

The exploitation of social tagging in libraries

Constantia Kakali, Christos Papatheodorou
Database & Information Systems group, Laboratory on Digital Libraries and Electronic
Publishing, Department of Archive and Library Sciences, Ionian University, Corfu, Greece
{nkakali, papatheodor}@ionio.gr

Abstract. Nowadays, many libraries have developed social tagging services, after the considerable use of social tagging and deployment as key components of Web 2.0. Another set of libraries have enriched the search and indexing services of their OPACs with the folksonomy of Library Thing. The evaluation of these metadata (folksonomies) and further their exploitation is one of our challenges. At the same time, we explore ways to define a methodology for the exploitation of user's vocabulary by the traditional indexing systems maintained by information organizations. Firstly, our research focused on the user acceptance for the OPACIAL an OPAC 2.0 with social tagging functionalities. The users' behavior was studied by qualitative evaluation using questionnaires and structured interviews. Social tags are then analyzed and categorized to identify the users' needs. After finding that a large number of tags consist new terms for the authority file of a Library, these tags were searched in other authority files. The research was completed by developing a methodology for social tagging evaluation and a proposal for developing policies to integrate social tags in their indexing processes. Moving to a new study, librarians - cataloguers assessed the value of the semantics of inserted tags and also investigated the possibility of using them for the subject indexing. Before the new experiment a new set of tags from LibraryThing's folksonomy had been added to the library. The experiment aimed to compare the two vocabularies and the participants recommended to develop the cooperation with users' communities in matters of terminology and apodosis of scientific terms.

1 Introduction

The Web 2.0 technologies offer to users the chance to create metadata by organizing their information resources. This metadata creation is implemented by adding uncontrolled keywords, named tags to the resources. The phenomenon is called social tagging or collaborative tagging and has grown in popularity firstly in social bookmarking sites like Delicious, CiteULike, Flickr etc. The set of the tags introduced for a resource is called folksonomy, it could be presented as a tag cloud and express the users' vocabularies and needs.

Folksonomies are referred as a borderline case of knowledge organization systems (KOS) [1]. It is distinguished from other KOS as a flat system with many limitations, despite the democratic generation of users' literacy [2]. In contrast to traditional classification systems and thesauri, there is neither "authority control", nor selection criteria and instructions for tag generation and as a result many similar tags are

generated. The main disadvantages of folksonomies are their flat structure and inherent ambiguity of tags, which raises polysemy and synonymy problems. Usually the tags are appeared in singular and plural form concurrently, while different users apply to the same tags different meanings [3].

Recently the social tagging has been proved useful in various information organizations as museums, libraries and archives. Libraries have been taking the advantage of folksonomies to allow users to organize personal information spaces, provide tags to supplement existing controlled vocabulary and develop on line communities of interest [4]. Many pioneer libraries launch new catalogues (OPAC) or web-based applications that are inspired by the technologies of Web 2.0. The new systems, usually called OPAC 2.0, are either open source software, such as VuFind, Scriblio, AFI-OPAC 2.0 and SOPAC, or proprietary applications, such as Aquabrowser Encore and Primo. They all provide a set of key features, such as folksonomies (user keywords, tagging) and search terms recommendations, as enhanced means of supporting users' search strategies. Other libraries have enriched the indexing and search services to their lists by linking the social web application cataloging: Library Thing. LibraryThing (<http://www.librarything.com/>), a social cataloging site, allows among other social tagging and annotations in bibliographic records, which are used for organizing personal collections of users.

Given that an increasing number of libraries develop social tagging systems in parallel to their traditional services to develop structured and controlled knowledge organization systems, a key issue concerns the impact of social tags to the subject indexing. This study is focusing on the alignment of the two different approaches and present two different experimental studies on the use and the value of social tags in a library environment. The paper aims to propose a policy for the exploitation of social tagging system by information scientists in libraries.

2 Related work

Immediately after their development social tagging systems were been researched and studied by various categories of scientists. Information scientists aimed to compare the classical thematic indexes to the vocabularies used in tagging systems.

