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This is a copy of the author's accepted version of a paper subsequently published in the proceedings of the 2014 Advances in Production Management Systems conference (APMS), Springer, pp.19-26, ISBN 9783662447383. The original publication is available at [www.springerlink.com](http://www.springerlink.com) ; [doi:10.1007/978-3-662-44739-0\\_3](https://doi.org/10.1007/978-3-662-44739-0_3)

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# A Framework for Improving the Sharing of Manufacturing Knowledge through Micro-Blogging

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**Abstract.** The purpose of this paper is to report on an industrial investigation, conducted within a leading power generation manufacturer, to better understand the organisational processes and challenges present in relation to the management and sharing of knowledge during product manufacturing. Findings reveal that the organisation is failing to fully benefit from web 2.0 technologies and particularly micro-blogging. Details of the investigation results are presented and a conceptual framework is proposed to demonstrate how organisations may enhance the sharing of explicit manufacturing knowledge using micro-blogging tools.

**Keywords:** Employee Collaboration, Enterprise 2.0, Knowledge Management, Manufacturing Management, Micro-Blogging.

## 1 Introduction

In a globally integrated enterprise environment, engineering and manufacturing organisations are increasingly required to develop flexible and responsive work processes to ensure their survival. Previous practices concentrating upon product cost, quality and time to market are no longer sufficient to maintain competitive advantage. The focus is progressively turning towards innovation with clearly differentiated product offerings being the result. Against this background, effective employee knowledge sharing is paramount and remains a significant challenge for both Small to Medium sized Enterprises (SMEs) and large multi-national organisations. The management and effective sharing of knowledge is recognised [1] as crucial for the survival of global manufacturing organisations. Research [2] suggests that, by sharing explicit employee and organisational knowledge already captured, companies are able to become more productive, enhance corporate performance and are more likely to survive than those that fail to discover hidden organisational knowledge.

The term Micro-Blogging falls under the technology umbrella of “Web 2.0”, a term first coined by Tim O’Reilly [3] in 2004 to define the next stage in the development of the World Wide Web; O’Reilly identified that modern websites were

providing users with a more interactive experience and enabled them to become responsible for the generation of their own content. More importantly, Web 2.0 offered the potential for greater collaboration and knowledge sharing; in this regard, micro-blogging may be defined as the posting of short character-limited messages (usually 140 characters), images or videos online and is different from traditional forms of blogs, which are often lengthy and published less frequently [4]. By employing Web 2.0 technologies, enterprises are able to connect people to people and people to information more effectively; they can facilitate connectivity, sharing and collaboration across boundaries, capture a wide range of views and information that is typically informal or highly dispersed and help colleagues locate previously unknown experts [5]. More specifically, employees are able to identify and share organisational resources more easily via a less formal communication channel; this in turn provides for greater interactivity and collaboration in the workplace. Current published research into the use of Web 2.0 technologies in enterprises has primarily focussed on the use of individual technologies, such as Wikis [6], and social networking sites [7]. However, there is limited research into how each of these tools may be used in a manufacturing setting to share explicit employee and organisational knowledge.

The purpose of this paper is to report on the findings of an exploratory industrial investigation conducted within a leading power generation manufacturer to understand the current challenges and opportunities in relation to the sharing and management of explicit knowledge. A conceptual framework is presented in Figure 1 to demonstrate how manufacturing organisations might make greater use of micro-blogging tools to improve the sharing of explicit knowledge in their operations.

## **2 The Importance of Employee Knowledge Sharing within Manufacturing Organisations**

In today's commercial environment, where manufacturing organisations are continually striving to achieve and maintain competitive advantage, successful employee knowledge sharing is fundamental to corporate success. According to Shin, Holden and Schmidt [8], knowledge management can be sub-divided into four categories – knowledge capture, knowledge management, knowledge sharing and knowledge application – while knowledge can be found in two forms – explicit and tacit; for the purpose of this article, the sharing of explicit knowledge is explored. Effective knowledge sharing in the workplace is observed to enhance employee learning, which in turn increases the agility of a company and improves the quality of products designed and manufactured [9]. O'Dell and Grayson [10] add that the knowledge sharing process involves getting the collected knowledge to the right people at the correct time in order to improve business functionality. Manufacturing organisations must, therefore, improve methods of capturing and sharing employee knowledge, while minimising barriers created by the use of different languages, the varying levels of technological competence of employees and, indeed, the potential unwillingness of individuals to share in the workplace.

