Investigating the use of social media in improving knowledge management within a collaborative product development and testing environments

Zammit J.P., Gao J., Evans R.D. and Saunders T.

This is an electronic version of a paper presented at the 13th International Conference on Manufacturing Research (ICMR 2015), University of Bath, 8th-10th September 2015. Accepted for publication in Newnes, L., Nassehi, A. and Dhokia, V. (eds.). Advances in Manufacturing Technology XXIX, Proceedings of the 13th International Conference on Manufacturing Research (ICMR2015), pp. 147-152, University of Bath, 8-10 September 2015, pp. 135-140.

INVESTIGATING THE USE OF SOCIAL MEDIA IN IMPROVING KNOWLEDGE MANAGEMENT WITHIN A COLLABORATIVE PRODUCT DEVELOPMENT AND TESTING ENVIRONMENTS

Joseph Paul Zammit
Faculty of Engineering & Science
University of Greenwich
Chatham Maritime,
Kent ME4 4TB, UK
J.P.Zammit@greenwich.ac.uk

James Gao
Faculty of Engineering & Science
University of Greenwich
Chatham Maritime,
Kent ME4 4TB, UK
J.Gao@greenwich.ac.uk

Richard David Evans
Westminster Business School
University of Westminster
Marylebone Road
London NW1 5LS, UK
R.Evans@westminster.ac.uk

Tim Saunders
Faculty of Engineering & Science
University of Greenwich
Chatham Maritime,
Kent ME4 4TB, UK
T.Saunders@greenwich.ac.uk

ABSTRACT

In the last three decades, the manufacturing industry has witnessed the growing benefits of incorporating knowledge management in to business practices, which have been documented in research literature worldwide. However, several manufacturing companies still struggle to successfully manage and extract the full potential of their in-house knowledge, both at organisational and individual levels, and are often unable to fully capture and utilise lessons learned into their new products. This research, through an exploratory survey conducted with an industrial partner operating in the power generation sector, explores the possibility of using alternative methods for knowledge management purposes, such as social media tools and video sharing as a means of capturing, sharing and discussing company knowledge in a product development engineering environment. The paper presents the results of the investigation which explored employee usage and tendencies of social media tools, preferred learning methods and their knowledge sharing habits.

Keywords: Product development, Product validation and testing, Social Media, Video Sharing, Knowledge management, Collaboration.

1 INTRODUCTION

Knowledge management (KM) is a necessary business activity for improving business processes and maintaining competitive capability when enterprises lose their key personnel (Briggs 2006). By successfully implementing knowledge management systems, companies should be able to transfer knowledge more easily and better reuse it in New Product Development (NPD) projects, because knowledge is a crucial asset for organisations that assists them to gain a sustainable competitive edge (Grant 1996), and gain a larger market share.

A critical task during Product Development (PD) is the process of development testing, which consumes a considerable amount of time during the development cycle and requires a considerable employee technical skill set that is flexible, adaptable and sometimes innovative, to constantly changing engineering requirements and advancements. These skill sets in product development testing consist of vast amounts of knowledge which are built up over time and are typically exclusive to the minds of individuals or technical experts. This limitation in knowledge can create bottle necks during development testing or create situations where readily available knowledge is recreated by someone else due to the original knowledge not being readily available or shared (Knowledge Re-Use).

According to these issues mentioned above, this research focuses on investigating and developing a methodology to improve the capture, sharing and discussion of PD knowledge using social media tools and video sharing, targeted for a product development engineering environments, with a primary focus on PD testing and validation. It has been identified, from a prior industrial investigation carried

out by the authors (Zammit, Gao et al. 2014), that there is a strong need to adopt an alternative method to handle employee knowledge, providing more tacit content that can be shared with others. This paper presents the results of an investigation which explored user tendencies to use tools such as social media sites and video sharing platforms in their everyday lives. This provided an indication of the acceptance of the proposed knowledge framework once it had been developed.

