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Towards Knowledge Sharing Through Social Media in Software Development: A Systematic Literature Review

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Abstract

An effective knowledge exchange among software developers is crucial for the competitive performance of their organisations. Today, the constant pressure on business to continually innovate and the increasing capability of information technologies to facilitate broader and more distributed communication are driving organisations to leverage social media tools to improve business performance. These tools enables people to connect, communicate and collaborate and have changed the way we share knowledge. Research within the area of social media and knowledge sharing is still in an early phase. Although several studies of the relationship is available, today there exists no comprehensive overview of what has been investigated.

Using a systematic literature review approach, this study aims to map the current state of literature on knowledge sharing through social media applicable to software development. Further, this study highlights the findings of research studies and identifies gaps in literature. Thereby, creating beneficial insights and awareness on the context for researchers and practitioners.

Keywords: Systematic literature review, knowledge sharing, social media, social software, software development, software engineering

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Track: Knowledge and Learning

1. Introduction

We are currently witnessing the infiltration of social media in companies internally (McAfee, 2010). Companies have started to recognise the potential of social media as an internal communication tool. The use of social media is rapidly rising (Keitt et al., 2011) and the tools are increasingly becoming a source for capturing and sharing knowledge (Ferro et al., 2012). Social media have some other features to provide than traditional communication tools and they enable unprecedented prospects for communication between employees. Social media creates opportunities for efficiently cross-boundary and cross-functional instant communication and knowledge sharing. They establish relations and knowledge repositories that were formerly not available to the employees. The term social media is used broadly here so as to denote a group of products and services that enable social interactions in the digital realm, such as blogs, wikis and social networking platforms (Kaplan and Haenlein, 2010; Chui et al., 2012). This definition refers to tools that are based on facilitation of social and interpersonal relationships; therefore, they are suitable for knowledge sharing.

Knowledge sharing is a prerequisite for success and, in this context; it can be defined as providing or receiving knowledge, know-how and feedback regarding a product or a procedure (Hansen et al., 1999). Knowledge sharing provides people with an understanding of knowledge and skills of others and makes them capable of responding to situational demands despite the complexity of the task exceeds the cognitive skills of the individual (Szulanski, 2000). Knowledge sharing also includes the implicit and social coordination mechanism of knowledge (Faraj and Sproull, 2000).

Software development processes are often highly complex processes that cannot be completed by a single individual. Therefore, knowledge sharing is a vital part of the everyday work of a software developer. Facilitation of the knowledge sharing activities is highly important in order to ensure speed, innovation and effectiveness.

One of the major reasons that software development organisations need to focus on the social creation and distribution of knowledge is that their knowledge workers are attempting to solve problems of a different order of magnitude compared to a few decades ago (Bertoni et al., 2012). As the scope of organisational activities rapidly changes, software developers need to share and utilise a wider array of data, information and knowledge that has previously not been readily available in a traditional organisational context. Together with the increasing globalisation, this makes organisations more reliant on information communication technology (ICT) (Bertoni et al., 2012). ICT systems are widely considered to have a positive impact and foster knowledge sharing (Davenport and Prusak, 1998; Choi et al., 2010).

Over the years, researchers in the field of computer supported cooperative work (CSCW) have focused on the development and implementation of social groupware (Grudin, 1994; Olson and Olson, 2003). It is widely accepted that workspace systems are vital for distributed communication (Eckert and Stacy, 2001). CSCW tools have been successful in increasing the amount of information available to the user (Khoshafian and Buckiewicz, 1995) and have helped to increase awareness and transparency (Moenaert et al., 2000) of what other people are working on (Gutwin and Greenberg, 2002).

