

Supporting Scientific Research Utilizing a Social Bookmarking Service

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Abstract

The paper proposes a new online service for supporting scientific research utilizing a social bookmarking service. The service provides functions for supporting information gathering, reference management, and research collaboration for scientific researchers. Requirements for the service are defined from developing scenarios of research support by identifying the researchers' needs from a survey of literature and field works.

1. Introduction

Although scientists use online services such as access to database and information services, the growing accessibility of the Internet has raised some problems for scientific researchers. For academic society, information overload has become a widely recognized problem associated with decreased job satisfaction, stress, and performance loss [13]. Scientific researchers spend too effort for gathering and monitoring information sources such as online publications and journals for the most useful and relevant information for their work. Researchers also need more effective management tools for their collection of references than the conventional management tools that organize the referred information sources [20]. In another situation, scientific researchers may need to construct the collaboration with other researchers who have the same interested topic. They do not only want to know “who know what” but also want to know “who know who” because it is more useful and fast to find an expert on a topic related to the issue at hand [29]. In the language of online tools such as social software, they can preserve the need of scientific researchers by various effects on the organization of work for scientific research. These online tools do not only contribute to an increase in the size of professional networks but also adopts in the way that reproduce and improve the research process [24].

Social software is the term used to designate, “the use of computing tools to support, extend, or derive added value from social activity – include (but not limited to) weblog, instant messaging, music and

photo sharing, mailing list and message boards, and online social networking tools” [17]. The emergence of social software presents an opportunity to transform the way of collaboration among people [2, 6]. For examples, weblogs provide participants with a way of publishing their own experiences while connecting with others having similar interest. Wikis provide an easy way of collaborative writing or group working with online editing function and built-in tracking ability. Social bookmarking tools let users save addresses of Web resources with tags (i.e., keywords) to organize them to make them searchable. Social networking systems create connections between people without regard to physical space offering some opportunities to contact with.

Because of inefficient information retrieval from the web and less support for matchmaking in research collaboration, the research aims to develop a new information tool for supporting scientific research utilizing social bookmarking service by developing the scenarios artifact of research support and analyzing the requirements from the scenarios artifacts.

The paper is organized as follow: A survey of research process model is described in section 2 and section 3 presents the online service as state of the art of social software and its evaluation. Section 4 then describes the scenarios of research support needed by researchers. Section 5 analyze and extract the requirements for research support from the scenarios and section 6 describes the evaluation of requirements. Section 7 summarizes the related work and section 8 provides the conclusion and the future work.

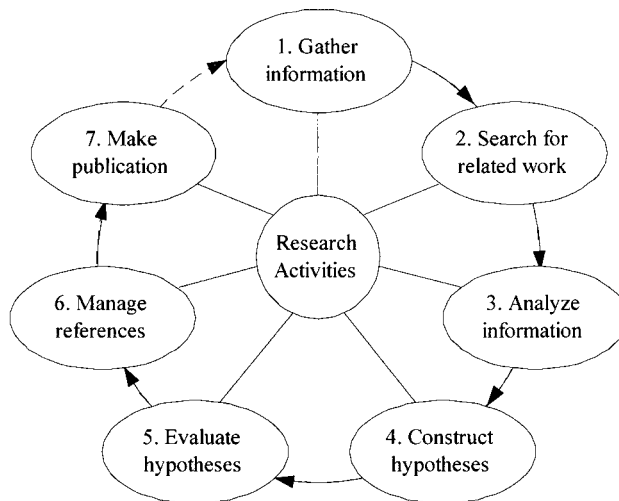


Figure 1 a research process model

2. Research Process Model

The research process can be classified into three main stages: Initial the research, Execute, and Publish the research result [28]. The Initial stage starts from idea-generating phase to identify a topic of interest to study. Researchers gather information that relate to their research topic. Researchers may want to search the related work by exploring other researchers' work to aware fellow researchers' work and clarify a vague idea for the research topic. Researchers may not only want to gather information from them but also want to communicate and collaborate with others [12]. After Initial stage, researchers execute their research by moving from the specification of the research objectives through the varied task that must be carried out to complete the research, as analyzing the retrieved information, constructing the hypotheses, evaluating the hypotheses, and then make publication. For publishing their research results, researchers may need to manage their referred publications for the references. Regarding to the research process, it can be figured out a common research process model of scientific research activities as shown in Figure 1.

