Social Networks for Knowledge Management

Ryan Zammit, Mark Woodman

School of Science and Technology

Middlesex University

London, United Kingdom

e-mail: r.zammit@mdx.ac.uk, m.woodman@mdx.ac.uk

Abstract—**Online social networks have changed the way many people communicate and interact as private individuals and employees. Sharing and communication through this medium has become, for many, a daily habit. Many of these networks provide a simple way to seek and find knowledge and expertise from both friends and strangers. Information technology has been used in many ways to support knowledge management initiatives. However the use of social networking technology has been little explored. It is thus argued that combining knowledge management systems with social networking technology would bridge this gap. Social software is becoming part of a standard arsenal of tools deployed within companies, tools that may help knowledge management. Evidence is presented from a review of relevant literature and through a survey, conducted via online social networks, asking respondents' usage of social networking for knowledge management purposes in both their private lives and also work-related practices. It shows that personal networks are often used as a medium to seek knowledge for personal and for organisational motives. The results confirm that online social networks, and their enterprise counterparts, are aiding knowledge management initiatives. Knowledge appears to be flowing through online social networks. Findings also include the confirmation of Dunbar's number, and reaffirming the strength of "weak ties" as originally proposed by Granovetter. The paper proposes the new concept of *temporary ties* that are aided through social networks. It also describes the work in progress and findings so far on the use of social networking technology and habits for aiding knowledge management initiatives.**

Keywords- knowledge management, knowledge management systems, social networking, strong ties, weak ties, temporary ties

I. INTRODUCTION

Knowledge management (KM) is generally taken as the systematic and organisationally specified process for acquiring, organising and effectively communicating knowledge of employees to other employees so that they can be more effective and productive in their work [1]. KM is applied where the interaction between people, technology, and techniques allow an organization to manage its knowledge by facilitating knowledge creation, knowledge validation, knowledge presentation, knowledge distribution, and knowledge application activities. All these aim to maximise business value by delivering what is needed at critical points when it is needed (Bhatt, 2011).

To aid KM initiatives, knowledge management systems (KMS) are often introduced. The aim of KMS is to enable the formation, communication and utilisation of knowledge [2]. Meso and Smith [3] propose two predominant perspectives of what constitutes KMS; the technical perspective and the socio-technical perspective. On one hand, the technical perspective takes the point of view that the technology is the KMS [3]. On the other hand, the socio-technical perspective recognises that technology alone does not make up a KMS and that most importantly people form part of the KMS. This paper takes the stance of the socio-technological view, and further argues that, the users are not simply part of the system but are critically central to it [4].

According to Aristotle, humans are by nature social animals: through socialisation, knowledge has been transferred from generation to generation since the very first days of communication. Technology now provides for the human need to be socially connected. Online social networks have proliferated and become a conventional communication medium for teenagers and adults alike (Evans, 2011). These systems have seen an unusually high user take-up for varying reasons. Most of the current online social networks (SN) allow friends to connect to each other and form virtual networks (e.g., Facebook, LinkedIn). Others enable the connection between total strangers, usually formed on mutual interest or experience, with connections being unidirectional or bidirectional, depending on the users' choice (e.g., Twitter).

An immediate advantage of using a social network is the possibility of the compilation of a user-updated digital address book of friends or acquaintances. However, social networks also provide a user with the ability to publicly display a profile, exposing to varying extents, personal interests, experience and expertise. Moreover user's *walls* or *streams*, which are a list of user's actions, updates, etc., provide a real-time feed of personal information to their friends and followers. These facilities engender and are supported by habits of SN users to keep their information up to date. This paper argues that KM initiatives stand to benefit from these new habits by introducing more social aspects in their KMS.

Arguably, informational systems categorised as KMS have hindered the practice through their lack of social elements. Separate research [5] shows that social interaction and network ties are indeed associated with greater knowledge acquisition for companies. This paper argues that online SNs are aiding companies to acquire new knowledge through employees' personal networks. The primary evidence comes from an online survey, published and shared mainly through SNs. Findings from the survey show that there are new tendencies of individuals and employees using their personal social networks to aid their knowledge. Connections are happy to help or refer connections to other users, which thanks to SNs are only a couple of clicks away. Personal expertise is exposed through *profiles* and this appears to be aiding network connections to learn more about one's interest and knowledge. Weak ties still prove to be an important source of new knowledge. SNs also appear to be facilitating the shifting, between ties, from strong to weak, or vice-versa, depending on personal situations. This concept is defined by this research as *temporary ties*.

