the creation of an information resource database, followed by the data preparation phase which mainly transforms the data into machine-readable formats. The second stage is finished by the data analysis, which includes mapping information flows and the analysis of the survey data. The results of this analysis are used to link the information resources with the organization's strategic objectives.

Stage four is called **data evaluation** and begins with the evaluation of problems and opportunities regarding their significance. This step is followed by the gap analysis which matches the current information situation with desired information situation. After that the evaluation is continued by interpreting the information flows, which means understanding which information flows are essential and considering their significance. Then a strategy is developed which tries to conquer the problems recognized in the previous steps. It takes gaps, problems and challenges concerning information resources and flows into account. Taking the developed strategy as a basis in the next step recommendations are formulated out of the findings of the strategy document and also an action plan is developed which offers an approach for implementing these recommendations.

The fifth stage concludes several methods for **communicating the recommendations** from the previous stage. A mandatory way of communication is the written report including the results and recommendations because it is the evidence of the undertaking's success. Another important step is presenting the results verbally to the employees and management to get their support for implementing the recommendations. Furthermore seminars are a less formal way to communicate the results to the employees, they allow the employees to ask questions and discuss problems. Besides objectors of the recommendations should also be considered and included into the communication process to turn them into supporters. A less personal form of communication is publishing the findings and recom-

mendations on the corporate intranet which allows discussion but lacks of personal feedback. Stage six begins after finishing the auditing process itself.

The **recommendations** have to be **implemented** to make the audit a successful undertaking. Therefore a change management process should be started even if the changes are relatively minor because the influence of the changes on the employees and their daily work processes shouldn't be underestimated. Furthermore the implementation process has to be structured with the help of a program or plan. The plan is a step-by-step approach where the objectives are firstly clarified by relating the recommendations to the problems and the individual employees. In the last steps of the implementation program the impacts of the change process on the employees are determined considering how much the employees are influenced by the process. Furthermore a communication channel for concerns is opened up. The last step of stage six is the implementation itself. In this last step the recommendations are integrated into the corporate business strategy and furthermore an information policy is developed which puts the recommendations for information management on record. Thereby they could be applied in the future. Besides the recommendations should not only be implemented but also be evaluated afterwards to prove their success.

Stage seven is the last stage of the audit and is also a task which is directed to the future. Henczel defines the **information audit as a cycling process** which has to be initiated frequently after the first audit has been finished. The changes in the information systems and services require periodic evaluation if the employee's information needs are still met and also if there are new problems occurring because of the new resources. Furthermore measuring methods for the evaluation have to be chosen to understand the success rate of the implemented changes and also look at how the rates change over time. The seven-stage information audit methodology is a framework for information auditors. However it is not a strict procedure which limits auditor's the freedom of decision. Because every organization has their individual needs and specifications the methodology has to be tailored to these needs every time a new information audit process is started. The tailoring is dependent on the complexity of the organization, the constraints or limitations and the maturity of the audit process which reflects on the experience of the organization with information auditing. Complexity refers e.g. to the structure of the organization, how many stakeholders influence the business and the number of external factors influencing the company. Constraints are mainly restrictions in resource availability or lacks of technology supporting the audit process. Maturity means that the organization has to consider how they assess their information situation at the moment and how advanced their information audit experience is. This stage is finished by the application of the findings from the previous steps. Performing an information audit for the first time requires undertaking the entire seven stages. However the decision process on how and in which order the steps are applied is up to the auditors. Next generation audits

leave more space for tailoring because many steps can be left out that were already completed in one of the previous audits (Buchanan & Gibb, 2008, p. 171-198; Henczel, 2001, p. 4p).

Information capturing is performed in the second stage of Henczel's methodology. Henczel's method is very comprehensive when it comes to the methods used for capturing the information. However it focuses more on how to collect the needed information from the information users than on conducting an information resource database. It uses the work of Buchanan and Gibb on that topic and adopts the information resources inventory from there. Hence the inventory adopted is pretty similar to the one already displayed in the section about Burk and Horton's InfoMap because they took InfoMap as a basis. InfoMap is generally accepted as a good framework if the aim is to find out what the corporate information resources are. However the information resource database from Buchanan is more detailed when it comes to linking the information resources with the related business units and objectives. It includes not only the metadata about the resources but also mentions tasks, problems and improvements which are related to the strategic resource. The information about the tasks, problems etc. is collected by the interviews undertaken in the first steps of the data collection phase. The information from the interviews supports the ranking of the information resources by their strategic importance. The more business tasks a resource is linked to, the greater its value for the business and the contribution to achieving business objectives.

Since the focus of this thesis is on the development of an information asset register the survey methods and questionnaires which are a very important part when it comes to collecting the data are left out in this section. To increase the understanding this section also focuses on the preparation phase of the survey. The audit begins by asserting what the auditors need to know to achieve the goals of the information audit. This task is facilitated by taking into account some guideline questions. Before starting the survey an idea has to be provided of what the strategic information resources are, their availability to the users needing them, their contribution to the business objectives and the source, they are coming from. Furthermore it should be made sure that the questionnaire covers all types and formats of data because employees could tend to e.g. only naming electronic resources and leaving out print resources. The importance of management support is already multiply outlined in this thesis; however it is also a key factor to ensure before starting the survey. The management has to encourage the employees to undertake the questionnaire and also provide the appropriate resources.

Furthermore a decision has to be made on which users are included into the survey procedure. It is mandatory to survey the management and main information users. However especially in large companies it has to be considered if it is possible to include every actual or potential information users in the survey. If the company is too large, the scope can also be limited by excluding departments whose employees only use information resources sporadically. In the next step the organization chooses a

survey methodology which is most suitable. The decision-making process is supported by the information collected during the planning stage. In the last phase of the preparation step it has to be made sure that the required resources are available for the survey process. The first resource is the people who will conduct the survey. It has to be chosen between internal or external staff which both has its benefits. A combination of both is probably the best choice for combining the advantages.

Furthermore it has to be made sure that the costs of the whole survey procedure are not underestimated. Not only the direct costs but also the indirect costs e.g. the staff time or the use of technical resources have to be considered. Keeping track of the money spent on surveying or auditing in general is a key aspect because it allows calculating the return of investment later on, which verifies the success of information auditing. Besides it has to be assured that the required physical and technical resources are available for conducting the survey. The consultants who undertake the audit have to be provided with office space or computers and printers for example. Henczel elaborates in detail how to conduct the survey with information on interview techniques, questionnaire design, management and administration of the interviews. Since this is not the predominant topic of this thesis, the thesis is continued with a comparison of the information capturing stages of the three methodologies (Henczel, 2001, p. 63-87).

3.1.2 Comparison and Evaluation

The first conclusion to be drawn is that the three methodologies vary widely in their comprehensiveness because their focus is differently. InfoMap offers a four step methodology whose main focus is the introduction of information resource management into the organization. Buchanan and Gibb's methodology is not that comprehensive because it was published in a journal article. It includes five steps by adding a promoting step at the beginning. The importance of promoting the audit to get support from management and employees is only briefly mentioned in InfoMap. Creating an own stage for that topic clarifies its relevance. Henczel proposed a seven stage methodology, which is the most detailed of the three methodologies when it comes to the scope covered during the whole auditing process. The first four stages are similar to Buchanan and Gibb's methodology because Henczel adopted her methodology partly from their five step methodology. However she puts more stress on what happens in the organization after conducting the audit. Communicating and implementing the recommendations which are based on the results of the audit as well as seeing the audit process as a continuum which has to be repeated frequently because the changing information environment always requires analysis and evaluation. But comparing the audit methodologies by their comprehensiveness is a difficult task because there is no standard model to which each of them could be contrasted with.

For facilitating the comparison Buchanan and Gibb (2008, p. 6) developed a generic seven stage framework which combines the most common stages from several methodologies (see figure 3.3). The setup stage is included in the Buchanan and Gibb's promote stage and in Henczel's planning stage. However the review stage is not a distinct part of either of these methodologies. In Henczel's methodology it is part of the initial planning stage, Buchanan and Gibb conduct that task in their identify stage together with information resource collection; Burk and Horton however are leaving out that stage completely. The stages in the middle including surveying, analysis and accounting information are quite similar in the three methodologies. The terms themselves may vary but the purpose of each stage is identical. This fact proves the pioneering task Burk and Horton accomplished with their work because the core information audit is still based on their four stage model until today.

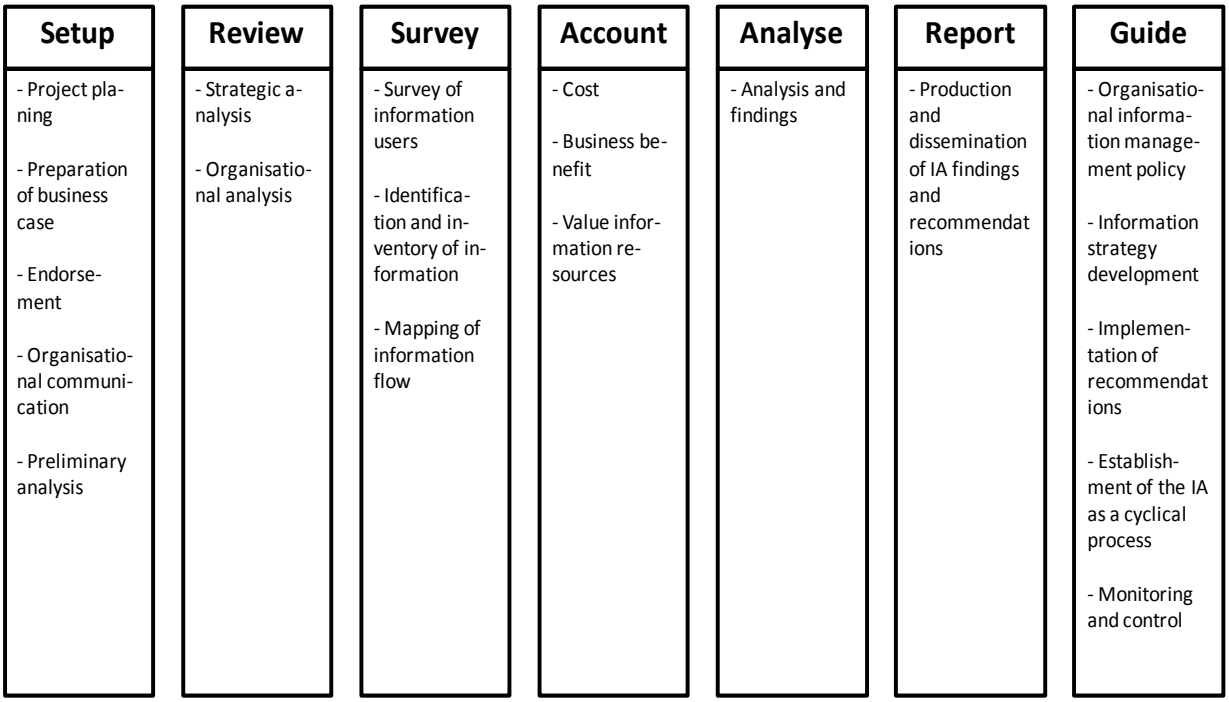

Figure 3.3: Generic Framework (Buchanan & Gibb, 2008, p. 6)

The report stage is also a part of the three methodologies but the labels used for it are different. Buchanan and Gibb and Burk and Horton call it "synthesis", Henczel used a self-explanatory designation and calls it "Communicating recommendations". However the task included in the stages are the same. The last stage from the generic framework differs in the three methodologies. While Burk and Horton do not include strategy development and the information audit as a cyclic process into their framework, Buchanan and Gibb cover the strategy and policy development but are lacking of advice on implementation of the recommendations and establishing the audit as a cyclic process. Henczel's is the most comprehensive methodology when it comes to the final steps of the audit because it provides guidance on the topics mentioned in the "guide" stage of the generic framework. The compari-

son in this paragraph is only superficial and does not include comparing the steps of the methodologies in detail. The overview given in that paragraph however could be useful for narrowing down the methodologies being considered in the respective organization (Buchanan & Gibb, 2008, p. 5-10).

Comparing the information capturing stages of each methodology should be started with Burk and Horton's methodology for two reasons. The first reason is that their methodology is the oldest one and therefore the methods used in it are adopted by the newer methodologies. Furthermore it provides the most guidance on classifying and recording the data collected during that stage. Buchanan and Gibb also include Burk and Horton's information resource inventory for creating an information resource database. However they add the identification of the organization's information flows proposed by Orna to the scope and also focus on rating the information resources by their contribution to business objectives and key tasks with the help of the key information users. While Henczel's collection stage is also very comprehensive, it mainly focuses on how to retrieve the information with questionnaires and several interview techniques. The advice on classification and creation of an information resource is condensed and in most parts adopted from Buchanan and Gibb. Burk and Horton start their approach with defining three information resource categories: systems, services and sources. A source is an entity which procures users with information, along the way a service is an activity for supplying, handling or transporting information. A system is a more sophisticated including several consecutive processes for handling information inputs and outputs. To subdivide these three categories information resource types are used to define each resource more clearly. Using this categorization an elementary decision has to be made choosing which level of detail is applied. A middle course between comprehensiveness and narrowness has to be determined.