According to the research process model, it can be identified 7 steps for research activities: 1. Gather information, 2. Search for related work, 3. Analyze information, 4. Construct hypotheses, 5. Evaluate hypotheses, 6. Manage references, and 7. Make publication. In Step 1 and step 2, researchers need support for information gathering to retrieve related information that is valuable for the research topic. Gathering information is channeled through paper-based referred academic journals and conference proceedings whereas the online publications are

becoming an essential part of the scientific research process as the information transfer within professional Communities of Practice (CoP) [16]. In addition to information gathering, researchers need support for collaboration with another to share idea and generate the research approach as well as to aware about other's work. Finally researchers make a publication for their research results where researchers need some referred academic publication to be cited in the publication. Researchers need support for reference management for their maximum productivity. Although they are useful exploration and information tools for researchers, the scientific researchers need more effective information tools to support their research activities.

3. Assessment of Social Software

The emergence of social software such as Social Bookmarking Service (SBS) has prompted a second look at this kind of collaborative software [22]. A number of SBSs are used in the scientific research communities, e.g. CiteULike [9] and Connotea [10]. These systems share a number of features: 1) allow individuals to create personal collections of bookmarks and instantly share their bookmarks with others, 2) use keywords or tags that are explicitly entered by the user for each bookmark. These tags allow the individual user to organize and display their collection with labels that are meaningful to them. And 3) provide chance to access through the entire bookmark collection to see other information sources of interest [22]. Marking content with tags is a common way of organizing content for future navigation, filtering or search [14].

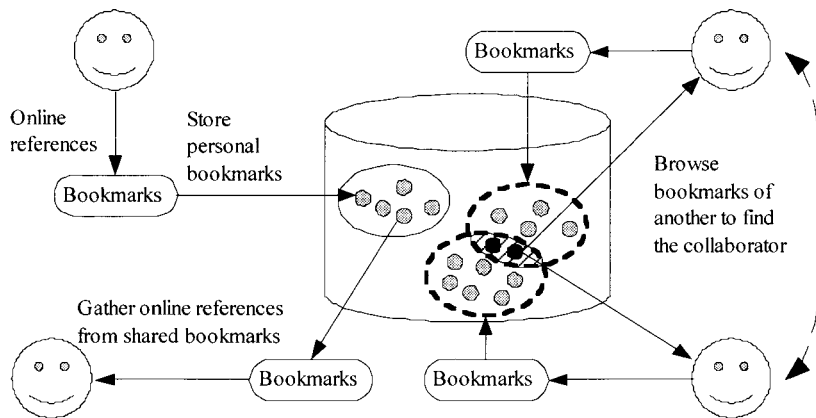


Figure 2. Interaction among stakeholders in a Social Bookmarking Service

As another type of social software, weblog is a web application that contains periodic time-stamped posts on a common webpage that can be published by one person or a group of people [2]. The topic within weblog can be wide-ranging and cover different field depending on the author. Although weblog presents a personal point of view in a conversion, it limits capabilities for retrieve the history of activities. People who using weblog can share opinion with other but difficult to gather the past interested issues. Whereas wiki is almost an inside out weblog, it contains articles that can be edited by all members of a particular online community. This structure allows an in depth and continuously evolving view on these articles [27]. According to the editing of articles in wiki that come from the all participants, it is hardly to organize and retrieve the content for individual.

4. Scenarios of Research Support

The scenario modeling approach is best used to address cases where there are multi-stakeholders with diverse concerns and expectations, leading to complex interactions among functional and non-functional requirements that need to be balanced and traded off [19]. Whether analyzing an existent artifact or envisioning an artifact in design, the system should begin by generating a set of basic-level task scenarios. Each scenario is a description (in text, in a storyboard, etc.) of the activities that a user might engage in while pursuing a particular concern [8]. Scenarios represent interaction among stakeholders as shown in Figure 2 and incorporate their different perceptions and requirements. In order to be legitimized in their eyes, the development method must ensure the participation of all stakeholders such that the resulting model integrates

their particular perception, capabilities and requirements [21].

(1) Information gathering

Researchers gather information as the input to initial research concept and determine what research has been conducted in the selected area [1]. There are several different ways to gather and retrieve information depending on researchers' skill. Researchers who have expert skill have the way to carry out the information differ from novices [5]. Experts seek the information to develop understanding of their problems. Novices, on the other hand, approach problems by searching for correct solutions and pats answers that fit their intuitions [5, 18]. In case of expert users who want to seek for information such shared bookmarks, they access directly to the relevant information such as bookmarks for a specific topic, which called a topic bookmark list. On the other hand, novice users seek for shared bookmarks rather than access direct to the information through the topic bookmark list.

