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Manifesto for a Standard on Meaningful Representations of Knowledge in Social Knowledge Management Environments

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Abstract

Knowledge Management (KM) [1] is a social activity. More and more organizations use social software as a tool to bridge the gap between technology- and human-oriented KM. In order to create interoperable, transferable solutions, it is necessary to utilize standards. In this paper, we analyze which standards can be applied and which gaps currently exist. We present the concept of knowledge bundles, capturing information on knowledge objects, activities and people as a prerequisite for social-focused KM. Based on our concept and examples, we derive the strong need for standardization in this domain. As a manifesto this paper tries to stimulate discussion and to enable a broad initiative working towards a common standard for the next generation of knowledge management systems. Our manifesto provides with eight recommendations how the KM community should act to address future challenges.

1 Introduction

How can we facilitate knowledge management in social environments? How can we ensure that as little (contextual) information as possible is lost during a knowledge sharing activity? How can standards contribute to better knowledge management? How to represent knowledge for the next generation of (socially focused) knowledge management instruments and methods? These are the guiding questions for this proposition paper.

The interdisciplinary research field of knowledge management (KM) [1] has come a long way since its inception by Drucker's [2] account of the knowledge worker and Penrose's [3] analysis of the idiosyncratic positions organizations are in and the rents they can derive from them. Many case studies have been conducted, surveys administered and instruments to solve specific KM problems have been designed, implemented and evaluated showing the breadth of methodological approaches applied in this multi-faceted research field. The concept of knowledge has also much been debated during that time, however, there is some agreement today that knowledge in organizations is an abstract concept that is represented in manifestations such as people [4], organizational procedures, practices and processes as well as digital artifacts [5]. A number of KM instruments have been created, their application results in manifestations of knowledge in digital form. Examples are best practices [6], boundary objects [7], lessons learned [8] or micro articles [9] to capture experiences made in, e.g., projects, processes or practices in which individuals or collectives of individuals are engaged. However, since these instruments have been used, numerous IT tools and systems have appeared to form a heterogeneous knowledge infrastructure that supports documentation, searching, collaboration, integration and learning of knowledge and thus provides a rich context surrounding these "knowledge objects" in a narrower sense. Examples are tags, comments, and contributions to forums or blogs, or in general activities on documented knowledge that may, e.g., be recorded in a collaboration system. Typically, organizations are challenged how to best prevent knowledge loss during knowledge sharing activities. Even though, social software supports the traceability of rich and contextualized knowledge sharing activities among multiple persons within and beyond organizational boundaries, it is not yet deemed ready to cover the various needs in the organizational knowledge management. We will argue that there is a strong need for interoperability solutions, in particular widely accepted standards, to further develop the domain of knowledge management.

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Comparing the fields of knowledge management and e-learning, the latter has invested a lot more in standardization, e.g., of learning objects (LOM) [10] or learner information (LIP) [11] while to the knowledge of the authors there is no specific initiative towards interoperable artifacts handled in knowledge management other than more generic approaches provided, e.g., by the Semantic Web initiative. This paper motivates for exploring the possibilities of standardizing containers or, to use a term with a more flexible connotation, *bundles of knowledge* that can be manipulated, e.g., stored, transferred, archived, and still comprise all the relevant data and metadata that allow the recreation of the represented knowledge by people receiving those bundles.

The paper is structured as follows: We begin by outlining in detail the theoretical background and identified research gap. Next, we introduce the main definitions related to new concepts, like knowledge bundle etc. Finally, we analyze an example of a typical knowledge management instrument: good practice documentation. We show what knowledge bundles are covered in such an instrument and highlight opportunities to combine this information with more activity-oriented, dynamic, contextual information to achieve meaningful representation. We conclude with a summary and recommendations for future work related to this manifesto project. The manifesto is the first step towards a broad initiative to create highly necessary standards for the domain.

2 Background and Related Work

We adopt the understanding that knowledge is not an independent object, but rather a temporary product, which is situated and relational. This means that it is connected with the current context and activities as well as with historical context and activities [12]. Subsequently, knowledge sharing is a complex phenomenon and challenged with the fact that the body of knowledge held by a person cannot completely be codified and shared [13, 14]. Additionally, codified knowledge can only be shared and supported by IT efficiently, when contextual information as well as potential adaptation requirements are known about the collaborative setting or situation [15]. As one of the key settings, we see the use of social software in organizations as this is a highly discussed and often – with more or less success – implemented design alternative for knowledge management.

In chapter 2.1, we illustrate how social media (SM) and social software (SSW) collect and exploit contextual information by allowing functionalities such as tags, comments, etc. Our understanding of knowledge sharing strongly relies on the concepts of knowledge activities and knowledge elements (as carriers of knowledge). Therefore, chapter 2.2 sheds light on these concepts and underlines our assumption that not only the knowledge and its context but also the description of the context where knowledge sharing occurs is of significant importance. Chapter 2.3 illustrates typical approaches to standardization and highlights the lack of standards in the domain of KM. Hence, we point out that there is a great necessity to develop an own framework for KM providing the standards to facilitate interoperation between IT systems.