Furthermore the used labels should be explicit. Therefore defining a corporate taxonomy for labeling each resource can be very useful. After categorizing the resources in the first steps of the survey stage the inventory data form (see section 2.2.1) can now easily be applied for clearly defining each information resource with appropriate metadata (Burk & Horton, 1988, p. 44-57). Buchanan and Gibb however also refer to Burk and Horton's classification. But they are not providing explicit advice or guidance on how to apply it properly or how relate information resource with their contribution to business objectives or key tasks. Therefore their methodology can be seen as superficial guidance while Burk and Horton's is much more detailed with a step-by-step approach which could simply be applied in any organization without major adjustments. Henczel's methodology also lacks of focus on classifying information resources. However it provides a new perspective by introducing an information resource database which relates the information resource with the business units, goals and tasks. The main goal of this step is to understand which information resources are crucial to economic success as well as evaluating the contribution of each information resource to the tasks they are used

for. The information about the relation of business units to information resources is gathered by small questionnaires addressing the managers of each unit. This information will foster the results in the evaluation phase of the information audit. In summary it can be stated that InfoMap provides the most comprehensive and illustrated tools for information capturing which are lacking on relating the information resources with business strategy, objectives, structure or culture. Henczel's and Buchanan and Gibbs's methodologies however are only slightly dealing with classification but they are more detailed in including business strategy, objectives and structure into the capturing process. The reason for that becomes clear considering the whole methodologies. While Henczel and Buchanan and Gibb include a planning stage in their methodology which refers to all of these aspects, Burk & Horton only slightly mentioned it in the introductive chapter of InfoMap (Buchanan & Gibb, 1998, p.43p.; Buchanan & Gibb, 2008; Henczel, 2001, p. 63-66).

3.2 Practical Examples for Information Asset Registers

The information asset register is a powerful information management tool. The methodologies introduced in the previous section do not refer to information asset registers; however the information resource database is a related tool. Before looking at information asset register templates and guidance on designing an information asset register, first of all definitions of the terms information asset and information asset management are provided and it is explained why it should be applied.

"An information asset is information held by an organization, categorized from the perspective of its content and business use rather than by the IT system that holds it. An information asset is information that has been grouped in a way that enables you to protect, manage, share and exploit it effectively. An organization will need to decide how to group its information to ensure that the asset is both useful and able to be effectively managed. An information asset can contain structured or unstructured information and may range from a single file to many files."(Lacy et al., 2011, p. 4)

Information assets and information resources are similar terms; however they differ in their specifications. While an information resource still contains some kind of unstructured and unmanaged types of information, the information asset is more developed and manageable, so it can be exploited more effectively. However the core meaning of both terms is the same. They both describe containers of information which is valuable to the respective organization. However it is challenge for information management to make sure that the value of the information can be fully exploited by the employees.

"Information asset management is the effective management, control and protection of information assets within an organization. Asset management is the process responsible for tracking and reporting the value and ownership of assets throughout their lifecycle." (Lacy et al., 2011, p. 4)

The difference between information resource management and information asset management is only fractional. They both focus on managing, controlling and protecting the organization's information resources throughout their life-cycle and establish clear responsibilities for each information resource to increase their value for the organization. However the organization's executives will question the implementation of information asset management principles because it is a time-consuming and costly undertaking. Therefore information managers have to point out that information is a valuable resource and combining the expertise from the information technology professionals and information managers leads to major improvements for the organization's business objectives. Furthermore it fosters satisfying the organization's compliance requirements because decision-making will be based on the right information and the risk of losing information which is crucial for achieving the business goals is minimized. Besides there are more benefits concerning information technology. First information asset management can lead to major cost-savings in information technology because it identifies information resources which are no longer used by the employees and therefore can stop being supported. This can also reduce the complexity of the corporate IT infrastructure because no longer used software is disposed. Secondly identifying useless information resources reduces storage costs which are caused through larger back-ups and more servers needed for storing the data. A further benefit is already repeatedly outlined is the improvement in understanding how the information resources are related to the business goals. After recognizing this relation it can be made sure that the information asset's usability and functionality are corresponding to its business value (Lacy et al., 2011, p. 4).

3.2.1 Designing and Description of Information Asset Registers

Before starting the description and comparison of different information asset register templates first the focus is on general guidance and advice from practitioners on information asset registers development. The ITIL white paper on managing digital information assets(Lacy et al., 2011, p. 9) provides comprehensive guidance on what has to be considered before designing an information asset register.

At first the decision on a **classification** scheme applied to the information assets has to be made. The number of categories needed for a sufficient scheme depends on the complexity and size of the respective organization. However the classification schemes which were already applied in other organizations can be taken as basis because there is genuinely a high correlation especially between organizations from the same sector. Although grouping the assets by categories is very helpful, every asset itself has to be uniquely identifiable to avoid confusion. This can either be achieved by unique **identification** numbers or names. Furthermore the **owner** of each information resource has to be identified because the responsibility for each asset has to be pointed out clearly for future changes. Another task which is very important from the management's perspective is quantifying the **business value** of each

asset and how it contributes to business tasks. Since it is impossible to figure out the exact monetary value, the resources have to be evaluated by their users and managers to establish a rating scale for valuing the assets. Directly related to the value of each resource from the manager's perspective are the **costs**. On the one hand maintenance costs which occur frequently and on the other hand acquisition costs, which both can be correlated to the value to calculate e.g. the return of investment. Furthermore the **content** and the **context** which describes the relation of the asset to other assets are both aspects which have to be considered in an information asset register. The **format** and the **location** of the information asset are both characteristics which can be identified easily. However they are both very important for information asset management because knowing the format of the information contained in the asset is crucial for assuring digital continuity and knowing the location is a basis for protecting the asset against any physical damage. A further characteristic is the **structure** of the content contained in the information asset. As already outlined in the section about Enterprise 2.0 the percentage of unstructured content in organizations is increasing. Therefore the degree of structure for each entity in the information asset registers has to be evaluated. A further aspect is the relation of each information asset to the organization's **technical environment**. Understanding the dependencies between that will support future decision on IT investments. The last aspect the white paper considers is **updating and reviewing** the information asset register. This is a mandatory task for insuring the quality of the information stored in the register. However the register has to contain information about responsibilities for updating and reviewing to make sure it is done by the appropriate person.

After pointing out some ground rules and guidelines in the previous paragraph information asset register templates are examined in relation to these guidelines.

InfoMap: The information inventory data form developed by Burk and Horton is part of their four step information audit methodology. The inventory data form is already displayed in figure 2.3 and its role in the survey stage is explained in section 2.2.1. The InfoMap methodology was developed in 1988. However there is still useful advice suitable for today's types of information resources. The inventory data form is a classic table with no support from a spreadsheet program. It includes unique identifiers for every information resource entity such as an identification number and an explicit resource name. Furthermore a focal point of Burk and Horton's methodology is classification of each entity. Therefore they add a broad classification level called category and a more detailed one called type to their data form. Defining the category they proposed three default terms: systems, sources and services. The types however can be chosen by the auditors on their own. Besides they zoom in on a lot of administrative metadata like the operating contact, the resource manager, the organizational unit and the location. For the implementation of the changes after finishing the information audit it is crucial knowing who is technically responsible and who owns the information resource because they are the gate-

keepers to the information. Further fields include the management perspective into the table by stating the resource entity's relation to the organizational goals and objectives supported. Furthermore the processes and purposes supported by the content of the resource entities are clearly described. A domain which none of the other registers include is a separate field for comments allowing the auditors to add information about relationships or future changes planned for the entity. In addition the fields inputs and outputs from the information resources entity are added containing information about the source of the input and furthermore the content, format and media. This field however is related to the management perspective because the inputs and outputs are highly relevant when considering process management. The last fields are including the actual storage medium and information about several forms of dates. It is important to know when the resource entity was created, when the entry prepared and when it was reviewed for the last time because an outdated information asset register can do more harm to the organization than benefit (Burk & Horton, 1988, p. 56-59).

TAHO: The Tasmanian Archive and Heritage Office proposed a whole methodology for the development and application of an information asset register as an information management tool. They created a seven stage methodology including planning, identification, design of the information asset register, gathering, analysis, report, maintaining and updating as well as possible next steps (see appendix). In this section only the design step is examined. However the other steps could provide useful advice for auditors because the structure is similar to the common information audit methodologies.

The paper identifies five key areas for gathering metadata about information assets: asset information, people, management, usability and technology requirements. The asset information section includes the asset name as a unique identifier as well as a short description of the asset's components. Furthermore information about the asset status and the creation and review date is gathered. The asset can be marked as active or closed which is important information to decide if changes to the asset are meaningful. Besides compliance metadata is included into this section. Every asset is marked if it contains any personal data which has to be protected according to privacy laws. Moreover the business sensitivity is category which marks the confidentiality of each asset.

The second section gathers information about the people using and managing the information asset. In fact there are only two important groups of people considering the information asset. On the hand the users, which need the information for accomplishing their task and on the other hand the managers which own and control the information assets. The next area incorporates the management perspective into the register. It contains three main topics: risk management, business value and retention of the information assets. The risk topic comprises two main questions. On the hand it deals with the risk which could occur from the asset and on the other hand it collects risks which could harm the quality of the information asset. Furthermore the business value, both financial and immaterial, is in-

cluded. However there is no guideline on how to determine the financial value. Dealing with retention is also a part of the umbrella term compliance which is already mentioned in the first section. The question how and when an asset can be disposed has to be answered according to business requirements as well as legal requirements.

The last two sections include the same five fields: find, access, work with, understand and trust. However they are looking at them from different perspectives: usability and technology. The first one considers the asset's searchability dealing with how users can find specific pieces of data in the asset and what technological device they need to do that. The second one deals with access which takes into account which people can access the information and how it is protected as well as the technology needed to access the asset. The next field contains information about how the employees can work with the information respectively which functionality it supports at the organization and which technology the employees need to effectively exploit the information. The fourth one deals with understanding what is contained in the information asset. On the one hand it is important to understand the content in the asset itself and which additional information and tools needed to exploit the asset effectively. On the other hand understanding requires the context of the asset expressed by appropriate metadata and software to record the metadata. The last field is again related to the compliance term because trust means if the information itself is what it claims to be or if it needs further validation and which technology is used to make the information trustworthy (Latham, 2013, p. 13-14).

ISO27000: The information asset register proposed by Steve McColl is part of the ISO27000 Toolkit for Information Security Management Systems (ISMS). The toolkit offers procedures and guidelines created by members of the ISO27000 forum. One of these procedures is the information asset register template by Steve McColl which is examined more closely in this section. The ISO27000 information asset inventory is displayed as a Microsoft Excel spreadsheet. The spreadsheet divides the fields for each information asset into three main categories.

The first category contains metadata about the organizational unit the asset is associated with and the relevant business process it is assigned to. However assigning each research to a business process requires highly developed business process management procedures at the organization. Therefore it has to be questioned if this field is appropriate for most organizations, especially small ones.

The next category is labeled "Information Asset Details" which contains common metadata also mentioned in the other templates. Every entity is labeled with a unique name as an identifier as well as short description which underlines the purpose of this asset and other major aspects. Furthermore each entity is assigned a type, which is used to classify it e.g. the type of media the content is stored in. The next three fields consider privacy issues by determining if the resource contains any kind of personal data which has to be protected according to valid privacy legislation. The classification

scheme differs between personal data in general, sensitive personal data, which has to be handled more carefully and sensitive customer data, which has the highest priority because leaked customer data is a business risk and could be a major threat to the organization's future success. Further fields are dealing with confidentiality, integrity and availability of the information asset. Considering confidentiality Steve McColl proposed four confidentiality levels: strictly confidential, confidential, business use only and public. The level of confidentiality limits the number of users which have access to the respective resource from managers only to all possible information users. The integrity field is also divided into three levels from high which corresponds with zero percent error rate to medium with one to five percent error rate to low with five to ten percent error rate. Integrity is also associated with the compliance issues mentioned beforehand because it has to be assured that the information critical decisions are based on can be trusted. For the determination of availability McColl also used three levels from high to low. High equates with no interruption beyond 12 hours, medium with no interruption beyond 1 day and low with no interruption beyond 7 days. The last two fields considering information asset details are the asset custodian which is synonymous with operating contact and the data retention period. The custodian is a person who is responsible for the maintenance and assuring the technical availability of the asset. The data retention period is related to the organization's records management procedures because it schedules how long the data has to be kept after it is out of use. This decision is mostly influenced by the corresponding laws for businesses which define how long respective data has to be retained.

The last of the three main categories is the level of protection for the information asset, which is divided into two fields: "At Origin" and "If Information is Moved". The first one describes how the data is currently protected at the location where it is stored e.g. by passwords or encryption. The second one deals with the applied security measures if the information is communicated from its current system to another. It lists measures for securing the transfer between business units e.g. by encrypting the data before it is forwarded (McColl, 2012).

HSCIC: This information asset register template is part of the Information Governance resource pack from the United Kingdom's Health and Social Care information Centre (HSCIC). The template is just a small part of the whole resource package. However it is one of the general practices which allow identifying gaps in information provision during the implementation of information governance principles. The authors did not create one generic asset register. They divided the assets beforehand into five categories: hardware, software, removable media, services and information. This section focuses on the information asset registers which is the author's main interest. However the four other categories are also taken into consideration for the comparison later on because they contain useful information

about classifying different types of resources. The HSCIC template is the smallest one considering comprehensiveness because it just assigns seven fields to each entity.

The first field assigns a date to each entity when it was updated for the last time. The next one determines the information owner or controller who is responsible for managing and controlling the information asset and will be the main contact person when implementing the recommendations of the information audit to the asset. The third category considers classification of the information assets by assigning a type like a database or spreadsheet to the entity. Furthermore the level of protection is also recorded, which corresponds with the sensitivity of the data. The level of protection is the basis for defining security measure appropriate for the data contained in the information asset. The "systems where processed" fields lists the systems where the information is handled to improve the understanding of the information flow in the organization and increase effectiveness of the employees working with the information. The sixth field determines the location of the information depending on the type of information. For physical types of information, e.g. paper-based, there is an actual location in the building where the information can be found. The digital types of information which are stored in the organizations information technology systems do not have a real physical location; however it can be determined where in the file systems the data is stored. The last field points out the security requirements which have to be applied according to the relevant Information Governance toolkit. The measures are also related with the level of confidentiality/protection, which is already identified in the template (HSCIC, n.d.).