Lin, Beaudoin, Bui, and Desai [5] compared social tags with automatically extracted terms from resource titles and descriptors from MeSH, in order to check the adequacy of three keywords sets (tags, term titles, and thesaurus terms) regarding indexing quality. The comparison showed that only the 11% of tags match the MeSH terms and this was due to the different goals of the controlled vocabularies and social tagging. They also investigated how tags could be categorized to improve the searching and browsing effectiveness. Margaret Kipp [6], in her analysis on tags of CiteULike resources, compared the vocabularies of users, authors and cataloguers, and showed that user tags are related to the author keywords and cataloguers subjects, and the majority of tags were broader or new terms. Moreover the study of Al-Khalifa and Davis [7] showed that the folksonomy tags overlap significantly with the human generated keywords in contrast to the automatically generated. Voss [8] explored the similarities and differences between Wikipedia, folksonomies and traditional

hierarchical classification systems (e.g. Dewey Decimal Classification) and he concluded that Wikipedia's category system constitutes a thesaurus based on a special combination of social tagging and hierarchical subject indexing.

Most of the researchers that studied folksonomies agree to a positive role in libraries in parallel with the heavy controlled indexing systems, despite their differences. Yi and Chan [9] investigated the relation of the LCSH and social tags selected from Delicious. The study of the tags distribution over LCSH concluded that LCSH "may greatly enhance the collaborative tagging systems information control process" and "it is possible to connect collaborative tagging systems with OPACs or digital libraries". Next year, Yi [10] examined ways of predicting relevant subject headings from the social tags of resources, using 5 different similarity metrics (tf-idf, CoS, Jaccard, mutual information, iRad).

Thomas, Caudle and Schmitz [11] performed a comparison of social tags with LCSH. They report an effort of the librarians of the Cataloging Department, Auburn that compares the social tags and LCSH assigned to a sample of ten books in problematic subject areas across a sample of libraries. The analysis followed a combination of tag classification criteria mentioned by Golder and Huberman [12] and Kipp [6].

LibraryThing content has been used by several tag analysis experiments and innovative systems. According to [13], the comparison of LibraryThing's tags against their equivalent LC subject headings showed that the number of LC headings varied from book to book, but on average there existed more tags than headings. Smith [14] and Bartley [15] explored the relationship between folksonomy and subject analysis in a study of LibraryThing tags and (LCSH) associated with the same documents, and her results showed that the tags identified latent subjects. Bartley [15] in similar research showed that the majority of tags are overlap with MARC fields of the records (245: Title & 600: Subject fields). Pera, Lund and Ng [16] designed EnLibS, an online library system that aims to take advantage of the keyword similarity searching and folksonomy datasets to reduce the need for complicated search strategies and knowledge of LCSH terms. Finally Lawson [17] compared the 31 top-level subject divisions and the tags from Amazon.com and LibraryThing associated with a sample of 155 books and she claimed that social tagging enables librarians to partner with users to enhance subject access.

Heymann and Garcia-Molina [18] compared social tags and LCSH and found a large degree of overlap, but also differences in the usage of common terms by users and professionals. Rolla [19], analyzing 45 entries with subject headings and social tagging, found that in general the user tags cover the scientific domains, but a large percentage are personal and without value for information retrieval. Lu, Park and Hu [20] analyzed the similarities and differences in systems, highlighting the value of the tags as additional and complementary to the subject indexing. Even for the type of digital objects such as photographs, Stvilia and Jorgense [21] found that the half of tags they had examined from Flickr is not included on TGM and LCSH.

3 The OPACIAL system – preliminary study

Few years ago, a new OPAC 2.0 was developed by the Panteion University Library, Athens, Greece. The added-value features of OPACIAL include tagging functionalities, folksonomy-based navigation to the library material, as well as tag searching. Moreover OPACIAL provides user annotations, ranking functionalities and use of reference tools. The users are able to annotate and rank each resource (on a 1 to 5 scale) and to export a record to external social networking sites by using a social networking site aggregator, like Socializer. A significant feature of OPACIAL is the integration of OPAC records with the ones of the University's digital repository, named Pandemos and also deployed by the Library. Thus, for each OPAC record the user is capable to retrieve similar digital objects. Recently, Opacial has been enhanced and every user of the library can develop and maintain its own personality.