2.1 Social Software and Knowledge Sharing

KM comprises a wide range of strategies and practices supporting the identification, creation, distribution, adoption, and utilization of organizational insight [16]. As a part of this, supporting collaboration between co-workers in a company is proven to be more important for an efficient

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KM than the exclusive use of document management [11]. The emergence of Social Media and Social Software implies a new understanding of KM [17] and creates new challenges for organizations. Consequently, Enterprise 2.0 changes the way colleagues interact [18]. In an increasingly rich social software (SSW) environment, they collaborate regardless of organizational hierarchies at any time and at low cost. Moreover, SSW does not only facilitate direct communication (e.g., by using instant messaging or micro blogging), but also allows users to communicate indirectly through objects of externalized and de-contextualized knowledge (e.g., in social enterprise networks). Users of SSW applications can store and present their work-related content or likewise search, scan, tag, edit, comment, or evaluate user-generated content of their fellow workers.

One main advantage of SSW is that it broadens and deepens the range of user participation through sharing and acquiring new knowledge. It delivers both, the maintenance of strong ties to frequent communication partners, and the occurrence of weak relationships, which span different sub-networks or communities [19, 20]. The strong user participation in SSW and the direction of collaboration can be guided and used for the purposes of knowledge management [21]. Consequently, SSW has the potential to facilitate the transfer of knowledge and the construction of new knowledge through social interaction in organizations [14, 22]. These are the prerequisites and at the same time the challenges of efficient and transparent knowledge sharing among knowledge workers and for increasing the innovation potential in a company.

Even though current SSW applications offer a wide range of contextual information through users' e-portfolios or content metadata, there is still room for further improving and sustaining knowledge transfer along the knowledge creation process. The increasing volume and complexity of information available as well as the proliferation of ICT emphasize the need for more efficient ways of sharing knowledge. Hence, in order to meet these needs, standardization efforts remain a key task, which resulted in this proposition paper for a framework suggesting first steps towards a standard for knowledge sharing in the context of knowledge management.

2.2 Knowledge Activities and Knowledge Elements

Increasingly, research studies [23-25] deal with the automatic detection of the users' task and activities based on collecting contextual data. The (semi-)automatic derivation of a user's activity, however has been shown to be challenging and cumbersome [23]. We argue that a better understanding of potential knowledge activities and their connection and traceability in IS is necessary to bring forward the various approaches in our disciplines. Basically, literature does not in agreement what KM activities are. However, this understanding is deemed necessary since KM tools strive to support KM activities [26-28]. The comparison of KM frameworks indicates that identified KM activities are different in their granularity and scope. Whereas [29, 30] only focus on knowledge creation, [31, 32] strive to cover in their KM chain model the whole lifecycle of KM and the respective activities.

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Author	Knowledge (Management) Activity
Aurum et al., 2008 [33]	knowledge creation knowledge acquisition knowledge identification knowledge adaptation knowledge organization knowledge distribution knowledge application
Newell et al., 2009 [34]	create knowledge integrate knowledge share knowledge codify knowledge
Hädrich, 2008 [35]	identification acquisition codification combination distribution search & retrieval application, development archiving & deleting learning networking
Nonaka and Takeuchi, 1995, Nonaka and Toyama, 2003) [29, 30]	Socialization externalization internalization externalization
[36]	creation storage/retrieve transfer apply,
Fong and Choi, 2009 [37]	acquisition creation storage distribution use maintaining
Holsapple and Singh, 2001 [31]	acquisition (identifying appropriate knowledge, capturing identified knowledge, organizing captured knowledge, transferring the organized knowledge) selection (identifying appropriate knowledge, capturing identified knowledge, organizing captured knowledge, transferring organized knowledge) generate (monitor, evaluate, produce, transfer) assimilation (assessing, targeting, structuring, delivering) emission (targeting, producing, transferring)

Figure 1: Review of KM activity frameworks

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Additionally, we see a demand to further clarify the understanding of knowledge elements in this respect. The term knowledge element is obviously related to knowledge and it can be understood as a carrier of knowledge [38]. “Knowledge elements can be regarded as inferred from one or more elements of information” [39]. Considering the distinction between information and knowledge, these elements of information must be interpreted and related to human beings and their actions in order to obtain knowledge elements. This process of creating knowledge elements is performed by individuals through transferring information, other knowledge elements or a combination of both [39]. The characteristics and the suitability of knowledge elements for certain circumstances have to be described in order to facilitate their usage [40]. On this note, knowledge elements can be regarded as combination of knowledge content and metadata [41]. Due to the huge heterogeneity in social networks the formats as well as the description of the knowledge elements needs to be standardized to ensure inter-organizational interoperability.