Section II discusses related work. Section III discusses socialisation in knowledge management and Section IV argues the use of social networks for knowledge management. Section V highlights the design and execution of the survey conducted. Section VI discusses the survey findings. Section VII presents a conclusion of the paper whilst proposing further research.

II. RELATED WORK

Social networking literature pre-dates today's modern tools and online SN. Maguire [6] points out how networks are formed on the basis of rewards, costs of participation, and social context; these factors continuously change whilst relationships are maintained as long as the costs of maintaining the network relationships do not exceed the rewards. Marin and Wellman [7] define a SN as "a set of socially relevant nodes connected by one or more relationships". For example, in the case of Facebook, socially relevant relationships form based on real life relationships, whilst in the case of Twitter, social relevancy would emerge based on interest and friendship. These often overlap and intertwine. The reasons why people decide to connect with others is out of scope of this research, however it is acknowledged that a relationship forms on a base of real world relationships or personal rewards and benefits. On such basis ties are formed.

Seminal work by Granovetter [8] posits that strong ties, i.e., the connections that are more similar to us, contribute a limited amount of new knowledge whereas weak ties may serve as a bridge to new knowledge. Thus weak ties hold a *greater* potential for new knowledge than strong ties would. Maguire [6] points out how "when new knowledge or unusual information is required, a network is often used with at least some weak ties that bridge other networks. One or more weak ties to different type of networks increase the likelihood of encompassing different opinions and information". Knowledge management thus stands to benefit in many and multiple ways through the interaction and exploitation of users' online activity, *sharing*, and their established networks.

Sharing has always been a crucial task for knowledge management. Yet knowledge sharing is a complex activity as knowledge held by a person cannot be completely codified and shared (Johnson et al, 2002 – cited in Bick et al., 2012). In Nonaka and Takeuchi's work [9], famously known as the SECI model, depicted in Figure 1, socialisation is the first step in the effort of knowledge sharing. The SECI model has wide implications on KMSs that merely try to use informational systems to capture knowledge for knowledge sharing without much effort on the socialisation aspect. KMS implementing social elements in their design seem to be preferred by users. Zammit and Woodman [4] argue that KMS take-up is drastically improved when social elements are introduced. The tools and techniques they implemented were mainly aimed to improve knowledge sharing and expertise localisation, often leading to face-to-face socialisation, which ultimately aided the KMS adoption. Arguably this ties in with the huge usage of public online SNs where users find it rewarding to maintain information as complete and up-to-date, even in real time.
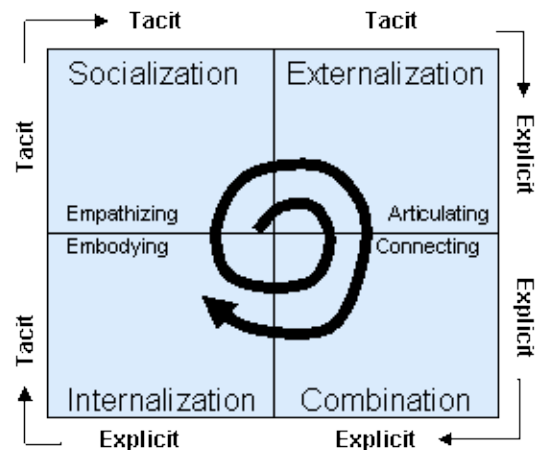

Figure 1 – SECI model (Nonaka & Tackeuchi, 1995)

The field of computer science and information systems is only now beginning to investigate the properties of SNs and the role of computer mediation for successful knowledge sharing (Mislove et al, 2007; Hossain et al, 2012). By contrast, other disciplines, including the social and behavioural sciences, economics, marketing and industrial engineering, have long been studying online SNs [10]. Although knowledge sharing in social networks can be observed on a daily basis, the effect of general social networking, and hence SNs, on KM has been little explored [11].