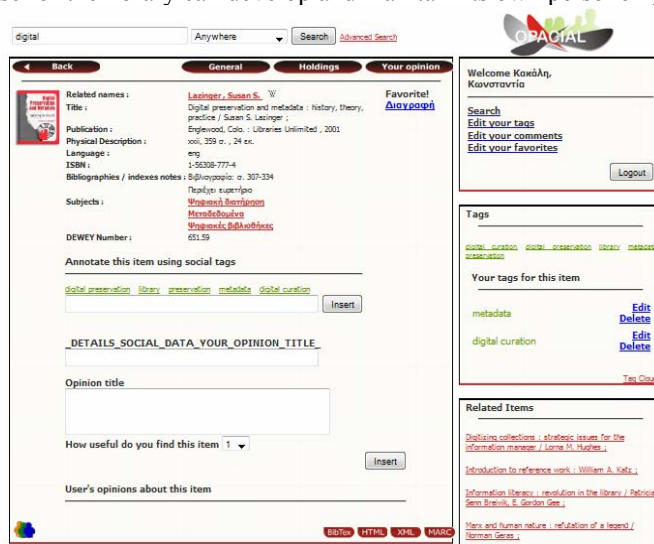


Fig. 1. OPACIAL's folksonomy management

OPACIAL has been evaluated by a technology acceptance experiment [22], in which twenty users (post graduate students and faculty members) used all its functionalities for a week, inserted more than 500 tags and finally were interviewed to assess the system usability and usefulness. The aims of this user study were to identify (a) the importance of social tagging for the users' information seeking process, (b) the difference in information search effectiveness between the use of tags and subject headings of the library catalog, and (c) the accessibility of the new services. During the empirical study a critical mass of tags was inserted by the participants, feeding the present research with valuable content.

The evaluation criteria were (a) relevance: how relevant items to the user needs returns the tagging functionality, (b) reliability: could the tags guide the users queries, (c) format: is the integration of OPAC records with object from the digital library helpful, (d) timeliness: the tags awareness, (e) learnability: how easy to learn tagging application, (f) navigation: how easy is the navigation, (g) Information architecture, (h) aesthetics. The first four criteria correspond to the usefulness concept, while the rest correspond to usability.

One of the important findings of the interviews was that the users in general consider tagging functionalities useful, as well as usable in their technological portrayal. Therefore they judged positively the new services, especially in comparison to the previous system, which was not regarded as satisfactory, despite the high level quality of the subject headings of the Library. Their general satisfaction grade was above average in the 7-point Likert scale, while the usefulness of tag introduction and search via tags functionalities recorded an average of 5.47. After experimenting with OPACIAL, the users rated the reliability of searching using tags with an average of 6.37. Referring to the second study aim users seemed prefer to use both the tags and the Library subject index. Specifically the users' view on the tags was that they play a complementary role to the existent subject index. Some of them used tags, either to describe precisely some OPAC records, or to correct wrong subject terms featured in them. Their preference was expressed by an 89.5% agreement on the assistive presence of both subject headings and social tags in their desktops. However, they were skeptical to browse the tag cloud and they were afraid of its constantly expanding size. Based on this remark a social tag searching functionality was added to the system. Concerning the tag introduction functionality the users suggested that domain experts should be allowed to add tags in order to create folksonomies and to suggest bibliographic lists for user communities. Finally, regarding the usability the general finding was that users found interaction with OPACIAL quite satisfactory and the level of accessibility quite high.

4 Tag analysis methodology

The results of the technology acceptance experiment provided an insight for the subject indexing process. This lead to a new objective, which was articulated as (a) the development of a policy for deciding the impact of the user community vocabularies to the local authority file development, and (b) the possibility of converging the user-based and the expert-based subject indexing approaches. For this purpose a tag analysis study was conducted considering several aspects of the tagging behaviour expected in this setting. The activities of the presented research could be grouped in concrete stages, formulating, thus, a methodology for the analysis and comparison of the two indexing approaches.

The methodology is shown in Figure 2 and its stages are briefly described as follows:

1. In Pre-processing stages the tag collection is delimited. The collection can be defined by some criteria such as the time, the taggers (group of users), or a particular domain of the total collection. In our case, the collection was defined

by the tags of the first users who were the participants of our experiment we had referred above.