2.3 Standards

One of the main aspects of intra- and even more inter-organizational knowledge management is the exchange of knowledge and related artifacts between systems: standards aim at creating exchange formats and guidelines for interoperable solutions. Due to the variety of methods, instruments and tools, there are very few domain-specific standards in knowledge management. Mainly technical standards exist for document-oriented knowledge management (such as document formats, metadata); guidelines and good practices have been published addressing human-oriented aspects in standardization institutions. However, there is no holistic standard framework integrating existing standards. Thus, it is highly necessary to analyze the current standardization landscape to identify relevant standards to enable interoperable solutions as well as guidance for stakeholders. Generally, we can distinguish between the following aspects of standardization relevant for the intended social KM settings:

- Metadata standards aim at describing aspects of artifacts to identify, retrieve and publish those. The main standard in this field is the Dublin Core specification [42] which aims at providing descriptions of various knowledge elements such as documents, books or ICT artifacts. The description is widely used; however, it is highly necessary to adapt the generic specification to a domain. Related domains, like the e-learning domain, have therefore created own standards. As the main standard, learning object metadata (LOM) [10] aims at describing any kind of resource for learning, education and training. Current activities in the ISO/IEC committee on IT for learning, education and training aim at creating a more modular standard containing information on contents but also pedagogical or technical aspects. However, this specification is still under development and not yet mature. For our proposal, metadata are equally relevant. They describe the knowledge elements to be shared and the contextual information of their intended use and their creation background. Due to the intended inter-organizational knowledge transfer, these descriptions need to be standardized to ensure the interoperability of the framework.
- Processes and activities describe one of the core aspects of knowledge management – standards in this field aim at making process descriptions interoperable. No specific standards for KM have been created. However, certain generic activities aim at creating business process descriptions (e.g., the business process modeling notation – BMPN [43]) whereas other standards aim at creating exchangeable but domain-specific activities.

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The main specification here is the learning design specification (IMS LD) [44] which describes learning-related activities in the context of education and training. A further generic standard exists: contextualized attention metadata (CAM) [45] capture activities a user has performed in a certain context. As a more generic standard, activity streams are currently being modeled; however, the specification is far from a standard. Due to the proposed consideration of the process context (in which knowledge is created and used), a standardized description is needed to use the data. Semantic richness and computable formats seem to be important for further usage of such descriptions in the proposed framework. Moreover, it seems very beneficial to coordinate these standardization activities with the initiatives in the field of content-related metadata.

- Semantic web standards are foremost technical ones to allow capturing semantic aspects. The semantic web stack describes the resource description framework (RDF) as the basis for semantic data, RDF schema as a way to describe the available classes and attributes for RDF documents and OWL (web ontology language) as a means to capture more semantics like inverse or transitive relationships. SPARQL is used to query RDF documents and more recently RIF (rules interchange format) was proposed to exchange rules that allow deriving new data out of given facts using inference and deduction [46]. Based on these standards, the linked open data initiative (LOD) is building a set of related real life ontologies derived from publicly available sources like Wikipedia, New York Times or MusicBrainz. They have not been standardized by any legal body, but are de facto used as standards by the community. For our matter, more specialized ontologies like the proposed upper tag ontology [47] or the general process ontology [48] are relevant, but there is no standard in this area yet [49].

It can be stated that the standardization aspects of KM are currently limited to providing guidance and implementation support. However, it is necessary to combine those with technical base standards. Furthermore, it is necessary to develop a clear framework for KM which standards are usable and which standards need to be adapted (application profiles).

We can state that standards to describe documents or digital objects in general are rather mature. Existing solutions such as LOM or Dublin Core can serve as a basis for our framework. Furthermore, base standards for semantic relations between aspects of the frameworks are also widely used and mature as well. The main weaknesses are description standards for processes and activities, in particular for the KM domain. As an additional aspect, context [50, 51] is in the center of knowledge activities, since they highly depend on the situation, on the organization, on the culture how, when and which information is shared between people. Currently, there are no standards to capture extended context information.

3 Towards Knowledge Bundles: A Concept for a Standard

In order to overcome the above-mentioned lack of standards that support an efficient knowledge transfer through additional contextual information, a framework is needed which serves as guidance for further standards development in the field of KM. Therefore, chapter 3.1 introduces several novel terms and base concepts which were originated in regular meetings by a large group of researchers. Hence, our definitions rely on our experiences with existing standards / specifications (cf. chapter 2.3) and current conceptualizations of KM. These concepts form the foundation to establish our innovative framework which is described in chapter 3.2.

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3.1 Conceptualizing Knowledge Bundles

In this position paper, we strive to rethink current metadata standards and their existing lacks of transferring knowledge objects without losing the amount of contextual information which is necessary to ensure appropriate interpretation after a knowledge sharing activity. To enable knowledge management in social software environments, we need to reconsider the current conceptualizations of knowledge management as well as their representations. Hence, we propose innovative new conceptualizations to support knowledge sharing of these knowledge objects. To prevent for misleading interpretation, new terminology is proposed, which was discussed and further developed in regular meetings within a group of researchers. Within this section we shortly discuss these terms before taking them up in the following application example.