2 KNOWLEDGE IN COLLABORATIVE PRODUCT DEVELOPMENT AND TESTING

Knowledge can be classified into two distinct categories: Explicit and Tacit. Explicit knowledge can be expressed in formal methods or natural languages, and can be shared and exchanged as formal data, formulae or documents. Tacit knowledge, on the other hand, is normally not expressed or sometimes cannot be expressed at all, emphasising personal skills, experiences and understanding; these traits are often very difficult to share and exchange by formal and systematic methods. This kind of knowledge is the opinion, experience and actions taken by a person, based on skills (Miller 1998). Knowledge embedded in an individual is multidimensional and includes explicit knowledge – knowledge that can be laid out in procedures, steps and standards, while tacit knowledge – knowledge that is stored in an individual's mind but cannot be fully explicated (Burrows 2001, Polanyi and Sen 2009). Explicit knowledge can be copied and used by a firm's competitors and thus, is unlikely to sustain the company's competitiveness. In contrast, tacit knowledge is derived from a person's lifetime of experience, practice, perception and learning (Polanyi and Sen 2009).

Nonaka and Takeuchi (1995) argued that tacit knowledge is difficult to capture and share due to a person's personal understanding of a subject matter. They stated that only tacit knowledge that can eventually be transformed into explicit knowledge can be successfully shared with others. Hislop (2002) suggested that tacit knowledge can be shared through 'direct communication among individuals' and provided three examples from literature as to how this may be achieved: 1) Stories, 2) Observing Others and 3) Learning By Doing within a community.

This situation prompted several attempts from researchers to explore new ways of capturing tacit knowledge in such a way that reduces the need for technical expert to waste precious time in sharing their own knowledge and experience, or in training younger or new staff, especially when dispersed global PD teams are involved. Universities worldwide have also tried and tested web-based solutions, such as eLearning, group forums, blogs and video sharing successfully, using these to create a student-centric learning environment, where students themselves create the critical and cognitive skills that higher education aims to develop (Jonassen, Mayes et al. 1993, Moron-Garcia 2002).
The aim of this research is to investigate employee usage and tendencies of social media tools, preferred learning methods and their knowledge sharing habits.

3 INDUSTRIAL INVESTIGATION

Following an extensive investigation at the collaborating company carried out between January and February 2015, it was determined that an alternative knowledge management system was required to capture and share knowledge using an innovative method. A possible solution arising from this study was the development of a knowledge framework which used web 2.0 functionality, such as user-generated videos and discussion forums. A study in to the tools to be used and the learning and sharing user preferences was required in order to formulize the optimal strategy to full fill the industrial requirements. The aim of the questionnaire was to obtain user input on three topic areas: The Use of Social Media, Learning Preferences and Knowledge Sharing Preferences; this is illustrated in Figure 1.

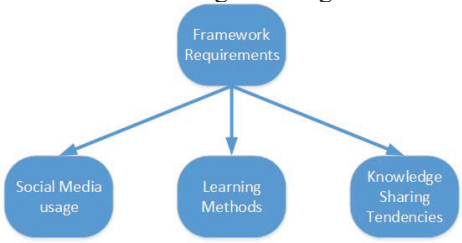

Figure 1. Framework requirements investigative questionnaire study structure

The investigation was exploratory in nature and aimed to understand end user requirements and tendencies in using social media, their preferred learning methods and their inclination to share their own knowledge with others in the workplace. The study consisted of 10 questions divided into three categories: 1) social media usage, 2) learning methods and 3) knowledge sharing tendencies. The intention of the study was to obtain an understanding of the eventual developed system users' opinion and tendencies on the three topic areas. The structure of the questionnaire consisted of multiple choice questions. The selected format provided an increased completeness of the questionnaire; during earlier studies it was noted that some participants skipped 'difficult to answer questions' in order to avoid writing in length to explain their opinion on a particular subject. Another reason for the selected format was to minimize the amount of work disruption of participant's time to complete the questionnaire.

