Abstract. Modern enterprise reporting portals commonly address the information needs of top management executives. With the advent of pervasive Business Intelligence systems other, larger, groups of users are moving into the focus of system designers. Along with them specific design requirements surface – transforming design considerations of prior efforts targeting management reporting needs. Owing to vast and heterogeneous target audiences, new breeds of enterprise reporting portals become necessary. As a core feature they need to provide effective and therefore usable means for bottom-up content personalisation, commonly referred to as Web 2.0 functionality.

This paper provides a research agenda using insights from research in Social Software to improve effectiveness and efficiency of collaborative enterprise reporting. It offers a comprehensive view on recent developments fostering collaboration between report users and report designers. We present two preliminary artefacts: a proposal for a concept for self-organising enterprise reporting portals and a design prototype implementing the concept.

Keywords. Enterprise Reporting, Business Intelligence, Social Networking, Reporting Portals, Collaboration, Social Software, Web 2.0, Enterprise 2.0

1. Introduction

Over the last couple of years design research in Business Intelligence (BI) has typically focused on the creation and improvement of technologies for the preparation, analysis, filtering and categorisation of existing data, strategies for data (quality) management or storage concepts and algorithms for vast amounts of data.

Due to larger user bases the challenges for IT departments to satisfy the individual informational needs of large heterogeneous user groups increase. Centralised control and content provisioning might not be the best strategy to solve this issue.

The major purpose of Social Software is the utilisation and stimulation of what is called the wisdom of crowds [18]. We argue that this concept should be applied to improve enterprise reporting portals as the proliferation of information and the participation in decision-making increases throughout enterprises. This is a fascinating field for further research. Our paper aims at the description of possible connections between the two disciplines in order to provide an agenda for future work. To demonstrate the technological feasibility of our approach we provide a prototype based on Social (Networking) Software, utilising the concepts of social tagging and recommendation.

After presenting related work we begin by describing the state-of-the-art in enterprise reporting portals before we introduce the concept of Social Software. Next we propose a blue print for the design structure of enterprise reporting portals. We conclude by carefully considering the derived insights in the face of practical implications imposed by our concept for the application of Social Software techniques within the reporting domain.

2. Related Work

Recent approaches from the field of Social Software have become increasingly popular within BI design research. Most publications emphasise the potential of using collaborative technologies for joint analysis ([2], [10], [9]) or the usage of corresponding information systems as data sources for reporting applications [8].

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The problem of overwhelming numbers of reports in organisations was discussed by Bevanda and Pavletic [4]. They suggest concept maps as a tool for reporting portal development. There is research covering Social Software in respect of Web 2.0 as a new way to deliver reporting content. It focuses mostly on the use of the Web 2.0 paradigm of mashups as a new architectural framework for BI [3].

3. Common Limitations of Current Business Intelligence Portals

The common approach of BI portals reveals several limitations: on the one hand, there is still widespread propagation of sequential development processes and models by decision-makers, both in IT and on the business side. On the other hand, a huge amount of available reports exist with no other accessibility options than a tree view or a fulltext search.

In a first phase the information demand of the users is gathered. Once this phase is completed hardly any re-evaluation of the outcome takes place until the portal is set up. Based on these results individual portal views using role concepts are designed – typically by regular IT staff, who often have only vague knowledge of cognitive ergonomics or business-related topics.

This approach leads to suboptimal, static composition of the portal, which by its nature cannot satisfy the individual information needs shown by the dynamic work space of most knowledge workers. Thus contributions of individuals, e.g. efficiency gains through improved reports, are not to be retained within the system.

The origin of BI portals lies in the attempt to provide a highly-aggregated generalised view of the enterprise for top management executives. Especially when it comes to front-line staff with tight time restrictions, great need for detailed information and a demand for actively investigating the data, many design considerations become insufficient.

For this reason many BI portals today provide generalised management views on data rather than an access point for hundreds or thousands of specialised and detailed reports. Often these reports are structured by taxonomy and searchable by fulltext search. This leads to time-consuming and inefficient searching for the right report.

We discuss Social Networking Software as a possible solution for both the static portal design and report overflow. Furthermore, we assume that limitations in control and reliance on the IT department for adaptation, finally lead to frustration and reduce overall effectiveness of organisational structures.

4. Social Networking Software

Today, a variety of usually web-based systems is in daily use by a large number of the population in developed countries. These systems allow individuals to access implicit knowledge and to make use of the collective intelligence from which it is derived. Some of these systems utilise the everyday recommendation habits: people exchange opinions and orientate their actions on what they have heard [15, p. 56].