- *Knowledge Activity (KA)*
  A knowledge activity is a set of goal-directed actions within a user's context, which is in line with activity theory. The actions change the state and existence of knowledge objects dynamically. A starting point for a standard in this field is in particular Contextualized Attention Metadata as they allow representing activities in a context.
- *Knowledge Object (KO)*
  Knowledge objects are codified representations of externalized knowledge. KOs can be single paragraphs, tables, mind maps or drawings, but can also consist of other KOs such as a compound document. As a starting point for the content descriptions, both, Dublin Core as well as LOM can be used. However, they need to be adapted to the domain of KM.
- *Knowledge Traces (KT)*:
  A knowledge trace is a codified representation of a user's action within a knowledge activity that is recorded in an activity stream and captures contextual information. As a starting point for description, the upper tag ontology can be used as discussed above.
- *Knowledge Activity Stream (KAS)*:
  A time-ordered list of entries that describe events that are the result of actions within knowledge activities that the user was involved in or monitors. It is a user-centric view of what has happened.
- *Contextual Information*:
  Contextual information, e.g., time, place, actions performed on knowledge objects, related people and their skills and experiences, provides common structures of background knowledge in order to support the knowledge sharing between the producer and the consumer of the knowledge objects. KT capture part of the context like who, did what, when and where. However, they usually include only shallow information about the entities involved, like a user's name, a room number or department acronym. Currently, only very broad specifications are available, however, the context specification by [51] as well as attention metadata or the concepts and attributes described in the DBpedia ontology might serve as starting points.
- *Knowledge Bundles (KB)*:
  A knowledge bundle is a collection of knowledge traces affiliated to a knowledge object. The knowledge traces can origin from multiple users. Therefore, the KB represents a KO-centric activity stream. For both, knowledge bundles and containers, no widely used standards are

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available. However, generic packaging standards (such as XML files in a ZIP container) as well as formats to relate entities (such as RDF and OWL) could serve as a starting point.

- *Knowledge Container (KC)*:
  A knowledge container holds both knowledge objects and their corresponding knowledge bundles with the purpose of improving knowledge transferability. It can be seen as a compound document, with additional context information on multiple aggregation levels.

The KC represents the focus entity in this discussion and should provide the appropriate amount and type of metadata, generated semi-automatically, to improve this position's goal: a new conceptualization of metadata that foster knowledge transfer and preventing of de-contextualization.

In general a knowledge activity stream (section 2.2) comprises various steps: knowledge activities influence and determine knowledge objects. Knowledge objects in turn are utilized for knowledge activities in a certain context. Moreover, knowledge traces are triggered by knowledge activities representing the influence on knowledge objects. New knowledge objects are created following (old) knowledge traces. (New) Knowledge activities influence newly created knowledge objects. Knowledge objects are utilized for knowledge activities for the same context or different context. Additionally knowledge traces are triggered by knowledge activities and represent the influence on knowledge objects. New knowledge objects in turn are created following knowledge traces.

3.2 Framework

Our idea is based on the dynamic connection of objects, people and activities. This is not a new concept; however, in particular in knowledge management settings in social software environments, it is highly necessary to be able to utilize contextualized knowledge. In the following, we introduce a knowledge management framework, which improves the understanding of contextualization and de-contextualization of knowledge objects from the user's as well as from the object's point of view.