3.2.2 Comparison of Information Asset Register Templates

The comparison of the four information asset register templates and the ITIL guidelines for designing an information asset register is based on the spreadsheet displayed in figure 3.4. The spreadsheet lists different categories in the rows of the table and the five templates in the columns. Every category which is part of the original template is marked with an X. All categories which have three mentions or more are bold because they form the core for the development of the new information asset register for enterprise social software. The reason for choosing these categories as the basis is that they are used in more than fifty percent of the templates and therefore their integration in the new template is mandatory. These categories form the elementary metadata, which every organization needs to know when compiling the asset register. Furthermore the author combined the categories proposed in the information asset register templates and chooses the categories which are most commonly mentioned for the comparison in the spreadsheet. Thus at the end 35 categories are identified. Anyhow several templates are using different terms with synonymous meaning. To avoid confusion which category is more appropriated these similar categories are merged.

The first two categories merged are classification and type. These two terms are hard to differentiate because the templates do not use a consistent definition. Therefore the information the authors of the templates expect from this category varies widely. The most extensive classification scheme is proposed by Burk and Horton which use a two level categorization with a lot of detail in considering information types. They are firstly dividing the information resource entities into systems, sources and services and then continue with a more detailed classification scheme by e.g. defining the type as a library, a database etc. However it is questionable if the benefits of the effort put into categorization will be paid off in the future. Furthermore every categorization requires a taxonomy which has to be established by the organization at the beginning of the process to insure everyone is using the same vocabulary.

Custodian and operating contact are also merged because of their synonymous application. In practice both terms are not distinguishable because they are lacking of clear definition and both describe employees which are responsible for maintenance and administration of the asset.

Integrity and trust are also merged into one category because they are used synonymously by different authors. Both terms are highly related because the level of trust an information user can put into an asset is dependent on the asset's integrity.

	ITIL	**InfoMap**	**TAHO**	**ISO27000**	**HSCIC**
Access			X		
Availability				X	
Business Processes and Task supported		X			X
Classification / Type	**X**	**X**		**X**	**X**
Comments		X			
Confidentiality				X	
Content	**X**	**X**	**X**		
Cost (acquisition / maintenance)	X				X
Custodian / Operating Contact		**X**		**X**	**X**
Date (creation / entry / disposal)		**X**	**X**		**X**
Description			X	X	
Disposal Requirements			X		
Format	X	X			
Identification (ID)	**X**	**X**			**X**
Inputs		X			
Integrity / Trust			X	X	
Location	**X**	**X**			**X**

Manager / Owner	**X**	**X**	**X**		**X**
Manufacturer / Provider					X
Name	**X**	**X**	**X**	**X**	**X**
Organizational Unit		X		X	
Outputs		X			
Relationships		X			
Retention Period			X	X	
Risks (from the asset / to the asset)			X		
Search / Find			X		
Security Measures				X	X
Sensitivity (Privacy)			**X**	**X**	**X**
Source		X	X		
Status			X		
Storage Medium / Technical Dependencies	**X**	**X**	**X**		
Structure	X				
Update responsibilities	X				
Users		**X**	**X**		**X**
Value	X		X		

Figure 3.4: Comparison of Information Asset Registers

The manager and owner categories are also combined in a single category. In most cases the manager and the owner of an information asset is the same person because the information asset is assigned to a business unit and the business unit manager is the asset owner. However for external resources the asset owner can vary from the responsible manager because the rights of ownership are held by an external person or organization. Anyhow the responsibility for management must still be assigned to an employee in the organization.

The last two terms which are merged into one category are manufacturer and provider. Especially for information assets which are based on the support of software knowing and contacting the manufacturer for further advice is essential for effective information management. Both categories however are highly related because the provider is a service provider for the manufacturer and he is also the interface to the manufacturer for the organization. Anyhow the provider still fulfills an important role by insuring the technical support and the proper operating mode of the respective asset.

Comparing the five information asset templates the first finding is that no matter how they differ in their design and classification the purpose of them is the same. The authors of the templates want to

foster information asset management with their tools and provide a comprehensive overview of the information resources in use. However the information asset registers are only basic concepts which are useless without further information management measures. The main difference between each template is not only the varying level of detail and the labels used for categorization but also the authors' different points of view.

The ITIL guidelines for designing an information asset register were published in a white paper about managing digital information assets with a focus on digital continuity. Digital continuity demands preserving digital data stored in the old system when the old information system is shut down and replaced with a newer type of system. In contrast to the other information asset registers evaluated the ITIL paper does not propose a template, it only provides general guidelines. Therefore the scope of categories is limited. However it forms a good basis for the development of the new information asset registers because it only focuses on the most important and inalienable categories (Lacy et al., 2011).

The inventory data form proposed by Burk and Horton in their InfoMap methodology is more extensive. In comparison to the other templates the inventory data form is the only one which is part of a whole information audit methodology. The advantage is that InfoMap offers further methods for analyzing and evaluating information resources which are based on the inventory data form. Besides it also includes aspects from classical resource management because the book's main goal is the establishment of strategic resource management for information. Furthermore the number of categories assigned to the resource entities is very comprehensive. This provides a broad overview of the resources. However the template is also the oldest one. Its development goes back to the 1980s. Therefore the evaluation has to be more profound because the attributes have to be checked to their timeliness. Furthermore the template has to be checked for missing categorization fields because the upcoming of new technology demands new levels of categorization (Burk & Horton, 1988).

The TAHO information asset registers template is part of the "Information Management Advice" on "Developing an Information Asset Register". The paper proposed a whole methodology for identifying, gathering, analyzing and improving an organization's information assets. The Tasmanian Archive and Heritage Office (TAHO) is a governmental organization responsible for the state's record keeping. Therefore the template also includes influences from records management practices. Compared to the other templates this one has the highest number of categories and therefore is the most comprehensive. It puts the spotlight one the management's perspective by looking at business risks and values as well as disposal requirements. Most of the other templates lack in this area. However the identification and definition of the information asset's values and risks is a difficult undertaking whose scope should not be underestimated. Furthermore the template includes usability and technology requirements dealing with searchability, access and understanding of the information asset. This is a further

advantage of the template because the other ones are also lacking in that area because they are not considering the implications of usability and technology on the information user's effectiveness working with the asset (Latham, 2013).

The ISO27000 was proposed by Steve McColl as a part of the "Information Security Management Systems (ISMS) Toolkit". ISMS are defined in ISO27001 and gather rules and procedures for insuring an appropriate level of information security in an organization. With its focus on information security the template also introduces a new point of view on information assets. It puts the spotlight on privacy issues like the sensitivity of personal data from customers or employees as well as the current level of protection for storing and communicating information. This is the template's main advantage because no other template considers information security to that extent. Besides it also considers process management in a small way because it assigns business processes and the respective process owner to the asset. However this is only a starting point for integrating information resource management with process management (McColl, 2012).

The last template compared is the information asset register proposed by the Health and Social Care Information Centre (HSCIC), which is a governmental organization from the United Kingdom responsible for the provision with information and IT systems. The template is part of the Information Governance resource pack which gathers several methods and procedures for implementing Information Governance principles in the organization. The focus on Information Governance introduces a new point of view on information assets. Since Information Governance is related with the compliance issues of information management already outlined in previous sections, it correlates the assets with topics like risk management, legal requirements or records management, which could also positively influence any further ventures in these areas. Considering the scope the HSCIC template is the most limited one. However it divides assets in five categories beforehand and assigns different attributes for each category. In comparison to the other templates it does not introduce any new types of categorization. However it excels the other templates in usability because it is easily applicable and also understandable for employees with limited information technology skills (HSCIC, n.d.).

In summary it can be stated that the different approaches to information asset register development have got their advantages because of their varying starting points. Therefore a combination of the influences from different areas insures the best results for the development in the following chapter. Considering the scope of the registers the number of attributes assigned to the assets varies from 7 to 24. However the insights from the smallest template are also useful for the analysis and development. In conclusion the TAHO template is not only the most comprehensive but also the most sophisticated framework because it includes detailed description of each category as well as a whole approach for

collecting, gathering and analyzing the information assets. Therefore the TAHO template is a good starting point for the development in the following chapter.

4 Development of a New Information Asset Register and Case Study

The following chapter deals with three core topics. The first section is about the development a new information asset register for enterprise social software. And the second one uses the newly developed register and applies it to an exemplary case. The third section on the other hand uses the asset register as basis for developing a template for information users setting up new information assets or work spaces on enterprise social software systems. The development in the first part of this chapter takes the comparison of information asset registers in the previous chapter as a basis and combines those to a new improved register. The case study in the second part applies the information asset register to the enterprise social software environment used in the Institute for Information Systems Research at the University of Coblenz.

4.1 Development of a New Information Asset Register for Enterprise Social Software

The following section explains the development process of the information asset register. The process is started by taking the categories from the comparison in the previous chapter as a basis and grouping them into seven categories. Furthermore each category is prioritized (see figure 4.1) by the MoSCoW prioritization method (Hatton, 2008). The last paragraph deals with finding a consistent format for each entry to make the information processible for database applications.

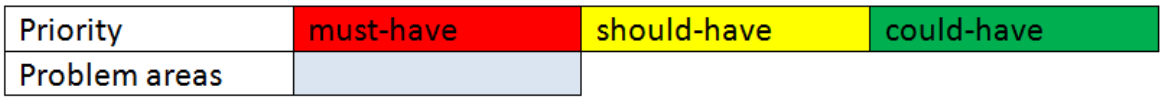

Figure 4.1: Legend for the Information Asset Register Template

4.1.1 Grouping the Categories by Topics

To improve the overview about the categories and to illustrate contextual relation between them the categories are assigned to seven topics.

General Information: This section (see figure 4.2) contains the basic information about the information asset. It includes the attributes, which are mandatory for identifying and locating the asset in the organization. Therefore a unique identification number and name as well as a short textual description are assigned to the asset to avoid confusion between assets. Furthermore the assets are generically grouped by their type.

Category	Description	Format (Example)	Source	Problems with ESS
Identification Number (ID)	A clear numeric identification of the asset which is usable as a key attribute	#00001	InfoMap	-
Name	A clear and unique name for identifying the asset	Name of the Asset	TAHO	-
Description	A definition of what the main characteristics and components of the asset are in a brief description	Headwords	TAHO	-
Type	Generic grouping for asset types (taxonomy recommended)	Name of the type	InfoMap	-
Organizational Unit	The name of the department in the organizational hierarchy where the asset is located	Name of the organizational Unit	InfoMap	
Location	The geographical location of the physical asset	Country/City/Street /Institution /Building/Room	InfoMap	Social content is hosted on servers. The actual geo-graphical location is less important for the employees for working with the asset.
System	The name of the software system the information asset is stored in	Name of the system	-	-
Comments	Any additional comments on the asset which are not mentioned in the spreadsheet (e.g. future plans)	Headwords	InfoMap	-

Figure 4.2: General Information

To establish a common vocabulary between employees, it is recommended to use a predefined taxonomy because in the majority of cases the asset registers will be filled by different employees who have different backgrounds. The organizational unit and the physical location are both elementary information because it is crucial to know the location and place in the organizational hierarchy when thinking about implementing changes to the asset. However the importance of the physical location is decreasing for information assets in enterprise social software. While the information can be accessed from all over the world via the Internet, the actual physical location is only relevant when e.g. elementary technology changes for the server are required. Furthermore legal reasons or taking the information risk perspective can validate the importance of the location because the applicable national law and the potential measures when emergency situations arise are dependent on the location. Additionally a category for naming the software system of the asset is introduced, which is more important than the actual physical location for Enterprise 2.0 assets. The last category is designated for collecting additional comments on the information asset, which are not mentioned in the other categories yet. The auditor could for example retain future plans for the asset like a planned update for the information system.

People: The people area (see figure 4.3) describes the properties of the asset relating to the persons using and controlling the asset. It can be differentiated between three kinds of people; the first kind is responsible has some kind of control over the asset, the second one is responsible for its technical support and the third is just using the information stored in the asset. The manager, creator and owner category gather the persons or institutions with specific rights concerning the asset. The owner is for example is legally relevant because he has the copyright for the content stored in the asset. Furthermore the creator is the person the respective organization wants to contact if it needs any further information on e.g. where the data in the asset was obtained from.

Category	Description	Format (Example)	Source	Problems with ESS
Manager	The name and role of the employee responsible and accountable for managing the asset	Name/Role/Contact Information	InfoMap	-
Creator	The name and role of the employee who originally created the asset	Name/Role/Contact Information	-	Multiple creators/creators not identifiable
Owner	The person or institution owning the information	Name/Role/Contact Information	TAHO	Multiple owners/owners not identifiable
Custodian	The name and role of the person for obtaining authorative information and responsible for technical support	Name/Role/Contact Information	InfoMap	-
Update Responsibility	The name of the employee responsible for updating the information asset register entry	Name/Role/ Contact Information	ITIL	-
Users	The names of the departments and users accessing and using the asset (sorted by frequency)	List of Names/Roles/Contact Information	TAHO	Numerousness of possible users/users are not identifiable

Figure 4.3: People

The manager is the person responsible for assuring the quality and usability of the asset and has the actual power over the asset. Therefore he is the main contact person when auditors want to establish changes to the asset. The next category of people is the custodian or operating contact who assures the availability and technical support for the asset. He is the contact person for the users if there are any problems occurring when using the asset. Furthermore the register records the employee who is responsible for updating the asset in a regular time frame to assure the information is always up-to-date because outdated information is a major business risk. The last category gathers data about the users of the asset related with their frequency of use. Identifying the main information users is a key aspect for information auditors when they want to improve the effectiveness of the resources. The number of users and frequency of use is also a good indicator for the value of the asset.

Management: Under the management topic (see figure 4.4) the relevant information for the executives of the company is collected. The managers are primarily interested in the costs and value the asset provides. However costing and valuing information is a very complicated task because the commonly known audit methodologies do not propose methods for that. Especially for social software assets it is hard to define the actual maintenance costs of the asset. While it could be easily calculated how much operating of the server costs. The indirect cost e.g. by maintenance or decreasing productivity because of the employees spending time on searching the appropriate information on the platform are hard to calculate. There is a similar problem for valuing information assets especially on social software platforms because calculating how much the new enterprise blog contributed to the annual turnover is impossible. Therefore further research is required on costing and valuing information in the same way as the classical resources. The next category deals with the tasks supported by the information contained in the asset.

