A Functional Model of Social Media and its Application to Business Intelligence

Rob MEREDITH¹ and Peter O’DONNELL²

Decision Support Systems Laboratory, Monash University, Australia

Abstract. The marketing departments of the major business intelligence (BI) software vendors have been quick to associate their products with the popular term ‘Web 2.0,’ branding the new releases of their product suites ‘BI 2.0.’ This paper argues that beyond its value as a device to enhance sales and marketing, the functions typically found in Web 2.0 web sites can be usefully applied to BI applications. It explores the application and role of Web 2.0 concepts within BI applications. The paper develops a simple framework to help understand the collaboration that is afforded by Web 2.0 applications. It classifies the functions that are provided in social media platforms to foster user collaboration and contribution. The framework is then used to examine how these forms of collaboration can be used to create more effective and ‘active’ BI applications.

Keywords. Business Intelligence, Web 2.0, Social Media, BI 2.0.

Introduction

One of the most significant changes over the last decade in the general use of technology has been the adoption of so-called ‘Web 2.0.’ Internet sites such as Wikipedia (http://www.wikipedia.org), Flickr (http://www.flickr.com), and Google (http://www.google.com), along with activities such as blogging (see, for example, http://www.blogger.com) and social networking online (see, for example, http://www.facebook.com) have been cited as examples of a fundamental change to the use of the Internet prior to 2000 [1].

Although some view the concept of Web 2.0 as a marketing concept and nothing more [1], O’Reilly defends the label as representing a paradigm shift from the old publisher-consumer model of the World Wide Web in the 1990s to a model where consumers are the primary source of material for a site or tool. This paradigm shift is better served by a slightly less used moniker – ‘social media’ – which emphasizes the shift of thinking from pushing information out to consumers to a social process of information sharing.

Internet technologies have made a major impact on the design and use of enterprise systems. Most enterprise package solutions (for example, SAP) have long had web-based interfaces [2]. Business Intelligence (BI) software vendors were also quick to realize the value of providing web-based interfaces to allow access to data held in a data warehouse [3]. These vendors have also been quick to notice and take

¹ Corresponding Author. PO Box 197, Caulfield East, Victoria 3145, Australia. E-mail: Rob.Meredith@infotech.monash.edu.au. Twitter: @rmeredit
² E-Mail: Peter.ODonnell@infotech.monash.edu.au. Twitter: @podonnel
advantage of the take-up and appeal of the label Web 2.0. The term has been adapted as ‘BI 2.0’ to imply a new and improved BI concept.

BI software vendors as well as industry commentators [4, 5, for example] have made the same kind of paradigm-shift arguments regarding BI 2.0 as Web 2.0 advocates. However, while current BI tools provide functions that allow users to collaborate, these tools are generally difficult to use, providing little more than the ability to attach a static report or view of data to an email message to be sent to another user. Elliott [4] claims that there is consensus on the definition of the term by BI vendors. However, there is no BI equivalent to O’Reilly’s [1] paper describing Web 2.0. The term BI 2.0 is very loosely used, largely as a marketing device for new product releases. In most cases, the use of the label borrows from the concepts behind Web 2.0, but often also includes a variety of technologies *du jour* such as decision automation, “real-time” data feeds [5], the adoption of a service oriented architecture (SOA) and others. Few of the current BI 2.0 tools support the kind of social interaction that allows end users to become major contributors to the content of a BI system.

The purpose of this paper is to bring some rigor to the concept of BI 2.0. The paper develops an argument for the inclusion of social media technologies within BI systems. A framework is developed that classifies the functions provided in social media sites generally to facilitate user interaction and contributions. In the next section of the paper an argument is then developed that the social nature of organizations implies that support of collaboration and interaction between end-users of a BI system would be a useful addition to the standard BI system functionality. The paper concludes by exploring the framework’s application to BI systems. Examples are developed to show the feasibility of including each of the types of functionality in the social media framework within a BI system.

1. What is Social Media?

The term Web 2.0 was coined to describe a change in the way that the Internet is being used to deliver services [1]. With Web 2.0, the Internet is considered a platform where content is created and shared, supported by algorithms and data structures that encourage the packaging and sharing of user-generated content [1]: hence social media.

A number of characteristics have been used to describe the nature of social media companies [1]. The central theme is the opening up of a service to users to both contribute content, as well as mixing and matching platform components to create new service offerings. For example, a user may incorporate photographs from *Flickr* with information about their location using *Google Maps* on their blog. The community of users becomes part of the development team in terms of content contribution as well as in the design of the platform and its ecosystem. Where the value of a traditional vendor is vested in the software that they create, a social media company’s value is not just derived from the platform, but also from the community of users they foster.

