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An e-mail embedded software prototype for knowledge management

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Abstract

Against the backdrop of today's knowledge economy and a strong pervasion of e-mail in enterprises, the paper at hand presents an e-mail embedded software prototype for knowledge management. Although information systems literature esteems the research field of e-mail-related knowledge management as phenomenon, few contributions have been made in artifact-based and problem-oriented research. As existing software applications lack in specificity and currency, a tailored information technology artifact grounded on the unique characteristics of e-mail has been developed in a joint university-industry project following the design science research methodology. "Memoro" facilitates knowledge capture/creation and knowledge sharing/dissemination. Core functionality is the lightweight storage and extraction of e-mail-related information to and from a central repository. With the limitation of a customized prototype, first evaluation results indicate that integrating knowledge management into the daily e-mail routine enables knowledge-intensive businesses to deal with their knowledge in more effective and efficient ways. From a research perspective, "Memoro" might serve scholars as origin for further research. We contribute to the body of knowledge by providing (1) an early version of an innovative design artifact and (2) a concept-centric literature review.

Keywords

Knowledge Management, E-mail, Design Science Research, Software Prototype, and Manufacturing Industries.

1. Introduction

Both researchers and practitioners agree that the capability to manage knowledge is becoming increasingly decisive in today's knowledge-driven economy. Knowledge has become an important factor of competitiveness (Nonaka, 1994; Davenport & Prusak, 1998; Dalkir, 2005). Extending this understanding, the knowledge-based theory of the firm even designates knowledge as most strategically significant resource and the core of competitive advantage (Kogut & Zander, 1992; Grant, 1996). Dalkir conceptualizes knowledge management as "deliberate and systematic approach to ensure the full utilization of the organization's knowledge base, coupled with the potential of individual skills, competencies, thoughts, innovations, and ideas to create a more efficient and effective organization" (Dalkir, 2005: p.2). Over the last

decades, a myriad of research directions has been pursued in knowledge management (Alavi & Leidner, 1999; Alavi & Leidner, 2001), including the role of e-mail (e.g., Lichtenstein & Swatman, 2003a; Lichtenstein & Parker, 2006). In the era of social media, a substitution of this medium has been forecasted at regular intervals. By contrast, recent research (Gill, 2013) confirms our gut feeling that e-mail still represents a backbone of our daily business life. In concrete figures, market research company The Radicati Group forecasts the number of sent and received business e-mails per day to 128.8 billion in 2019, compared to 112.5 billion in 2015 and 110 billion in 2010 (The Radicati Group Inc., 2010; The Radicati Group Inc., 2015).

Against the backdrop of today's knowledge economy and a strong pervasion of e-mail in enterprises, we consider the further development of this research field as relevant and timely. An accomplished literature review unveiled that in the information systems domain e-mail-related knowledge management has been investigated rather as phenomenon guided by the social sciences paradigm. Existing literature extensively emphasizes the aptitude of e-mail for knowledge management (e.g., Lichtenstein & Swatman, 2003a; Lichtenstein & Swatman, 2003b; Lichtenstein, 2004; Lichtenstein & Parker, 2006). For example, Lichtenstein and Swatman (2003a) identified nine advantages reaching from attention-attracting to sense-making through contextualization. In contrast, artifact-based and problem-oriented research following the design science research paradigm has been comparatively neglected. Existing software applications (e.g., Maybury, 2007) lack in (1) specificity regarding e-mail as main source, (2) specificity regarding the industry context, and (3) currency. Hence, the paper at hand aims to address this research gap and presents the creation process of an information technology artifact according to the design science research methodology by Peffers et al. (2007). "Memoro" – an e-mail embedded software prototype for knowledge management – has been developed in a joint university-industry project with the underlying research question:

"How to design an e-mail embedded software prototype for knowledge management in the context of an industrial engineering enterprise?"

For this purpose, the remainder of this design science research paper is structured as recommended by Gregor and Hevner (2013): First, we review the existing knowledge base by a literature review. Second, we introduce the applied design science research methodology. Third, we present our research results focusing on the design and evaluation activities of "Memoro". Finally, we conclude with a discussion, contributions, and implications for practice and research.

