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Capturing and Sharing Product Development Knowledge using Storytelling and Video Sharing

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Abstract

In today's global marketplace employee knowledge is seen as a crucial asset for organisations, which enables them to gain a sustainable competitive edge over competitors. Much of the knowledge generated during New Product Development (NPD) and NPD testing can be categorised as tacit knowledge, developed from employees' personal experiences and perceptions during Product Development (PD) projects; this makes it more difficult to capture and document for future sharing. This research explores whether storytelling and video sharing tools are capable of facilitating the capture and sharing of employee knowledge during the PD cycle. It also considers the creation of a knowledge framework that is directly driven by the knowledge user, providing both knowledge direction and content.

Keywords: Collaboration; Knowledge Management; Product Validation and Testing; Social Media; Video Sharing

1. Introduction

During NPD, employee knowledge is critical for innovation [1] – to remain competitive in today's global marketplace, knowledge is seen as a crucial asset for organisations which enables them to gain a sustainable competitive edge over competitors through the creation of new innovative products [2]. Knowledge Management (KM) can be defined as "the ability to harness and build upon an organisation's intellectual capital" [3]. Companies need to identify and record what they know and to use this knowledge effectively. The size and dispersion of global organisations make it especially difficult to locate existing knowledge and deliver it to where it is needed [4].

The creation of new methods of capturing and sharing knowledge amongst PD teams, both local and dispersed, assists companies to capitalise on pre-existing valuable resources; the ability to quickly browse and acquire knowledge or to identify knowledge experts within a business can provide competitive advantage.

The aim of this paper is to report on ongoing research which explores the use of social media and video sharing tools to facilitate the capture and sharing of employee knowledge during the PD lifecycle. This research is being conducted in collaboration with a globally-dispersed industrial partner operating in the manufacturing sector. During the project, we explore the development and trialling of a knowledge capture and sharing framework which is directly driven by the knowledge user, who provides both knowledge content and direction.

This paper is organised as follows: section 2 introduces background information related to knowledge management, social media and video sharing. Section 3 provides the requirements and basis of the developed knowledge framework. Section 4 describes the approach adopted for implementation work to date. Section 5 provides a summary of initial user feedback and future work, while section 6 presents research conclusions.

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2. Background

Knowledge can be classified as either Explicit or Tacit. Explicit knowledge can be expressed in formal methods or natural languages and can be easily shared and exchanged; Tacit knowledge, on the other hand, cannot normally be easily expressed due to its content, which is constructed from personal skills, experiences and understanding, making it difficult to share and exchange by formal and systematic methods [5]. Much of the knowledge generated during NPD and NPD testing can be considered tacit knowledge, which is connected to problem solving and is dependent on interactions between colleagues within PD teams [6]. This type of knowledge is highly abstract and closely related to 'know-how' [7]. Thus, one may acquire tacit knowledge in one context and apply and stimulate this knowledge in another context [8, 9].

Nonaka and Takeuchi [10] argued that tacit knowledge is difficult to capture and share due to a person's personal understanding of the subject matter. They stated that only tacit knowledge which can eventually be transformed into explicit knowledge may be successfully shared with others. But Hislop [11] suggested that tacit knowledge can be shared through "direct communication amongst individuals" and provided three examples of how this may be achieved: 1) stories, 2) observing others and 3) learning by doing within a Community. However, in today's marketplace, accelerated PD timelines to deliver new products in the shortest possible time are critical for success. This generally means that experienced staff have limited opportunities and time to share their own knowledge with younger and less experienced staff [12].

There have been several attempts by researchers to develop new methods to capture and share tacit knowledge. Several universities have tried and tested web-based solutions, including eLearning, group forums, blogs and video sharing as tools to create a student-centric learning environment, where students themselves create the critical and cognitive skills that higher education aims to develop [13, 14]. All of these technologies have been used extensively in academic settings to capture and share knowledge more effectively. Academic staff, who may be considered as experts of in their fields of study, have used eLearning and social media technologies to capture, prepare and share knowledge content within clearly defined groups [15].