Category	Description	Format (Example)	Source	Problems with ESS
Costs	What are the acquisition and maintenance costs of the asset? (if calculable)	Acquisition costs in EUR / Maintenance costs in EUR/year	ITIL	Maintenance costs are hard to calculate for ESS. Costing is a complex topic because of the different types of costs.
Value	How does the asset contribute financially to the organization's success? How does it contribute to achieving the organizational objectives?	Value in EUR / Value defined by tasks supported(scale): >= 5 Tasks = high / 4-2 Tasks = medium / <1 = low	TAHO	Exact financial value of information assets is hard to determine. Information valuing is an own, very complex research field.
Tasks supported	Which business task or business processes does the asset support?	List of names of the tasks supported	InfoMap	It is difficult for some types of social assets to explicitly assign them to business tasks.
Risks	What are the risk occurring from the asset? What are the risks to the asset? What would be the impact of losing the asset? What would be the costs for replacing the information (if calculable)?	List of risks from the asset / List of risks to the asset / Impact of losing the asset / Costs in EUR	TAHO	Information risk analysis is an own, very complex research field. Determining the impact and cots of losing an asset is a complex task.
Input	What are the primary inputs of the asset (source)?	List of inputs (content/format/media)	InfoMap	The input and output category are based on a classical view on resources. For many social assets it is not applicable or hard to determine.
Output	What are the primary outputs of the asset?	List of outputs (content/format/media)	InfoMap	
Relationships	What are the relationships between different assets?	List of dependencies to other assets	InfoMap	-

Figure 4.4: Management

Relating the business task or business processes with the information assets they are supported by is also an indicator for the value of the asset because the more business tasks the asset supports the greater the value for the organization will be in most cases. A further category deals with information risks. Influenced by the discipline of risk management every asset is assigned with risks which could possibly harm the asset, risks caused by the asset itself and the impact of losing the asset. Understanding, minimizing and handling those risk and mitigating the impact are important tasks for the management. Therefore the executives are interested in an in-depth risk analysis for every information asset. The next two categories are recording the inputs and outputs to and from the asset. Understanding what information input is needed for the asset and improving the way of providing this information is a major interest of the management as well as increasing the quality of the information, which is provided by the asset and after that used by the employees. Therefore managers will appreciate the first overview the register provides. The last category deals with the relationships between different assets and lists the dependencies between them. Especially when deciding on changes or disposal of an asset an overview about the dependencies is very helpful to minimize the risk of losing business relevant information or diminish the functionality of an application.

Compliance: The compliance area (see figure 4.5) gathers categories which are related to satisfying legal requirements, protecting assets against external and internal threats as well as insuring the reliability of the assets according to business rules and objectives. Therefore this area begins with defining what users and departments are allowed to access the asset. In enterprise social software many assets are accessible for the users of the platform. However business critical information should only be accessed by a limited number of employees.

Category	Description	Format (Example)	Source	Problems with ESS
Access	Which departments/groups of people can access the information asset?	List the names of the departments/employees	TAHO	Access is a problematic for ESS because ESS is based on the idea of open access.
Confidentiality	Which protection requirements are assigned to the asset?	Scale: Strictly confidential / confidential / business use only / public	ISO27000	-
Integrity/ Trust	How high is the error rate of the asset? Does the data need any further validation? (Distinguish between external or internal assets)	Scale: <1% error rate = high / 1-5% error rate = medium / >5% error rate = low	ISO27000	Integrity is difficult topic because rating integrity of information with a scale is impractical. The numerousness of sources of social assets impedes the task.
Source	Where was the asset obtained from? Where was the information created? Distinguish between external or internal assets.	External sources: Name or Organization/Location/ Contact Information / Internal sources: Name or Department	TAHO	Identifying the sources is difficult because of their numerousness and web resources can be hard to trace/ not identifiable.
Sensitivity	Does the asset contain any types of personal data, which has to be protected?	Scale: No personal data / personal data / sensitive personal data / sensitive customer data	ISO27000	-
Relevant Law	Which laws are significant for the asset? Which legislation is applicable depending on the location of the asset?	List of significant laws	-	Identifying the applicable law can be very difficult because there may not be an applicable law for social software assets or the identification of the law needs juristic expertise
Security Measures	Are there any kind of security measures implemented for the asset?	List of security measures	ISO27000	Security measures and usability which is a core feature of ESS are an area of conflict because comprehensive security measures limit the usability.

Figure 4.5: Compliance

Related to the access is the confidentially of the asset which ranks the asset by its importance to the business from strictly confidential information like trade secrets to publicly accessible information like marketing brochures. The next two categories considering compliance are also related. The first one deals with the integrity of the asset which is directly linked to the source because in most cases internal information is more trustworthy than external and it doesn't need any further validation. External information on the other hand has to be tested for its integrity dependent on the trustworthiness of the source. The integrity is evaluated with the percental error rate of the asset. This information is very important for users when their decision-making process is based on the asset; they need to be sure that they are using integer information. The source records where the information was obtained from and the person or organization who or which was responsible for its creation. Since the use of enterprise social software fosters the integration of external resources into the company the asset registers helps to provide an overview of where the organization purchases their information. A further category dealing with the compliance topic is the sensitivity of the information asset which refers to privacy issues. It is crucial to know for the organization if the asset contains any kind of personal data which has to be protected according to privacy laws. The organization has to implement appropriate measures to avoid getting sued because of applicable privacy legislation. Furthermore the trust of the customers in the organization is diminished considerably if personal data is leaked e.g. by hacker attacks. As an addition to the sensitivity category the asset register gathers the applicable laws for the asset. In this field not only the relevant privacy legislation is listed. Significant business law or contract law which is applicable to the information in the asset is also recorded. The category however is classi-

fied as “could-have” because the legislation topic is not the main focus of the auditors when conducting the audit. It is only additional information. The last category deals with the security measures applied to the asset. The security measures are related to both confidentiality and sensitivity of the asset because an increasing confidentially or sensitivity requires more sophisticated security measures to satisfy these conditions. The information gathered in the compliance area is very useful for the organization’s IT security professionals because they have to adjust their measures to the increasing risk of losing information since the idea of Enterprise 2.0 was derived from Web 2.0 whose basic principle is open-access (O’Reilly, 2009).

Category	Description	Format (Example)	Source	Problems with ESS
Creation Date	When was the asset originally created?	DD.MM.YYYY	TAHO	-
Update Date	When was the entry updated for the last time?	DD.MM.YYYY	InfoMap	-
Disposal Date	What is the disposal date of the asset? (retention period)	DD.MM.YYYY	TAHO	-
Review Cycle	Fixed period of time, when the asset has to be checked for changes	Timeframe in month/Next update date(DD.MM.YYYY)	TAHO	-
Status	What is the current status of the asset?	Scale: Active/Active but not updated/Inactive	TAHO	Social assets are based on active participation. It has to be decided if inactive assets have to stay in the register.
Disposal Requirements	Are the any legal or business requirements, which have to considered, when disposing the asset?	List of requirements	TAHO	Social software is lacking of important archive and disposing functionality.

Figure 4.6: Life-cycle

Life-cycle: The life-cycle topic (see figure 4.6) collects information especially record managers need to know when managing the asset from its creation to its disposal. Therefore the relevant dates for the information asset’s life-cycle management are gathered in this section. It begins with the creation date of the asset and the date the asset has been or will be disposed. Furthermore an update date is recorded for defining when the entry in the register was updated for the last time. There is also a review cycle category for determining the time span until the next update and the exact date of the next update. Regularly updating the entry is very important to ensure effective information management because an outdated asset register is of no use for auditors. Furthermore the status of the asset is identified which has basically three parameters. The asset can be active and updated, active and no longer updated or inactive which means it is no longer possible to update the asset. Identifying the current status of the asset is elementary for record managers when initiating the disposal process. The last category’s intention is listing the disposal requirements applicable to the asset. The disposal requirements come from two different backgrounds. On the hand there are the mandatory requirements which are predetermined by commercial law and failing to meet those requirements can lead to a

lawsuit with indefinable financial risk for the organization. On the other hand there are requirements based on business significance of the asset. Especially strictly confidential types of information have to be disposed in a secure way so that no one can access them any longer.

Technological Requirements: This section of the asset register (see figure 4.7) focuses on the categories concerning the underlying technology of the asset. It firstly deals with the availability of the asset which is mainly dependent on the update frequency of the software system and its technical reliability like the stability of the server and the connection.

Category	Description	Format (Example)	Source	Problems with ESS
Availability	How many hours approximately is the asset unavailable per month?	Scale: <8h = high / <24h = medium / >24h = low	ISO27000	-
Usage Model	What usage model is in place for the software system?	On-Premise/Off-Premise/Cloud/Other	-	-
License Model	What license model is used for the software system?	Concurrent User/Named User/Token-based/Other	-	-
Technical Dependencies	Is the use/access to the asset dependent on any kind of technology? (e.g. browser)	Names of the dependent technologies	TAHO	Technical dependencies are a comprehensive topic in ESS. It has to be decided by the auditors which level detail they want to apply.
Manufacturer/ Provider	Who did provide/manufacture the software/ hardware for the information asset?	Name/Location/Contact Information	HSCIC	-

Figure 4.7: Technological Requirements

High unavailability rates can have a major impact on the business because employees whose work is based on the respective information asset will be decreased in their productivity. Therefore auditors can recognize high unavailability rates with the help of the asset register and undertake appropriate measures. Most of the templates compared in the previous chapter used the storage medium as an important category. However with its focus on enterprise social software the new template does not require a category for the storage medium because the information is stored on a hard disk for almost every asset. Instead of the storage medium two new categories are introduced which are suitable for enterprise software. The license model as well as the usage model are both elementary decisions when an organization is introducing a new information system. When auditors are evaluating and analyzing the information assets it is important for them to know the limitations of the usage and license model because a usage model where the provision of the software is dependent on another organization limits the scope of action for the auditors. The next category is the technical dependencies of the asset which forms the basis for understanding the information infrastructure of the company. Since the information asset register provides a condensed overview of the dependencies the managers will understand for the first time how a change to one component of the information infrastructure will in-

fluence the others. The last category records the manufacturer and/or the provider of the software system. This information is important for the information technology department because they need the support of the manufacturer or provider for technical problems. The register provides an overview for every asset with its respective contact person and therefore will facilitate the communication when solving technical issues.

Category	Description	Format (Example)	Source	Problems with ESS
Content	What kind of content is stored in the asset? (e.g. text, videos)	Description of Content	InfoMap	The number of content types for ESS is very high. Gathering detailed information about every content type can be difficult.
Format	Is the data stored in the asset in any kind of format?	Name of the format(s)	InfoMap	-
Structure	How structured is the information contained in the asset?	Scale: high = very good structure, easily understandable and machine-readable / medium = existent structure and machine-readable but not easily understandable / low = no or poor developed structure, not machine-readable	ITIL	-
Search/Find	Is the content of the asset searchable with some kind of search engine?	Yes/No (+Description)	TAHO	-

Figure 4.8: Properties of the Data Itself

Properties of the Data itself: The last section of the template (see figure 4.8) focuses on properties of the data stored in the asset itself. The first category deals with the content of the asset and provides a short description on what types of media are stored in the asset. Understanding what kinds of media are stored in the asset is crucial for implementing appropriate information management procedures. Especially since social software contains many of the unmanaged content types like videos or instant messages (see figure 1.2) understanding what explicit types the specific asset contains is crucial for improving information management. The next two categories the format and structure of the asset are highly related. On the one hand the content stored on the asset comes in many different machine-readable formats like jpeg or HTML. However understanding the implications of the format on information management and initiating the appropriate measures to decrease the number of formats and insure that older formats are transformed to newer technologies are major tasks for information management. The structure is highly dependent on the format because most document types especially spreadsheets, text-files or HTML are highly structured because they are created with computers. Many media files like videos or pictures however are less structured because they don't contain textual information and therefore need further management measures. Hence the asset register provides a good starting point for solving problems with content types lacking in the format or structure area. The last category focuses on the searchability of the information asset. Searching for the appropriate

information is a major requirement for information users today because they are used to highly performing search engines from their private environment (Google, Facebook). Therefore recording if the content in the asset is searchable and how well the search engine is working is an important fact for information auditors. Knowing the potential for improvement in that area will foster the establishment of appropriate measures by the management.

4.1.2 Prioritizing the Categories

The proposed information asset register template is very comprehensive and provides a great number of different categories. However an organization which wants to apply the asset register is not constrained to using the whole scope of the register. They can adjust the asset register to their specific needs and requirements. To facilitate the decision-making on which categories are indispensable for an information asset register a rating scale is provided which divides the categories in "must-have"(red), "should-have"(yellow) and "could-have"(green) categories (Hatton, 2008). The respective organization can start with identifying the must-have categories and then decide if any of the further categories are needed for their endeavor.

General Information: Clear numeric and textual identification are both "must-have" categories because numeric identification is important for database tools as a key attribute and humans will at first identify an asset by its name. The description is an optional field because it depends on the asset if a further description is needed and helpful for the users of the asset register. The type however is a mandatory attribute since it is important for identifying similar assets to harmonize their management. Furthermore the organizational unit on the one hand is a "should-have" category as in smaller organizations the organization is not divided into units or it is not possible to assign the asset to one specific business unit. Therefore this field should only be completed if the asset is clearly matching with an organizational unit. On the other hand the location is mandatory especially for legal reasons since in emergency situation e.g. when the company is attacked by hacker knowing the physical location can be crucial for protecting the asset. The comments field is only a nice-to-have feature because it is an additional field for the auditors where they can add information they think is missing in the register. The system category is classified as "must-have" since the asset is dependent on the system it is stored on and knowing the systems is crucial information for understanding the implications of any kind of changes enforced on the software.