III. SOCIALISATION IN KNOWLEDGE MANAGEMENT

Socialisation is a key stage in the knowledge transfer and hence in KM. From the SECI model [9], it emerges that the transfer of knowledge originates through socialisation. The SECI model proposes knowledge transfer as a spiral model starting in a 2 x 2 matrix in which existing knowledge can be of either form, i.e., tacit or explicit, and the objective of knowledge transfer is to convey knowledge.

On a daily basis, one may observe socialisation happening in the workplace through the so-called "water-cooler" conversations, or other official team-building activities [12]. Successful KM concepts and elicitation methods, such as Communities of Practice [13], Collaborative Innovation Networks [14], Storytelling, Knowledge Cafés, Cynefin [15], and KMS development methodologies such as the Five-Phase Methodology [16] all have a major feature in common; socialisation is central to their method and socialisation is given importance over the technology used.

Delmonte and Aronson [17] analyse the correlation between socialisation and KMS success factors finding that there is a significant relationship between social interaction within an organisation and KMS success. Other empirical research also suggests the importance of the social environment in the enhancement of collaboration activities [12]. This is also corroborated in other findings, which denote that a sole technology approach to knowledge management has serious limitations [18].

However, the view that KMS are a subclass of information systems still persists [19] and KMS development is often oriented towards information systems development [20]. Information systems are weak in interpreting information and high level communication [21] and tend to view the class of users as an external entity to the system. Contrastingly in KMS this should not be the case. Yahya and Goh [12] argue that the interpretation of information is the corner stone for KM. If so, then it is the human that makes it a knowledge system, and thus, systems need not only enable and aid knowledge management, but also aid socialisation in order to achieve better knowledge management.

In the situation of knowledge socialisation, knowledge can be considered to be flowing among the parties, and techniques for socialisation are creating knowledge flows. Socialisation is thus important in the context of KM initiatives and attendant KMS. Surprisingly, very little emphasis is found on this aspect in the KMS literature.

Social software development is prospering and a number of public sites have seen record number of users signing-up. Software is also available for enterprises to setup there own social networks, often referred to as enterprise social networks, and other software packages, such as customer management systems, are also including social elements in their systems. Britaniu and Orzea [22] posit that public social

networks sites can be regarded as settings for knowledge transfer, sharing and knowledge dissemination [22].

Arguably traditional KMS development focuses on the capturing and dissemination of knowledge, to the detriment of the social aspect in knowledge transfer. A system aimed at the capture and dissemination of knowledge, analysed under the SECI model, falls within the Externalisation quadrant and aides the Internalisation quadrant. Socialisation and Combination are arguably left out or not aided by information systems branded as KMS. By contrast, a social system, such as an SN, will also include the Socialisation and Combination aspect thus satisfying the spiral of knowledge transfer according to the SECI model.

While socialisation within KMS seems to be improving system take-up, the effect of social networking on KM has been little explored (McLure Wasko & Faraj, 2005; Bebensee et al, 2011; Rashid et al, 2011). This paper looks into how social networking, especially through an electronic medium such as social networks, is an emerging trend and how this trend is helping knowledge management initiatives. This paper places importance on socialisation and collaboration, and the impact that social networks are having on knowledge management efforts in acquiring, capturing, and transferring knowledge.

IV. SOCIAL NETWORKS FOR KNOWLEDGE MANAGEMENT

SNs are shaping our daily lives including our social and working habits. The level of adoption of SNs and the amount of sharing over them is unprecedented. Facebook, for example, is a remarkable case study: it has over one billion monthly active users as of October 2012 [23]. SNs provide a constant stream of status updates, photos, and news from online social circles, often in real-time fashion. These shared updates are of interest to a number of connections to which the posts may constitute a source of knowledge.

The statistics on information management that can represent knowledge sharing are of considerable note. For example, on an average Facebook day [24]:

15% of Facebook users update their own status.
22% comment on another's post or status.
20% comment on another user's photos.
26% "Like" another user's content.
10% send another user a private message.