This research project aims to use the same principles of eLearning and social media to capture and share knowledge; the key difference, however, is that industrial experts will be employed as opposed to academics. It may be argued that an industrial expert might not have the same level of expertise as an academic and, therefore, might not be able to develop suitable structures within knowledge contributions for effective knowledge transfer; similarly, they may not be able to use eLearning and social media technologies as effectively.

Nevertheless, these industrial experts are already transferring knowledge to their peers using traditional direct communication and face-to-face methods; therefore, they are already transferring knowledge effectively in an informal manner. As for eLearning and social media tools, most of these are already being used by industrial experts on a daily basis when, for example, they are browsing the internet and using smart phones. Accordingly, it is the researchers' opinion that these industrial experts are the ideal people to capture knowledge, as 1) they are the experts in their fields and 2) if user friendly tools are developed, these knowledge experts will find it difficult to capture required knowledge in a structured electronic format.

2.1. Social Media, Storytelling and Video Sharing tools for Learning and Knowledge Transfer

Web 2.0 and social media tools are widely used today in our daily lives, providing opportunities for people to communicate, learn together and share their experiences [16], with software applications such as Facebook, YouTube and Twitter being readily available. These applications have emerged as main steam communication channels for people to communicate, collaborate and share daily experiences all over the world like never before. They have, however, changed the way our planet communicates.

Macaskill and Owen [17] defined Web 2.0 as a web-based platform which allows users to gain access, contribute, describe, harvest, tag, annotate and bookmark Web-mediated contents in various formats, such as text, video, audio, picture and graphs. Anybody with minimal ICT skills can contribute and share their information [18]. According to Moron-Garcia [14], the use of web-based technologies can facilitate the creation of student-centered learning environments. Learning environments, designed with reference to constructivist theories of learning, will embed in students the critical and cognitive skills that higher education aims to develop [13, 14].

Reamy [19] suggested that storytelling is the best way to transfer tacit knowledge, conveying information and context in a form that is easy for other people to understand. According to LeBlanc and Hogg [20], stories make information more meaningful, making tacit knowledge more explicit and allowing information to be organised into learnable chunks. This method was also suggested by Martin-Niemi and Greatbanks [21] who proposed using storytelling with new generation Web 2.0 technologies, providing individualised and customisable user experiences which included virtual social interactions, shared collaborative portals and communication tools; however, it was not implemented during their research.

An ideal medium to capture and share storytelling is video sharing. Balcikanli [22] concluded that YouTube, a video sharing website, can be integrated as an effective tool for learning due to its ease of use and its connection to an abundance of video clips that not only teach, but also demonstrate the cultural context in which the material can be properly applied to.

3. Industrial Requirements and Created Knowledge Framework

An extensive industrial investigation was carried out with a global OEM company with design and manufacturing plants in the UK. The main outcomes of this investigation

highlighted the importance of managing in-house knowledge, allowing employees to capture and share their knowledge more cost effectively within the company [23, 24]. Resulting from the findings of the research, the knowledge framework, shown in Figure 1, was developed.

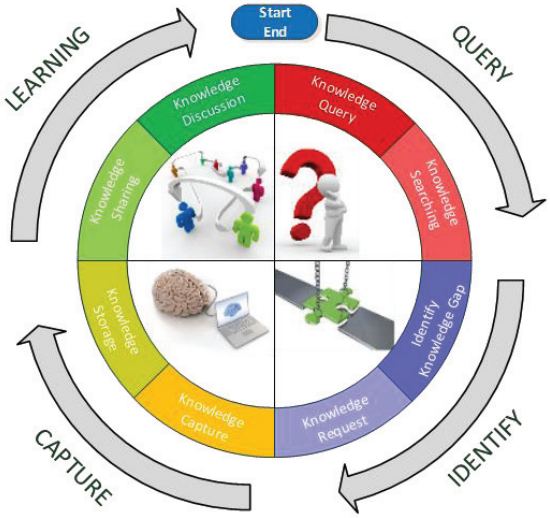

Fig. 1. Knowledge Framework to support the PD team.

The developed knowledge framework represents an iterative knowledge cycle, which not only enables knowledge to be captured and shared within organisations, but also builds upon the knowledge already available; it provides for framework autonomy which informs the knowledge direction, dependent upon end users' interests and knowledge needs. The framework is made up of four main quadrants: Query, Identify, Capture and Learning, which allow knowledge users to Query the readily available knowledge; if this is not found, a knowledge gap is Identified, activating the knowledge Capturing task by a knowledge expert and, finally, the Learning process from the captured knowledge [25].