People: The people section has only mandatory categories with the exception of the update responsibilities. As already outlined previously Web 2.0 tools are user-centered tools (O'Reilly, 2009). Therefore any kind of person who is responsible or participating in the operation of the tool is an important contact person for the auditors and therefore has to be recorded in the asset register. The manager

for example has to insure the usability and appropriate access rights, the owner has the copyright for the information stored in the asset, the custodian is the contact person when facing any kind of technical problems and the creator is the person to contact when users are having problems in understanding the information. Recording these persons provides the auditors with indispensable knowledge. Therefore these categories are classified as “must-have”. Furthermore the users are also a “must-have” category because when auditors think about improving effectiveness and efficiency of the employees in dealing with their information assets, understanding which are the most important information users of the asset is crucial information for the auditors because they start the improvement process from the user’s perspective. The only optional field records the update responsibilities for the entry in the register, which has to be assigned to a specific person. However it is recommended to assign it to one of the employees already mentioned in this section like the custodian.

Management: The management area is of major importance for any organization because it deals with the contribution of the information assets to the organization’s economic success. However it is also the section with the greatest further effort required to complete the fields. Therefore especially for small organization’s it is questionable if they can benefit from that effort because the costs for calculating and identifying the entire required information can easily excel the benefits. Therefore almost every category in this section is optional besides the field which deals with the supported business tasks. Understanding the relation between the information assets and the business task is a starting point for the information audit and for any kind of recommendations which are provided at the end of the audit process because only if auditors know in which area the assets support the employees in their daily work they can increase the asset’s usability. Cost and value as well as a possible risk analysis for the assets are optional for the reason of their complexity. It requires a lot of effort undertaking these tasks. Therefore further research is required for identifying appropriate methods for costing and valuing information. Especially condensed methods for smaller companies are unexplored territory. The input and output categories are both optional because they are derived from classical resource management and therefore are not suitable for every type of information asset. However not only machines are based on input and output. Also many information assets need information input to operate satisfactorily and produce valuable information output. Hence auditors should think about identifying the main inputs and outputs for every asset for better understanding the information flow through the organization. The last category is about identifying the relationships between the assets. The field is also classified as “should-have” because it is an optional task which is suitable for larger organizations. Small organizations with a limited number of assets are not profiting from the findings of the relationships analysis as well as bigger organizations with dozens of information assets. For those organizations the identification of relationships can be a starting point for mapping the whole infor-

mation infrastructure which is an elementary task for understanding how changes to one asset can influence the other assets.

Compliance: The following section deals with defining fields which are covering the whole scope of the compliance area. The first two categories are both mandatory: identifying the people who are allowed to access the information assets and defining the protection requirements. Both topics are related because they deal with protecting the assets from unwanted access. Especially for companies with information assets containing crucial business information like trade secrets limiting the access to these assets is one of the major tasks for information managers to avoid losing these information to competitors and thereby losing competitive advantage. The next two categories are also related and both classified as optional. The degree of trust an employee can put in an information asset mainly depends on the source the asset was obtained from originally. Internal assets are in general more trustworthy than external ones. However it is a complex task to identify the integrity of the asset. Thus the identification of the integrity is left up to the auditors which have to decide if the field is applicable for the respective organization. McColl (2012) proposed a scale depending on the error rate of the asset. It is questionable especially for comprehensive assets if the error rate is easily calculable. Therefore further research is required in this area. Identifying the source auditors face the same problem. Especially social software assets are obtaining information from so many sources that tracing all of them afterwards could be an impractical task. A further field deals with the sensitivity of the data contained in the assets. As privacy issues are of growing interest for companies because of latest developments like the Sony or MasterCard leaks understanding where personal information is stored in the respective organization is mandatory for auditors. Knowing where the personal information is stored and protecting it against unwanted access forms the basis to avoid lawsuits because of privacy violations. Furthermore the register also gathers laws from other areas like business or copyright law. The main problem in that area is finding out which law is applicable for the specific asset and depending on where the asset is located which national legislation is relevant. In the case study the important legislation is e.g. German law on privacy and copyright. The last category identifies security measures applied to the assets to avoid the previously mentioned problems in the compliance area. This category is classified as “could-have” because most of the social software assets are protected by the measures already implemented in the system. Establishing more sophisticated requires further effort which only companies with it security professionals can afford. Furthermore it is questionable if those security measures don’t decrease the usability of the system in a way that the users try to avoid the asset in their daily work.

Life-cycle: This area defines and identifies fields considering information which is important for managing the life-cycle of the information asset. The first three fields record the most important dates for

the asset and therefore are mandatory for every asset register. The creation date and the disposal date frame the information life-cycle. The update date defines the actuality of the entry and is a starting point for managers when evaluating the quality of the asset register because an outdated register cannot be used as a basis for information auditing. The review cycle is closely linked to the update date because it defines a date and a time frame for the next update of the entry. Establishing a review cycle is recommended by the authors, the usefulness and effort for undertaking the task however is highly dependent on the organization. For small organizations a specific review cycle for every asset is optional. They can assign a responsible manager for the whole asset register, who is also accountable for regularly updating the entries. The following field considers the status of the asset. It is also an optional category because the benefit of recording the status for social software assets is questionable. While classical information assets can vary in their status most of the social software assets are actively used and updated because social software depends by definition on the participation of the users. The last category records the disposal requirements for the asset if there are any in place. The disposal requirements can be dictated by official legislation which forces to the business to keep documents for several years or by the importance of the documents themselves because information with crucial value to the business has to be retained for future use. However for many new types of information created and stored in social software disposition and retention are unexplored territories for organizations. Many companies are failing to meet eDiscovery requirements because it is too complicated and costly to archive the amounts of information created in Enterprise 2.0 software. Failing those requirements can cause lawsuits and financial penalties for these companies (Williams, 2012, p. 18). Therefore firstly research is required for the auditors if there are any legal requirements or records management frameworks applicable to social software assets.

Technical Requirements: This section of the asset registers deals with the attributes of the asset regarding the hardware and software which is required to operate the asset. The first category identifies the availability of the asset and is an optional category. The level of availability is dependent on the downtime of the system the asset is hosted on. The availability field is classified as mandatory because businesses highly depend on the availability of the assets. Longer downtimes during the daily working hours can cause high financial damage to the organization. The next two fields are derived from the area of business software because the usage and license model are fields which are not applicable for general information assets. However with the focus of this template on enterprise social software both categories are optional information for auditors and can support them in their analysis and evaluation process. Especially the usage model defines which opportunities the respective organization has to apply changes to the used software. If they have outsourced the operation of the software to an external provider, changes recommended by the auditors at the end of the audit process have to be arranged with the provider firstly. The license model could also be an obstacle to the effective use

of the system because a limited number of parallel users hinders the organization of fully exploiting the benefits of social software which is based on user participation. The next category is classified as mandatory and identifies the technical dependencies between the asset and software or hardware products used in the organizations. Understanding the dependencies between those could be very beneficial for the organization because it is a starting point for mapping the information technology infrastructure and improving decisions on acquiring new and disposing old technologies. The last field records the name and contact data of the manufacturer or provider of the respective. This category is classified as optional because in most cases the provider or manufacturer are not the main focus of the information audit. The benefits of knowing this data are limited because the changes and recommendations from the information audit have to be implemented by the organization itself respectively the employees responsible for the operation of the system. Despite recording a contact person especially for emergencies and major technical problems is important for organizations to quickly conquer these situations.

Properties of the Data itself: The last section of the template gathers data about the types and properties of information stored in the information asset itself. The first category is mandatory and collects information about the content stored in the asset. The main focus is on identifying the different types of content stored in the asset. Especially social software includes many different types of information like videos, instant messages or status updates which are mostly unmanaged (Williams et al., 2013). Therefore collecting this information can be a good starting point for information managers to deal with that problem. The next two categories are both classified as “should-have” and they are related with regards to content. Collecting the different formats of the data can be helpful for auditors as well as information about if and how the information is structured. Documents and other types of information saved in well-known formats are easier to manage. Furthermore well structured documents enable automation of workflows because they can be processed by computers without any support from humans. Therefore it is important for auditors to collect this information about the asset. The last category is classified as “could-have” because it describes a feature of software which is well established in the area of Web 2.0. However including a comprehensive search engine which is able to cover every asset is a complex task because most software types are lacking of integration with software from other manufacturers. Therefore searchability is a nice-to-have feature for any asset. However it should not be foregrounded by auditors.

4.1.3 Establishing a Consistent Format

Establishing a consistent format for every entry in the asset register is very important for the well functioning of the register. Especially comprehensive registers from bigger organisations will be ana-

lysed with the help of database software. To gain the most benefits from this analysis a consistent format for the entries is indispensable. In the asset register six different types of formats are used with slight variations. Most of the formats are text-based due to the natures of the spreadsheet which does not allow visualization. For further analysis and evaluation the auditors are recommended to use graphic visualization like maps or process diagram to display workflows or relationships between the assets.

Some categories just require to numeric value for which it is easy to establish a consistent format. Dates for example are recorded in the standard European format DD.MM.YYYY, financial values like costs are defined in Euro. The format of the identification number can be individually defined by the respective organization. Furthermore many fields require the name and role of a person or an organization especially in the people section. For auditors it is important to establish a consistent notation scheme for both names and roles. Every name is required to be in the format First Name followed by the Last Name und the roles should not vary throughout the register. The CEO for example should be called CEO in every field and not manager or any other title to avoid confusion. Related to the names and organizations is the contact information needed to communicate with the respective person. In the end the success of the information audit is mainly dependent on the employees participating during and after the audit process. Therefore auditors have to collect every possible data to facilitate communication between auditors and key employees. The entries should include address data like country, city, and street and also communication channels like Email address or telephone number. The format of those entries is dependent on the regional circumstances. Therefore auditors should use the most commonly known format in the respective country or geographical area.

For any kind of field which requires longer textual description headwords are recommend to increase clarity and to lower the effort for the auditors. To make the information in those fields more usable the employees completing the register should limit the description to the most important facts. Besides several fields require lists or enumerations because they are filled with more than one value. To limit the complexity of the spreadsheet simple bullet point lists of the respective values are recommended. However for fields with a great number of values bullet points can be confusing for the readers. Therefore auditors should come up with better methods for visualizing these categories. Accomplishing that task is not part of this thesis and is only an indication of opportunities for further research. The last type of format used in the asset registers are scales for types of field whose values can be brought into order. In the register template the applied scales are adapted from other register templates discussed in the previous chapter. However these rating scales are not using clear numeric values. The labels used for the evaluation were developed by the respective authors and can be seen as a suggestion for the organization applying the template. However the auditors themselves have to

decide if the suggested scale is applicable or have to come up with a new one which is better fitting for their organization. Especially fields like availability, integrity or structure are hard to describe with generic scales because the assessment of these topics highly depends on the organization it is used in.

4.2 Case Study and Problematic Areas for Enterprise Social Software

The following section applies the template which is proposed in the first part of this chapter to an exemplary case. The exemplary case chosen is the IBM Connections system of the Information Systems Research Group at the University of Coblenz. The asset register is applied to a blog and a wiki used by the members of the research group on the platform. The goal of the case study is to identify occurring problems during the application of the register which are only recognizable in practical use. Therefore the following sections mainly focus on problems and difficulties during the application and do not describe every step of the application in detail. The identified social software issues described in this chapter are summarized in the table displayed in figure 4.9. The completed information asset register is displayed in the appendix. The problems outlined in the following paragraph are also highlighted as problem areas and shortly explained in the spreadsheets in the previous chapter.

The first category which is causing problems when completing the register is the location field. Identifying the location is very important for physical assets because auditors need to know where the asset is accessible. Social software assets however are usually stored on servers where the location of the server itself is not as important as for physical assets. However, especially for privacy and emergency issues organizations can benefit from knowing the exact location of the server. In the case study the location of the server is easy to identify because IBM Connections is hosted at the university.

In the people section several challenges have to be conquered by employees completing the register because of the nature of enterprise social software. For physical assets it may be easy to identify who originally created the asset. Since enterprise social software is based on the principles of participation and information sharing identifying the authors can be very difficult for two reasons. First the number of creators of an asset can be very high especially for collaborative tools like wikis. Furthermore especially for web resources it can be impossible to identify the creator because he is unknown. The owner category is influenced by the same problem: identifying an owner for an asset where the original creator is not traceable is sometimes not possible and is also causing problems relating to copyright issues. In the case study the author is confronted with the same problem. The wiki on the platform is created by the whole research group. Therefore it is hard to list every creator of the wiki especially because of members joining and leaving the research group. Identifying the information users is also difficult because of their sheer amount. The principle of openness which is basic for Web 2.0 allows every person who has access to the platform to use it. However looking at enterprise social software the number of

users is limited to the employees of the company. In the case study the users are the registered members of the IBM Connections platform. Despite it is important for auditors for further analysis to identify the main information users and not only the people who can access the asset. Identifying those requires further effort like surveys or interviews which are not part of the case study.

Category	Problem Description
Location	Social content is hosted on servers. The actual geographical location is less important for the employees for working with the asset. However the physical location is important for legal reasons and in emergency situations because knowing the location is critical for identifying the applicable law and undertaking the appropriate measures.
Creator and Owner	The number of creators and owners is significantly higher compared to classical assets. This can lead to problems in identifying and/or tracing the every creator and owner.
Users	The number of possible users is significantly higher compared to classical resource because of the open access principle of ESS. It also can be a comprehensive task to identify every information user because of their numerousness.
Costs and Value	Defining the costs and value for social software assets is a very complex and comprehensive task. Determining the exact financial value or the maintenance costs of an asset is not possible for every social software asset.
Business Tasks	Some types of social software assets e.g. cannot be explicitly assigned to specific business task because they only provide additional information for the employees and are not integrated into any task
Risks	Information risk analysis is an own, very complex research field. Determining the impact and costs of losing an asset is a complex task.
Input and Output	The input and output category are based on a classical view on resources. For many social assets it is not applicable or hard to determine because of the sheer amount of inputs.
Access	Access is a problematic for ESS because ESS is based on the idea of open access. However the IT security professional and the management is interested in limiting the access to only trustworthy users
Integrity/Trust	Integrity is difficult topic because rating integrity of information with a scale is impractical. The numerousness of sources of social assets impedes the task.
Source	Identifying the sources is difficult because of their numerousness. Web sources can be hard to trace or not identifiable.
Relevant Law	Identifying the applicable law can be very difficult because there may not be an applicable law for social software assets or the identification of the law needs additional juristic expertise
Security Measures	Security measures and usability which is a core feature of ESS are an area of conflict because comprehensive security measures limit the usability.
Status	Social assets are based on active participation. It has to be decided if inactive assets have to stay in the register.
Disposal Requirements	Social software is lacking of important archive and disposing functionality. Records management procedures for social software assets are not fully developed.
Technical Dependencies	Technical dependencies are a comprehensive topic in ESS. It has to be decided by the auditors which level detail they want to apply.
Content and Format	The number of content and format types for ESS is very high. Gathering detailed information about every content type can be difficult.