Based on the above statistics the definition of SN knowledge sharing activity, for purposes of this research, is taken to be an update to a profile, commenting on other posts or status, or private messaging. Based on this definition it emerges that 47% of daily usage on Facebook happens for knowledge sharing. Facebook is huge with over 1 billion users. That gives 470,000,000 knowledge posts. For the sake of argument, if about 10% of this sharing contains valuable knowledge to a user, then 47,000,000 posts contain relevant knowledge. From this rough estimate, the huge potential for knowledge sharing is clear. Of course not all of this knowledge is directly accessible to an

individual's direct network; however, if an individual user has an average network size of 150 connections, a good number of accessible posts will contain knowledge. Furthermore, considering that these 150 connections might be aware of a person seeking certain knowledge, then the potential growth in knowledge accessibility is exponential. Moreover, the streams of information being posted and shared by a user's network are already pre-filtered by the SN, which, in theory, should reduce information overload – i.e., by social-filtering. As strong ties have same interests, posts from strong ties should strengthen user's knowledge, whilst on the other hand posts from weak ties should increase user's exposure to new knowledge.

Thus, SNs constitute a source of knowledge and are suitable for aiding KM initiatives. SNs provide an electronic platform to maintain a large network of contacts, supporting both the existing social connections, and the formation of new ones [25]. Moreover, these contacts are willing to share knowledge that may provide benefit to their network. Above this, SNs provide an easy direct way to contact connections, and to keep abreast with their updates.

Using the SECI model quadrants to analyse SNs for KM, they appear to provide a means of Socialisation through connecting people, a means of Externalisation of user's knowledge through the sharing of posts, the Combination through receiving users posts which also aids Internalisation. Ellison [25] and Hampton [26] also find that there is a clear trend for those who use Internet and social technologies to receive more support than other people who do not. This is also corroborated in other research (Yli-Renko et al, 2001; Gloor et al, 2008; Hossain et al, 2012; Phelps et al, 2012). For KM this implies that aiding users to maintain more connections would aid the KM initiative.

However, although having more connections seems to be more beneficial, it is contrary to Dunbar's findings [27]. A (non-tech) social study by Dunbar shows that humans are limited in their ability to maintain a network to between 124–153 active connections (Dunbar, 1992; Hill and Dunbar, 2003). SNs nowadays might appear to be disproving this with people having more than 1,000 so-called 'online friends'. Dunbar himself has denounced Facebook 'friends' as something that can't be described as relationships [28]. Having a connection does not imply having active interactions with a person. Since neither Dunbar nor Granovetter [8] had the computing power or the SNs we have today, a number of experiments, to prove or disprove this number using modern SNs have already been run. These, however, have achieved mixed results [28].

To date, no studies have been found on whether, and how users use SNs for knowledge management purposes. To address this gap in published work, this research conducted a survey to assess users' social networking habits in relation to seeking help and finding knowledge. Section V describes the survey followed by the discussion of the findings in section VI.

V. SURVEY DESIGN AND EXECUTION

In order to quantify the usage of SNs for knowledge purposes, this research has run a survey [29] asking the participants about the way they use SNs with respect to their help-seeking tendencies.

The respondents were asked general questions from their age, to which SNs they use, to how often they visit these sites. Furthermore they were asked the amount of connections, or "friends", they have within their network and how well they consider they know these connections. The survey asked respondents about how they seek for help through personal profiles, private messages, or walls. For the purpose of this research this establishes the usage trends of knowledge seeking. Respondents were then asked if they mainly seek help for their personal problems or for work related issues. This helps the research establish whether SNs are being used for seeking work-related knowledge.

Next, respondents were asked whether they have learnt about their contact's area of expertise through SNs or if they knew it beforehand, which helps the research shed light into how users chose to contact whom and what role SNs play. Lastly, the users were asked about their tendencies to provide help to their contacts, showing whether or not users are willing to act as bridges to new knowledge.

The survey was mainly shared online via the researcher's SNs, namely Facebook and Twitter. Sharing the survey solely through two social networks had the risk of collecting the sole view of those networks' users. This was addressed by using a personal connection that is known to shy-away from SNs. Through link-tracking mechanisms it is possible to ascertain that 18.66% of responses came through this source.

To avoid inadvertent bias, the survey did not explicitly define what 'active connections' or 'acquaintances' are. The respondents were left to use commonplace meanings.