(2) Reference management

Researchers who use large information spaces store and manage information sources those they have previous found and interested in by them in order to recreate the search in the future [7]. According to the growth of Internet technology, researchers store their reference list online as bookmarks that are linked directly into the literature and easily to share with another. These personal bookmarks keep individuals entire collection of reference in one online repository that is always accessible and easy to share. In the context of usage of SBSs, researchers assign tags that are the free-form categories to the bookmarks they have saved by

their meaning and the system automatically collects the bibliographic information for those online publications or books that are being linked to. So they can store the bookmarks as their information sources for themselves by their own keywords. Whereas tagging allows the individual users to organize and displays their collection by their meaningful keywords.

(3) Research collaboration

One typical situation of research process is that researchers acquire the knowledge about current research issues and other researchers' expertise by participating in some research communities or exploring others' work or shared bookmarks. Researchers participate in some research communities to seek new ideas for their research topic, ask about the problem at hand, mutual exchange the shared interest, and so on. One example usage of collaboration is expert finder system that tries to locate expert for specific topic [4]. Because of researchers do not only want to know the shared information as shared bookmarks but also want to know the owner of that information. In case of the shared bookmarks were not adequate for the primary goals, researcher wants to communicate with the owner of shared bookmarks to generate ideas or solutions for his study within confident environment.

5. Requirements of Research Support

From the scenarios, requirements for supporting scientific research utilizing SBSs can be extracted. The extracted requirements are based on the purposes of individual users using SBSs. To figure out the requirements, each scenario should be detailed and developed to capture and explore the finer structure of the operative psychology in the situations of usage has observed [8]. Requirements represent the need of users and what supporting functions that SBSs should provide.

(1) Information gathering

From a scenario of information gathering in research process, researchers who use SBSs need supporting for gathering and retrieving the most useful information for their research topic as the *topic bookmark function*. This supporting function facilitates searching for related online publications as bookmarks for researchers to use them as references and idea generating. This function also assists the construction of topic from a list of bookmarks which are the search result. Users can create a topic bookmark list from a search result, which is the shared bookmarks, with the specific tags. Researchers can not only search for the related

publications but also search for new publications from the interested topic. Whereas this function provides the recommended topic relating to individual's interest to user. Researchers can retrieve the new issue on the related research topic as well as they can access directly to the related online publications that relate to their work as social navigation.

(2) Reference management

According to one scenario of supporting scientific research, researchers need a supporting function for manage their collection of references as *online bookmarks function*. In the context of SBSs, personal bookmarks can be a valuable information source because it is the results of information retrieval from WWW and some of them are adequate for the future work. Online bookmarks functions facilitate managing the entire collection of personal bookmarks for individual researcher in the way that easy to access as well as can shared it with others in the meaning of reference management. Tag convergences and directory which are the features of SBSs emerge as a consequence of pooling the information [14]. This supporting function provide tagging feature as "rename tag" that is not only allows individual users to change their mind about the way they organize their personal collection of bookmarks, it also facilitate the development of shared tags. It enables the way of finding new and related content as a community-driven recommendation.

(3) Research collaboration

Concerning with the scenario of collaboration in research process, researchers need the support for research collaboration as *topic group function*. Collaboration utilizing a SBS can be carried out by specific function [15]. This supporting function facilitate the creating a topic group for a specific community. According to the topic bookmark function described in information gathering, it is not only creates a topic bookmark list from search results but also allows users to subscribe a topic as a member of the topic group. This function aims to facilitate the communication and interaction between researchers in the topic group that lead to research collaboration. This supporting function allow users to join into a specific community that members can collaboratively search online publications by sharing bookmarks of which the members store the search results in each personal bookmarks. Also members in a specific topic community can communicate with other to collaborate and share it.