2. Literature review

The importance of literature reviews in order to anchor new research in the existing knowledge base has been highlighted in several articles (e.g., Cooper, 1988; Webster & Watson, 2002; vom Brocke et al., 2009). As established field of research and practice, the role of e-mail in knowledge management has been discussed extensively in literature as well. Hence, the objective of this subsequent review is twofold: First, we strive to provide on overview on related work, second, we aim to explore design objectives for the successive artifact creation. Thereby, we build our artifact upon relevant, extant work which we find in the domain of information systems, complemented by management and computer science literature. Although the methodology for accomplishing literature reviews is not standardized, we conducted our research according to the established approach by vom Brocke et al. (2009). Furthermore, valuable contributions from other sources (Cooper, 1988; Webster & Watson, 2002; vom Brocke et al.,

2015) are considered. As vom Brocke et al. (2009) emphasize the importance of rigor in documenting the accomplished review process, we pursue transparency despite the limited space.

a) Definition of review scope - The definition of the review scope represents the first step of the review in order to specify its boundaries. Drawing upon Cooper (1988), six characteristics need to be determined: The focus lies on research outcomes and research methods (1). With regard to the goal, our aim is the identification of central issues (2). We are presenting our findings from a neutral perspective (3). The coverage of this literature review is representative (4). Thereby, the organization is concept-driven (5). With reference to the audience, we refer to specialized and general scholars as well as practitioners (6).

b) Conceptualization of topic - The conceptualization of topic represents the second step of the review with the objective to involve all facets of the reviewed topic. The suggested approach by Webster and Watson (2002) to consult sources which provide a summary is not an easy task in the case of knowledge management as more than 100 published conceptualizations from business, cognitive/knowledge science, and process/technology perspective have been identified (Dalkir, 2005). During a pre-screening of standard references (highly cited books in Google Scholar and the Senior Scholars' Basket of Journals) a concept map consisting of synonyms, superordinate, infraordinate, and related terms was created. Since we strive for a broad overview, we finally assessed the concept "knowledge management" with the specification "e-mail" in all variant forms of spelling as appropriate.

c) Literature search - The literature search represents the third step of the review targeting the identification of the actual literature. In order to catch the most important contributions in peer-reviewed journals and conferences, major scholarly databases were searched. Thereby, we used the search string "knowledge management AND *mail" for the key word search. As we faced the challenge that literature search results were strongly falsified as we searched all meta data (e.g., […] the survey questionnaire was distributed by e-mail [...]), we iteratively adapted our search process and applied the key word search to the most important meta data types (Table 1). To catch the most recent contributions, a time frame from January 2000 to November 2015 was taken into consideration. Table 1 summarizes the conducted literature search and results.

Database	Search specification	Results	Net hits
AIS Electronic Library	"subject, title"	3	3
EBSCOhost	"title, subject terms"	23	4
Emerald	"publication title, key words"	4	2
IEEE Xplore	"document title, author keywords"	93	4
PAIS International	"document title, identifier (keyword)"	37	11
Science Direct	"title, keywords"	2	0
Web of Science	"title"	16	2
Interim results (database search, inclusion/exclusion)		178	26
Final results (duplicates, inclusion/exclusion, forward/backward, recommendations)		37	

Table 1: Literature search and results

The original database search resulted in 178 items. This sample was screened in a three-step approach examining title, abstract, and full text. According to the purpose of the review and the planned design science research project, we specified inclusion/exclusion criteria: Articles are included if (1) knowledge management and e-mail are central topics covering a large share of the publication or (2) an essential statement on their relationship is made. Furthermore, we applied a forward/backward search process screening the publication titles which unveiled additional ten publications. Additionally, we included further articles (six publications) advised by senior scholars and experienced practitioners, as recommended by Webster and Watson (2002). After removal of duplicates, application of inclusion/exclusion criteria, forward/backward search

process, and recommendations (Webster & Watson, 2002), the final count of publications included in this study dropped to 37 items.