Some argue that social media is a continuation of traditional CSCW tools (Höltta and Eisto, 2011). Yet, social media encourage a shift from information pushing to information pulling (Höltta and Eisto, 2011) and increase visibility and relations. Kotlarsky and Oshri (2005) argue that an introduction of organisational mechanisms that create social spaces between people is required in order to achieve successful collaboration (Kotlarsky and Oshri, 2005). Social media can help to connect people with knowledge and experience that is new and possibly complementary rather than

well-known and possible redundant (Bertoni et al., 2012). Thereby, social media can help software developers to more effortlessly and effectively develop the 'know what' (Ryle, 1984), 'know-how' (Ryle, 1984) and 'know-who' (Larsson, 2005) needed to achieve their objectives.

However, knowledge sharing through social media is still at an early stage. There are many disparate conceptualisations of the technologies (Richter et al., 2011) and the literature is often vague and dispersed (Gancho et al., 2013). However, social media increases to influence the literature of fields related to software development such as software engineering and computer-supported cooperative work and there is a rising recognition that the tools can have beneficial impact on knowledge sharing activities within software development. Consequently, there arises a requirement to provide practitioners and researcher within software development with an overview of the current state of the art.

2. Method

To overcome the perceived weaknesses of narrative review (Tranfield et al., 2003) this study apply a systematic literature review methodology based on the five-step approach outlined by Denyer and Tranfield (2009). This approach provides comprehensive coverage of the literature and ensures auditability and repeatability for future searches. The five steps as illustrated in Figure 1 can be grouped into five main phases: planning, searching, screening, extraction and synthesis, and reporting. Each step is discussed in the next sections.

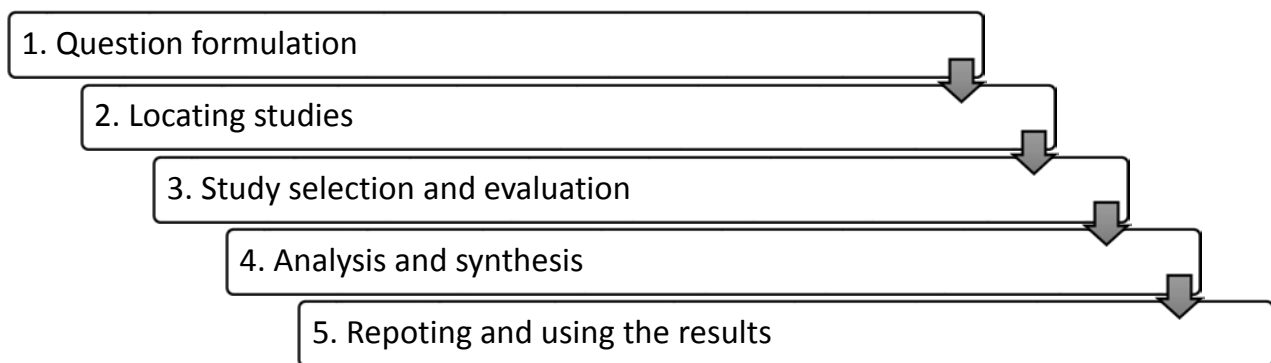


Figure 1 - Overview of the five-step systematic literature review approach

2.1 Planning

In the first phase, the research questions guiding the review was formulated. A clear research question is critical to provide the focus and direction for a systematic literature review. The main research question was defined through discussions between the authors along with additional colleagues.

The research question was framed by the following CIMO logic (Denyer et al, 2008):

Context: Software developers and software engineering teams.

Interventions: The use of social media tools in software development and in software engineering projects.

Mechanisms: Knowledge sharing activities.

Outcomes: Usage of social media for knowledge sharing in software development.

2.1.1 Research Questions

To examine the current state of knowledge sharing through different social media tools, the following primary research question was formulated:

How may social media support knowledge sharing activities in software development?

Supported by two sub-questions:

1. Under which conditions does social media influence the facilitation of knowledge sharing activities in software development and software engineering?
2. What are the benefits and challenges of using social media for knowledge sharing in software development and software engineering?

2.2 Searching

The systematic review aim to locate, select and appraise as much as possible of the research relevant to the review question (Denyer and Tranfield, 2009).