Social Software and especially the subclass of Social Networking Software (SNS) can be thought of as a mere technical manifestation of the described behaviour. These kinds of services make use of Web 2.0 technologies and concepts to facilitate active participation of large groups of individuals for the provisioning of content. By that they overcome the limitations of widespread yellow page applications, i.e. the problem of actuality. SNS supports interpersonal communication, coordination and collaboration in a broad sense. According to [16] the provided functionalities can be segmented into six classes:

- **Identity management**, meaning the ability to consciously provide and restrict access to personal identity data.
- **Expert finding**, or expert search enabling users to actively search for and to pro-actively receive recommendation of interesting contacts.
- **Context awareness**, referring to the capability of an SNS to provide users with information on common contexts, such as common contacts, common interests, etc. Context awareness is an essential feature of SNS, as it helps to create trust among users.
- **Contact management**, summarising all functionalities related to maintaining a personal network, e.g. tagging users.
- **Network awareness**, comprising potentials sensing the activities of contacts (awareness), e.g. user status.
- **Exchange**, combining all possibilities for exchanging knowledge directly, e.g. personal messages or blogs.
5. Social Techniques for Improving BI Portals

Important techniques for the creation of SNS are recommendation algorithms and social tagging mechanisms. These concepts are new to the BI domain and thus contain the potential for innovation through their application in BI portals.

5.1. Recommendations

An important cornerstone of SNS are recommendation algorithms. They have been widely applied in e-commerce websites [13] and become increasingly popular in SNS like Facebook [5]. The foundations of this class of algorithms are located in their capability to process data such as previous contacts, CVs and current residence of a user to generate lists of recommendations for different (predefined) aspects of interest.

Simple algorithms as they are used by online shops merely take advantage of data explicitly linked to specific customers, e.g. their buying history. Well-known examples of this approach are collaborative filtering techniques and cluster analysis. More advanced procedures take into account further data like articles viewed, demographic attributes or personal user interests. Different approaches allow the detection of similar customers as well as similar articles. Methods of this group of approaches are commonly based on searches respectively item-to-item collaborative filtering algorithms as used by Amazon [13]: items bought or rated by a specific customer are condensed and compared with other articles to identify similarities. The result is then presented as a list of recommendations to the customer.

Recommendations can be given in various forms [13, p. 71]. We will list only a few of them as an example: personalised product recommendations, which include a brief justification of why a particular item has been recommended, as well as ways to single out manually specific articles; a list of articles which appears each time an article has been moved into the shopping basket; a list of products bought by other customers in correspondence with recent transactions.

Apart from these automatic recommendations, user reviews and ratings provide an important component of current shopping sites. This kind of mechanism constitutes quasi-expert recommendations. The buyers here are the experts, who offer recommendations and ratings on articles, and thus reveal their implicit knowledge. In addition to this item-related information, customers make themselves known as experts in certain areas. In this case access is possible to their profile and further recommendations (e.g. favourite articles).

5.2. Social Tagging

Social tagging is a similar mechanism. It allows users to assign short labels (tags), to content instead of long reviews or ratings. If sufficient user participation is provided, it is possible to derive a comprehensive description of a single item by merely analysing the tags. Further, it also becomes feasible to identify core items within an item set.

A widely-used application of this principle is the technique of social bookmarking. Founded in 2003, the social bookmarking service del.icio.us was one of the first service providers utilising this concept and thus was able to draw a large user base very quickly [14, p. 111]. Given the success of such systems in private internet use, several attempts have been made to transfer the concept into the enterprise context: Dogear [14] and Onomi [6] are examples.

For companies, a number of potential benefits arise. In the first place, the sharing of knowledge and the supporting collaborative work must be mentioned [17, p. 16]. These result mainly from improved distribution, organisation and searching of content in the enterprise [12, p. 1]. By indication of new or modified sources (alerting), distribution is further supported [14, p. 115]. Through the use of Tag Clouds, tagging can provide compact visualisation of information [11].

The forming of social networks around tags is of interest as well. Thus, experts in certain areas could be detected and ranked according to their influence. The number of bookmarks tagged by a certain user provides a basis for that kind of analysis [12, p. 2ff.]. A summary of other social-matching algorithms is provided by [19].

6. Concept of Self-Organising BI Portals

In this paragraph we present a design prototype incorporating the previously described concepts in a BI portal. A screenshot of the implementation is shown in Figure 1. The GUI prototype depicted has been implemented as a
web application. It focuses on current design paradigms of Web 2.0. The segregation into separate portlets enables integration with and into existing portals. Individual portlets are numbered and will be presented in the following paragraphs.

Portlet 1 shows the use of social networking software within a BI portal. To characterise the employees, only information is used which already exists within the IT system (e.g. in authentication mechanisms) like name and position description. Thus, users are not bound to provide additional information and identity management will be reduced to a minimum in this case.