d) Literature analysis and synthesis - The literature analysis and synthesis represents the fourth step of the review and condenses the included publications. For this objective, a concept matrix was developed. Table 2 illustrates the results of the literature analysis and synthesis. Dimension 1 and 2 refer to the review objectives, dimension 3 to 7 represent meta-information about the articles as proposed by Cooper (1988). The categories were derived from three sources: First, whenever possible, established frameworks grounded in literature (Cooper, 1988; Creswell, 2003; US Census Bureau, 2012) were applied. Second, for more vague dimensions a mix of inductive and deductive methods (Nickerson et al., 2013) was applied. Third, we evaluated the concept matrix with senior researchers and practitioners. It is not within the scope to outline all possible dimensions, instead we focus on those that are relevant for the mentioned objectives.

#	Dimension	Categories				
1	Research outcome	Central issues [20]	Model/framework [7]	Process/algorithm [8]	IT artifact [2]	
2	Research method	Literature review [2]	Case study [17]	Empirical testing [2]	Other [7]	Not specified [9]
3	Industry	Public administration [3]	Manufacturing [3]	Educational services [7]	Other [4]	Multiple/independent [20]
4	Domain	Computer science [8]	Information systems [18]	Management [11]		
5	Audience*	Specialized scholars [12]	General scholars [28]	Practitioners [25]	General public [2]	
6	Time frame**	<1999 [2]	2000-2005 [16]	2006-2010 [11]	2011-2015 [8]	
7	Literature type	Conference proceedings [25]	Journal article [10]	Patent [2]		
*not mutually exclusive,** recommendations by senior scholars <1999*						

Table 2: Literature analysis and synthesis

Principal research outcomes (1) are central issues and models respectively processes. This fact is also reflected in the applied research methods (2) which are mostly case studies. From an industry perspective (3), e-mail-related knowledge management is investigated in heterogeneous branch contexts. Most articles are rooted in the information systems domain (4). As applied research issue, in most cases a mix of specialized scholars, general scholars, and practitioners (5) is addressed simultaneously. With regard to the time frame (6), most articles were published between the years 2000 and 2005. In terms of publishing channels (7), conference proceedings were preferred.

Investigating more detailed the objectives of the review in terms of research outcomes, most articles contribute to a better understanding of the phenomenon by identifying central issues such as advantages (Lichtenstein & Swatman, 2003a) or knowledge flows (Bontis et al., 2003). Furthermore, some articles contribute to the body of knowledge by developing more structured models or frameworks, for example the model of collaborative knowledge creation (Lichtenstein & Parker, 2006) or the maturity model for e-mail communication in knowledge organizations (Gottschalk, 2008). Although some articles deal with processes and algorithms such as knowledge extraction from professional e-mails (Matta et al., 2014), few publications refer to information technology artifacts. With reference to the applied research methods, it is evident that the majority applied qualitative research strategies such as case studies.

Beyond the academic body of literature, there have been numerous attempts to create commercial software applications to provide access to distributed experts and their expertise such as AskMe, Tacit, or Autonomy (Maybury, 2007). However, shortcomings were apparent during the authors` research: First, from a source perspective, most tools pursue a multidisciplinary approach and are not tailored to the exploitation of e-mail-related knowledge. Second, from a context perspective, most tools target several business use cases simultaneously

and hence neglect specific requirements of manufacturing industries. Third, from a time perspective, most tools are outdated with design origins of ten and more years in the past.

Finally, looking at the body of knowledge as a whole in order to aggregate the results: The relevance and appropriateness of e-mail for knowledge management has been highlighted of wide scope, yet few articles apply this rich knowledge base to today`s challenges in the knowledge management landscape of manufacturing industries. In the following, we address this research gap by creating a fitted information technology artifact grounded on the unique characteristics of e-mail.