2. Kinds of User Contributions to Social Media

The purpose of this section is to propose a framework for understanding the kinds of user contributions possible with social media platforms. Broadly, contributions by users are placed into three categories. The first is described in [1] as a contribution to
the “dataset”, but will be referred to here as ‘contribution of content.’ The second category consists of contributions to the social network, and the third consists of contributions by users to the social media platform itself [1].

2.1. Contribution of Content

Content contributions can be categorized according to three types. The first of these we call a primary contribution. This refers to an original contribution, typically addressing the main purpose of the social media platform. In the case of a photograph-sharing site like Flickr, a primary contribution by a user is a photograph uploaded to their account. The primary contribution may include the photograph itself, as well as metadata such as a title, ‘tags’ describing the photograph, a textual description and data about the technical details of the photograph. Figure 1 shows an example.

![Figure 1](image_url)

**Figure 1.** A Flickr photo page showing a photograph, title, description and tags created by a user.

The second type of content contribution we call a secondary contribution. This is typically a response to a primary contribution. With Flickr, the most common secondary contribution is a comment on a photograph. Other secondary contributions include adding a photograph to your list of favorites, adding to the list of tags, and making a note on the image itself. Secondary contributions allow for a dialog to develop between users (see Figure 2 below), encouraging communities to form.

![Figure 2](image_url)

**Figure 2.** A conversation between users regarding the photograph in Figure 1.
2.2. Contribution to the Social Network

In addition to the content of the social media platform, users can contribute to the social network of users itself. Most social media platforms require users to register a unique account with a username, and allow users to identify their social connections. We suggest that there are three different types of contribution to the social network: network formation, network administration and socialization.

In some cases, the nature of the social media platform means that there is an overlap between the categories in this section and those described in section 2.1. In particular, the secondary contributions described above often have a strong social element to them: on some platforms, social interaction is the primary contribution.

The formation of networks on social media platforms can happen in several ways: users can specify pre-existing connections such as friends, colleagues and families, as well as intra-platform communities. In the case of Flickr, groups can be set up around a particular theme or topic with users attaching selected photographs in their collection to the group “pool.” Networks have a variety of purposes, norms and rules.

The second type of social-network related activity is therefore the administration of social groupings. Initially this is performed by the user or users who established the group, but over time the users responsible for performing administrative tasks will often grow to include active and respected members of the group. Administrative tasks may include a gate-keeping role, moderation and possible censorship, taking action against group members who violate the norms of the group, as well as policy development.

Not all social networks are explicitly embedded in the structure of the social media platform. Just as in any social setting, groups and networks can form and evolve in a variety of ways, so long as it is possible to form relationships with other users. Groups and sub-groups can form, even within explicit groups. Even in such cases, the functions of network formation and administration can still be observed.

Most important of all to the social aspect of a social media platform, however, are the acts of socialization that various users perform. As mentioned above, primary or secondary contributions are often social acts, but in some cases a social act is carried out privately or within a context in which the act is not essentially a contribution to the platform directly, but rather a contribution to the social network itself. Examples include discussion forum posts within groups in Flickr, or direct messages akin to
email sent privately between users. The primary and secondary contributions, along with social network related activities make up the social fabric of a social media platform. The technology and social networks on a social media platform provide the structure within which the social acts of users take place.

2.3. Contributions to the Platform

The third category of contribution is based on “harnessing collective intelligence” and treating users as “co-developers” [1]. There are two aspects to this. The first is that the platform’s design needs to be responsive to the way users want to use the platform.

The success of a social media platform depends on people choosing to use it: if the platform doesn’t allow a particular user to use it in the way that they want to, then they are unlikely to make use of it. This is a challenge for social media platforms because people will use the platform in unanticipated ways as they socialize. An example of this is Twitter’s support for the ‘@’ terminology to refer to another twitter user. This usage came about because users found that they sometimes needed a way to direct their messages to a particular person, especially in the context of replying in a conversation [6]. In an interview with the Financial Times [7], a former MySpace executive attributed the decline of that platform to an increased emphasis on advertising that led to a poorer user experience, as well as a less responsive and more bureaucratic process for design changes. If a social media platform fails to adapt to user needs, then users may no longer use it.

The second contribution to the platform that a user can make is to develop a third party tool that works with the platform. While this is a much less common contribution than the others described above, such a contribution can have a significant effect on the usability and visibility of the platform. In the case of Flickr, there are a variety of third-party applications that have been developed and endorsed by the official Flickr development team (see http://www.flickr.com/services). Examples of these tools include applications that enhance existing Flickr functionality, such as the ability to upload photographs in a batch.