### **3 Adoption of Micro-Blogging within Business**

Along with other Web 2.0-based technologies, micro-blogging is increasingly being used in our social lives and amongst the academic research community to share and disseminate information. However, this is not perceived to be the case in industry where there appears to be a lack of recognition of the potential on offer to enhance knowledge sharing. Micro-blogging has been identified [11] as a particularly useful tool to facilitate employee collaboration and knowledge sharing and its specific benefits include: an ability to inform others easily and rapidly of current activities; a facility to provide colleagues with current work schedules, product availability, feedback and other explicit information in a timely manner; an accessible channel for the marketing and promotion of products/services and solicitation of customer feedback; the facilitation of communication with third parties, including potential customers and suppliers; and the potential to direct colleagues to informative content by re-posting.

The activity of knowledge sharing faces numerous barriers typically relating to either social factors or the technology adopted or a combination of both. Businesses often cannot identify what is known within their organisations and, consequently, best practices, expertise and knowledge and skills cannot easily be applied and transferred. Successful knowledge sharing within an organisation requires openness and a willingness to share between two parties. Trust *inter alia* is a key issue with regard to sharing knowledge with colleagues. Dyer and Singh [12] acknowledged that knowledge sharing could generate relational incomes for both parties, although Simatupang and Sridharan [13] stated that more often than not, companies do not like to share their private information completely.

### **4 Industrial Investigation**

An Industrial Investigation was conducted within a leading power generation manufacturing company in the UK between October 2013 and March 2014 and, for the purpose of this report, the organisation is referred to as 'the Company'. The aim of the investigation was to gain an understanding of the Company's current practices and challenges in relation to knowledge management and sharing. The methodology used during the investigation was informal audio-recorded face to face interviews lasting between 60 and 90 minutes. In total, 17 employees were selected for interview and participants included the Plant Manager, Maintenance Engineers and Assembly Line Operatives. Interviews were conducted on an individual basis by a panel consisting of two PhD students and one post-doctoral research fellow. The interviewers followed a standardised questionnaire, which asked participants a variety of open-ended and closed questions to identify the knowledge management methods, practices and tools employed within the Company; the findings relating to these questions are now summarised.

#### **4.1 Analysis of responses to the Question: How do Employees Currently Identify Best Practice Knowledge for Specific Manufacturing Problems?**

Employees explained that for every manufacturing project, a set of work instructions are produced detailing relevant knowledge in relation to the design, manufacture and assembly process for a complete product. This explicit knowledge is stored on an internal database, which is the first point of reference for operators working on the Assembly line. The database is accessible directly from the shop floor using touch screen monitors and product designers and change engineers can modify product documentation remotely. It was reported that the company promotes a “who you know” culture, whereby employees are encouraged to ask colleagues to share knowledge and, if that colleague does not have the required knowledge, ask if they can suggest someone who does. If it is not possible to find required knowledge internally, employees are encouraged to use external resources, such as commercial search engines. There is no system in place for the storage, identification and retrieval of explicit knowledge of employees. Currently, information is captured in word document format when users are completing work processes, although no further action is taken to convert it into explicit knowledge. Finally, if someone experiences a problem, they are encouraged to visit Team Room, an intranet accessible by colleagues working within the same project group, and ask questions via an instant messaging tool.

#### **4.2 Analysis of responses to the Questions: How Does the Organisation Currently Store Best Practice Knowledge?**

Employees confirmed that best practice knowledge is typically stored in spreadsheets and then made available via the EASE touch-screen system. Knowledge is occasionally input into ‘Team Room’, although this is not considered a standard practice. It is recommended by the corporate IT department that employees store all manufacturing documentation on a shared server or on the internal intranet, but this does not always happen and often information is stored locally on personal hard-drives. During the NPD process, the company aims to capture lessons learnt during projects at the product closure stage. This activity informs colleagues of issues which arose during manufacture, testing and execution and is stored for future reference. After product delivery, however, there is no requirement to update this information (e.g. when a product is repaired in the field) and in-service experiences are not added to the lessons learnt document. It was stated that the company is currently seeking to adopt paperless working and a new system called EASE has recently been introduced, which offers a Touch-screen workstation for assembly line operatives. The system stores all product development project documentation, from work instructions to training manuals and all critical product characteristics. The company also operates a system called “QSI”, where all training materials are stored; this is an electronic system controlled through revision changes and approval processes and allows for the preparation of operator instructions when new products are introduced.