Figure 4.9: Social Software Issues

The management section requires the most effort to complete the fields because the complexity of the attributes is the most advanced of the whole register. Especially the cost and value category are hard to identify and define. In the case study the exact costs and value of both assets are not calculable because measuring the cost of setting up and maintaining a blog or a wiki is very hard to measure. Therefore completing these fields would require further research on information valuing and in accounting if auditors want to fill these fields. However valuing enterprise social software assets is unexplored territory. Identifying the business tasks and processes which require the use of the social software assets is a very important task because it is an indicator of the asset's importance for the organization. However in the case study it is difficult to relate the assets to business tasks because the research group is not a common company with classic business tasks like selling products or buying raw materials. Despite there is evidence for tasks which are supported by the research group's wiki which contains tutorials or annual reports. The blog on the other hand does not offer information which is clearly assignable to a specific task. It only includes additional and not required information for the members of the research group. The next category deals with the risk analysis of the asset. Information risk analysis is an separate area of research and therefore the asset register covers only a small part of the whole area because conducting a comprehensive risk analysis would be too time-consuming since it requires a lot of effort e.g. for surveys and interviews. The risk topic is divided into four different aspects. The case study only touches each aspect lightly and does not gather every risk from or to the asset. Calculating the costs the occurrence of each risk could cause is not feasible for the same reasons as already outlined in the cost and value section. The last two categories which are causing problems in completion are input and output. Defining input and output streams is adopted from a classical view on resources like machines who convert raw materials into products. This view however is not applicable for social software assets. The identification of an output for a blog or a wiki is nearly impossible because they don't contribute directly to a product or a service which is sold by an organization. Their contribution is indirect because they assist the employees through the production process. The inputs of the asset are easier to identify. However they are also varying from the classical assets because the inputs are not converted. The main goal of social software is gathering the different inputs, combining them and thereby making them more usable for potential information users. In the case study the main inputs of both blog and wiki are other web resources which are taken to create new information resources. In the output section of the blog field the comments for each blog entry are recorded because the discussion about a topic between the employees can be seen as an output since they probably create new insights.

In the compliance section the integrity field causes problems for auditors because as already outlined in the previous chapter about formatting the information it is hard to rate integrity on a scale. However the assets used for the case study are both internal information assets which are only created by

members of the research group. Therefore the trust level of the assets can be rated as high. However the evaluation is a complex task if the asset combines multiple external resources which do not have the same trust level. The source category is closely related to the inputs already recorded in the management section. However it is still an important category for auditors because it provides a full overview of where the organization is obtaining their information from. Understanding where the information is obtained from can be a first step to preserving these resources and fostering their exploitation. The case study however shows that gathering the sources can be a confusing task because the number of sources is very high. Therefore auditors have to come up with an idea to assess the sources by their importance. Gathering and identifying the relevant law for the social software asset can also be very difficult. On the one hand there may not be any industrial or commercial law in place for social software assets. On the other hands identifying the applicable law may require additional juristic expertise. The last category mentioned in this paragraph is security measures. The platform used for the case study is a closed environment and only allows registered users to access the assets. Furthermore IBM Connections allows restricting the assets to a specific user group. Security measures for enterprise social software however is a complex field which is not discussed in this thesis to its full extent. The auditors have to be aware that increasing the protection level by introducing new security measures decreases the usability, which is a core aspect of social software, in most cases.

The next area is dealing with life-cycle information about the assets. This section did not cause any problems during the conducting of the case study because it mainly requires simple types of information like dates which are easily identifiable. The status however is a field which is not useful in the case study. The IBM Connections platform is supporting the members of the research group in their daily work and therefore the active use of the assets is indispensable. Furthermore the status is also related to the disposal requirements in an adjacent field. If a platform is shut down and replaced by a new system, it is very important for the organization especially from a records management perspective to decide how to proceed with the inactive assets on the legacy system. Archiving and meeting legal requirements in the area of eDiscovery are both topics which are neglected by information practitioners. Therefore the assets in the case study are also lacking of advice on how to correctly dispose the information after its retention period or how to archive it. For that reason the asset register is a starting point for overcoming this problem and thinking about implementing records management procedures in the system or encourage the manufacturer of the system to include this functionality.

The technological requirements section is also easy to understand and complete for the auditors because the scope for each field is very narrow. The only category which is unspecific is the field recording the technical dependencies. In the case study the author decided to focus on direct dependencies namely the software which is required to access the asset. However thinking about broader scope au-

ditors could also line out hardware dependencies or software working at the backend like database applications or operating systems. If the auditors want to map the organization's information technology infrastructure, the second approach would be recommendable.

The final section of the register focuses on properties of the data itself meaning what types of information the asset contains. The first category records the different types of content stored in the asset like videos, messages etc. The case study shows that this is a comprehensive undertaking because in comparison to classical information assets the variety of content types increases strongly. Recording the different types of content is a starting point for effective and efficient information management. To improve information management dealing with the different formats of information is also very important. The case study shows that the information is basically formatted in HTML. However the textual information is easily convertible to commonly known formats like DOC. Establishing standardized formats for every asset and information type is also a basis for implementation of effective content management systems. Therefore recording the formats in the register can initiate a thinking process about establishing these formats.

4.3 Developing a Metadata Template for Enterprise Social Software

This section takes the information asset registers introduced in the previous sections as a basis for developing a metadata template (see figure 4.12) which can be used by employees setting up a new work space on an enterprise social software platform. The aim of the template is to make the work spaces comparable to each other and to provide them with meaningful metadata. Comprehensively described assets can be a major benefit for organizations because e.g. clear responsibilities are assigned for each asset and not only the structure of the work spaces is increased but also the searchability for the metadata attributes. In this case the focus of the metadata template is on communities in IBM Connections. Introducing and defining comprehensive and meaningful metadata cannot only be beneficial for communities. Concrete elements of the communities like blogs or wikis should also be assigned with meaningful metadata. The scope of this research is limited to IBM Connections communities. Providing social software components with appropriate metadata templates leaves space for future research.

The following template is adjusted to the requirements of IBM Connections. It provides the users with additional metadata for setting up a new community on the platform. At the moment the platform only provides rudimentary metadata as displayed in figure 4.10. The users creating the community are only forced to assign a name and the access level from public to private. Furthermore they can add tags, a description and add members to the community which are registered on the platform. To pro-

vide organizations with additional guidance on which metadata is indispensable for setting up new communities the attributes are divided into mandatory and optional attributes (see figure 4.11).

The respective organization can decide if they want to implement the optional attributes in their system depending on their suitability with their requirements. Furthermore the attributes creation date and creator of the community are already automatically recorded by the system without any further implementation required. The identification number should also be automatically assigned by the system to guarantee a consistent format. IBM Connections already includes the name as a mandatory attribute for identifying the community and optionally an additional textual description which can be added by the creator.

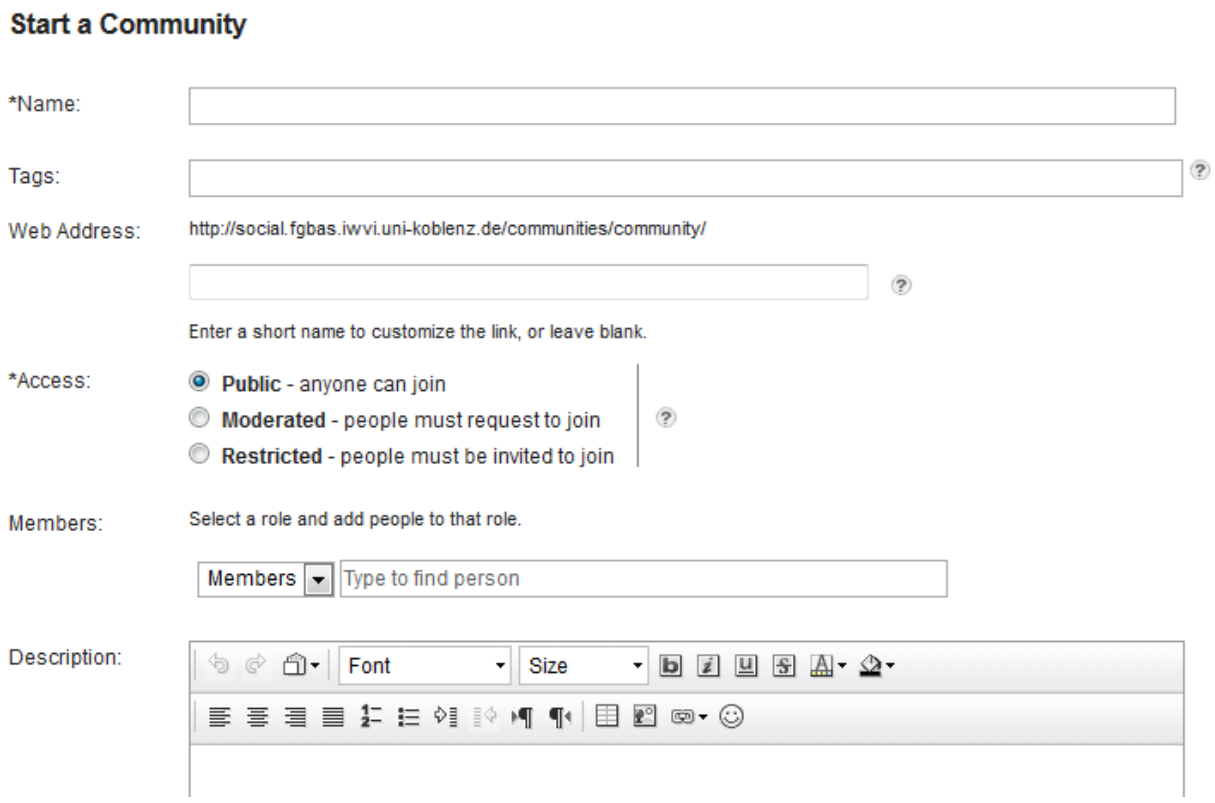

Figure 4.10: Setting up a Community on IBM Connections

Automatically assigned by the system	
Mandatory attributes	
Optional attributes	

Figure 4.11: Legend for the Metadata Template

The organizational unit and the location are both optional attributes which can be implemented by the organization if they profit from the additional information e.g. because the organization is really huge

and consists of several organizational units or the organization stores business critical information in the community which has to be protected against potential emergencies.

Attribute	Description	Topic
Identification Number	A clear numeric identification of the community which is usable as a key attribute	GENERAL INFORMATION
Name	A clear and unique name for identifying the community	
Description	A definition of what purpose and objectives of the community are in a brief description	
Organizational Unit	The name of the department(s) in the organizational hierarchy to which the community is assigned to	
Location	The geographical location of the hardware on which the community is hosted	
Manager	The name and role of the employee responsible and accountable for managing the community	PEOPLE
Creator	The name and role of the employee who originally created the community	
Owner	The person or institution owning the information in the community and who is legally responsible for the information	
Custodian	The name and role of the person for obtaining authorative information and responsible for technical support	
Update Responsibility	The name of the employee responsible for updating/checking the community and its metadata	
Access	Which departments/groups of people can access the community?	COMPLIANCE
Confidentiality	Which protection requirements are assigned to the community?	
Sensitivity	Does the community contain any types of personal data or sensitive data, which has to be protected?	
Security Measures	Are there any kinds of security measures which have to be additionally implemented for the community?	
Creation Date	When was the community originally created?	LIFE-CYCLE
Update Date	When was the community metadata updated for the last time?	
Disposal	A fixed disposal date for deleting or archiving the community or a timeframe depending on the last update defining how long it has to be kept (retention period)	
Review Cycle	Fixed period of time, when the community and its metadata has to be checked for changes	

Figure 4.12: Metadata Template

The people area forces the creator of the community to assign clear responsibilities for the community in several areas. The creator is automatically recorded by the system. However it is also mandatory to assign clear management responsibilities to an employee who is accountable for the community and its content. If it is possible to determine who owns the information which is going to be stored in the

community, the creator has to define the owner attribute. The organization can profit from this information because it identifies the legal owner who is relevant for copyright issues. Besides the mandatory attributes custodian and update responsibility have to be assigned to the community.Both the main technical contact person and the employee responsible for checking the community metadata for timeliness are indispensable information for the organization because they guarantee the usability and effectiveness of community and the employees working with it.

In the compliance section IBM Connections already constraints the creator to assign access restrictions to the community which correlate with the confidentiality criteria. However it is recommended to assign the confidentiality attribute to each community because it is important to protect the information stored in the community according to its business criticality. Furthermore the creator could also determine if the community will contain any privacy sensitive data e.g. when the community is used by the human resource department. This metadata will help in avoiding potential lawsuits because of privacy violation. The last optional attribute in this section is the security measures which records any additional precautions the creator wants to have implemented. In IBM Connections the system does not offer any further security measures. However, the IT department can add additional protection if it is required by the organization.