4 RESEARCH FINDINGS

The participant sample consisted of a mix of people from an engineering PD background, consisting mainly of product validation engineers, as this area of the collaborating company is the primary focus of this research project. Others questioned were their stakeholders, including product design engineers and project management engineers, which interact on a daily basis with them for NPD validation. The questionnaire was circulated electronically using the collaborating company's official survey tool to 40 selected participants which resulted in a 95% response rate. In the following sections we will analyse the response obtain from this study.

4.1 Social Media

This section of the questionnaire explored end users current level of usage of social media tools. As shown in Figure 2, 78% of participants currently use social media in one form or another.

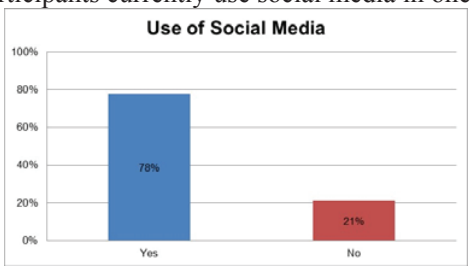

Figure 2. End-user usage of social media tools.

As for the quantity of usage of social media tools, it can be seen in Figure 3 below 45% of participants use them on a daily basis, in the form of Facebook, twitter, YouTube *inter alia*, while 35% stated that they use social media from 'time to time'. The remaining 20% of participants stated that they do not use social media tools.

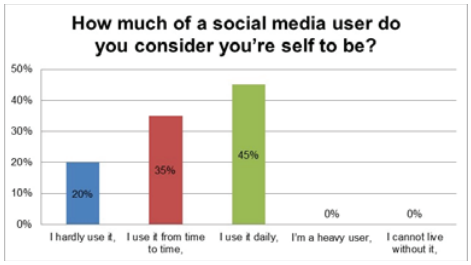

Figure 3. End-user, quantity of usage of social media

With regard to the type of contributions on social media sites, the majority of participants (74%) considered themselves as passive users, while 26% considered themselves as active contributors, as shown in Figure 4.

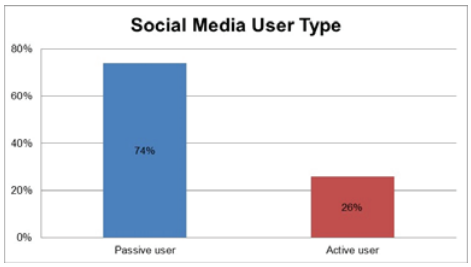

Figure 4. End-user social media user type

The fact that 78% of end-users that participated in this study use social media sites is very encouraging. Provided that the developed framework exploits social media functionality as a means to share captured knowledge by using storytelling and video sharing, it should provide a platform that enables discussion of the knowledge stored in the system. While 74% of the participants considered themselves as passive users of social media, this was discouraging as a figure so high allows us to hypothesise that 'at the beginning of the project, there will not be enough participation in the knowledge discussions which are expected to results from the captured knowledge that will be shared'. It is hoped, however, that the 26% of active participants will contribute in the beginning from whom the others will follow suit, after a period of slow adoption.

4.2 Learning Methods

In this section, the first question related to the diagram shown in Figure 5, 'The Learning Pyramid', which provides the order of different learning mediums and their effectiveness in delivering knowledge being conveyed (National Training Laboratories (NTL) for Applied Behavioral Science 1960). As anticipated, passive techniques, such as lectures and reading, are not as effective as open discussions or teaching a topic to your peers, because passive learning, for it to be effective, needs the student to engage with the material, otherwise they will not gain anything from the lecture or the book they are reading. On the other hand, with active learning, if a student needs to teach a topic to their peers, they will make extra effort to understand the subject matter in order for them to convey what they have learnt.