The development of these tools means that the social media platform has a richer ecosystem of applications, extending it to a wider group of users and uses. The fostering of this ecosystem of third-party applications depends on an open standard for interacting with the core services offered by the social media platform. Simple, flexible access through application programming interfaces (APIs) and standard protocols such as RSS and HTTP allow developers to easily work with the data that the platform provides [1]. The more flexible and accessible the developer interface to the platform, the richer and more varied the ecosystem and its use will become.

To summarize, this section has outlined a functional framework of social media platforms, a summary of which can be seen in the Appendix. The next section will explore the application of these concepts to a BI setting.

3. An Argument for Social Media Enabled Business Intelligence

BI systems are tools used to support decision-making in organizations. BI systems are a class of decision support system (DSS) that allow users to analyze organizational data in an intuitive fashion, typically in the form of interactive reports. Typical BI systems will allow users to access integrated, subject-oriented data [8] contained in a data
warehouse or data mart, sourced from a variety of internal and external data processing systems, to answer a variety of business questions. Data will usually be presented in an interactive ‘dimensional’ structure [9] that permits the user to navigate through reports by clicking on data items, ‘drilling-down’ to more detailed reports from summaries as well as constructing their own reports as needed.

Figure 4 illustrates a typical web-based BI system: a report shows the profitability of an organization in the leisure industry by region over time. The data is displayed in tables, bars charts and a stylized gauge. In the example, the user has clicked on the item representing the region Australia in the time period 2009 to obtain a report showing more detail.

BI systems tend to be large-scale when compared to personal DSS [10], usually being deployed at either the department or enterprise level. Despite the fact that BI software is designed by the tool vendors to support multiple users with each deployment and it is not uncommon for such systems to include functionality to facilitate collaboration, these features are generally poorly designed and hard to use. Typically, the features offered are no more sophisticated than the ability to embed a report or view of data, usually in a non-interactive format, within an email. As a result, these features are not well used and fail to encourage any significant interaction between the users.

In fact, BI systems have a poor record in terms of their use generally. Even though BI is cited by industry analyst firm Gartner [11] as a top priority amongst chief information officers, deployed BI systems are only used by around seven percent of the people who have access to them [12].

The importance of social factors in organizations within organizational theory has been recognized for some time. The concept of ‘social capital’ has been proposed as an alternative to older theories of organizations such as transaction cost theory [13], and [14] argues that organizations can be considered communities for the purpose of sharing and creating knowledge.
Social capital theory is based on the premise that non-monetary forms of ‘capital’ can provide access to resources, influence and power in a similar way to monetary forms [13]. Any theory of organizations that ignores the social networks formed within an organization necessarily ignores a significant component of the organization’s behavior. While sociability can be shown to have negative as well as positive consequences [13] – social structures can be used as much to exclude as include, for example – understanding how the accumulation, access to and spending of social capital occurs provides an important perspective on why organizations act as they do.

The idea of using technology in organizations to facilitate social interaction is not new. Computer supported collaborative work (CSCW) tools and group support systems like Lotus Notes have been around since the 1980s. More recent trends towards the use of portals and intranets to support knowledge management are also notable. McAfee [15] argues, however, that such technologies have generally been of two types: ‘channels’ such as email where there is widespread authorship, but access is limited to the few to whom the messages are addressed, or ‘platforms’ like intranets where authorship is centralized and narrow, but consumption widespread. Users of both channels and platforms are dissatisfied with the tools [15]. The use of Web 2.0 technologies in organizations, which McAfee calls “Enterprise 2.0,” offers the potential for both widespread authorship and consumption of information.

The nascent concept of Enterprise 2.0, however, has not yet been extensively researched, despite widespread adoption of the term in industry. The peer-reviewed academic literature consists of a number of conference papers and a handful of journal papers. Few deal specifically with the use of social media for decision support or business intelligence, tending to focus instead on adoption by operational staff.

However, decision-making in organizations also has an important social aspect to it. Although the classical rational choice model [16] fails to explicitly incorporate social factors, as do phased decision models such as Simon’s [17], other descriptive models explicitly acknowledge the social aspect of decision-making, particularly in regard to the political aspect of strategic, organizational decision-making [18]. The norms, customs, traditions and habits that inform our decisions (along with other empirical and logical factors) are imparted and enforced through social, communicative acts [19]. People will tend to act in accordance with how they see other people act as opposed to official, written norms [20].