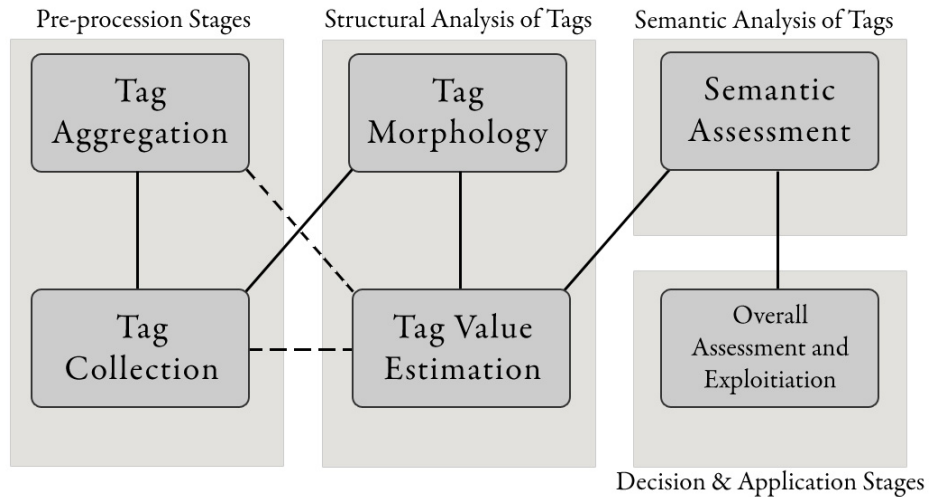


Fig. 2. Methodology of Tag Analysis

2. In the stages of Tag's structural analysis, in Morphology stage we began with a lexical analysis for grammatical forms. In the same stage, a significant activity is the study of the distribution of the tags over the bibliographic records. The interesting is that as the number of subject headings per record increases, the number of tags decreases (Fig. 3). This result confirms the assumption that tagging plays a complementary and enhancing role to weak subject descriptions.

Continuing the search with the stage of Tag's value estimation, we aimed to emerge the similarities and differences between the tags and the descriptor terms in the authority file. A significant indicator which supports the behavior analysis held on this stage is the percentage of tags which already exist in the authority file. The 46.2% (269 tags) of the total amount of tags is not present in the existing authority file.

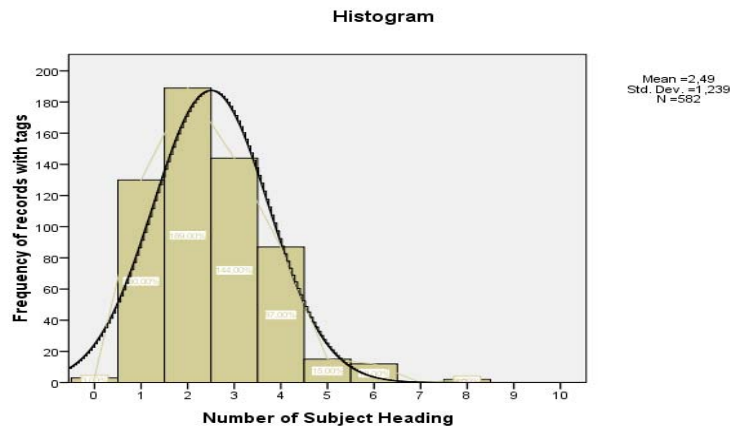


Fig. 3. Distribution of the number of subject headings over the tagged records

A following step is to categorize the user behaviors and to discriminate the purposes for social tagging. During the particular case study the one by one assiduous examination of the 582 tags emerged the following classes of tagging purposes and their frequency:

- (a) 2.1 % of the tags correct the thematic description of a record, to propose more accurate terms for the particular bibliographic records.
- (b) 80% of the tags enhance / refine the thematic description of a record, manifested by two partial behaviors:
 - (bi) uses terms that belong in the authority file as tags but not for the particular record,
 - (bii) adds new terms, disjoint from the authority file descriptors.
- (c) 3.8 % are new terms, disjoint to the local authority terms, expressing new concepts or synonyms, denoting both correction and enhancement.

Moreover there exists a group of tags (13.4%) that does not contribute to the precise expression of the subject of the documents since they are the same with the most of subject terms of the corresponding records. It is crucial to mention that these classes were confirmed by the interviews with the taggers.

3. In the stage of Semantic Assessment was examined the semantic value of tags that are not included in local authority file of the library. For this purpose five systems were selected, namely the Library of Congress Authorities (LCSH), Greek National Documentation Centre (NDC) Thesaurus, Thesaurus of Social Sciences Index Terms (SSIT), Wikipedia and WordNet, and this selection is based on three criteria: coverage, language, relevance.

