APPROACHING KNOWLEDGE MANAGEMENT IN ORGANISATIONS

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Abstract: The paper is about studying knowledge management practices in organisations. First we summarise the basic definitions of knowledge and knowledge management. After showing several studies on knowledge management in industrial context by stressing different classifications developed so far including our online survey we introduce our approach to knowledge management in organisations. It is a spiral model illustrating knowledge life-cycle in organisations which is relating different types of organisations (time-, product-, service-based) to knowledge, volatility, and knowledge management. By doing so, business processes and the structure of organisations are considered. Special focus is given to specific individual and organisational knowledge created and shared within and outside the organisational boundaries, impacts of different volatility factors to knowledge, knowledge management processes, and change processes triggered by knowledge management practice in organisations. Finally we conclude our paper by stressing our future work in this area.

1 INTRODUCTION

In the last decade the role of knowledge and knowledge management got the whole attention of organisations. It became clear that nowadays business processes rely on this very critical economic resource. Knowledge is unique selling proposition of organisations which makes them special. How knowledge can be managed and integrated in business processes is still an open issue for most organisations.

In the research and consulting literature there are several definitions of knowledge (see Section 2) and approaches with differing foci to knowledge management (see Section 3). First of all, it is important to understand how knowledge can be created, modified, shared, and maintained in an organisational context. Executive managers of companies are furthermore interested in ways of application of knowledge management in their business domain to make available knowledge and experiences persistent and accessible for later use in their organisation. In particular, companies want to know how they could deal with knowledge management in their concrete business situation. By current technologies and frameworks there is still no big help provided to organisations for the identification of their knowledge management elements and other crucial impact factors, for the definition of their own knowledge management processes according to their business context, and for the establishment of methods and supporting systems to manage the dynamic context-dependant changes in knowledge management.

In this paper, we want to show how we approach this problem and what we suggest to deal with this challenge. In our approach we see knowledge management integrated in the coordination activities in an organisation. Our studies about coordination so far show relevant evidence that organisations need to manage their knowledge flow within and outside the company boundaries. They have to define approaches to deal with the dynamics of changes in an organisation, which causes adaptions, improvisations, reactions to current practices, and most of all, regular monitoring and planning of change processes at all business levels.

First we want to summarise different definitions of and approaches to knowledge and knowledge management (Section 2). Then we show several studies on knowledge management in industrial context. We stress different classifications developed so far including some relevant outcomes of our online survey we established. In our survey we wanted to find out

the current understanding and use of social network services by organisations for cooperation and sharing with other companies (Section 3). After introducing our approach as a spiral model of knowledge management (Section 4) we conclude our paper.

2 KNOWLEDGE AND KNOWLEDGE MANAGEMENT

Knowledge is a bunch of "facts, feelings, or experiences known by a person or group of people"[1] related to context. Knowledge is the combination of information, skills, experiences, and personal capability of people (Baker et al., 1997). Knowledge can be found in artefacts people produce, in communications they carry out, at the places they work and live. So, it can be related to people, products, processes, or culture. Human behaviour and interactions with others – no matter private or professional – are guided by knowledge one has.

To understand knowledge and mainly to approach it from scientific point of view and furthermore to use it for design of systems, several categories have been introduced so far. The most known distinction is between implicit (tacit) (Polanyi, 1958) and explicit knowledge (Bloodgood and Salisburny, 2001). Although there are lots of differences between them, they can be seen as two sides of the same coin because they are equally relevant for organisations (Vahedi and Irani, 2011).

Explicit knowledge can be easily expressed, better codified and communicated than the tacit knowledge. After writing down or just verbally it can be passed to others. Furthermore, it can be acquired through articulation and codification. It is then relative simple to transfer and imitate, like in case of product characteristics or documented processes like accounting procedures and marketing strategies (Bloodgood and Salisburny, 2001) (Raghu and Vinze, 2007). Being "practical knowledge that is key to getting things done" (Vahedi and Irani, 2011, p.445) tacit knowledge is difficult to capture, codify, communicate, and retrieve. It can only be learned through experience and by immersion. There are difficulties in expression and awareness of the existence of this kind of knowledge by its possessor. This makes its management very hard to almost impossible.