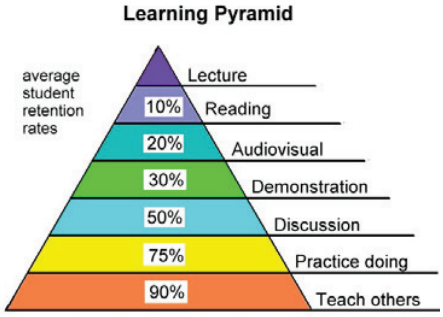

Figure 5. Learning Pyramid (National Training Laboratories (NTL) for Applied Behavioral Science 1960)

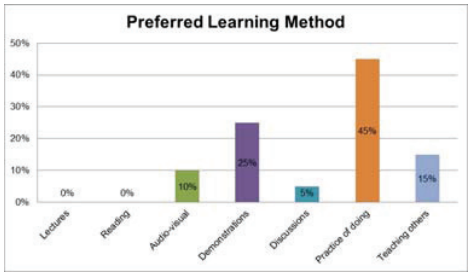

Figure 6. End-user preferred learning method

Figure 6 shows the preferred learning methods chosen by the end-users. The preferred method was 'practice by doing', with 45% of participants selecting this method of learning. 'Demonstrations' came

in second (25%), followed by 'teaching others' (15%), 'audio-visual' (10%) and discussions (5%), all of which are active learning methods. This identification of preferred learning methods has been takin into consideration during the development of the proposed knowledge sharing framework. The audio-visual, demonstrations and teaching others methods are all critical components of the developed knowledge capturing procedure, while all of the selected learning methods form part of the knowledge sharing procedure through the video sharing platform and social media sites for knowledge discussions.

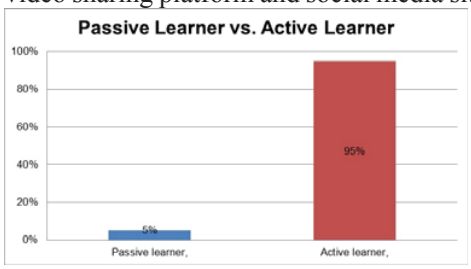

Figure 7. End-users - Passive learner vs. Active learner

When participants were asked if they consider themselves passive or active learners, their response correlated with the learning methods they previously selected, that of active learning. Due to the proposed system adopting video sharing functionality to capture and share knowledge, end-users were asked the preferred length of audio-visual demonstrative knowledge sharing media. The end-users were split in their views between short video presentation of 5 – 10 minutes each, and medium length videos lasting between 15 – 25 minutes each, as identified in Figure 8. In order to avoid user rejection in capturing knowledge and loss of interest during knowledge sharing, it was decided that knowledge contributions will be short segments of 5 -10 minutes. This should guarantee that knowledge contributors capturing knowledge will not find the task to onerous and impossible to accomplish, while also knowledge sharing would be quick and straight to the point.

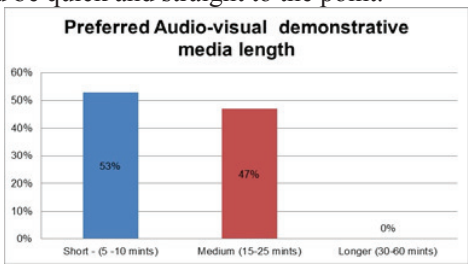

Figure 8. End-users preferred audio-visual demonstrative media length

4.3 Knowledge Sharing Tendencies

The last section of the study explored end-users tendencies towards knowledge sharing. The participants response on how they felt about sharing their own knowledge that they have acquired during their years of service produced a strong response. 55% of participants stated that they would be prepared to openly share all the knowledge they have acquired because it makes their job easier. 40% of participants were open to the thought of sharing, while 20% of them openly with others and another 20% if asked to do so, as can be seen in Figure 9.