The 269 “missing tags” were searched in these KOS either as a preferred or non preferred term (in Wikipedia as an article or proposed article, and any term in Wordnet) and the lexical overlap was very high in Wikipedia (61.7%), as Table 1 shows. For example, the tag “modernity” is not an authorized term in LCSH. Moreover the tag “social ontology” exists as a term in Wikipedia in some articles for social scientists, but there is not yet an article for it. Although its large size,

LC authorities cover the 34.6% of the 269 “missing tags” (28.3% in main entries and 6.3% as non-preferred terms). The main reason for this impressive coverage percentage might be the frequent update of the user-based KOS, which follows closely the vocabulary evolution of the scientific communities.

A next step in the same stage is the investigation of the semantic relation between the folksonomy tags and the local authority file terms. We formulated for each of the tagged of 245 bibliographic records ek a set of pairs (ti, sj) corresponding to all possible combinations of the tags (ti) and the subject headings (sj) used for the thematic description of a particular record. This procedure generated totally 1420 pairs, 1125 of which being unique. For each tag ti the records ei that include in their description both the tag ti and the descriptor sj were retrieved by the mentioned KOS.

Table 1: Number of tags that exist in other KOS (percentages inside parentheses)

	LCSH Authority	NDC Thesaurus	SSIT Thesaurus	Wikipedia	WordNet
Exist	76 (28.3)	26 (9.7)	35(13.0)	166 (61.7)	26 (9.7)
Not exist	176 (65.4)	229 (85.1)	234 (87.0)	66 (24.5)	243 (90.3)
Exist as non preferred	17 (6.3)	14 (5.2)	-	37 (13.8)	-
Total	269 (100.0)	269 (100.0)	269 (100.0)	269 (100.0)	269 (100.0)

Example: for the pair “archetype” - “Symbolism (Psychology)”, it is found in LC authorities that the subject heading “Archetype (Psychology)” has an associative relation with the subject heading “Symbolism (Psychology)”. The search of each relation opposed the full records of LC authorities, the Greek and Social Sciences thesauri, the WorldNet synsets for the tag ti (“archetype”) and finally the “See also” terms occurring in the article entitled by the tag ti (“archetype”).

The search showed that the majority of the pairs are not correlated in any KOS (60.6%). Once more, Wikipedia includes the majority of the correlated pairs, 28.8% of the total pairs were found.

The derived results could be explained by observing the significant differences in the philosophy and practices between social tagging and subject description.

4. The following stage, Overall Assessment and Exploitation considers two aspects of information management: (a) the micro decision making level, which focuses on particular actions and tasks regarding the inter-relations of tags and headings, and (b) the macro decision-making level, which outlines the vision of the information organization and the framework of its activities. The micro-level decisions includes the assessment and the performance of particular corrective actions on the local authority file, while the macro-level focuses on the policy development issues on social tagging by the information organization.

Concluding, the development of a policy for the exploitation of social tagging is equivalent to the establishment of a Library 2.0 environment in an information organization grounded on the concept of user collaboration and the design of collective information services.

5 Developing micro-level policies

These promising results triggered the design of a new experiment, which aimed to survey the subject cataloguers' opinion concerning the impact of the user community vocabularies to the local authority file evolution and the definition of a policy to converge the user-based and the expert-based subject indexing approaches.

A representative sample of 30 socially tagged bibliographic records was selected, which carried 72 subject headings, 66 being unique. The corresponding tags were gathered, totally 540, 120 being from OPACIAL and 420 from LibraryThing. The bibliographic records along with the corresponding subject headings and the associated tags were presented in a tabular form (Table 2 presents a part of the data).

Table 2. A sample of tagged records

Bibliographic Record	Subject Headings	Tags
Author: Weber, Max (1864-1920), Roth, Guenther (Editor), Wittich, Claus (Editor). Title: Economy and society: an outline of interpretive sociology / Max Weber; edited by Guenther Roth and Claus Wittich Publication: Berkeley, Calif. : University of California Press, c1978	Sociology Economics	19th century 20th century Europe Germany Verstehen Weber bureaucracy class structure economic sociology economics economy german history interpretation knowledge philosophy political economy political science political theory politics religion social theory society sociological theory sociology state the state theory world history Αξιολογική Ελευθερία Γερμανοί Φιλόσοφοι Κατανόηση Κοινωνιολογία

Then the Panteion University Library's subject librarians (9 cataloguers) were interviewed in order to (a) compare the expressive power of the local and the LibraryThing tags and (b) assess the semantic value of both the local and the LibraryThing tags, with respect to the corresponding subject headings that describe thematically the selected records. The focus of the discussion was on whether the tags correct, enhance or refine the subject description of the selected documents.