Some research has been done on knowledge acquisition and transfer by focusing on communication and networking technologies (Bloodgood and Salisburny, 2001) (Raghu and Vinze, 2007). Implicit organisational routines or generally accepted background understandings and competitive strategies are some examples of this kind of knowledge. Parts of this knowledge are called "experiential knowledge" (Seethanraju and Marjanovic, 2009) and can be shared, e.g., in processes of collaborative problem solving or when people experience the same. We can find further definitions in the literature according to the following criteria (Kalpic and Bernus, 2006): awareness of (explicit or tacit) knowledge (can a person explain it or is he/she just able to show it), internalised or externalised knowledge (has an external record been made, e.g., written text, drawings, models), formalised or not-formalised knowledge (is the external representation of the knowledge in a consistent and complete form). Figure 1 shows the categorisation of knowledge based on these criteria (Kalpic and Bernus, 2006). An interesting interpretation leads to the assumption that tacit knowledge can be transformed into informal explicit knowledge (by conversation, sharing common experiences, or other approaches) and this may be converted into formal explicit knowledge (Kalpic and Bernus, 2006). The question still remains whether the context in which this can happen has an impact on this type of transformation of implicit to explicit knowledge.

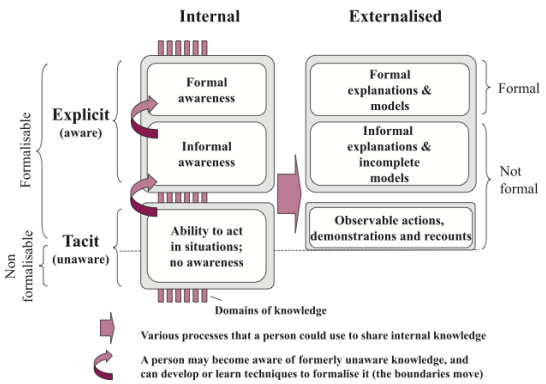

Figure 1: Knowledge categories by Kalpic and Bernus (2006).

So far we were mainly referring to individual knowledge, also called content knowledge by Holsapple and Joshi (2002). Being embodied in usable representations, which are mainly artefacts, content knowledge can be preserved, transferred, and shared across organisational boundaries (Tellioğlu, 2012). This tickles other types of challenges in knowledge management, namely managing organisational or collective knowledge. This type of "schema knowledge" (Seethanraju and Marjanovic, 2009), which can be described in terms of knowledge embedded in the cul-

[1]Collins English Dictionary, 1991, p. 860

ture, infrastructure, purpose, and strategy of an organisation (Kalpic and Bernus, 2006), is represented or conveyed in the working of an organisation (Kalpic and Bernus, 2006). Here again, artefacts play an important role for capturing and preserving it. In organisational settings it is important to consider how to deal with this type of knowledge. One way to approach this is to apply knowledge life-cycles.

Knowledge has to flow by being acquired, shared, or exchanged to generate new knowledge, otherwise the existing knowledge ages and becomes useless. Therefore, Nonaka and Takeuchi developed the life-cycle of knowledge, which consists of the following four phases (Nonaka and Takeuchi, 1995) (Kalpic and Bernus, 2006) (Vahedi and Irani, 2011) (Alavi et al., 2010) (Figure 2):

- Socialisation – tacit to tacit knowledge – This is the process of transferring tacit knowledge from one individual to another in communities of practice and interest. This can happen through observation or working together with someone more skilled or knowledgeable.
- Externalisation – tacit to explicit knowledge – The process of externalisation takes place if an individual generates explicit knowledge from her or his tacit knowledge. Examples are documentation, verbalisation, or if new best practices are chosen from informal work practices.
- Internalisation – explicit to tacit knowledge – Individual tacit knowledge can be created through the internalisation of explicit knowledge by learning and training.
- Combination – explicit to explicit knowledge – Combination means the generation of explicit knowledge through the combination of existing explicit knowledge. This action supports problem-solving and decision-making, e.g., through the application of data mining techniques.

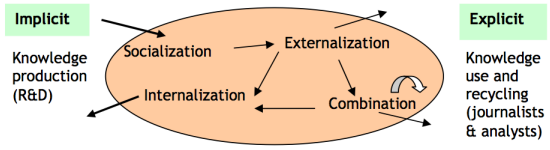

Figure 2: Knowledge life-cycle by Nonaka and Takeuchi (1995).