Communicative acts play several roles in the decision-making process. They act as inputs to decisions as decision-makers consider the implications of social capital [13] and provide access to information resources that they do not possess themselves [14, 21]. Harnessing “the wisdom of crowds” [22] is cited by O’Reilly [1] as a core benefit of social media and when incorporated into the decision-making process can lead to better informed, more rigorous outcomes.

Decisions are inherently communicative acts: after a decision has been made, this is communicated to the rest of the organization, and the act of deciding itself is a communicative act that contributes to a social context [23]. It follows that understanding and responding to the social factors present in a decision context is important to decision-makers. Technologies used to support decision-making processes that address the social as well as the logical-empirical factors involved are therefore likely to provide a richer, more thorough level of support than those technologies that focus on the logical-empirical factors alone.

This idea is supported in the information systems literature. The concept of organizational decision support systems (ODSS) was originally used in 1981 [24] to
refer to systems that support communication and collaboration in decision-making. It is true that BI systems are not ODSS: [10] points out that BI tools are really just the modern incarnation of executive information systems (EIS), and [25] explicitly points out that ODSS are different to EIS. However, the difference lies in the integrated nature of the decision processes that ODSS seek to support whereas BI systems are not developed for any one specific decision problem. Otherwise, however, there is some obvious overlap in the concepts of the two types of system – BI systems could be considered a passive type of ODSS, in the sense used in [26].

The label BI 2.0 brings the concept of BI even closer to the concept of ODSS, with ODSS’s explicit acknowledgement of the role of the social in organizational decision settings. The following types of ODSS technologies from [27], adapted from an original list in [28], can be seen to apply to the idea of a more social version of BI:

1. **Communication.** Technologies used to facilitate and encourage collaboration within and between groups, the organization and other organizations [28].
2. **Coordination.** Technologies used to manage shared resources and tasks (eg. calendaring systems) [28].
3. **Decision-making.** Technologies specifically aimed at supporting structured and semi-structured decisions [28].
4. **Monitoring.** Technologies for summarization of information for senior management, to alert them to problems and opportunities [28].
5. **Artificial intelligence for filtering/automation.** Technologies (intelligent agents [28] and other AI [27]) to filter out and summarize information. A more active version of monitoring.
6. **Data / knowledge representation.** Technologies to manage data and knowledge within the system, making it available to other system components and their users [27].
7. **Processing and presentation.** Technologies for taking the data within the system and presenting it to the end user [27].
8. **Distributed architectures.** Technologies to distribute data storage and presentation to a wide set of geographically disperse groups. This includes distributed storage, as well as processing and presentation via channels such as the World Wide Web [27].

Current BI technologies already address types 3 (BI is essentially data-based decision support), 4 (dashboards and corporate performance measurement systems), 6 (dimensional modeling and other data structures), 7 (processing and presenting data is a core BI capability) and 8 (BI has always been based on multi-tiered architectures, including data storage in data marts/warehouses through to distribution via the Internet and mobile devices). The tools also commonly address 1, albeit generally in a poor, ineffective way. If BI 2.0 tools adopt the kinds of technologies seen in the use of social media, then it will also not only be able to support activities related to 2, 3 and 5, but it may also support the activities associated with communication in a much more effective manner. By borrowing from the technologies of Web 2.0 and social media, BI will provide better technologies for 1, 2 and 5, as well as improve 3 and 4.

Communication is the most obvious point of difference between current BI tools and BI enhanced with social media. Many of the offerings from different BI vendors already have some capability for the sharing of reports, as well as, in some cases, the annotation of and commenting on reports for other users to see. The capabilities are very basic, and in some cases the design is such that they are also difficult to use. In Figure 4 for example, while the tool supports the posting of comments, these are
hidden in a separate window from the report itself, breaking the context. Taking the framework described in section 2, the report itself corresponds to a primary contribution, while the secondary contributions (comments on the report) have been moved so that other users may not be aware of them. A BI 2.0 system, on the other hand, would have the comments placed in a prominent place alongside the report itself, with the capability for a fully-threaded conversation. Other secondary contributions might also include the ability to vote on comments (eg. like or dislike) so that popular comments are drawn more easily to the attention of other users. Notification of activity on the report, such as someone commenting or replying to a comment, could be sent to the original report creator, as well as other relevant users. The more active and dynamic the access to the primary and secondary contributions are, the more likely users will interact and take part in the communicative activities supported by the system.