3. Design science research methodology

In contrast to social and natural sciences, the main goal of a design science research approach is the creation of a new artifact (Hevner et al., 2004; Peffers et al., 2007). In the case at hand, the design artifact is an information technology artifact – namely the e-mail embedded software prototype. Whereas design science research is rooted in several domains such as engineering as well (Simon, 1996), we refer to its understanding in the information systems domain. Accordingly, we adapted the six steps suggested by Peffers et al. (2007):

- **Activity 1:** Problem identification and motivation
- **Activity 2:** Definition of the objectives for a solution
- **Activity 3:** Design and development
- **Activity 4:** Demonstration
- **Activity 5:** Evaluation
- **Activity 6:** Communication

Contingent on the boundaries of the research project, we adapted this methodology and shifted our attention to the mid-section of the cycle. The rationale for this approach is put forth along two lines: First, Peffers et al. (2007) describe multiple research entry points. As the problem of insufficient knowledge management has been identified and motivated in academia and practice copiously, we shorten this section and enter the design cycle with the definition of the objectives for a solution and focus on the design and development stage. Second, as our research with demonstration, evaluation, and communication is still ongoing, we present the status quo. Design science research is inherently iterative (Hevner et al., 2004; Peffers et al., 2007). Furthermore, in his three cycle view of design science research, Hevner (2007) accentuates that three closely related cycles must be present:

a) Design cycle - The design cycle represents the central activity in the design science research methodology and encompasses the actual design and evaluation tasks (Hevner, 2007). For this endeavor a project team of eight graduate students from Germany and Switzerland – half of it with focus on business innovation and half of it with focus on information technology – was set up in the summer of 2014. Over a time period of nine months, the team iteratively passed through the aforementioned design science research methodology.

b) Relevance cycle - The relevance cycle “bridges the contextual environment of the research project with the design science activities” (Hevner, 2007: p.88). Beyond academia, we had the opportunity to team up with a machinery and plant engineering company, embedded in one of the largest industrial consortiums in Europe. This generous setup with a range of practical expertise from different domains provided us (1) rich and detailed context information for understanding the research problem and acted as (2) environment for the subsequent artifact evaluation.

c) Rigor cycle - The rigor cycle "connects the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project" (Hevner, 2007: p.88). By accomplishing a rigorous literature review, we integrated (1) "experiences and expertise that define the state-of-the-art" through information systems databases (e.g., AIS Electronic Library) and (2) "existing artifacts and processes found in the application domain" through computer science and engineering databases (e.g., IEEE Xplore) to our best knowledge.

4. Results

4.1 Problem identification and motivation

The problem identification and motivation is the first activity in the design science research methodology. As the problem has been identified and motivated copiously, we provide a summary: Although knowledge is a considered as critical resource (e.g., Kogut & Zander, 1992; Grant, 1996), knowledge management in practice faces several challenges (Alavi & Leidner, 1999; Alavi & Leidner, 2001). In contrast, the appropriateness of e-mail for knowledge management has been substantiated (e.g., Lichtenstein & Swatman, 2003a; Lichtenstein & Parker, 2006), yet no appropriate and tailored solution is available (Maybury, 2007).

4.2 Definition of the objectives for a solution

The definition of the objectives for a solution is the second activity in the design science research methodology. Relating to Hevner`s rigor and relevance cycle (Hevner, 2007), design objectives were collected from the knowledge base and enriched by contextual complements from the industrial engineering company, collected in advance in the style of a case study following Eisenhardt (1989) and Yin (2009). Applying Yin`s classification for sources of evidence (2009), thirteen in-depth interviews with employees from different departments including observations of their daily knowledge work and the analysis of artifacts such as existing software applications were conducted. As space is limited within this format, we provide an overview on objectives for a solution in Table 3.