The findings of this study provide a great opportunity to the library staff to reconsider and evaluate the organizational schemes of subject indices, and to renew their content by adding new terms or relations. In particular the study addressed that the tags express directly the evolution of a scientific domain and the library should (a) create new subject descriptors, (b) substitute the current subject headings with more appropriate ones and (c) create references between the subject descriptors of the local authority file.

Concerning the results of the research, the interviews proved that OPACIAL has more representative and accurate tags than LibraryThing. In particular, the cataloguers “vote” for the 60% of OPACIAL tags are useful and more precise and 40% for LibraryThing. This finding is explained by the fact that OPACIAL serves a scholar community that uses a specialized vocabulary; on the other hand LibraryThing is a general-purpose collaborative cataloguing service.

All librarians confirmed that in general the tags enrich the subject description of the documents and they found a significant number of tags that are identical to authority records but not used for the thematic description of the particular records. This opinion was confirmed by the fact that only 21 tags were the same with the subject description of the selected documents, while the majority of the tags, 355 out of 540, are identical to the subject descriptors of the library authorities.

Indicative examples of this analysis are given in Table 2. The 2 subject headings of the record are included in the tag cloud. The tag cloud consists of 34 tags and 28 of them belong to the local authority. The evaluation of the tag cloud revealed that 11 of the tags could be used in the subject description of the record, while 2 of them are new terms.

Finally the librarians found that several tags constitute either new concepts or neologisms, or alternative translations of terms to the Greek language and admit that social tagging could help them to approach the user’s way of thinking and help them more effectively as well as to observe the communities terminology evolution.

Regarding the macro-level of the library policy, two librarians proposed the creation of a wiki to enhance the collaboration of subject cataloguers and the faculty members for the disambiguation of the inserted tags, the apodosis of subject descriptors in the Greek language and in general the improvement of the library authorities.

6 A methodology for enriching library authorities

Given the mentioned analysis an interesting summative question for assessing the value of the social tags is whether they improve the information seeking performance. This investigation needs the adoption of the precision and recall metrics, probably modified by a new definition for the set of relevant returned records. Besides, another issue is the definition of a criterion for the incorporation of a social tag in the thematic description of a bibliographic record and to be added as new subject term in the library’s authority file. For this purpose the following methodology is proposed:

- (a) Examination of the overlap degree between the folksonomy and the authority file of the library. Examining the degree of overlap of social tags to the terms of

the authority file we intend to highlight the percentage of social tags, which represent new terminology for the subject description of resources of the library.

(b) Examination of the overlap degree between the folksonomy and the library catalog queries logs (searches based on the following indexes: subject, author, title, language, notes, publisher, series title, anywhere and the independent index based on social tags). The aim of this step is to define the percentage of queries that are new terminology for the subject description of resources of the library.

(c) Examination of the relevance degree between a social tag and the thematic description of an annotated bibliographic record with this particular tag. The relevance measurement arises as a combination of metrics, originated by two approaches:

(i) the social aspect, in which the popularity (the frequency) of the tags applied to a record is taken into account. This estimation could be based on well-known social tagging systems, such as Library Thing, in which the number of users who have applied it to annotate a resource accompanies each tag.

(ii) the content aspect, in which the frequency of a term generated by automatic indexing systems is taken into account. In this aspect the generated index terms that are common with the tags of a bibliographic record will be selected. This estimation could be exploit known automated indexing sources, e.g. Google books. Moreover the tf-idf metric could be used in this case, instead of measuring the frequency of each index term.

7 Conclusions and further research

As a matter of fact several open issues there exist to obtain a policy for the activation of users to collaborate for the generation of a Library 2.0 environment. First of all comparative user studies should be organized and performed so that to investigate in depth the hypothesis that users prefer an information services capable to integrate the social and the traditional knowledge organization approaches. Moreover significant research should be made on the convergence of tags of a folksonomy and other knowledge organization systems in order to fulfill the user's trend who demands such integration. Given this hypothesis significant effort should be made for the incorporation of the folksonomy tags in the ideas of information organizations. The work is laborious and demands the cooperation of both the users and subject cataloguers, as well as the exploitation of semantic web technologies and collaboration tools.

References

1. Stock, W.G. (2010). Concepts and Semantic Relations in Information Science. *Journal of the American Society for Information Science*, 61(10),1951-1969
2. Quintarelli, E. (2005) Folksonomies: power to the people. In *ISKO Italy-UniMIB meeting*. Milan, Italy. <http://www.iskoi.org/doc/folksonomies.htm>.