The media requirements for effective knowledge transfer need to be: in a format that is easy to use, with the ability to capture complex knowledge content; quick to create and quickly to absorb; and allows for different technical levels of competence to understand and use with minimal training [25].

3.1. Query: Knowledge Search Process in the Knowledge Framework

Collecting and storing knowledge in an electronic format offers great benefits to any organisation. However, it would be pointless if a company is only able to store captured knowledge but not be able to retrieve it in the shortest time possible, on demand and when it is needed. This Section describes the process that knowledge users must follow in order to 1) search and find the knowledge they are seeking, 2) search and find the knowledge and expand it by discussing and questioning the knowledge content, and (3) search and identify a knowledge gap within the knowledge base.

The process starts with the knowledge users having a specific knowledge question, from which they can then perform a search. The proposed repository will have five search functions, including; general search, keyword search, look-up of knowledge categories, look-up of specific knowledge contributors and general system browsing.

If the users cannot locate the knowledge they are seeking, they will need to identify the knowledge gap and submit a request through the system for a new knowledge contribution. On the other hand, if the knowledge is available in the database, they can absorb and utilise the knowledge content. If the content is sufficient, the search stops there.

However, if the knowledge is not sufficient, the users have two options. They can either start a discussion with the knowledge contributors or identify a new knowledge gap and submit a new knowledge request through the system. The knowledge discussions with the originator can be in the form of either a question to challenge the knowledge or a comment to discuss the knowledge. In both cases, these discussions create direct interactions between the users and the providers.

3.2. Identify: Knowledge Gap Request Process in the Knowledge Framework

A critical component to guarantee the continuation and repetition of the proposed knowledge cycle is the knowledge request process. The aim of the process is to create a formal structure that allows users or administrators to identify and highlight potential knowledge gaps to be addressed by the system. While it was previously stated that the framework should be driven by users, it is recognised that the administrator should also have the ability to identify knowledge gaps and, at the same time, be able to provide the initial stimuli to get the knowledge cycle started, thereby inviting initial contributions for the knowledge database. The process flows are described in more detail below for both user and administrator knowledge requests.

A knowledge request is submitted when a user identifies a gap in the knowledge database. This allows the user to obtain knowledge about a specific subject matter. Alternatively, the user could identify a process that, if captured and documented, would raise awareness, be of benefit to colleagues and stakeholders or simply point out improvements to the process.

An additional reason for a knowledge request may involve highlighting product design issues or facility improvements. Sometimes, it is easier to demonstrate an actual issue than to write it down in an e-mail or report. The impact of showing a problem is often greater than when explaining it in words [26, 27], the critical element of this being the changing of written dialogue into visible tangible actions.

The process illustrated in Figure 2 can generally be used for all previously mentioned knowledge requests. The start of the process is when a user identifies a knowledge gap, from which they specify, in a formal structure, the reason for and benefits of the identified gap. Once this information is uploaded to the system, a user's request can be submitted.

Once the request is submitted, the responsibility for completing the request is assigned to the administrator who

evaluates the request and checks whether the knowledge already exists. If this is the case, the administrator will provide the user with a link to the knowledge required. On the other hand, if the knowledge is not available and the request is of benefit to the company, the administrator will approve the request, select the most appropriate person to fulfil it and invite the knowledge contributor to create and submit the content.

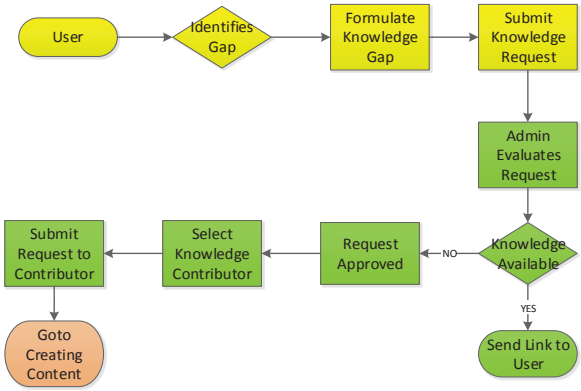

Fig. 2. Knowledge user – Knowledge request process flow.