Requirement	Description	Sources
Requirement 1: The IT artifact has to be directly embedded into the daily e-mail work flow.	In order to exploit the advantages of e-mail for knowledge management at best, the IT artifact needs to be aligned with daily e-mail routines as close as possible. Each deviation or additional task might result in a less useful solution.	Lichtenstein & Swatman, 2003a; Lichtenstein & Swatman, 2003b; interview study
Requirement 2: The IT artifact has to cover the complete knowledge management cycle.	In order to enable effective knowledge management, the IT artifact needs to support each stage of the knowledge management cycle. Strong knowledge sharing/dissemination functionalities require strong knowledge capture/creation functionalities and vice versa.	Dalkir, 2005; Maybury, 2007; interview study
Requirement 3: The IT artifact has to exhibit "modern" value-adding functionalities.	In order to enable efficient knowledge management, the IT artifact needs to provide value-adding functionalities known from state-of-the art software. Examples for such functionalities are user assistance through task automation and the possibility to interact with and to share content between users in a lightweight manner.	Maybury, 2007; Matta et al., 2014; interview study
Requirement 4: The IT artifact has to consider the industrial engineering context.	In order to design a tailored, non-generic knowledge management solution, the application environment needs to be taken into account. As result of demanding quality, time- and cost-to-market targets, knowledge management in the industrial engineering context is characterized as highly integrative, distributed, and dynamic.	Maybury, 2007; interview study

Table 3: Overview on objectives for a solution

4.3 Design and development

The design and development is the third activity in the design science research methodology. The created information technology artifact is "Memoro" (Bastian et al., 2015), an e-mail embedded software prototype for knowledge management, named after the Latin word "memor"

meaning “mindful”. Drawing upon the integrated knowledge management cycle (Dalkir, 2005), “Memoro” represents a central enterprise platform to ease knowledge capture/creation and knowledge sharing/dissemination. Core functionality is the lightweight storage and extraction of e-mail-related information to and from a central repository. Grounded on technical requirements by the industrial engineering enterprise, “Memoro” was realized as an add-in for the e-mail client software Microsoft Outlook (Figure 1). Furthermore, an implementation at Google’s web-based e-mail client GoogleMail is available. Responsive design techniques were applied to optimize this implementation for use on mobile devices.