6. Evaluation of Requirements

The key information to evaluate requirements of research support is what it would like to see in term of knowledge management outcomes [3]. The knowledge management outcomes include the effectiveness of the output by analyzing input and output of the system. Referring to the scenarios of supporting scientific research, input of the system can be described as analyzing the needs of users to use SBSs for their research topic whereas outputs from the system are the improvement of the knowledge creation and sharing as well as the quality of collaboration in individual and community. Another way to evaluate the system is that the novice or expert experience that research quality is improved. Also members in research communities are improved by using the SBS based on the requirement analysis and the supporting function for scientific research. By using SBS, novices should aware of knowledge management principles and objectives as well as apply them in their research.

By consideration the key evaluation criteria of supporting scientific research utilizing a SBS, the preliminary results of the system evaluation are follows.

1. Do the required functions help researchers to seek related information and facilitate the information retrieval?

YES. The required function of the SBS provides fundamental functions for information retrieval and facilitates researchers to ease access to information sources as shared bookmarks.

2. Do the services have mechanisms to communicate with other researchers? What mechanisms does it have?

YES. In case of researchers acquire collaboration, the SBS shows that it can provide the mechanisms to communicate with others. The mechanisms to communicate and construct the communities can be implemented with ICT tools such as mailing list.

3. Do the service mechanisms detect who is working on similar tasks and propose communities?

YES. The SBS also shows the detection mechanisms to filter researchers who are interesting in the same topic by using a specific function as topic bookmark lists. The model can serve the goals of users not only novices user but also expert users.

4. Do the service mechanisms recommend others' researchers who interest in the related topic or recommend the related topic to users?

YES. In case of using a recommender system, the SBS shows that the system can recommend others related researchers based on their personal bookmarks to promote the collaboration among members in research communities.

Considering the results of evaluation as above shows that the required functions of the SBSs can

preserves the identification of users' goals as well as facilitates the knowledge management goals.

7. Related Work

CUPTRSS [28] proposes a new and effective tool for research institution, researchers and scientists in order to support their research activities by investigation and examination of Web-based Support Systems (WSS). Such a tool will assist researchers to improve their research quality and productivity. The design and the implementation of viable WSS depend on a clear understanding of research activities and process, so they classified research activities into two levels, the institutional level and the individual level, and modeled research procedures in seven phases, namely, Idea generation, Problem definition, Observation/experimentation, Data analysis, Results interpretation phase and Communication phases

Onomi [11] is an open source tool based on the hypothesis that the tool would be valuable for information sharing, information management and social networking in the corporate intranet. The design and architecture of Onomi aims to leverage search capabilities to enhance the information retrieval experience of the user. In Onomi, tags are atomic while the notion of tag type helps clarify the meaning of tags and allow deeper system interpretation. Whereas email and mailing lists are the primary means of communication and collaboration within the experimental environment, Onomi has integrated an email capability so that users could distribute their resources simultaneously when bookmarking them.

GroupMark [25] aims to help Internet users find the most reliable, valuable, important and interesting information quickly and easily. It is a select-based social recommendation tool for the WWW that is based upon shared bookmarks. GroupMark uses pooled bookmarks to reason about user interests via recommender groups and their associated group profiles. In addition, it allows the group owners to accurately match other users' interests to their recommender group description. This feature helps to ensure that GroupMark will only recommend a particular user to an interest group where there is a reasonable amount of certainty that it holds some interest to that user. It provide the group owner to controls the membership by defining a group membership that users must be able to match in order to join the group.

Dogear [23] is a Social Bookmarking Service designed for a large enterprise. It provides bookmark management function that meets both personal and organizational needs. The results of trial show that individuals often explore their own bookmark collections and both the survey results and blog posts indicate that providing a means of improved personal

bookmark management. As user surveying, a majority of respondents agree that Dogear helps them to find information on both the corporate intranet and the external web. There are opportunities for service improvements to increase the ability to shared information with group and locate individuals with specific interest/expertise.

8. Conclusion and Future Work

The paper proposed a new online service utilizing a Social Bookmarking Service to support scientific research. The needs of researchers for supporting scientific process are analyzed by creating and analyzing the scenarios of SBS's usage based on a survey on research process and social software. From the scenarios, the new functions are developed as topic bookmark function for information gathering, topic group function for research collaboration, and online bookmark function based on the existing SBSs for reference management.

The research will develop a prototype system *ReMarkables* [26] to verify whether these supporting functions satisfy the users' needs for supporting scientific research process utilizing a SBS. The communication tools will be considered to extend the performance of the system to promote the collaboration among members in the community. Also a recommender system can facilitate the information gathering and retrieving in research collaboration for a specific research topic.

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