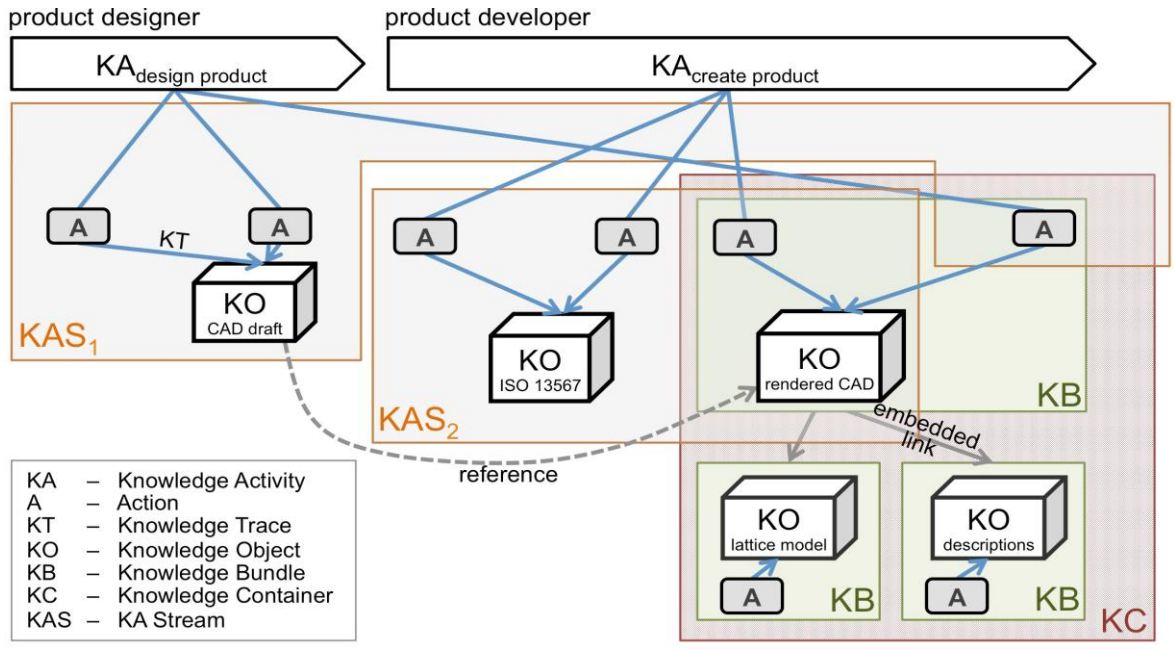

Figure 2: Example of product development

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From a *user-centric perspective*, the concepts are applied as follows: Every knowledge worker, e.g., a product designer or a developer (cf. Figure 2), is involved in different knowledge activities (KA). During his activity (e.g., “design product” or “create product“), he applies a set of goal-directed actions (A) on one or more knowledge objects (KO). He, for example, “creates a CAD draft”, “reads and adds comments to ISO 13567” or “adds textures to CAD model”. These actions may or may not influence the state and existence of a KO through knowledge management instruments or other software tools, for instance an Enterprise Wiki or a CAD software. A knowledge trace (KT) records these events by capturing contextual information, such as the person that performs the action, the type of action, the time when the action is triggered, the software tool applied, and the reference to the corresponding KO. All KTs of one knowledge worker are then represented as a personal time-ordered knowledge activity stream (KAS).

Secondly, we can apply the concepts from an *object-centric perspective*: A knowledge object (KO) is influenced by multiple actions of different knowledge workers. Each action on a KO can be codified as a knowledge trace (KT). All KTs that belong to one KO are combined to an object-oriented knowledge bundle (KB). A KO can be embedded as a part of another KO on a higher level of aggregation or can have references to other KOs. Both the KOs and its KBs related to a specified knowledge instrument or compound document are combined to a transferable knowledge container (KC). The size and complexity of a KC depends on the degree of influence of the KBs to provide meaningful contextual information. More specifically, only the KO in focus and its related KB are summarized to a KC. Following the degree of influence, we can also include, together with their KBs, all embedded KOs, referenced KOs or even KOs that are connected to similar or same KAs.

However, the concept focuses in particular on the interplay of user- and object-centric perspectives – in our example, the personal-created KAS of a knowledge worker will be matched against the KBs while retrieving a KO. The matching results will then be used to filter embedded or referenced KOs depending on the knowledge workers former involvement in the same or other KOs. Skills, experiences, and preliminary knowledge of the knowledge worker will have an additional impact on the extent of provided contextual information. Furthermore, the knowledge worker might also get contextual information about the history and evolution of the KO. Finally, all contextual information can be sorted regarding their relevance. Influences on the KO from a long-distant past might not have such an impact on the interpretation of a KO than events that were occurring recently.

The example above shows the new way of handling and representing knowledge – it is a basis for KM using SSW. However, it is still necessary to either adapt existing metadata specifications or create new standards, specifically for the domain of knowledge management.

4 Knowledge Objects in Action: Analyzing a Good Practice Guide

In the following, we describe an application scenario as a case study for our approach. We aim at illustrating the approach as well as providing a first proof of concept for a selected case: We discuss how our approach could be utilized for a widely used KM instrument, the exchange of good practices.

Good practice guidelines (GPG) are a widely used knowledge management instrument. In the following, we illustrate our concept using a good practice guide created by a large group of experts in the European standardization body CEN on quality management for education.

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This good practice guide [52] aims at supporting the selection, implementation and improvement of quality management approaches for educational organizations. The guide describes processes and activities of quality management and illustrates those by several successful cases.

Generally, good practices are created by analyzing, structuring and abstracting cases which have been successful in their domain. In most cases, the outcome is an electronic or paper-based document such as the above-mentioned publication. However, in many cases the process of documenting and analyzing the cases as well as creating consensus provides much deeper insights into the problem domain as it could be codified in a simple document. When real life experiences are documented, for example using a pre-defined structure, valuable knowledge is lost (e.g., why was the case successful, what was the context, why did certain things go wrong).

In principle, a good practice should describe a problem solution answering the following questions [53]:

- What is the subject / problem to be solved?
- Who is the intended target group, who solved a problem?
- When and where was the problem solved?
- Why is the problem / case relevant for a user? Why was the case successful?
- How was the problem solved?

In the following, we discuss whether the good practice answers the questions above and which information traces in the good practice description process would be useful and hence should be represented in a knowledge container.

Question	Dimension	Answer	Additional Information
What	Topic	How to implement quality approaches in organizations	More information on the motivation and background could have been given if project proposals or discussions on those were available.
Who	Person	Intended for quality managers, problems solved by quality managers in educational organizations	Rich information on the participants could be extracted when the project communication as well as interaction processes would have been provided.
When	Time	Decision taken in 2004, work started in 2005, work finished in 2007	The foreword captures a few information about the creation context, but it is not enough to give the reader a good impression of the timeline and activities.
Where	Location	Experts across Europe contributed and companies from Europe, North America and Africa took part in the study	Very limited information about locations of creation context is given. More details about the location of the companies and authors would be helpful.
Why	Process	Information is given which factors were considered as critical in the process	It would be useful to get to know different participants' opinions and not a generalized view. As an example, a discussion on the most important success factor would provide insights into different perspectives.
How	Type	The cases provide a description of their activities structured by a pre-defined process model	Communication on problems, successes and opinions on those would be highly valuable to understand the real activities as well as problems and pitfalls.