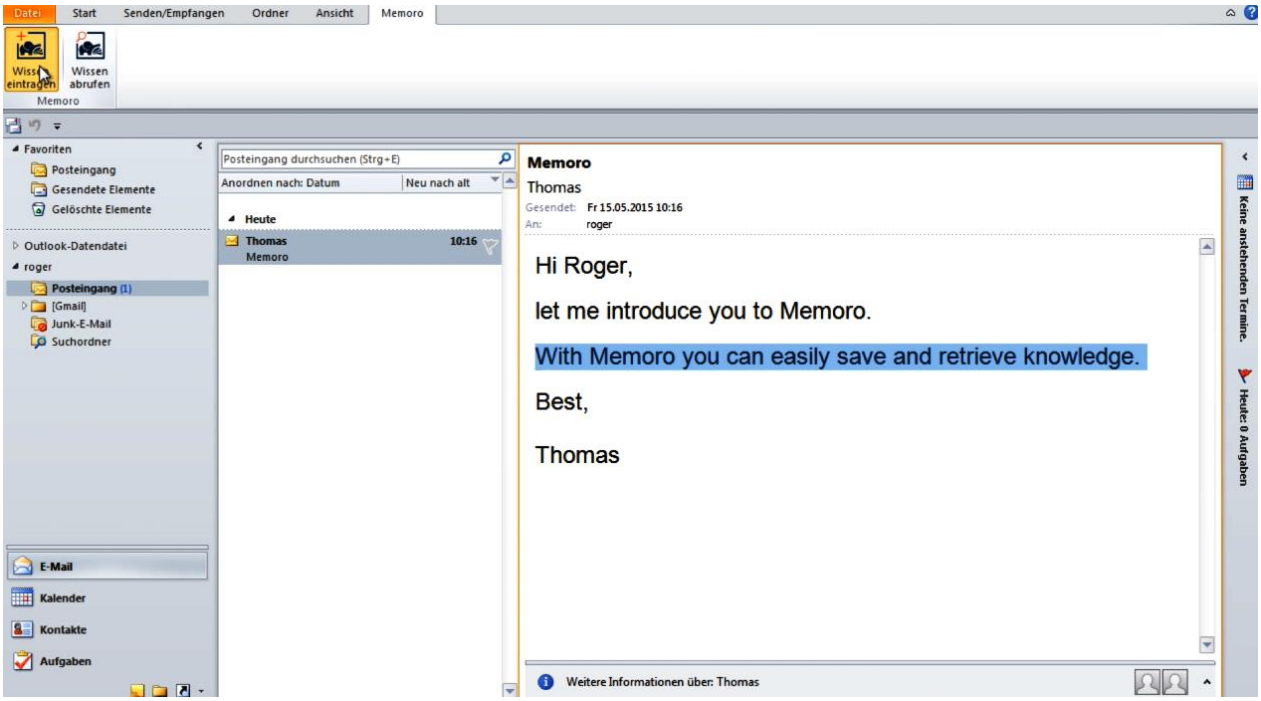

Figure 1: Graphical user interface of “Memoro” implemented in Microsoft Outlook

In the following, an overview on key functionalities by the aid of graphical user interface mockups is provided. Figure 2 (a) illustrates the central graphical user interface of “Memoro”. By the aid of a separate tab which includes two ribbons to create new knowledge database entries and to search the knowledge database, “Memoro” is integrated seamlessly into the daily e-mail workflow of the user.

Knowledge capture/creation - Figure 2 (b) depicts the graphical user interface for knowledge capture/creation. If an e-mail contains valuable information or knowledge, a new knowledge database entry is created by selecting the relevant text paragraphs and pushing the correspondent ribbon in the “Memoro” tab. Accordingly, the text boxes for knowledge database entry title and knowledge database entry content are prefilled, but can be edited and formatted by the user. For classification purposes, three different types of attributes (category, project, and keyword) can be assigned. The first attribute “category” refers to the content of the entry, the second attribute “project” relates to the company-internal project numbering system. In contrast, the third attribute “keyword” can be entered as free text. Furthermore, “Memoro” provides the possibility to attach additional documents such as office or engineering documents.

Knowledge sharing/dissemination - Figure 2 (c) depicts the graphical user interface for knowledge sharing/dissemination. The search function enables the user to search the knowledge

database with the previously created knowledge database entries. In the light of numerous relevant knowledge database entries, the search function prioritizes the search results considering title, category, project, keywords, and search term frequency. For enhanced search results, Boolean search terms and browsing through knowledge database entries are possible. The "Memoro" entry indicator will search the knowledge database automatically if the user starts writing an e-mail with relevant key words. Furthermore, "Memoro" encompasses collaboration functionalities: Knowledge database entries can be shared, commented, and edited while retaining previous versions. Beyond, the author can be contacted for further discussions and his contributions to "Memoro" can be screened. Finally, a rating functionality addressing the usefulness of knowledge database entries acts as incentive for "Memoro" contributors.