VI. SURVEY FINDINGS

The survey itself is an example of how knowledge can be acquired through SNs. The survey questions may be regarded as a knowledge-seeking effort; the replies regarded as information gathering, the accumulation of which results in new knowledge. In less than 12 hours from the survey being released more than 100 respondents had, not only answered the survey, and shared their knowledge, but also "shared" to their networks. This sharing may be seen as effective new knowledge that would have been otherwise inaccessible, without a considerable amount of effort.

134 respondents answered the survey, with 47.76% of the respondents aged 18-24, 44.03% aged 25-34, 2.24% aged 34-44, 2.99% aged 45-54, and another 2.99% falling within the 55-64 age range. 49.51% of the respondents visit SN sites "Extremely Often". The survey results clearly indicate a shift in culture towards using SNs for knowledge

management purposes. All respondents have admitted to actively seek help through their contacts with 21.35% of respondents admitted to learning about their contact's area of expertise through SNs. This indicates that users learn more about their weak ties thanks to SNs, opening up possibilities for knowledge from these ties. Qualitative research suggests that perceptions formed on another person through direct interaction, observation or recommendation affects the likelihood of seeking information from them in the future, and thus learning someone's expertise or knowing how to reach him or her quickly, affects the probability of seeking that person for information in the future [29].

Respondents disclosed that SNs prove to be helpful for both personal and professional problems. 80.9% indicate that SNs are helpful with regards to "Common Personal Problems", 71.9% indicate SNs are helpful with "Specific Personal Problems", 76.39% indicate SNs are helpful for "Common Professional Problems" and 69.66% indicate that SNs are helpful with "Specific Professional Problems". Therefore it emerges that users are using their SNs in order to overcome work problems more or less to the same degree to which they use SNs for private problems. Personal SNs are thus being used to the benefit of the employing organisation.

Interestingly, 30.78% of the respondents refer their contact (Contact A) to another contact (Contact Z) in their network for help when they themselves are unable to help. Thus SNs appear to be providing a medium for contacts to act as bridges between unconnected ties. Ref to Figure 2. Haythornthwaite [30] defines the concept of "latent ties" as those social network ties that are ''technically possible but not activated socially'' [30]. Hence SNs are facilitating latent ties to be introduced to the user's network. Similarly SNs appear to enable ties to temporarily shift from being weak ties to becoming strong ties, without much effort. In order to achieve a goal a weak tie may temporarily shift to become a strong tie. Thus *temporary ties* are defined by this research as being those ties that are shifted in one's network to benefit a specific need. Whether these replace a previously strong tie or not, in-line with Dunbar's limit, is unimportant as the behaviour of shifting one's network ties is naturally observable with relationships shifting naturally over time. The concept of shifting ties is novel and further research into this concept may be required.
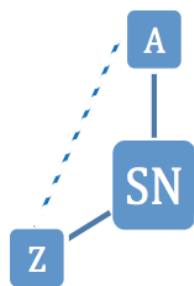

Figure 2 - SN bridging unconnected ties.

As a side-product of the survey, results also indicate that Dunbar's number still holds within SNs. Respondents declared an average total of 663 connections with an average of 206 as "active" connections and 287 as "acquaintances".

The survey has thus exposed that knowledge management is occurring through public online SNs. Albeit in an ad-hoc manner, SNs are providing a medium for communication and knowledge exchange. Knowledge is being sought and directly exchanged, through direct personal messages, or indirectly found through "updates", "streams", "timelines" or "walls". Arguably, previous to SNs, knowledge-seekers needed to actively search for help. For example one would need to remember that contact C knows about topic X and devise a way to communicate with C for help, be it in person, or email etc. This is also true for contact C wanting to share his knowledge. They would need to actively think about who might need what he knows and actively send, or document in a repository, his knowledge.

The findings could be strengthened by running the same survey through separate networks like, for example, starting from Person A where person A is not connected, or is far away from the centre, of the researchers network. However, these findings are believed to be a good representation of the trends in the use of social networking for knowledge-seeking efforts.

VII. CONCLUSION

This paper builds an argument for the use of social networks for knowledge management purposes. Through the reviewing of related work, evidence is exposed that social networking technology may benefit knowledge management initiatives. A gap is exposed on the lack of use of social networking technology within knowledge management initiatives.