Initially, the selection of the knowledge contributor needs to be carried out on the basis of the administrator's experience and knowledge of employee expertise. Once the knowledge sharing platform is populated with content, experts and active contributors will be highlighted and, therefore, will provide an active selection pool from which to choose. A rating scale will be available for users to rate the contributions in the system both for knowledge content and knowledge discussion. This will provide both a quality check, instigated by the users, and a rating of content originators.

3.3. Capture: Knowledge Capture Process in the Knowledge Framework

Knowledge Management can be defined "as the ability to harness and build upon an organisation's intellectual capital" [3]. While organisational competitiveness is rooted in the mobility of knowledge that is realised through knowledge sharing and transfer [28], knowledge capture is the critical component required in order to achieve this.

The medium selected for knowledge capture is a combination of video sharing and storytelling. Reamy [19] suggested that storytelling is arguably the best way to transfer tacit knowledge, in that you are able to convey information and context in a form that is easily understood by most people. According to LeBlanc and Hogg [20], stories make information meaningful, while tacit knowledge is more explicit and allows information to be organized into learnable chunks.

The proposed process to capture the requested knowledge is illustrated in Figure 3. The starting point of the process begins when a knowledge contributor receives a knowledge request from the administrator, from which information the contributor needs to evaluate the specific needs of the request. If the contributor possesses the required knowledge and skills to deliver the requested contribution, they move on to the next step of planning the knowledge capture. On the other hand, if they do not possess the knowledge requested, they need to look it up and acquire this knowledge through available sources, including books, internet searches, equipment manuals and company procedures, and then proceed to the planning stage.

Once a knowledge contribution plan is created, the user is advised to make a quick literature search to make sure that the knowledge available is up-to-date and relevant, before creating the knowledge contribution plan and submitting it to the administrator. This provides a quick quality check and avoids wasted time in creating knowledge contributions which are inconsistent with the specified requirements.

Once the knowledge contribution plan has been reviewed and approved by the administrator, the contributor can start collecting the information in any format required to start creating the knowledge story. Once all the information is collected, it will be compiled into a single video file with additional voice over to explain the knowledge being shown. This compiled knowledge contribution is submitted for a second round of approval as a means of quality assurance, which once approved, will be uploaded on to the knowledge sharing platform within the organisation.

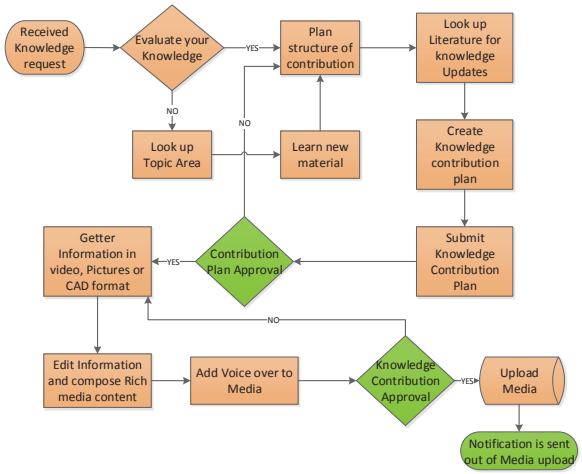

Fig. 3. Knowledge contributor – Knowledge capture process flow.

4. Development of the Knowledge Capture

The key principle of any kind of knowledge capture for this framework requires the use of video capture of knowledge situations such as processes or demonstrations. An assumption of this research is that video cameras today are widely available and are often integrated into communication equipment, such as smartphones, tablets and digital cameras. Therefore, it was assumed that the majority of people have a basic working knowledge of video cameras and photography

equipment. Nevertheless, a basic 'How to use a Camera' training video was created to demonstrate this skill.

Once the raw video images had been captured by the knowledge contributor, the next step in the knowledge capturing system was to compile the raw media into a single coherent video, delivering a story told knowledge message.