The last section deals with life-cycle attributes of the communities. The first attribute, the creation date, is automatically recorded by the system when the creator opens a new community. The update date on the other hand is an attribute which is not already recorded in IBM Connections. The platform only records the date when the data stored in the community was updated for the last time. The date when the metadata was checked for timeliness is not captured by the system. However it is important information for managers to know if they can still rely on the metadata. The metadata in this case does not only include information automatically captured by the system but also information like the custodian who has to be assigned by the manager. The disposal date is an optional attribute which can be defined by the creator of the community e.g. if the community is used for a specific project which covers a fixed timeframe. Knowing when the community can be deleted saves disk space and increases clarity on the platform. The last life-cycle attribute recorded is the review cycle which is a mandatory attribute because proofing that the metadata is up-to-date is elementary information for managers and the IT departments especially when they are planning the implementation of changes to the community. Therefore IBM Connections should automatically alarm the responsible custodian to check the community repeatedly over a fixed period of time. The review cycle and the update date are connected attributes which should be automatically related by the system. The next review date should always refer to the update date and the review cycle.

5 Summary and Outlook

The following chapter first summarizes the findings of the literature analysis and continues by taking the research questions as a basis for outlining the results of the main section. Secondly it provides an outlook on the future implications of this research by outlining future developments and changes in Enterprise 2.0 and their consequences for information auditing.

5.1 Summary

At the beginning of this thesis the terms Information Audit and Enterprise 2.0 have been defined. The first finding is that the Information Audit is lacking of a general and standardized definition (Buchanan & Gibb, 2007, p. 161). Information auditing however is such a diversified topic that the lack of a general definition does not pose a threat for information practitioners because the audit has to be adjusted to the needs of the specific organization in which it should be undertaken. Furthermore the benefits of information auditing are gathered in a spreadsheet and grouped by their range of influence. The broad spectrum of benefits shows the diversity of information auditing and is an encouragement for managers to undertake the audit because they can look at the multiple areas of improvement and understand how they can include information resources in their corporate strategy. On the other hand challenges are also outlined. The challenges are as numerous as the benefits of the audit because of the general complexity of the audit. However identifying the challenges provides a good starting point for auditors to arrange appropriate measures beforehand. The key challenge for information auditors however is to include the people in the process because the managers as well as the employees are the crucial factor and getting their support during the whole process is indispensable.

The definition of Enterprise 2.0 states its main features referring to McAfee. Focusing on Enterprise 2.0 a summary of the main challenges is also provided because organizations have to carefully think about the potential threats of implementing social software tools. These challenges are also of interest for auditors dealing with those tools during the audit process. Similar to the audit including the users in the software and fostering their participation is the key success factor of social software. Furthermore problems like information overload, privacy or IT security are identified as major threats.

The information audit is not a fully accepted information management tool (Steven Buchanan & Gibb, 2007). The research on information asset registers reveals that several branches are already using information asset registers. However, these companies are not fully exploiting the opportunities of the asset register by taking it as a starting point for improving information management. Therefore this research combines these different views from the branches already using asset registers and takes it as basis for developing a register for enterprise social software. It is also taken into consideration how

the specific requirements of enterprise social software can be included in the register. Furthermore the register is analyzed and condensed for creating a metadata template which can be directly implemented into social software to provide assets with meaningful metadata. The condensation is necessary because applying all attributes from the register to the template would be too much effort on the one hand. On the other hand it would not be suitable for several categories because their primary focus is not social software. The process described in this paragraph is guided by the research questions which are outlined and answered in the following section.

5.2 Answering the Research Questions

RQ1: Which information audit methodologies exist, what elements do they contain and how do they differ?

RQ2: How is the step of information capturing defined in each of these methodologies?

RQ3: Which types of information asset registers (IAR) are used in companies or other institutions?

RQ4: What are the requirements for information capture and an information asset register for enterprise social software (ESS)?

RQ5: How well do existing methods of information capture meet the requirements of enterprise social software?

RQ1: The whole thesis is guided by the research questions. Therefore the main section of this thesis (chapter 3 and 4) begins with analyzing and describing three exemplary and generally accepted information audit methodologies and compares them to each other. This analysis increases the understanding of the core elements and difference of the methodology. The main finding is that the core of each methodology is similar. Burk and Horton's InfoMap which is the oldest methodology is used as a template by the other authors. Therefore the four core steps of InfoMap remain the same in the other two methodologies. However they are developed further by adding stages at the beginning and the end and the four core steps are defined in more detail.

RQ2: Furthermore the role of information capturing which is the main focus of this thesis is analyzed in more depth by taking a closer look on the information capturing stages of each methodology. The main finding of that analysis is that InfoMap is the most comprehensive methodology in the area of information capturing because it provides the auditors with a handful of methods building on each other and these methods are also well documented. Buchanan and Gibb only suggest methods which could be used for information capturing but do not explain them like Burk and Horton do comprehensively. Henczel however introduces a new perspective to information capturing by providing methods

for relating the information resources with business objectives or business tasks which is a missing area in InfoMap.

RQ3: The following section focuses more closely on information capturing by looking at information asset registers. To introduce the area of information asset management information assets and their management are defined. The main finding is that the difference between information assets and information resources is negligible and the terms are partially used synonymously. The next section deals with the comparison of practical examples for asset registers. Therefore the identified asset register templates are firstly described and then compared by their main attributes. The main outcome of that comparison is that the templates vary widely mainly because of their different view on information management. The TAHO template occupies a records management perspective on information assets and was developed by a public authority. Whereas InfoMap is focusing on private companies and does not take a specific perspective. The ISO27000 template however is occupying an information security perspective which strongly differs from the records management perspective. These different perspective lead too many verifying attributes used to classify information assets in a spreadsheet. The varying perspectives however are a major advantage for the following research step because the development process is an opportunity to integrate these different perspectives.

RQ4: The development process is initiated by gathering the categories identified previously under seven generic terms and providing each of them with a general description and a suggestion for a format which is important to support the register with database functionality. Furthermore the categories are prioritized with the MoSCoW classification scheme to provide auditors with a first idea on which attributes are indispensable and whose application depends on the respective organization. The thesis is finished with a case study applying the asset register at the Information Systems Research Group's social software system. In this chapter the relation between the register and Enterprise 2.0 is established for the first time. Referring to the research questions no specific requirements for information asset registers applied to enterprise social software are identified by the author. The scope of the asset register chosen as a basis for the development of the new template is so widespread that adjustments caused by Enterprise 2.0 are minor. The new categories "Usage Model" and "License Model" are introduced which are derived of the business software background. Furthermore a category for recording the software system in use is implemented. The storage medium which is a main attribute for classical resources however is left out for obvious reason because it is stored on hard disk for every social software asset. The core elements in the seven areas of the register however stay the same because the difference between "older" and social software assets are negligible for the asset register.

RQ5: The case study however reveals several problems during completion of the asset register with two exemplary social assets. The findings of the case study indicate that the existing methods do not

fully meet the requirements of social software because some categories which are important for evaluating the assets are hard to complete without any further research, which could include the development of new rating scales or creating methods for visualization. An example for this problem is the user category. While physical assets in most cases have one or a small number of users social assets like wikis are accessible for the whole organization. Recording the whole amount of users can be a very time-consuming task or even impossible.

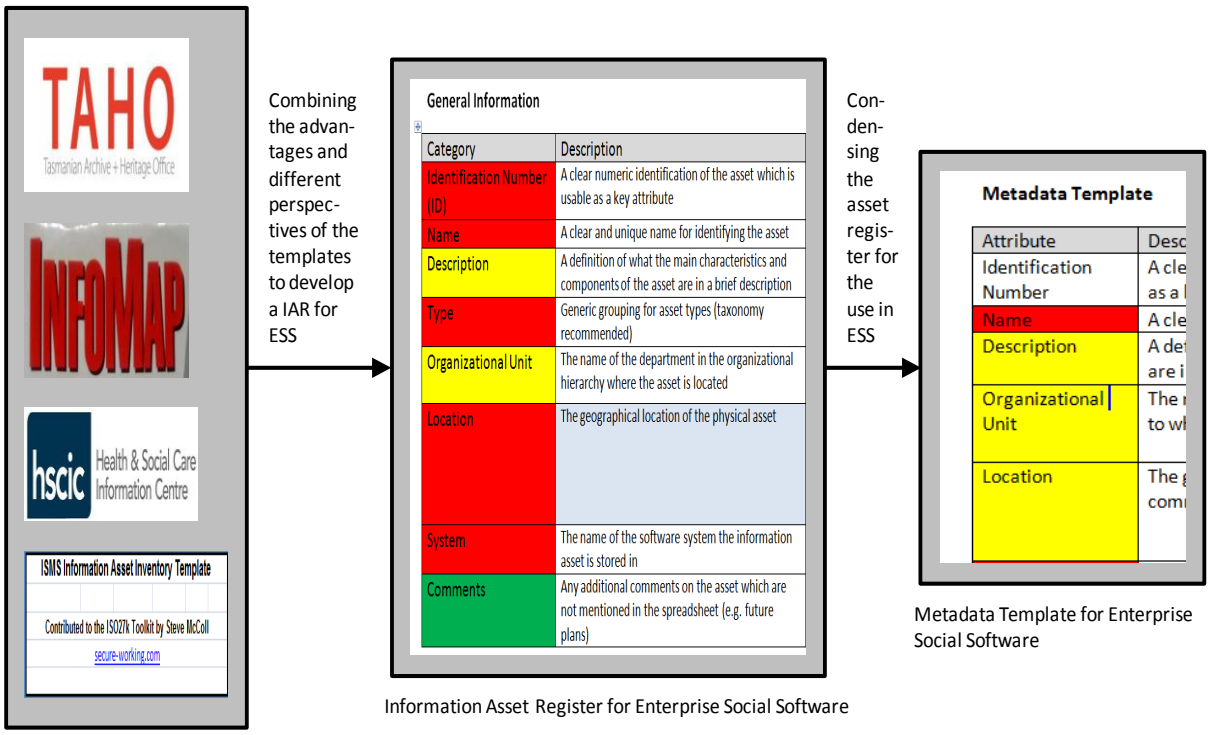

Figure 5.1: The Development of the Metadata Template (Burk & Horton, 1988; HSCIC, n.d.; Latham, 2013; McColl, 2012)

The research is rounded up with the development of a metadata template for creating new work spaces in enterprise social software. Figure 5.1 displays the development process of the metadata template. It begins with the creation of the comprehensive information asset register before condensing this register to develop a template appropriate for providing social software work spaces with meaningful metadata. The template improves the comparability of work spaces among each other and is useful guidance for information managers revising the assets because they are already specified with the appropriate metadata.

5.3 Outlook

Auditing information created and stored in enterprise social software will become a topic of increasing importance for information practitioners as well as researchers. Several future developments will facil-

itate the decision of organizations on undertaking an information audit. The growing information volumes (see figure 1.1) will affect companies and also lead to a growth in the area of unmanaged content which is already a major challenge for information managers (see figure 2.10). Many organizations are already using enterprise social software tools as the EIM survey reveals (Williams et al., 2013) and additionally they are planning on upgrading old or acquiring new information systems (see figure 5.2). These plans are going to increase not only the volume of information but also the number of assets. To provide an overview of these assets gathering them in an asset register is a starting point for applying information management measures. The asset register developed in this thesis is a basic template for organizations. However it requires further review and revision in the future to adapt to new developments in the area of social software. The future research does not refer to developing a new register because the register in this thesis is already extensive. Providing each field with appropriate data and developing methods for that is a major task for the future. It can be stated that this thesis provides several links for further research. Not only in the area of information asset register development but also information risk analysis and information valuing are research topics which require further research. Especially connecting these topics with the new influences and requirements of enterprise social software is a mostly unexplored territory.

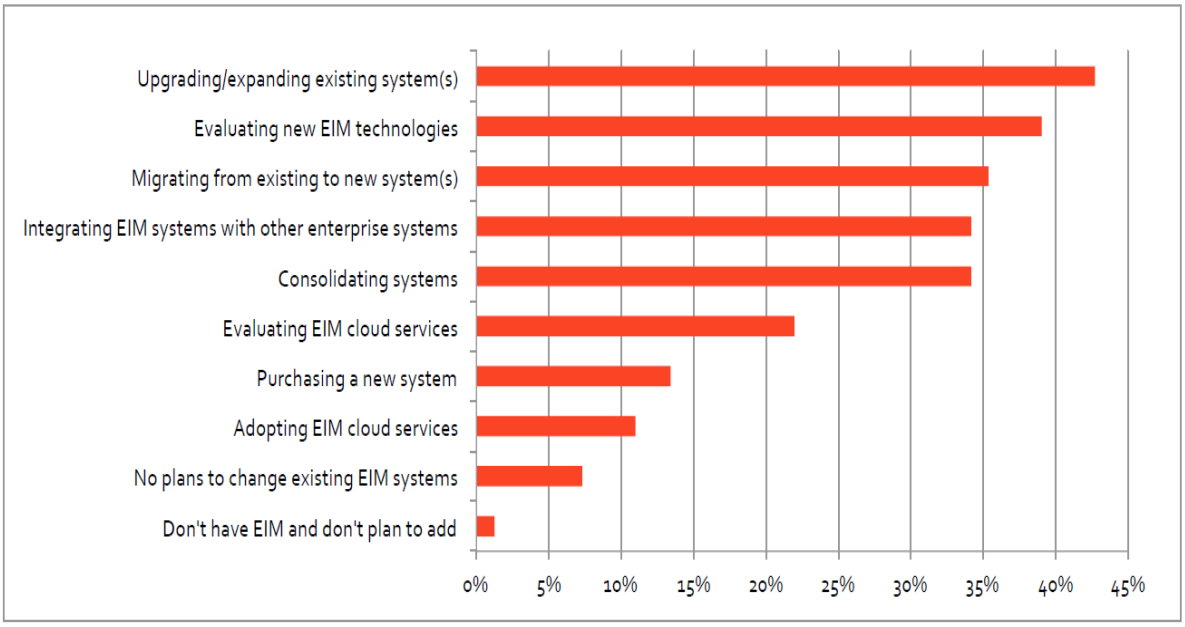

Figure 5.2: Future Plans for EIM Technologies (Williams et al., 2013, p. 17)