#### **4.3 Analysis of responses to the Questions: How do You Currently Share Best Practice Knowledge with Dispersed and Co-located Colleagues?**

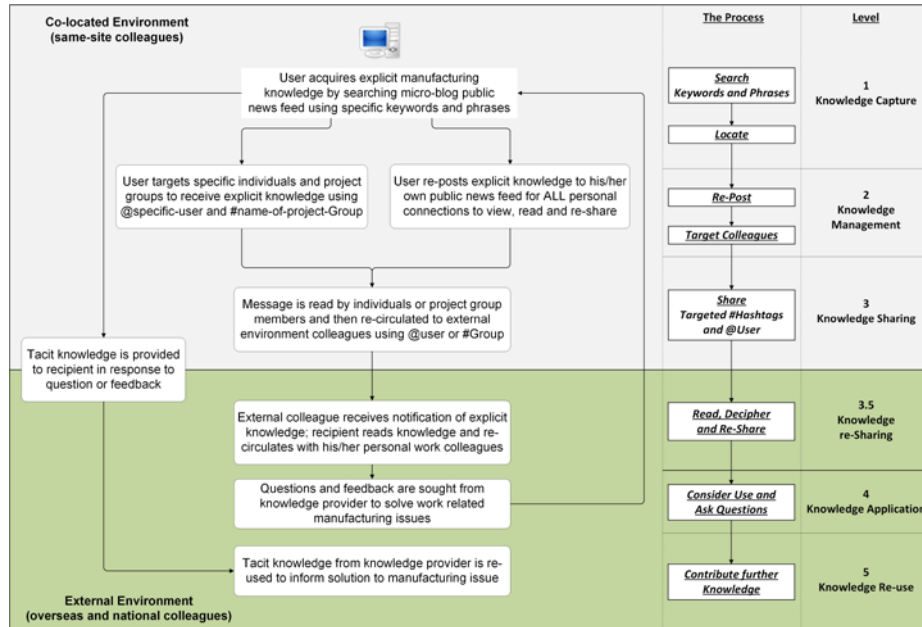
It was confirmed that the Company does not currently have a standardised method for sharing knowledge relating to best practices, although employees commented that they try to make their knowledge as easy as possible to understand; to this end, they aim to remove from documentation any unnecessary technical jargon for stakeholders who do not have a technical background. It was revealed by interviewees that they usually use e-mail as their preferred communication tool when sharing knowledge. An internal intranet facility, called Team Rooms, exists to support project work and it is the responsibility of functional team leaders to ensure effective communication between team members.

#### **4.4 Analysis of responses to the Questions: What Knowledge Management Tools are Currently Used within the Company? How Frequently are these Tools used?**

With regard to the use of specific knowledge management tools employed within the organisation, none were identified. For the recording of maintenance issues, a T-card system is employed where users note down in paper format any problems or issues being experienced with manufacturing and assembly equipment. Interviewees reported that the company relies heavily on e-mail and corporate management are trying to encourage employees to collaborate more pro-actively and, thereby, share greater knowledge through informal communication. It was confirmed that the Company provides an instant messaging system for informal communication and a corporate intranet is available to transmit company-wide information. It was pointed out that project groups are also able to create and manage their own intranet sites for communication purposes, although no micro-blogging functionality is available to facilitate business processes.

### **5 The Proposed Conceptual Framework for Improved Knowledge Sharing**

Based on the findings of the industrial investigation, which conclude that no formal business process exists within the Company for the sharing of explicit manufacturing knowledge, a conceptual framework, displayed in Figure 1, is proposed to illustrate a new method for enhancing knowledge sharing and collaboration within organisations through the deployment of micro-blogging. The process demonstrates how an engineer or operative may search for explicit manufacturing knowledge by searching for specific keywords and phrases on public activity feeds, which may be accessed through an internal or external micro-blogging tool.