This was achieved by compiling a knowledge video using video editing software. For this project, Adobe Premier Pro was selected due to its availability within the collaborating company. The software allowed for the editing of video footage and the addition of special effects and sound recordings. Training material on 'How to use the Video Editing Software' was developed using a knowledge capturing methodology, which is mentioned in the next section.

In order to produce a coherent knowledge video, it was determined that the knowledge contribution needed some form of structure in order to assist the knowledge contributor to build the media, while also helping the knowledge receiver to absorb the knowledge by creating knowledge contributions that have common features, such as ease of knowledge understanding and knowledge structure.

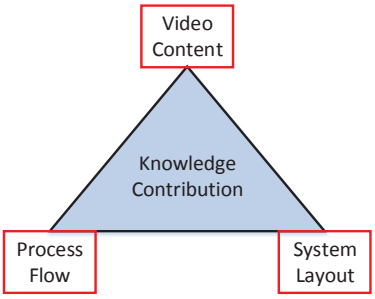

Fig. 4. Knowledge contribution main components.

The key elements identified to improve a user's understanding of a knowledge contribution are shown in Figure 4. This is made up by 1) the video content with voiceover explaining what is being demonstrated, 2) the process flow chart of what is being demonstrated, and 3) the physical layout of the system to help the knowledge receiver to comprehend the location dynamics. This layout provided the best knowledge format, as reviewed by the system users, as it allowed them to make links and connections to what they were seeing in the video in relation to the physical location and the order in the process tree. This structure was then created into a template which was used by the knowledge contributors for the case study.

5. Validation of Design, Initial Feedback and Future Work

The aim of the validation exercise is to confirm that the developed knowledge sharing framework, methodology and prototype knowledge sharing tool, fulfills the collaborating company's need to capture, disseminate and transfer knowledge more efficiently and effectively throughout the organisation using rich media and social media tools. This validation study should provide an indication of the framework's adaptability to a wider audience and, therefore, show that it is not limited solely to the collaborating company's usage. This is being accomplished by means of a validation exercise undertaken by a number of selected employees from the collaborating company. The participant selection criteria varied from different age groups, ranging from 20+ to 40+, and different levels of skill/education, ranging from Technicians, Engineers to Managers, in order to obtain balanced user experience feedback, representative of the complete workforce from the collaborating company.

The validation process consists of two groups of participants: knowledge contributors and knowledge receivers. The 'knowledge contributor' group consists of 6 employees, while the 'knowledge receiver' group consists of 15 employees, all selected according to the set criteria. The knowledge contributors consist of 3 engineers and 3 technicians, while the knowledge receivers consist of 3 managers, 6 engineers and 6 technicians. User feedback is being gathered using one-to-one interviews followed by survey. The sample size for the validation process is relatively small (21) and, therefore, the results may only be considered indicative, but the feedback obtained so far is promising and shows strong user acceptance and usability. Furthermore, it is the collaborating company's intention to continue with the development of the developed tool. The validation process has been designed with four key steps:

1. Creating number of knowledge contributions;
2. Workshop and survey with knowledge contributors to capture end-user feedback;
3. Workshop and survey with knowledge receivers to capture end-user feedback; and
4. Live workshop with knowledge receivers to assess actual knowledge transfer.

The first stage of creating the knowledge contributions is currently underway with the selected Contributors submitting their generated knowledge. Once complete, the subsequent steps will be taken.

6. Conclusion

The intention of this research project was to answer the research question of whether social media and video sharing tools were capable of facilitating the capturing and sharing of employee knowledge during the PD testing cycle. Based on this, a knowledge capture and sharing framework has been developed, which is directly driven by the knowledge user, providing both knowledge direction and content.

The novelty of this research lies in the developed methodologies to capture and share knowledge, addressing the special nature and application context of integrated PD and testing operations. Similarly, the use of social media, video sharing and storytelling technologies to capture complex engineering knowledge by the knowledge experts themselves, rather than by media professionals whom are paid to develop content, is relatively unique. This should guarantee the organisation more informed knowledge content and a reduction in costs to develop knowledge content.

Initial feedback from the knowledge contributors participating in this research has been positive in relation to

both the framework and methodology employed. Comments suggest that the proposed methods aid employees in their task of capturing knowledge, while already demonstrating value in having the knowledge electronically stored and readily available for knowledge transfer.

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