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Appendix

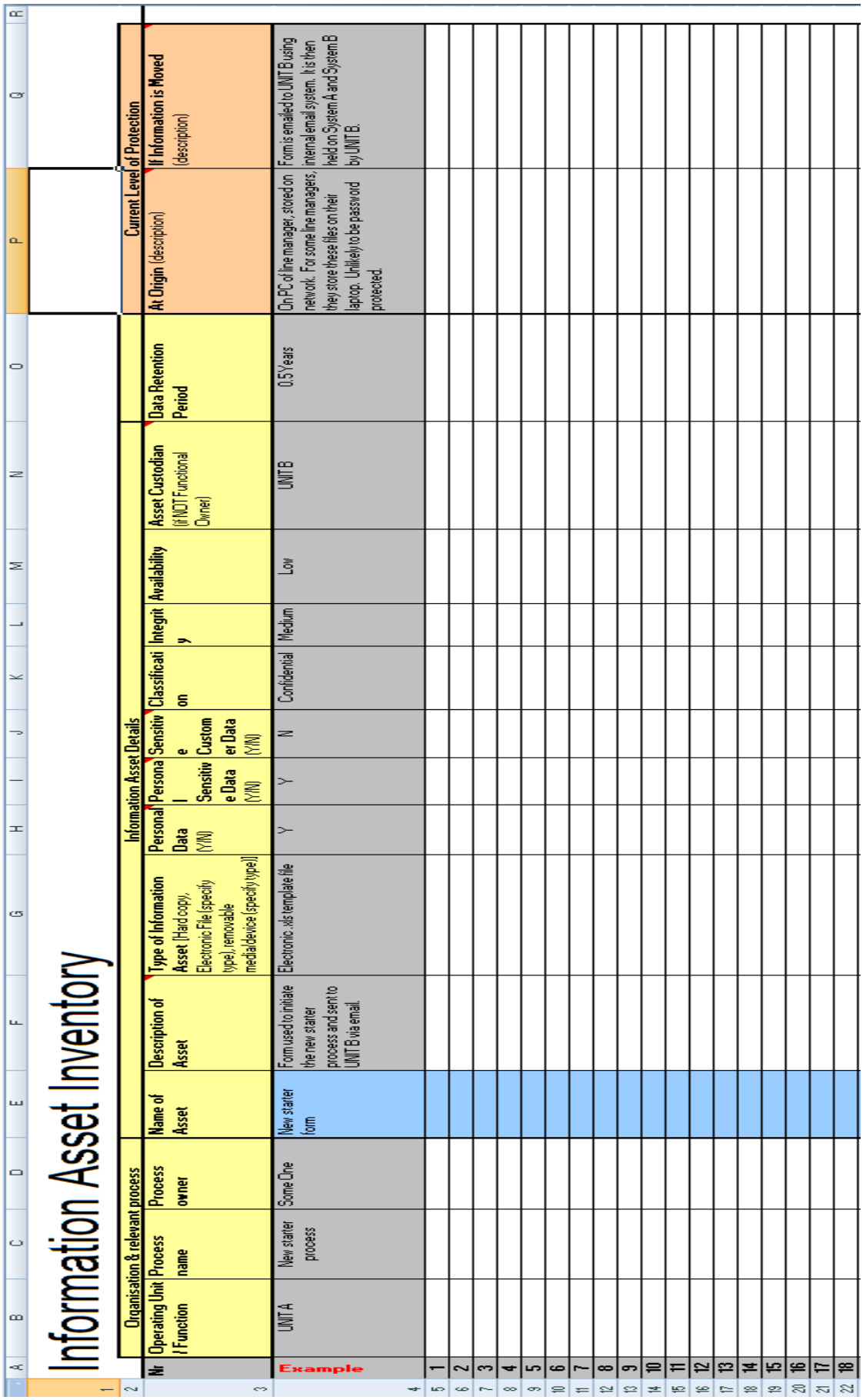
Information Asset Register (IAR)	
Asset information	
Asset name	A simple way to identify the asset.
Description	Brief description of what the asset is. Detail on what the components of the asset are.
Asset status	Is this asset being actively updated? Has the asset been closed, what date was it closed?
Personal data	Does the asset contain information which will fall under The Personal Information Protection Act?
Sensitivity	Is the asset protectively marked?
Creation	Original creation date of asset, or date it was transferred into the organisation. Who created it, or who was it transferred from?
Date IAR reviewed	The date this entry on the IAR was last reviewed or updated.
People	
IAO	Who is the Information Asset Owner?
Users	Who are the departments and third parties who use or access the asset?
Management	
Business risk	Risks to the business FROM the asset? What would be the business impact of losing the asset? What would be the cost of replacing the information?
Business value	What is the value of the asset to the business, both the financial value and the use it delivers to the business?
Risk to the asset	What are the risks to the asset?
Retention period	The period it needs to be kept for and why.
Disposal requirements	How must the asset be disposed of?
Usability requirements	
Find	How will you **find** the information? The granularity and depth of the search required will depend on the type of asset; it may involve finding the asset itself, searching within the asset for files, or searching within those files to find specific pieces of data.
Access	Who can access the information and how? These requirements cover not only the security issues around people gaining access to restricted or private information, but also the opportunities for sharing information internally and more widely.

Appendix 1: TAHO Information Asset Register Template Part 1

Work with	What do you need to be able to **do** with the information? This is where you define the functionality that you require from your information assets, how you use them and what you need them to do. This area may overlap with the access requirements in that there may be different groups of users who need to access the assets in different ways.
Understand	What do you need to be able to **understand** about the information? This is about understanding the content and context of your information asset. This additional information is not necessarily included within the asset itself but is vital to making the asset usable. The information may be stored digitally as metadata, but it may also be specific knowledge held by individuals, which may involve training or handover procedures if staff change.
Trust	To what extent do you need to **trust** your information is what it claims to be? The level of trust required of an asset will vary considerably. The majority of your assets may well not require any additional validation – they speak for themselves. However for others you may have to prove they have not been tampered with, or to certify them as created on a specific date.
Technology requirements (optional - you can use your IAR to record technology dependencies if this information is not held elsewhere)	
Find	How will you enable people to **find** the information in the way you need it? This is both about the technology actually used to search for information and also the technology that is used to store the information.
Access	What technologies, configurations and management processes need to be in place to meet the **access** requirements.
Work with	What hardware and software is required to be able to **work with** the information?
Understand	What technology do you need to provide the 'context' you need to **understand** it, i.e. to be able to record the required metadata?
Trust	What technology is needed to protect the information and to deliver the proof that is required (so that you can **trust** the information is what it claims to be)?

This Information Asset Register (IAR) template was developed by the National Archives of the UK.

Appendix 2: TAHO Information Asset Register Template Part 2



Information Asset Inventory

	Organisation & relevant process			Information Asset Details										Current Level of Protection	
Nr	Operating Unit / Function	Process name	Process owner	Name of Asset	Description of Asset	Type of Information Asset (Hard copy, Electronic File (specify type), removable media/device (specify type))	Personal Data (Y/N)	Personal Sensitive Data (Y/N)	Sensitive Customer Data (Y/N)	Classification	Integrity	Availability	Asset Custodian (if NOT Functional Owner)	Data Retention Period	At Origin (description)	If Information is Moved (description)
Example	UNIT A	New starter process	Some One	New starter form	Form used to initiate the new starter process and sent to UNIT B via email.	Electronic .xls template file	Y	Y	N	Confidential	Medium	Low	UNIT B	0.5 Years	On PC of line manager, stored on network. For some line managers, they store these files on their laptop. Unlikely to be password protected.	Form is emailed to UNIT B using internal email system. It is then held on System A and System B by UNIT B.
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Appendix 3: ISO 27000 Information Asset Register Template

	A	B	C	D	E	F	G
1	**Inventory of PRACTICE held Information Assets**						
2							
3	**Date**	**Information owner / Data controller**	**Information type**	**Protective Classification**	**Systems where processed**	**Location**	**NHS IG security requirements**
4							
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Appendix 4: HSCIC Information Asset Register Template

	A	B	C	D	E	F	G	H	I
1	General Groupings	General Information							
2	Categorization	Idenfication Number (ID)	Name	Description	Type	Organizational Unit	Location	System	Comments
3	Blog	#00001	Petra Schubert's blog	A blog where Petra Schubert shares and exchanges information about different topics concerning the research of the FG BAS	Blog	FG BAS	Germany/Coblence/Universitätsstraße 1/University of Coblence	IBM Connections	The blog is accessible via Petra Schubert's user profile on KoConnect
4	Wiki	#00002	Wiki der FGBAS	The wiki collects knowledge and important administrative as well as research data for the members of the research group. It contains reports, tutorials, guidelines, lists etc.	Wiki	FG BAS	Germany/Coblence/Universitätsstraße 1/University of Coblence	IBM Connections	The wiki is accesible via the FGBAS community on KoConnect

Appendix 5: Case Study Part 1

	I	J	K	L	M	N	O
1	General Groupings	People					
2	Categorization	Manager	Creator	Owner	Custodian	Update Responsiblity	Users
3	Blog	Petra Schubert/Head of Research Group/Germany/Coblence/Universitätsstraße 1/University of Coblence/Building A/Room 123/schubert@uni-koblenz.de/+49 261 287-2525	Same as manager	Same as manager	Söhnke Grams/Research assistant/Germany/Coblence/Universitätsstraße 1/University of Coblence/Building A/Room 108/grams@uni-koblenz.de/+49 261 287 2549	Same as custodian	All members of the KoConnect platform, especially the members of the FG BAS
4	Wiki	Petra Schubert/Head of Research Group/Germany/Coblence/Universitätsstraße 1/University of Coblence/Building A/Room 123/schubert@uni-koblenz.de/+49 261 287-2525	The wiki is created by all members of the FG BAS community.	Same as manager	Söhnke Grams/Research assistant/Germany/Coblence/Universitätsstraße 1/University of Coblence/Building A/Room 108/grams@uni-koblenz.de/+49 261 287 2549	Same as custodian	All members of the FG BAS

Appendix 6: Case Study Part 2

	O	P	Q	R	S	T	U	V
1	General Groupings	Management						
2	Categorization	Costs	Value	Task supported	Risks	Input	Output	Relationships
3	Blog	not calculable	not calculable	?	**From:** Sharing sensitive or misleading information **To:** User error/Server shutdown **Impact:** Loss of the blogposts can hinder the users from obtaining critical information for their work **Costs:** not calculable	Web resources(links/articles/videos)	Comments on blogposts	FG BAS community blog
4	Wiki	not calculable	not calculable	> writing and storing the annual report > tutorials for new members of the research group > organizing and recording the working hours of the student assistants	**From:** Sharing sensitive or misleading information **To:** User error/Server shutdown **Impact:** Loss of the wiki entries can hinder the users from obtaining critical information for their work **Costs:** not calculable	Most of the inputs are created by the members of the research group themselves. The wiki also includes web resources like Emails, hyperlinks, etc.	None	None

Appendix 7: Case Study Part 3

	V	W	X	Y	Z	AA	AB	AC
1	General Groupings	Compliance						
2	Categorization	Access	Confidentiality	Integrity/Trust	Source	Sensitivity	Relevant Law	Security Measures
3	Blog	All members of the KoConnect platform / The members have to be registered on the platform to access it via browser or app	Business use only	High	Petra Schubert	No personal data	BDSG, TMG, UrhG	The access to the blog requires registration on the KoConnect platform
4	Wiki	Members of the FG BAS community	Business use only	High	Members of the FG BAS	Personal data	BDSG, TMG, UrhG	The access to the wiki requires registration on the KoConnect platform and an invitation to the FG BAS community

Appendix 8: Cast Study Part 4

	AC	AD	AE	AF	AG	AH	AI
1	General Groupings	life-cycle					
2	Categorization	Creation Date	Update Date	Disposal Date	Review Cycle	Status	Disposal Requirements
3	Blog	22.05.2012	03.03.2015	n.d.	6 month / 03.09.2015	Active	none
4	Wiki	03.04.2012	13.03.2015	n.d.	6 month / 13.09.2015	Active	Personal data has to be deleted according to privacy legislation

Appendix 9: Case Study Part 5

	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
1	General Groupings	Technological Requirements					Properties of the Data itself			
2	Categorization	Availability	Usage Model	License Model	Technical Dependencies	Manufacturer / Provider	Content	Format	Structure	Search / Find
3	Blog	medium	On Premise	Named User	Browser or IBM Connections App / Server on which IBM Connections is hosted	IBM Deutschland GmbH/IBM-Allee 1/Ehningen/Germany/hal loibm@de.ibm.com/+49 800 225 5426	The blogposts contain mainly textual information and links to other web resources(articles,videos,etc.)	HTML	high	Yes / The blog is searchable via the integrated search engine in IBM Connections
4	Wiki	medium	On Premise	Named User	Browser or IBM Connections App / Server on which IBM Connections is hosted	IBM Deutschland GmbH/IBM-Allee 1/Ehningen/Germany/hal loibm@de.ibm.com/+49 800 225 5426	The wiki entries contain mainly textual information and tables as well as links to other web resources	HTML	high	Yes / The blog is searchable via the integrated search engine in IBM Connections

Appendix 10: Case Study Part 6

	AN	AO	AP	AQ	AR
1	General Groupings	Properties of the Data itself			
2	Categorization	Content	Format	Structure	Search / Find
3	Blog	The blogposts contain mainly textual information and links to other web resources(articles,videos,etc.)	HTML	high	Yes / The blog is searchable via the integrated search engine in IBM Connections
4	Wiki	The wiki entries contain mainly textual information and tables as well as links to other web resources	HTML	high	Yes / The blog is searchable via the integrated search engine in IBM Connections

Appendix 11: Case Study Part 7