To address this gap, a survey is conducted in order to assess the habits of public online social network users in their quest to acquire knowledge. The survey results show that personal social networks are being used for knowledge management purposes, both for personal and professional reasons. This appears to be benefiting the employing organisation by expanding their boundaries.

Social networks are clearly being used for knowledge management purposes. Further research needs to be done within the field of knowledge management to explore the possible benefits of integrating social networking technologies within knowledge management initiatives.

The survey results also reaffirm the strength of weak ties, and that Dunbar's limit seems to still hold. Through this paper the concept of shifting temporal ties are proposed. Through social networking technology it appears that knowledge seekers shift their weak ties closer in an effort to satisfy their knowledge needs. Further research possibilities exist here to explore this concept further.

REFERENCES

[1] J. Hahn and M. R. Subramani, "A Framework of Knowledge Management Systems: Issues and Challenges for Theory and Practice," , Brisbane, 2000.

[2] J. Gonzalez-Reinhart, "Wiki and the Wiki Way: Beyond a Knowledge Management Solution," 2005.

[3] P. Meso and R. Smith, "A resource-based view of organizational knowledge management systems," *Journal of Knowledge Management*, vol. 4, no. 3, 2000, pp. 224-234.

[4] R. Zammit and M. Woodman, "A Case for Repositories in Knowledge Management Systems," in *13th European Conference on Knowledge Management*, Caratgena, 2012, pp. 1289-1297.

[5] H. Yli-Renko, E. Autio, and H. J Sapienza, "Social Capital, Knowledge Acquisition, and Knowledge Exploitation in Young Technology-Based Firms," *Strategic Management Journal*, vol. 22, 2001, pp. 587-613.

[6] L. Maguire, *Understanding Social Networks*.: Sage Publications, Inc., 1983.

[7] A. Marin and B. Wellman, "Social Network Analysis: An Introduction," in *The Sage Handbook Of Social Network Analysis*, John Scott and Peter J Carrington, Eds.: Sage, 2012, pp. 12-25.

[8] M. S. Granovetter, "The Strength of Weak Ties," *American Journal of Sociology*, vol. 78, no. 6, May 1973.

[9] H. Nonaka and I. Takeuchi, *The Knowledge Creating Company: How Japanese Companies*. New York: Oxford Press, 1995.

[10] S. Wasserman and K. Faust, *Social Network Analysis Methods and Applications*, 15th ed., M. Granovetter, Ed. New York: Cambridge University Press, 1994, vol. 15.

[11] T. Bebensee, R. Helms, and M. Spruit , "Exploring Web 2.0 Applications as a Mean of Bolstering up Knowledge Management," *The Electronic Journal of Knowledge Management* , vol. 9, no. 1, 2011, pp. 1-9.

[12] S. Yahya and W. Goh, "Managing Human Resources Towards Achieving Knowledge Management," *Journal of Knowledge Management*, vol. 6, no. 5, 2002, pp. 457 – 468.

[13] E. Wegner, R. McDermott, and W. M. Snyder, *Cultivating Communities of Practice: A Guide to managing knowledge*.: Harvard Business School Publishing, 2002.

[14] P. Gloor, R. Laubacher, S. B. C. Dynes, and Y. Zhao, "Visualization of Communication Patterns in Collaborative Innovation Networks: Analysis of some W3C working groups," in *Proc. ACM CIKM 2003*, 2003, pp. 5-6.

[15] F. C. Kurtz and D J Snowden, "The new dynamics of strategy: Sense-making in a complex and complicated world," *IBM Systems Journal*, vol. 42, no. 3, 2003, pp. 462-283.

[16] M. Woodman and A. Zade, "Towards a Practical Guide for Developing Knowledge Management Systems in Small Organizations," *Electronic Journal of Knowledge Management*, vol. 10, no. 2, 2012, pp. 184-195.

[17] A. J. Delmonte and J. E. Aronson, "The Relatonship Between Social interaction and Knowledge Management System Success," *Journal of Knowledge Management Practice*, August 2004.

[18] L. Damodaran and W. Olphert, "Barriers and facilitators to the use of knowledge management systems," *Behaviour & Information Technology*, vol. 19, no. 6, 2000, pp. 405-413.