2.2.1 Search String

The automatic search of electronic databases was conducted using a broad and comprehensive search string. The search string was defined as a combination of three sets of keywords adhering to social media, the subject and the actors.

{Social Media} **AND** {subject} **AND** {actors}

Social media comprises several terms used by practitioners and researchers. Thereby, the following terms were used for the first part of the search string:

“social media”, “social software”, “social technolog”, “social network*”, “web 2.0”, “social bookmark*”, “social tagging”, “social platform*”, “social web tool*”, “social web”, “user generated media”, “user generated content”, “instant messaging”, wiki*, Facebook, Twitter, blog*, microblog*, Sharepoint and Yammer.*

The subject was defined though a terminology used to identify all papers relevant to different knowledge sharing activities:

“knowledge sharing”, “knowledge transfer”, “knowledge distribution”, “computer-mediated communication”, “computer-mediated collaboration” and “computer supported co-operative work”.

The actors of the review was defined to identify software engineering and its main phases;

“software engineering”, “software development”, “IT development”, “software quality”, “software testing”, “software architecture”, “requirement engineering”, “requirement specification” and “quality assurance”.

The selected keywords were then used to construct the search string with Boolean operators (AND and OR). The final search query is shown in Table I. The definition of the search terms ensures the identification of a list of papers that would be both wide enough to recall a sufficient quantity of references and precise enough, in the light of information explosion, to eliminate unnecessary material (Duff, 1996, p. 15).

Table I – Keywords and search terms used in the search string

Social media		Subject		Actors
"social media" OR		"knowledge sharing" OR		"software engineering" OR
"social software" OR		"knowledge transfer" OR		"software development" OR
"social technolog*" OR		"knowledge distribution" OR		"IT development" OR
"social network*" OR	AND	"computer-mediated communication" OR	AND	"software quality" OR
"web 2.0" OR		"computer-mediated collaboration" OR		"software testing" OR
"social bookmark*" OR		"computer supported co-operative work"		"software architecture" OR
"social tagging" OR				"requirement engineering" OR
"social platform*" OR				"requirement specification" OR
"social web tool*" OR				"quality assurance"
"social web" OR				
"user generated media" OR				
"user generated content" OR				
"instant messaging" OR				
wiki* OR				
Facebook OR				
Twitter OR				
blog* OR				
microblog* OR				
SharePoint OR				
Yammer				

2.2.2 Databases

The second key decision to make when locating the studies is to choose which search engines to use. First, databases used in similar studies within the same field were identified. Secondly, by consulting with a review expert who has conducted some comprehensive acknowledged literature reviews within the same field, the list of identified databases was scrutinised and narrowed down to five. Given that the context for the study is social media and knowledge sharing in software development, these were identified as the databases providing the best coverage of the field. Table II shows the selected databases and the corresponding number of identified objects based on the search string.

Some objects identified in Scopus was also identified in other databases (e.g. IEEE, ACM). These duplicates were deleted. Some objects identified through Scopus was not identified through the direct database (e.g. Science Direct, EBSCO, Springer Link) even though the object was placed within this database. This enhances the rationale of choosing several different types of databases for the search.

Table II - Databases and number of items identified

Databases	No. objects	No. of objects left after screening of titles	No. of objects left after screening of abstracts and full papers
Scopus	2.381	214	41
Science Direct	317	13	0
Springer Link	18	1	0
Association of Computing Machinery (ACM)	717	179	77
EBSCO	29	5	2
Web of Science	237	56	15
The Institute of Electrical and Electronics Engineers (IEEE)	536	103	31
Total	4.235	571	166

2.3 Screening

All identified objects were exported to the reference management software package, Refworks (Refworks). The software was used to eliminate duplicates. Subsequently, a screen based on the relevance of the title of the object identified papers relevant for a more in-depth review of the abstract. Relevant papers was selected using explicit inclusion and exclusion criteria (Table III) and quality criteria covering alignment between research questions, chosen methods and execution of research, methodological rigour and contribution to knowledge (Miles and Huberman, 1994).