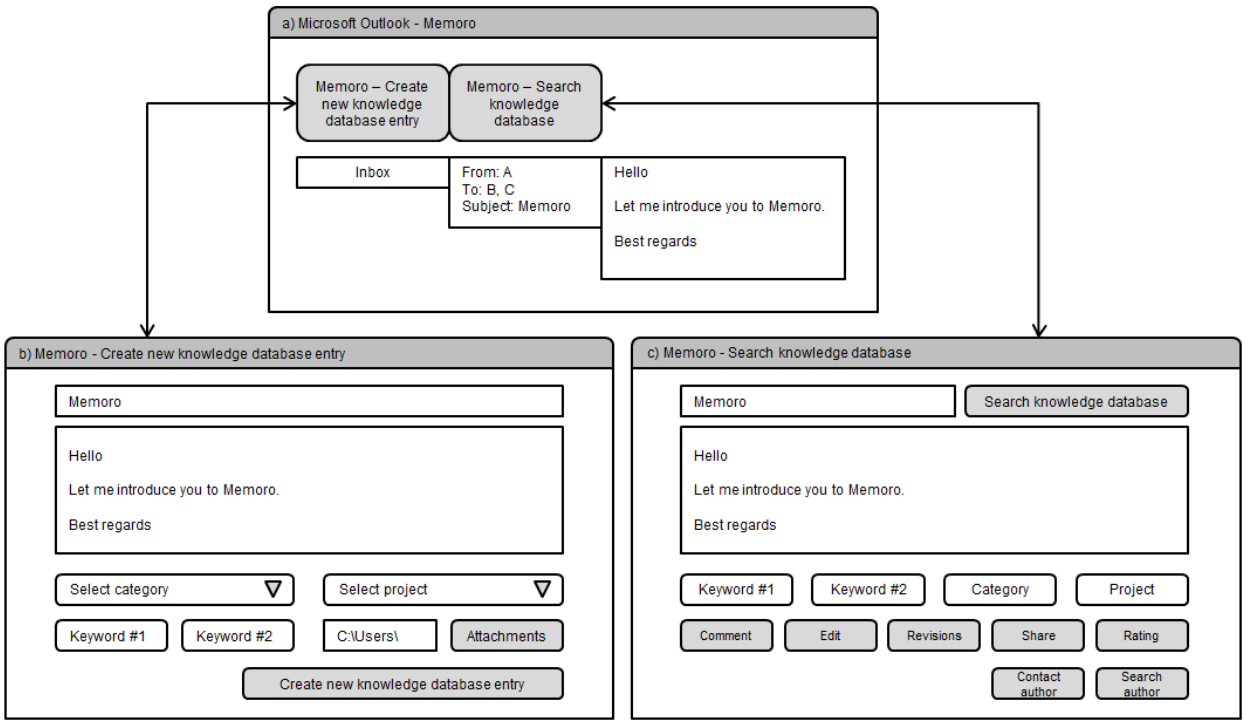

Figure 2: Graphical user interface mockups of "Memoro":
a) Overview, b) Knowledge capture/creation, c) Knowledge sharing/dissemination

4.4 Demonstration, evaluation, and communication

The demonstration, evaluation, and communication are the fourth, fifth, and sixth activity in the design science research methodology. As these phases are still ongoing, this section describes the applied methodology, preliminary findings, and an outlook.

Applied methodology - Sonnenberg and vom Brocke (2012) distinguish between ex ante evaluation and ex post evaluation. As our goal is the artifact refinement during the design process, we selected ex ante evaluation also applying related guidelines for action design research suggested by Sein et al. (2011). In terms of evaluation methods, Hevner et al. (2004) designate several techniques. According to the principle of triangulation, we chose a multi-method evaluation strategy. Since we consider knowledge management as contemporary phenomenon deeply rooted in real-life context, we assessed the observational method of a case study (Hevner et al., 2004) as suitable. The evaluation was conducted in the industrial engineering enterprise and involved test users which were not participating in the design process.

Overall, for seeking feedback, ten interview sessions (average duration: 28 minutes) for testing the prototype were completed. Beyond, as recommended by Tremblay et al. (2011), test users formed three exploratory focus groups (average duration: 51 minutes). For both evaluation techniques, participants "familiar with the application environment and potential users of the proposed artifact" (Tremblay et al., 2011: p.604) such as product developers and project managers acted as test users. Interviews and workshops were recorded (audio), anonymized, and transcribed. For data analysis, grounded theory techniques with open coding procedures (Strauss & Corbin, 1997) were applied to aggregate the feedback. With the objective of rigorous and efficient data analysis, computer-assisted qualitative data analysis software (Alam, 2005; Sinkovics et al., 2005) was utilized (NVIVO 10).

In addition, as descriptive evaluation method (Hevner et al., 2004), the team created exemplary scenarios which are narrative descriptions of activity sequences (Carroll, 1995) to prove the required usefulness. An exemplary scenario: In a long e-mail conversion with various stakeholders, a globally distributed engineering team carves out essential design parameters for a current project. "Memoro" makes recourse to the advantages of e-mail for knowledge management and facilitates economic re-use. Up to now, the descriptive evaluation method resulted in 14 concrete scenarios. Thereby, scenarios comprised of ID, title, and abstract.