Table 1: Analyses of good practice guide

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Table 1 shows that quite a lot of information generated in a quality management project would be helpful to gain insights why processes were successful. Although PDF file format that was used for storing the information is capable of comprising custom metadata in XMP format, this feature is not used.

Especially communication, people and context descriptions as well as connections to the processes / activities would be helpful to know. In the following, we describe how our approach could facilitate the representation and utilization of those.

The guideline represents one large knowledge object and consists of several smaller KOs as described in its chapters 3.1, 4.1 and 5, which in turn can be decomposed in atomic KOs like corresponding figure 1 and the large table in chapter 5 as integral parts of the GPG.

Since there are multiple authors involved, the according knowledge bundle would consist of knowledge traces from several activity streams. An example for such knowledge traces would be that “Michaela M inserted figure 1 at 2006-12-10 14:10 in London office from Visio into the Word document in WMF format”– or “Claudio D is discussing with his colleagues about the good practice procedure at 2006-11-28 10:40 in Napoli”. These examples are information that could be automatically captured from the system (example 1) or is typical for a status information given by a user in a social software system like Facebook or a communication tool like Skype (example 2). However, they do not really capture a lot of information about the knowledge activities that is behind the actions. To get a better impression of the KAs, the reasons behind the action would need to be captured, e.g., the motive of making the process of creating a good practice document easier to understand. One step to bring in some more information, but still use only data that can be captured automatically or is typically recorded by users would be to use metadata entities instead of shallow text information. That means that Michaela M should not only be stored as text but also include a pointer to the system holding the master data about Michaela and the unique identifier to find this data, so that a user can simply click on the name in order to view her profile and learn more about her skills, interests and organizational affiliation. The same applies to the reference to the London office. The user should be able to learn the exact address of these offices and maybe even see the floor plan with Michaela’s room. This should not be an issue as long as the knowledge container is not leaving the organization. For inter-organizational knowledge transfer, e.g., to Claudio in Italy, there are both security issues as well as technical obstacles, since the references will probably not work outside the originator’s intranet. There are two possible solutions for that. First we could store the referenced information inside the knowledge container in an encrypted format and require e.g., a certain certificate or authentication against a central system for decryption. Second, we could borrow mechanisms from federated identity management to set up a trust relationship between the cooperating organizations and define policies which grant access to certain information of the partner’s intranet so that they can be loaded on demand, once the user tries to access them. In both cases, the knowledge container itself is not enough to grant access to the desired information. The information system that displays the contents or even parts of the IT infrastructure must be prepared to fulfill their part in the transaction.

The case study has shown that our concept can be applied to widely used knowledge management instrument of good practice guides. We have identified weaknesses of this type of guide and illustrated which additional information could be useful for the reader. When applying

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our concept, we can structure knowledge and information in the development process of a GPG for later usage. However, it would be necessary to make the information usable in different systems and platforms.

5 Recommendations and Future Directions

The paper has illustrated how KM concepts are changed when SSW or SM are used as key instruments. We have provided the key concepts and their relations, focusing on knowledge objects, activities, and people. Our examples have shown how these concepts could be applied in practice. In particular, we have shown how rich contextualized information could be utilized. Especially, we have discussed the shift from a user-centric activity stream to knowledge object-centric knowledge traces in order to capture the dynamic context. In that facet, our proposal is similar to the living documents approach [54]. The knowledge container is needed for bundling context information tied to several intra-organizational systems and allows transferring the knowledge object with all relevant context information across organizational borders.

Our initial analysis emphasized that currently no standardization approach covers the broad range of concepts and approaches needed. However, we have identified related standards from similar domains which can serve as a starting point or candidate standard.

Our manifesto does not aim at creating a complete or fully implemented approach – we aim at stimulating the discussion and starting a broad initiative working towards a common standard for the next generation of knowledge management systems. Based on this assumption, we propose the following steps and requirements,

1. KM is a social activity and directly leads to SSW and SM: The historical gap between technology and human orientation is bridged by SM. This trend will be more and more acknowledged by the research community as well as practitioners.
2. Stop using outdated frameworks: Current framework standards for knowledge management like Dublin Core do not take technological advances into account. A new, widely agreed conceptual KM framework is needed as a starting point, which considers social media as a source for contextual metadata.
3. KM research needs to focus on specifications and standards: The KM community has ignored standards for decades. It is necessary to take this dimension into account when designing and experimenting with innovative systems.
4. Standards need to be created now: KM and SSW is in a status mature enough that we understand the key success factors. The KM community needs to create standards as an agreement in the community to allow innovative and interoperable solutions to remain competitive.
5. Form an enterprise-research alliance for standards: Standards can only be created in consensus of all stakeholders, in particular researchers and enterprises. From the very beginning, a balanced community needs to be formed.
6. Utilize existing standards and specifications: The KM community has specific characteristics but this does not mean that standards need to be created from scratch. We need to use existing base and similar standards already successfully in use.