3. Mathes, A. (2004). *Folksonomies - cooperative classification and communication through shared metadata. Report*. Graduate School of Library and Information Science, Illinois Urbana-Champaign. <http://www.adammathes.com/academic/computer-mediated-communication/folksonomies.html>
4. Spiteri, L. F. (2006). The use of folksonomies in Public Library catalogues. *Serials Librarian* 51, 75-89.
5. Lin, X., Beaudoin, J. E., Bui, Y., & Desai, K. (2006). Exploring characteristics of social classification. In *Proceedings of the 17th ASIS&T Classification Research Workshop, Austin, Texas, USA*. <http://dlist.sir.arizona.edu/1790/01/lin.pdf>.
6. Kipp, M.E.I. (2006). Complementary or discrete contexts in online indexing: a comparison of user, creator, and intermediary keywords. *Canadian Journal of Information and Library Science* 30(3). <http://dlist.sir.arizona.edu/1533/01/mkipp-caispaper.pdf>
7. Al-Khalifa, H.S., & Davis, H.C. (2007). Exploring the value of folksonomies for creating semantic metadata. *International Journal on Semantic Web and Information Systems*, 3(1), 13-39.
8. Voss, J. (2006). *Collaborative thesaurus tagging the Wikipedia way*. <http://arxiv.org/abs/cs.IR/0604036>.
9. Yi, K., Chan, L. M. (2009). Linking folksonomy to Library of Congress subject headings: an exploratory study. *Journal of Documentation* 65(6), 872-900.
10. Yi, K. (2010). A Semantic Similarity Approach to Predicting Library of Congress Subject Headings for Social Tags. *Journal of the American Society for Information Science*, 61(8),1658-1672.
11. Thomas, M., Caudle D., Schmitz C. (2009). To tag or not to tag? *Library Hi Tech* 27(3), 411-334.
12. Golder, S., & Huberman, B. (2006). Usage patterns of collaborative tagging systems. *Journal of Information Science*, 32(2), 198-208.
13. Mendes, L.H. Quinonez-Skinner J., Skaggs D. (2008). Subjecting the catalog to tagging. *Library Hi Tech* 27(1), 30-41.
14. Smith, T. (2007). Cataloguing and you: Measuring the efficacy of a folksonomy for subject analysis. In *18th Workshop of the American Society for Information Science and Technology Special Interest Group in Classification Research, Milwaukee, Wisconsin, USA*. <http://dlist.sir.arizona.edu/2061/01/Smith%5FUupdated.doc>.
15. Bartley P. (2009). *Book Tagging on LibraryThing: How, why, and what are in the tags?* Available at: <http://www.asis.org/Conferences/AM09/open-proceedings/papers/28.xml>.
16. Pera, M.S., Lund, W., Ng, Y-K., (2009). A sophisticated library search strategy using folksonomies and similarity matching. *Journal of the American Society for Information Science and Technology*, 60(7), 1392-1406.
17. Lawson, K. (2009). Mining social tagging data for enhanced subject access for readers and researchers. *The Journal of Academic Librarianship* 35(6), 574-82.
18. Heymann P, Garcia-Molina H. (2009). Contrasting Controlled Vocabulary and Tagging Do Experts Choose the Right Names to Label the Wrong Things? In *Proceedings of the Second ACM International Conference on Web Search and Data Mining - WSDM '09*.
19. Rolla, BPJ. (2009). User Tags versus Subject Headings Can User-Supplied Data Improve Subject Access to Library Collections? *Library*, 53(3):174-185.
20. Lu, C. Park J-r., Xu, (2010). User tags versus expert-assigned subject terms: A comparison of LibraryThing tags and Library of Congress Subject Headings. *Journal of Information Science*, 36(6):763-779.
21. Stvilia B, Jørgensen C. (2010). Member Activities and Quality of Tags in a Collection of Historical Photographs in Flickr. *Journal of the American Society for Information Science*, 61(12), 2477-2489.
22. Gavrilis, D., Kakali, C., & Papatheodorou, C. (2008). Enhancing library services with Web 2.0 functionalities. In *Proceedings of the 12th European Conference on Research and*

Advanced Technology for Digital Libraries (Aarhus, Denmark, September 14 - 19, 2008).
Lecture Notes in Computer Science, vol. 5173. Springer-Verlag, Berlin, Heidelberg, 148-159.