After recognising knowledge as an important economic asset, business and scientific professionals started to study how to deal with knowledge in complex environments like organisations and in more and more connected cooperative settings. Knowledge management enables capture, store, exchange, and retrieve valued information for all relevant stakeholders and through this facilitate the base for informed decisions. In management science, knowledge management is defined as the active management of knowledge in an organisation by using systematic processes. Human resource management defines knowledge management as a necessary endeavour to transport knowledge from those who have it to those who needs it. Besides increasing efficiency and using multiple knowledge sources effectively to create a competitive advantage, one of the most important requirements organisations have is to keep knowledge in the organisation, no matter what happens, even if employees leave the company or cooperations are conducted with other – probably competitive – organisations. The organisational and technical environment must be setup in ways that allows knowledge flow through all the different phases of its life-cycle. Knowledge management must support that goal (Vahedi and Irani, 2011).

For the management of knowledge many researchers defined some elementary strategies, frameworks, activities, and phases. Davenport and Prusa identified four knowledge processes: knowledge generation (creation and acquisition), knowledge codification (storing), knowledge transfer (sharing), and knowledge application (transitions between knowledge types) (Kalpic and Bernus, 2006). Another approach defines knowledge sharing, knowledge utilisation, knowledge storage, and knowledge refinement as the main activities for knowledge management in organisations. Knowledge sharing means the exchange between individuals and groups, while knowledge utilisation includes all activities of the application of knowledge in business. Furthermore, knowledge refinement is the filtering and optimising of the knowledge, which is saved in the organisational memory at knowledge storage (Alavi et al., 2010).

Alavi and Marwick identified acquisition, indexing, filtering, classification, cataloging and integrating, distributing, and application respectively knowledge usage as the major knowledge management activities (Alavi and Marwick, 1997). Procure, organise, store, maintain, analyse, create, present, distribute, and apply are the more detailed activities for knowledge management, which were presented by Holsapple and Whinston (Holsapple and Whinston, 1987). Four essential knowledge manipulation activities, which were defined by Holsapple and Joshi are acquiring, selecting, internalising, and using (Kalpic and Bernus, 2006). A further approach is about knowledge storage and retrieval, knowledge sharing

and knowledge synthesis as the phases essential for knowledge management (Raghu and Vinze, 2007).

3 KNOWLEDGE MANAGEMENT IN INDUSTRIAL CONTEXT

The "technology-push model of knowledge management" was criticised by some researchers because it underestimates the process of knowledge management in organisations. Storing the organisational data is not enough to maintain and guarantee knowledge management in such an environment, especially when it means that the right persons should get the data at the right time (Vahedi and Irani, 2011). However, emerging technologies and communication channels, like messaging, texting, micro-blogging, or blogging, offer new ways to deal with the distribution and capturing of knowledge. They, at the same time, facilitate an easier handling of tacit knowledge in organisations (Vahedi and Irani, 2011).

Chan and Chao studied knowledge management in practice in small and medium-sized organisations (Chan and Chao, 2008). The most SMEs started with knowledge management because of its success in other organisations. The main goal was to increase the profit, to reduce the costs by avoiding duplicated work, and through this to gain competitive advantage. Only 16% could encourage innovation by applying knowledge to existing resources. Examples of reasons for failure in applying knowledge management in SMEs are the resistance by the employees, poor knowledge management systems, or the false assumption that the IT department is able to transform a knowledge management vision into a knowledge management system including all activities and programs (Chan and Chao, 2008). The result of this study is that there is still the need to continue the knowledge management research in organisations to develop better understanding, better methods, and so, more flexible and suitable approaches to knowledge management in such complex cooperative settings.

Kankanhalli et al. studied 20 successful companies representing a variety of industrial contexts (Kankanhalli et al., 2003). They classified the organisations along two dimensions: product-based versus service-based and high- versus low-volatility context (p.69). Volatility refers to the change processes in a company which is seen in a multidimensional context including technological, regulatory, sociocultural, and economic. If knowledge is time-sensitive then the volatility is high, so knowledge must be updated regularly and made available to all who needs it. Besides deriving implications for practice, Kankanhalli et al. tried to categorise these different four types of organisational settings in relation to a knowledge management approach (Kankanhalli et al., 2003, p.73). The categories were codification versus personalisation levels in a low to high scale. This is a purely industry classification without considering knowledge management strategies and IT support in detail. Though, it helps to systemise the knowledge management arena in an organisation.