Preliminary findings - Overall, feedback on the e-mail embedded software prototype for knowledge management was positive. Most of all, test users underlined the (1) ease of use and (2) usefulness in their day-to-day business. Furthermore, test users regarded e-mail embedded knowledge management as suitable solution to administer information that is particularly heterogeneous and fluctuating. From a functional perspective, this first evaluation also unveiled future work for enhancements: Currently, the prototypical implementation of "Memoro" does not provide ease of use for mobile knowledge capture/creation. The complex text marking on small screens of mobile devices could be overcome with screenshots and follow-up editing or text dictation. For a large-scale roll out, the underlying knowledge database might be improved with a hierarchic keyword structure. In the same context, functionalities for duplicate prevention play an important role. Furthermore, rights management for confidential content has to be included.

Outlook - As a group-wide deployment of a more mature release of "Memoro" is in debate in the industrial consortium, the artifact should be evaluated more rigorously, for example by an analytical or experimental approach (Hevner et al., 2004) with an iterative re-design (Hevner et al., 2004; Peffers et al., 2007). The status quo of "Memoro" has been communicated to both technology-oriented and management-oriented audience in form of practitioner manuscripts and management presentations as proposed by Peffers et al. (2007). With this paper we strive to contribute the e-mail embedded software prototype to academia as well.

5. Discussion and conclusion

The paper at hand discusses the creation process of an e-mail embedded software prototype for knowledge management, guided by the design science research methodology by Peffers et al. (2007). Our research was prompted by two rationales: First, e-mail-related knowledge management has been perceived by information systems literature predominantly as phenomenon. Second, existing software applications in the context of artifact-based and problem-oriented research lack in specificity and currency. The developed information technology artifact "Memoro" facilitates knowledge capture/creation and knowledge sharing/dissemination. In line with existing literature (e.g., Alavi & Leidner, 1999; Bontis et al.,

2003; Lichtenstein & Swatman, 2003a; Lichtenstein & Parker, 2006), preliminary findings from our evaluation phase reinforce the relevance and appropriateness of e-mail for knowledge management purposes. Furthermore, our research suggests that e-mail embedded knowledge management represents a valuable building block in a larger knowledge management portfolio which is qualified to address heterogeneous and fluctuating information. This combination of complementary knowledge management techniques also resonates in previous studies (e.g., Alavi & Leidner, 1999; Alavi & Leidner, 2001). However, our research also indicates that critical issues such as privacy concerns need to be overcome for a successful exploitation. In the narrower sense, the development of appropriate guidelines and measures is a pivotal task. In a broader sense, these critical issues need to be addressed in their entirety as related work from Wong (2005) demonstrates.

This paper contributes to the academic discussion on artifact-based and problem-oriented research on knowledge management. We contribute to the body of knowledge by providing an early version of an innovative design artifact (Hevner et al., 2004) for the "solution of an heretofore unsolved problem" (Hevner et al., 2004: p.87). More specifically, Gregor and Hevner (2013) distinguish knowledge contributions by application domain maturity and solution maturity. As we designed a new solution for a known problem, our contribution can be classified as improvement (Gregor & Hevner, 2013). Furthermore, another minor contribution is the concept-centric literature review.

In consequence of the nature of this project, certainly the implications for practitioners outweigh. "Memoro" enables knowledge-intensive manufacturing enterprises to deal with their knowledge in more effective ("capture knowledge in e-mails") and efficient ("capture knowledge in e-mails workflow-aligned") ways. However, the introduced research should be regarded in the light of some limitations: First, we conducted our project in a specific industrial engineering company with specific requirements. Second, grounded on a single company, our findings are not representative. Finally, despite complete functionality, the realized application has to be viewed as a prototype. Beyond the addressed functional enhancements and future work on demonstration, evaluation, and communication, "Memoro" might serve scholars as origin for further investigations of the phenomenon.

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