**Fig. 1. Conceptual Framework to improve the Sharing of Explicit Manufacturing Knowledge through Micro-Blogging**

In Figure 1, in the column headed ‘The Process’, guidance is given on what actions users should take at each level of the knowledge management process in order to improve the sharing of explicit manufacturing knowledge, through the use of micro-blogging tools. Further explanation of this process is now provided in Table 1.

**Table 1.** Business Process for improving the sharing of explicit manufacturing knowledge

Level	User...
Knowledge Capture	Searches and locates explicit manufacturing knowledge employing targeted keywords and phrases.
Knowledge Management	Targets internal colleagues who would benefit from receipt of explicit manufacturing knowledge. Re-posts knowledge to his/her own personal news feed so that others can search and locate knowledge.
Knowledge Sharing	Shares manufacturing knowledge with targeted colleagues and project groups using specified #Hashtag or @user functionality.
Knowledge re-Sharing	Reads and deciphers knowledge and shares with targeted colleagues and project groups using specified #Hashtag or @user functionality.
Knowledge Application	Considers supplied knowledge and applies to business needs, where appropriate. Posts questions and gives feedback to knowledge provider.
Knowledge Re-Use	Provides tacit or further explicit knowledge in response to knowledge recipients’ questions or feedback. Re-uses knowledge received to improve business processes and re-distributes to project group members.



## 6 Conclusions and Further Work

The industrial investigation confirmed that the Company does not currently have any formalised method for sharing explicit employee knowledge. Some tools and procedures exist to facilitate knowledge exchange, but the organisation lacks a standardised process for the capture, management and sharing of explicit knowledge. Given the relatively flat organisational structure and a corporate culture of “who you know”, employees are expected to seek out knowledge from identifiable colleagues. This is frequently completed on an oral face-to-face basis while written documentation is shared. However, it may be concluded that the Company is failing to embrace social technologies to facilitate employee collaboration and enhance knowledge sharing; furthermore, the investigation highlighted how web 2.0 technologies, such as micro-blogging, may offer significant benefits to the Company and allow employees to collaborate and share knowledge more effectively, while moving towards paperless operations. Utilising the findings of the industrial investigation, it has been possible to develop a conceptual framework for the improvement of sharing of explicit knowledge in extended manufacturing organisations. The framework has been developed to address specific issues highlighted during the investigation, but further work is recommended to identify how bespoke web 2.0-based technologies may be employed to enhance knowledge sharing in other industrial sectors and functional areas.

Micro-blogging in particular is able to help both SMEs and larger organisations improve knowledge management practices. The introduction of micro-blogging can provide employees with real-time access to explicit knowledge and allow them to raise questions and queries with knowledge producers. Employees are able to access knowledge through ubiquitous computing devices, such as smart phones and tablets, and this is possible from most locations around the globe. Micro-blogging facilitates and encourages communication through less formal and potentially more inclusive channels, with individuals employing established communication practices used in their social lives. It is important to recognise, however, that micro-blogging cannot overcome all barriers to knowledge sharing which may be present within organisations, both large and small. Within SMEs, the barriers may appear less evident than in large organisations as colleagues may often hold meetings to share knowledge more easily, but difficulties still exist. Knowledge silos may exist which restrict the sharing of knowledge, but these may be minimised if knowledge is made available via a micro-blogging tool accessible throughout the organisation. Language barriers can also occur in large multi-national companies, but these may be overcome through the use of an integrated translation mechanism. The adoption of the proposed knowledge sharing framework, based on micro-blogging functionality, which is discussed in this paper, offers significant potential to enhance knowledge sharing within manufacturing organisations.

**Acknowledgements.** This paper is based on work funded by the European Program INTERREG IVA France-Channel-UK under the project “Building an Expertise

Network for an Efficient Innovation and Training System (BENEFITS)”. The authors would like to thank all at the collaborating company for their support with this project and their input to the Industrial Investigation.

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