Calabrese and Orlando defined 12 steps to implement a knowledge management system to provide a framework and methodology for the implementation of a management system in organisations (Calabrese and Orlando, 2006). The second step is about conducting work-centred analysis followed by planning actions on a higher level to communicate by the leadership with senior management. It is done by the leadership because it is strongly related "to the cultivation of business strategy through the driving of values for knowledge creation and sharing" (Smuts et al., 2009, p.72). It is a crucial process because it values the main elements of an organisation, like individual ways of dealing with work, communication and cooperation patterns established. A thorough contextual inquiry is needed (Beyer and Holzblatt, 1998), especially from all relevant parts of the organisation. This avoids overseeing certain work practices or ignoring certain communities of practice. A special attention must be given to gather data about and from people who are the real workers, and not managers. Expertise of real workers embed valuable information about knowledge they have, and how they apply their tacit knowledge at work. If this type of data can be captured consistently and in detail – which is very difficult – the most challenging part of knowledge acquisition is done.

Smuts et al. (2009) wanted to proof the concept of 12-step process by Calabrese and Orlando (2006). They ended up in a framework and methodology for the implementation of a knowledge management system. The methodology procedure is composed on a rather abstract level around five framework components: strategising, evaluation, development, validation, and implementation. After studying their approach in a real company, they showed that each step of the methodology maps at least to one of the steps defined by Calabrese and Orlando (2006). Unfortunately, the study was not large enough and not considering different types of organisations with their specific contexts, so they could not generalise the framework and the methodology they created.

One of our own studies based online surveys in this area delivers interesting results and helps understand organisational context with respect to knowl-

edge management and sharing[2]. We wanted to find out what the current understanding of social network services (SNS) and their private and professional use is. Besides some information about the person, the company, the area of business, etc., the online survey contained 31 questions on the popularity and availability of SNS for private and professional use, on areas of application with the duration of use, motivation, features used, integration into the daily work, and possible impacts on one's own work processes. After two months we had 282 answers that we could use for evaluation and analysis. Some of the interesting results are: Organisations use only certain SNS and applications, like Skype, blogs, Windows Live Spaces, RSS feeds. Skype, mainly its IP-based telephony feature, is the most and longest used application for communication. 68% mean that the collaboration with other organisations or partners is the same with SNS as it was without using them, whereas 31% see an improvement in collaboration processes when SNS are applied. Among the ones who found that SNS improve the collaboration processes, 30% found that SNS speed everything in business organisation and work processes, and the coordination of work becomes easier. 21% found that the distribution of work can be carried out faster and easier, and additional 18% meant that there are other advantages of the use of SNS in organisations. 41% perceived that SNS ease the cooperation at all. 73% would recommend the use of SNS in business processes to their existing and new partners. 64% would use SNS again in the future projects, 15% would not use them any more. An interesting outcome of the survey is that 66% of the SNS users want to separate their private contacts and exchange with others from the ones which are work-related, whereas 16% currently make no difference between private and professional, but can imagine to do that in the future, and 18% do not see the need to separate them.

4 THE SPIRAL MODEL OF KNOWLEDGE MANAGEMENT

Previous sections showed that there is a correlation between business processes and knowledge management. We know that organisations host structured predictable and unstructured situated processes at the same time. The degree of structuredness of a process is dependant on the knowledge available to carry out the particular activities included in processes. If unexpected contingencies arise in work practices responses must be given in an ad-hoc manner considering the circumstances in which the processes must be carried out.

Based on the research, studies, and findings in several ethnographic case studies in different companies within an European research project called MAPPER (Schmidt et al., 2009), we first want to show how organisations can be characterised depending on their main activities, business focus, and organisation of work. After analysing our findings in our studies, we ended up in differentiating time-, product-, or service-based organisations. These types help analyse the organisational context and economic, environmental, cultural circumstances in which the organisation has to exist.