Table III - Criteria for including and excluding identified papers

Criteria	Rationale
<i>Inclusion criteria</i>	
Papers in peer reviewed journals, conference papers, working papers, workshop proceedings, editorials and reviews	The field of social media is experiencing increasing attention in the later years. However, it is still an emergent field and excluding work-in-progress like conference papers and working papers could leave out important discoveries. Additionally, since the development within the studied field takes place so rapidly, many studies only contributes with conference papers, because the process of revision and acceptance for publication in a journal, makes the findings outdated before reaching publication.
Papers has to have social software and collaboration as a main theme	The focus of the research is to study knowledge sharing through social media.
Papers has to be focused on software development or related fields	The aim of the research is to explore and map the current state of studies on knowledge sharing through social media applicable to software development.
Selection of papers will be open to any time frame	The field has developed significantly in later years but some parallels can be drawn to much earlier papers.
Theoretical papers, empirical papers and review papers, either qualitative or quantitative	Different approaches have contributed to the field of study.
<i>Exclusion criteria</i>	
Papers related to topics where the focus is not on knowledge sharing and social media	Many papers focus on other ways to share knowledge but the focus in this study is on knowledge sharing through social media.
Papers related to fields not comparable to software engineering	Many papers focus on other fields e.g. education and healthcare.
All studies in any other language than English or Danish	These languages are the ones that the researchers of the review can read.

When identifying objects reporting the same study or objects that are predecessors to another identified object, only the most complete or newest version was retained. Removing duplicates and the subsequently first screen based on the relevance of the title of the identified objects to the object of study resulted in retention of 571 for a more in-depth review of the abstract. Selection was then carried out by first reviewing the abstract and afterwards reviewing the full papers that was selected on the basis on the abstract. A total of 405 objects was rejected mainly based on reviewing the abstracts but for a minor part based on reviewing the full papers, leaving 166.

2.4 Extraction and Synthesis

A summary of the information contained in each paper was prepared using a spreadsheet format organised under descriptive, methodological and thematic categories (Table IV). The descriptive and

methodological analysis was more deductive in nature and focus on the categorisation of the identified papers by year, journal, title, paper type, etc.

A more inductive approach was taken at the thematic analysis. This analysed and mapped the presentation in research studies of social media tools suitable to support knowledge sharing in software development. The purpose is to identify the emergent constructs around different social media tools to facilitation of knowledge sharing and to identify gaps and future research agendas.

Two researchers coded the data independently to ensure inter-coder reliability (Cho, 2008). Where the views differed, the issues of disagreement was discussed between the authors until resolved (Miles and Huberman, 1994).

Table IV - Categories used in extracting and analysing data from the identified papers

Area	Category	Rationale
Descriptive	Authors	Name of author(s)
	Title	Complete title of the paper
	Year	Year of publication
	Journal	Journal in which it was published, book section or conference proceedings
	Country	Country where the research was conducted
	Place of publication	Country where the research was published
Methodology	Method used	Identify the method used to conduct the research.
	Paper type	Identify whether the paper is analytical, empirical or if it is a literature review. These are further divided into categories that are more concrete.
	Sampling	Identifies sample size.
	Population studied	Identify whether the studied population was co-located, distributed or globally distributed.
	Community	Identify the community in which the paper was published.
Thematic	Type of social media	Identify the type of social media studied.
	Theme	Identify the focus of the research (e.g. motivation, communication, collaboration, etc.)
	Other	Any other information presented in the study that is relevant for this research.

4.5 Reporting

The paper will be the first formal presentation of the results to an academic and practical audience. The remaining parts of the final paper will be dedicated to reporting the findings descriptively and thematically and the sub-questions will be used as a structure for the discussion.

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