Furthermore, requested reports are connected with users. The data created are then picked up by recommendation algorithms. Clicking on the user means that the other reports called by him/her become visible. This supplies the possibility of discovering previously unknown but potentially better-fitting reports tackling a current issue investigated by the user. At this point we abstain from the implementation of additional functionalities for contact management in favour of probably already existing practices within the enterprise (e.g. email or instant messaging). The presented social networking component is thereby addressing the functions of expert finding, context awareness and network awareness.

Our concept involves social tagging to describe reports. Portlet 3 displays a resulting tag cloud based on tags assigned to reports by users. By selecting certain tags a list of related reports is opening. Portlet 2 proposes potentially useful reports based on the user’s assigned tags and tasks or similar user profiles.

Finally, portlet 4 is designed to assess recently accessed reports. This assessment is established intuitively by simply selecting an appropriate number of stars on a linear scale. Additionally, if a bad rating is awarded, a field for an optional commentary opens.

7. Analysis of the Proposed Approach

Using social networking features BI-meta-portals enable companies to gain higher value from their knowledge base. Because of the abstraction between the information level and the reports’ meta level, the overall BI system is

![Figure 1. Enterprise reporting portal prototype screen](image-url)
getting more modular. Even redundant and overlapping reports do not attract spam to the system over time as the network precipitates systems cleansing in an evolutionary manner. Furthermore, the usage of Social Networking Software generates additional information: experts working in the Business Intelligence domain are mapped with their areas of responsibility and cross-linkings wherein no central editorial authority is needed.

Careful attention has to be paid, as Social Software techniques should not be adopted in business organisations in an unreflected manner. It is important to consider that successful use presumes a crucial number of users and tags [6, p. 3; 14, p. 113]. Besides the ambiguity of keywords and synonyms [12, p. 2] misuse and poor quality of content metadata [17, p. 16] induces potential problems – not to mention the quality of the data presented in the reports themselves. A further critical success factor regarding the operational application of Social Networking Software is the stability and security of the applied concepts. The use of the network effects largely depends upon the efficiency of the recommendation engine’s results. [15, p. 56] therefore examined various scenarios.

The implementation of the presented approach in the operational environment requires partial logging of staff activities. This involves reports called, the number of calls and eventually further details of the workflow. After being processed and comprised those data are made available for other employees as well as superiors in the enterprise. Thus privacy concerns and legal issues could be raised and need to be taken into consideration according to country-specific legal regulations.

Furthermore, organisational and psychological questions emerge and have to be dealt with. Corporate culture, employee participation in decision-making processes as well as typical involvement in the development of IT systems impose boundary conditions on the implementation of the approach. In addition, the successful induction of collaborative reporting systems as part of corporate knowledge management initiatives requires the deployment of incentive systems [10].

The success of collaboration facilities in general depends on the participation and contribution of large groups for which mainly intrinsic motivational incentives exist. A variety of ideas is discussed, e.g. games with a purpose, to attract users to contribute [1; 7].

On the other hand, the proposed portal concept might lay the foundations for the pricing of reporting services and internal cost allocation. The popularity of reports can be regarded as a democratic estimation of the quality and value of certain reports as well as an indication of demand for that piece of information. The non-complex monitoring of the system performance as well as the performance of single contributors could also induce efficiency gains by means of internal competition. Popularity, based on total number of calls, user ratings, frequency of use, and so on, provides such a benchmark.

8. Conclusion

Current reporting portals show two major downsides: either they emphasise the presentation of single report data in the form of graphs or tables, which assumes that it is possible to aggregate the data presented and only overall insight is requested by the user; or they provide predefined lists of reports. With the proliferation of reporting portals for knowledge workers in (financial) controlling and other areas, the significance of finding specific reports in a quick and straightforward fashion increases. The requirements for enterprise reporting portals are changing from the presentation of information to the entry point into further research, which is based on individual reports.

In our scenario, reports signify products requested by individual knowledge workers and offered by other business users or IT staff. Consumers are embedded in a social network, which can be depicted through social networking software. The proposed features of tagging, recommendation and evaluation of reports need to be integrated into the actual reporting component. Enriched with these techniques, enterprise reporting portals enable bottom-up personalisation of individual entry points into reporting systems and thus foster the utilisation of knowledge from distributed report users.

We discussed topics for further research from a social, legal and business point of view. Beside of that much space for future work is left, concerning evaluating and transferring knowledge from information systems disciplines to this special use case. Such tasks could be finding suitable recommendation algorithms, creating a time-sensitive rating algorithm, dealing with tagging issues (e.g. synonyms, typos) and much more.
Finally, the next logical step for our research is to implement the existing design prototype with a real-world scenario to test the approach towards its abilities to solve the research question and help creating successful reporting portals.

9. References