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7. Context will be the key factor to understand KM: In both, research and standardization communities, context has been rarely analyzed or represented. This was one reason for a lack of transferability of results. Adequate specifications are needed to represent context and thus reach better comparable, transferable results.
8. Shift from document-oriented to dynamic activities: We need different ways of representing knowledge – the focus should shift from document-oriented to an activity oriented view to better capture the dynamic process.

From our point of view, these steps are abundant to handle future challenges of knowledge management. We would like to encourage feedback and discussion on our paper and our recommendations as a starting point to establish a broad and productive KM standardization community. We invite all members of the KM community to participate in this activity.

6 References

[1] Graham, P; Bowerman, C; Bokma, A (2004): Adaptive navigation for mobile devices. In: Attewell J;Savill-Smith, C (Hrsg.), *Learning with mobiledevices.* Learning and Skills Development Agency, London.

[2] Drucker, PF (1994): The Age of Social Transformation. The Atlantic Monthly 274(5):53-80.

[3] Penrose, ET (1995): The Theory of the Growth of the Firm. Oxford University Press, Oxford.

[4] Grant, RM (1996): Toward a knowledge-based theory of the firm. Strategic management journal 17:109-122.

[5] Kimmerle, J; Moskaliuk, J; Cress, U (2009): Individual Learning and Collaborative Knowledge Building with Shared Digital Artifacts. International Journal of Human and Social Sciences City 4(9):650-657.

[6] O'Dell, C; Grayson, CJ (1998): If only we knew what we know: identification and transfer of internal best practices. California management review 40(3):154-174.

[7] Star, SL; Griesemer, JR (1989): Institutional ecology, translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social studies of science 19 (3):387-420.

[8] Schindler, M; Eppler, MJ (2003): Harvesting project knowledge: a review of project learning methods and success factors. International Journal of Project Management 21(3):219-228.

[9] Willke, H (1998): Systemisches Wissensmanagement. Lucius & Lucis, Stuttgart.

[10] IEEE LTSC (2002): Learning Object Metadata Standard.

[11] IMS Global Learning Consortium (2005): IMS Learner Information Package Specification.

[12] Maaninen-Olsson, E; Wismén, M; Carlsson, SA (2008): Permanent and temporary work practices: knowledge integration and the meaning of boundary activities. Knowledge Management Research & Practice 6(4):260-273.

[13] Johnson, B; Lorenz, E; Lundvall, BÅ (2002): Why all this fuss about codified and tacit knowledge? Industrial and corporate change 11(2):245-262.

http://www.digibib.tu-bs.de/?docid=00048061

Digitale Bibliothek Braunschweig

[14] Kimmerle, J; Moskaliuk, J; Cress, U; Thiel, A (2011): A systems theoretical approach to online knowledge building. AI & Society 26(1): 49-60.

[15] Haake, J; Hussein, T; Joop, B; Lukosch, S; Veiel, D; Ziegler, J (2010): Context Modeling for Adaptive Collaboration. International Journal of Cooperative Information Systems 19(1).

[16] Lehner, F (2009): Wissensmanagement: Grundlagen, Methoden und technische Unterstützung. 3. Auflage. Hanser Verlag, München.

[17] Koch, M; Richter, A (2009): Enterprise 2.0: Planung, Einführung und erfolgreicher Einsatz von Social Software in Unternehmen. Oldenbourg Wissenschaftsverlag, München.

[18] Stocker, A; Tochtermann, K (2010): Wissenstransfer mit Wikis und Weblogs. Gabler, Wiesbaden.

[19] McAfee, A (2008): Eine Definition von Enterprise 2.0. Enterprise 2:17-35.

[20] Hansen, MT (1999): The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. Administrative science quarterly 44(1):82-111.

[21] Maier, R; Thalmann, S (2008): Institutionalised collaborative tagging as an instrument for managing the maturing learning and knowledge resources. International Journal of Technology Enhanced Learning 1(1):70-84.

[22] Rollett, H; Lux, M; Strohmaier, M; Dosinger, G (2007): The Web 2.0 way of learning with technologies. International Journal of Learning Technology 3(1):87-107.

[23] Shen, J; Fitzhenry, E; Dietterich, TG (2009): Discovering frequent work procedures from resource connections. In: Proceedings of the 14th international conference on Intelligent user interfaces, Sanibel Island.

[24] Rath, AS; Devaurs, D; Lindstaedt, SN (2009): UICO: an ontology-based user interaction context model for automatic task detection on the computer desktop. In: Proceedings of the 1st Workshop on Context Information and Ontologies, Heraklion.

[25] Ochoa, X; Duval, E (2006): Use of contextualized attention metadata for ranking and recommending learning objects. In: Proceedings of the 1st international workshop on Contextualized attention metadata: collecting, managing and exploiting of rich usage information ACM, Arlington.

[26] Qureshi, S; Hlupic, V; de Vreede, GJ; Briggs, RO; Nunamaker, J (2003): Managing knowledge in a collaborative context: how may intellectual resources be harnessed towards joint effect?. In: Hlupic, V (Hrsg.), *Knowledge and business process management*. Idea Group, London.

[27] Maier, R (2005): Modeling knowledge work for the design of knowledge infrastructures. Journal of Universal Computer Science 11(4):429-451.