Social media enabled BI could have the capability to support different groupings of users, either reflecting pre-existing social networks in the organization, or the formation of new groupings based on interests in various topics covered by the BI tool. For example, users from a variety of departments may have an interest in the impact of a marketing campaign for a new product. In this sense, the kinds of social-network contributions supported by social media allow for a kind of coordination of interest, rather than just a coordination of activity in an organization. While it is certainly conceivable that social media style tools could be used to support calendaring and resource allocation, this is more truly the domain of ODSS rather than BI.

Because BI is a passive rather than active [26] style of decision support, the decision making process itself is largely prescribed by organizational policies or individual preference. It is up to the user (or developers working on the user’s behalf) to create a supportive decision environment for a specific decision through the creation of reports, analyses and other “ephemera” inherent in an evolutionary decision process [29]. Where decision makers currently tend to utilize spreadsheets for their own ad hoc and flexible decision support, a lightweight, modular BI platform that allowed non-technical users to build their own analytics tools within the platform and then share those creations with others, should encourage them to use the BI system. By sharing these analyses and ad hoc tools with others in a controlled social media environment, as opposed to the standalone nature of spreadsheets on a desktop, many of the problems inherent in spreadsheet use such as security and errors can be addressed.

Intelligent filtering (technology type 5) was included by both [27] and [28] to refer to technologies used to automatically find, summarize and filter information. However, the kinds of algorithms that make use of the data generated by passive and social activities in social media platforms can be used to address these same problems. Tag clouds could be used to help BI users find useful reports easily. Coupled with the social networks that can be formed on a social media platform, a recommendation system could allow a user to see which reports other people that the user ‘follows’ are looking at and what they think is important: for example, a manager may note that several subordinates are looking at and discussing a certain set of reports and so may also look at and comment on those reports too. Rather than relying on data mining or other intelligent algorithms to find important data in a large data set – many BI systems draw on data from data warehouses containing terabytes worth of data – “human computing” [30] can possibly achieve the same end more effectively and accurately.

The final column of the table in the Appendix summarizes this section while Figure 5 shows a mockup of what a social media enabled BI system might look like.
4. Concluding Comments

This paper has explored the potential role of web-based social media within BI systems. A framework that allows the classification of the typical functions found on social media web sites has been developed. The application of this framework to BI has been explored. A case has been made that it is feasible to include social media functions within BI applications. An argument has been developed for the potential value of these functions if they are included in BI systems.

The framework developed has a number of potential uses. First, it provides developers of BI systems with a structured and comprehensive basis for design decisions they make about the use of web-based social media within BI applications. The framework allows BI developers to understand what functions they can use within their systems, and if they choose to use them, provides a useful framework for understanding how each of the types of functionality might apply to a given system.

The framework also has a role in research. It represents an underlying proposition that the inclusion of social media will have a positive impact on a BI system. The discussion in the paper has argued that social media will enhance the usage and understanding of a BI system and its content. That proposition needs to be tested. The classification of the framework provides a conceptual foundation that could be used to guide the collection of empirical data aimed at investigating the value of social media functionality within a BI system.

References


## Summary of the Contributions Framework

<table>
<thead>
<tr>
<th>Form of Contribution</th>
<th>Examples from various social media platforms</th>
<th>BI 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Contribution of content</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a. Primary contribution</td>
<td>Creating a video</td>
<td>Posting a ‘tweet’</td>
</tr>
<tr>
<td>1b. Secondary contribution</td>
<td>Submitting a link</td>
<td>Rating a submission or comment</td>
</tr>
<tr>
<td>1c. Passive contribution</td>
<td>Rating a video</td>
<td>Rating a comment</td>
</tr>
<tr>
<td>1c. Passive contribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2. Contribution to the social network</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a. Network formation</td>
<td>Creating a video</td>
<td>Creating ‘sub-reddits’</td>
</tr>
<tr>
<td>2b. Network administration</td>
<td></td>
<td>Deleting submissions</td>
</tr>
<tr>
<td>2c. Socialization</td>
<td></td>
<td>Deleting comments</td>
</tr>
<tr>
<td>2c. Socialization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c. Socialization</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Contribution to the platform</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a. Contribution to platform design</td>
<td>Various features added at the request of users’</td>
<td>Introduction of a ‘not safe for work’ tag for risqué links</td>
</tr>
<tr>
<td>3b. Contribution to the platform’s ecosystem</td>
<td>Applications for video upload</td>
<td>iReddit iPhone application</td>
</tr>
<tr>
<td></td>
<td>YouTube access from media and home theatre devices</td>
<td>Browser plugins / scripts to modify the user experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>