[19] M. Alavi and D. Leidner, "Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quaterly*, vol. 25, no. 1, 2001, pp. 107-136.

[20] A. Moteleb, M. Woodman, and P. Critten, "Towards a Practicle Guide for Developing a Knowledge Management System," in *European Conference on Knowledge Management*, 2009, pp. 559-569.

[21] G. Bhatt, "Knowledge management in organizations: examining the interaction between technologies, techniques, and people," *Journal of Knowledge Management*, vol. 5, no. 1, 2001, pp. 68-75.

[22] C. Bratianu and I. Orzea, "Knowledge Strategies in Using Social Networks," in *European Conference on Knowledge Management*, Cartagena, 2012, pp. 127-134.

[23] Facebook. Facebook. [Online]. HYPERLINK "Newsroom" http://newsroom.fb.com/Key-Facts, [retrieved: December, 2012].

[24] PEW Research Center, "Social networking sites and our lives," PEW Internet, PEW Research Center, 2011.

[25] N. B. Ellison, C. Steinfield, and C. Lampe, "The Benefits of Facebook ''Friends:'' Social Capital and College Students' Use of Online Social Network Sites," *Journal of Computer-Mediated Communication*, vol. 12, 2007, pp. 1143-1168.

[26] K. Hampton. New York Times. [Online]. HYPERLINK "Social Media As Community" http://www.nytimes.com/roomfordebate/2012/02/12/the-advantages-and-disadvantages-of-living-alone/social-media-as-community, [retrieved: June, 2012].

[27] R Dunbar, "Neocortex Size as a constraint on group sizes in primates," *Journal of Human Evolution*, vol. 20, 1992, pp. 269-293.

[28] P. Bogolyubov, "The Strength of Ties on Social Networks: An examination of Demographic Determinants," in *European Conference on Knowledge Management*, 2012, pp 93-99.

[29] R. Zammit. Social Networks For KM. [Online]. HYPERLINK "http://bit.ly/sn4km" http://bit.ly/sn4km [retrieved: March, 2013].

[30] S. P Borgatti and R. Cross, "A Relational View of Information Seeking and Learning in Social Networks," *Management Science*, vol. 49, no. 4, pp. 432-445, April 2003.

[31] C. Haythornthwaite, "Social networks and Internet connectivity effects," *Information, Communication & Society*, vol. 8, no. 2, 2005, pp. 125-147.

[32] L. Hossain, S. Reay Atkinson, R. T. Wigand, and S. Carlsson, "Knowledge Sharing through Social Networks," in *The Second International Conference on Social Eco-Informatics*, 2012, pp. 27-34.

[33] R. A. Hill and R. I. M. Dunbar, "Social Network Size In Humans," *Human Nature*, vol. 14, no. 1, 2003, pp. 53-72.

[34] A. Mislove, M. Marcon, K. P. Gummadi, P. Druschel, and B. Bhattacharjee, "Measurement and Analysis of Online Social Networks," in *Internet Measurement Conference*, San Diego, 2007.

[35] M. M. Wasko and S. Faraj, "Why Shoud I Share? Examining Social Capital and Knowledge Contribution in Electronic Network Practice," *MIS Quaterly*, vol. 29, no. 1, March 2005, pp. 35-37.

[36] A. Rashid, W. Wang, and K. Hashim, "Social Networks and its Impact on Knowledge Management," in *International Conference on Control System, Computing and Engineering*, 2011, pp. 227-230.

[37] C. Phelps, R. Heidl, and A. Wadhwa, "Kowledge, Networks, and Knowledge Networks: A Review and Research Agenda," *Journal of Management*, vol. 38, no. 4, July 2012, pp. 1115-1166.

[38] S. Evans. AdAge. [Online]. HYPERLINK " Kickstart Slide Deck" http://adage.com/article/adagestat/stats-day-50-social-media-stats-kickstart-slide-deck/231093/ [retrieved: November, 2011].

[39] M. Bick et al., "Manifesto for a Standard on Meaningful Representations of Knowledge in Social Knowledge Management Environments," in *Multikonferenz Wirtschaftsinformatik,* 2012.