[28] Holsapple, CW; Joshi, KD (2002): Knowledge manipulation activities: results of a Delphi study. Information & Management 39(6):477-490.

[29] Nonaka, I; Takeuchi, H (1995): The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford University Press, New York.

[30] Nonaka, I; Toyama, R (2003): The knowledge-creating theory revisited: knowledge creation as a synthesizing process. Knowledge Management Research & Practice 1(1):2-10.

http://www.digibib.tu-bs.de/?docid=00048061

Digitale Bibliothek Braunschweig

[31] Holsapple, CW; Singh, M (2001): The knowledge chain model: activities for competitiveness. Expert systems with applications 20(1):77-98.

[32] Holsapple, CW; Jones, K (2004): Exploring primary activities of the knowledge chain. Knowledge and Process Management 11(3):155-174.

[33] Aurum, A; Daneshgar, F; Ward, J (2008): Investigating Knowledge Management practices in software development organisations – An Australian experience. Information and Software Technology 50(6):511-533.

[34] Newell, S; Robertson, M; Scarbrough, H; Swan, J (2009): Managing knowledge work and innovation. Palgrave Macmillan, Houndmills.

[35] Hädrich, T (2008): Situation-oriented provision of knowledge services. PhD Thesis, Juristische und Wirtschaftswissenschaftliche Fakultät, Martin-Luther-Universität, Halle-Wittenberg.

[36] Alavi, M; Leidner, DE (2001): Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly, 25(19):107-136.

[37] Fong, PS; Choi, SK (2009): The processes of knowledge management in professional services firms in the construction industry: a critical assessment of both theory and practice. Journal of Knowledge Management 13(2):110-126.

[38] Carlsen, S; Coll, GJ; Maehle, A (2003): Knowledge Re-Activation Mediated Through Knowledge Carriers. In: Junghagen, S; Linderoth, HC (Hrsg.) *Intelligent management in the knowledge economy*. Edward Elgar, Cheltenham.

[39] Hicks, B; Culley, S; Allen, R; Mullineux, G (2002): A framework for the requirements of capturing, storing and reusing information and knowledge in engineering design. International journal of information management 22(4):263-280.

[40] Hanakawa, N; Matsumoto, K; Torii, K (2002): A knowledge-based software process simulation model. Annals of Software Engineering 14(1):383-406.

[41] Hsu, TY; Ke, HR; Yang, WP (2006): Unified knowledge-based content management for digital archives in museums. The Electronic Library 24(1):38-50.

[42] DCMI (2003): Dublin Core Metadata Initiative - Dublin Core Metadata Element Set. http://dublincore.org/documents/dces/. Abgerufen am 12.01.2012.

[43] Chinosi, M; Trombetta, A (2011): BPMN: An introduction to the standard. Computer Standards & Interfaces 34(1): 124-134.

[44] IMS Global Learning Consortium (2003): IMS Learner Design Specification Design.

[45] Najjar, J; Wolpers, M; Duval, E (2007): Contextualized attention metadata. D-Lib Magazine 13(9):1082-9873.

[46] Hebeler, J; Fisher, M; Blace, R; Perez-Lopez, A (2011): Semantic web programming. Wiley, Indianapolis.

[47] Ding, Y; Jacob, EK; Fried, M; Toma, I; Yan, E; Foo, S; Milojević, S (2010): Upper tag ontology for integrating social tagging data. Journal of the American Society for Information Science and Technology 61(3):505-521.

http://www.digibib.tu-bs.de/?docid=00048061

Digitale Bibliothek Braunschweig

[48] Lin, Y (2008): Semantic annotation for process models. PhD Thesis. Norwegian University of Science and Technology, Trondheim.

[49] Davies, J; Grobelnik, M; Mladenić, D (2009): Semantic Knowledge Management: Integrating Ontology Management, Knowledge Discovery, and Human Language Technologies. Springer-Verlag, New York.

[50] Richter, T; Pawlowski, JM (2007): Adaptation of E-Learning Environments: Determining National Differences through Context Metadata. TRANS Internet Journal for Cultural Studies, 17.

[51] Pawlowski, JM; Richter, T (2010): A methodology to compare and adapt e-learning in the global context. In: Breitner, MH; Lehner, F; Staff, J; Winand, U. (Hrsg), *E-Learning 2010 - Aspekte der Betriebswirtschaftslehre und Informatik*. Physica-Verlag HD, Berlin.

[52] CEN/ISSS (2007): CEN/ISSS Workshop on Learning Technologies: CWA 15660 Providing Good Practice for E-Learning Quality Approaches. Brussels.

[53] Maier, R; Sametinger, J (2004): Peer-to-peer information workspaces in infotop. International journal of software engineering and knowledge engineering, 14 (1):79-102.

[54] Garcia-Castro, A; Labarga, A; Garcia, L; Giraldo, O; Montana, C; Bateman, JA (2010): Semantic Web and Social Web heading towards Living Documents in the Life Sciences. Web Semantics: Science, Services and Agents on the World Wide Web 8(2):155-162.

http://www.digibib.tu-bs.de/?docid=00048061