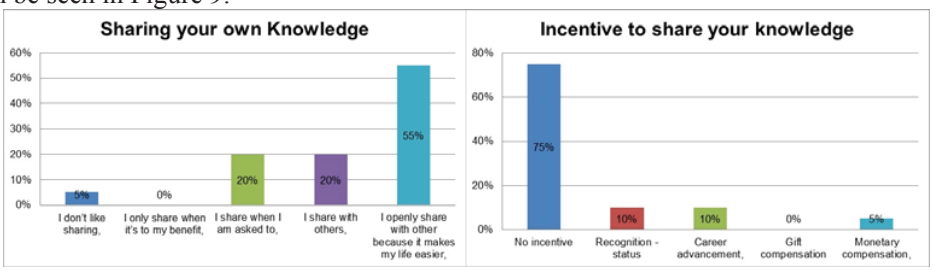

Figure 9. End-user knowledge sharing tendencies

With regard to what could incentivise employees to share knowledge, 75% of participants responded that they do not require any kind of incentive in order for them to share their knowledge.

Only 20% mentioned they would expect recognition and career advancement, which are not selfish requests. These results are not surprising because, during the observation period, the research noted that the culture, especially within the testing facility, is that of openness, sharing and helping one another, which is also reflected in the responses received during the study, as shown Figure 10. This kind of attitude towards sharing increases the eventual possibility for a full implementation of the knowledge sharing framework after the completion of this project.

5 CONCLUSION AND FUTURE WORK

The proposed knowledge management framework is based on the concept of using social media tools and video sharing as a means to capture, share and discuss knowledge within product development environments. The investigation presented in this paper showed promising results in terms of user acceptance of such innovative and alternative knowledge management systems.

Many manufacturing companies have identified the need to improve and find new ways in which to capture and share companywide and individual knowledge, but yet it still remains a challenge because in the short term it always is referred to as non-productive work and, therefore, can be quickly put a side (Mueller 2014). For any knowledge management system to be adopted and successful, top management buy-in is still the most important critical step for its success (Frost 2014).

The next phase in this project is to finalise the developed knowledge framework and create the required work flows to compliment the framework. This will be followed with an in-depth case study to validate the proposed framework and the developed proof of concept tool.

REFERENCES

Briggs, H. C. (2006). Knowledge Managemnt in The Engineering Design Environment. the 47th IAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference. Newport, Rhode Island.

Burrows, B. (2001). "Common Knowledge: How Companies Thrive On Sharing What They Know: Nancy M. Dixon, Harvard University Press (2000), 188 pp. npq." Long Range Planning **34**(2): 270-273.

Frost, A. (2014). "A Synthesis of Knowledge Management Failure Factors." Retrieved April **1**: 2014.

Grant, R. M. (1996). "Prospering in dynamically-competitive environments: Organizational capability as knowledge integration." Organization science **7**(4): 375-387.

Hislop, D. (2002). "Mission impossible? Communicating and sharing knolwedge via information technology." Journal of Information Technology **17**(3): 165 - 177.

Jonassen, D., T. Mayes and R. McAleese (1993). A manifesto for a constructivist approach to uses of technology in higher education. Designing environments for constructive learning, Springer**:** 231-247.

Miller, P. (1998). Mobilising the Power of What you know: Handbook of Knowledge Management. London, Random House.

Moron-Garcia, S. (2002). Using virtual learning environments: lecturers' conceptions of teaching and the move to student-centred learning. Computers in Education, 2002. Proceedings. International Conference on, IEEE.

Mueller, J. (2014). "A specific knowledge culture: Cultural antecedents for knowledge sharing between project teams." European Management Journal **32**(2): 190-202.

National Training Laboratories (NTL) for Applied Behavioral Science (1960). The Learning Pyramid, National Training Laboratories,(Bethel) Maine The percentages represent the average “retention rate” of information following teaching or activities by the method indicated. .

Nonaka, I. and H. Takeuchi (1995). The Knowledge-creating company. Oxford, UK, OxFord University Press.

Polanyi, M. and A. Sen (2009). The Tacit Dimension, University of Chicago Press.

Zammit, J., J. X. Gao and S. Shah (2014). A knowledge sharing framwork for improving the testing processes in global product development. International Conference on Manufacturing Research (ICMR 2014), Solent Univeristy.