The differentiation between product- and service-based organisations was also made by Kankanhalli et al. (2003). They used this classification only to differentiate between high and low volatility, and levels of competition in industrial context. They did not describe or analyse the processes within organisations. They aimed to understand the relation between knowledge and volatility in different types of organisations. We, on the other hand, try to define and analyse processes, management, coordination and cooperation issues, success factors in such organisations, by focusing on knowledge management processes to provide support for organisations. In our studies we identified that some organisations are mainly driven by time and time-dependant duties or deliveries. So, we add to the two categories the time-based organisations.

In *time-based organisations* deadlines and temporal conditions drive the activities. The end delivery date is used to define the logical and temporal order of activities in a specific project. The allocation of human and non-human resources is done in line with the time-based work plan created. For cases of unexpected contingencies, there must be a temporal space for improvisations, which may also trigger changes in business processes. Simultaneity and ad-hoc changes in resource allocation are common in such environments. Decisions are mainly made distributed. Besides for coordination of work meetings are used to up-to-date the project progress and, in case of troubles, to reallocate resources. Success is achieved mainly if deadlines are met, and of course, only if the expected results are delivered in expected quality.

In *product-oriented organisation*s the product is central. Its design, development, and maintenance define the organisational and work-related structures. All activities are arranged around the product in attention. If it is a complex product, it is normally di-

[2]The online survey was developed and used in the scope of a master's thesis (Klemen, 2012).

vided into parts, which are assigned to different persons, work groups, or even companies. Interfaces between parts must be defined which is normally a dynamic process. They can be changed, adapted, and revised several times in the course of the production process. Interdependencies between product parts determine the coordination of work in the whole project. On the one hand, the implementation of the interfaces agreed on, on the other, the timeliness in delivering the planned parts in planned quality and quantity are main issues of coordination protocols. Project managers deal with these interface definitions and dependencies between the productions. They create a plan which maps the product structure and assigns to groups or individuals. Monitoring of the progress of work on product parts, interventions in case of problems, and reallocation of resources, if necessary, depending on the availability are common. Changes in work processes or work assignment occur depending on personal, technical, commercial, complexity-related, or strategic problems that may arise. Not only to solve such problems, but also to bring different groups together to exchange their work progress and other issues relevant to all, regular meetings are established. Configuration management tools or other central common information spaces are used as coordinative artefacts enabling standardisation of protocols. Decisions are made centrally involving the responsible persons for the product parts letting them to negotiate their open issues. Success is measured in the quality of the product, in its integrity, completeness, and unity.

If organisations are *service-based*, processes are central in the entire business. Services are valuable results of usually predefined, well structured, and in most parts routine processes. Several groups are assigned to tasks. A workflow or likely system is used to model the processes and to monitor them in real time. It is the only coordinative construct by providing the coordinative protocols. If there are deadlocks or problems in carrying out certain tasks in the workflow, project managers intervene and reallocate resources or reassign people to tasks. In a supply chain or customer relationship, coordination of work goes further to externals like customers, suppliers, distributed teams from other locations, etc. The system used embodies the coordination mechanism. It enforces people to do certain things in a certain order. To skip or postpone a task is almost not possible. Modifications of workflow can be done in some cases, but normally not in an ad-hoc manner. Improvisations are difficult or impossible. In case of contingencies, the cooperative work is coordinated directly by people involved, which is not coupled to the system used. In routine work, decisions are made centrally which may then modify the workflow system. People carrying out the work are not included in decision processes. Success is measured in the workflow system. A project of this kind is successful if work processes are carried out according the workflow in an efficient way, so the services are delivered at the right time to the right people.

Depending on the type of an organisation changes are needed over time, not only in processes, people, products or services, but also in requirements to supporting elements of an organisation, like ICT, work environments, conventions and norms, work and coordination protocols, knowledge management processes, etc. Organisations often do not know how to deal with the volatility context they are in, and with their knowledge and change management practices, especially when changes initiated internally or externally occur technologically, regulatory, sociocultural, or economic. Current practices need to be evaluated. If there is a need for change, plans need to be made to adapt the organisation on all related levels. Knowledge plays here a crucial role. Experiences of past activities and knowledge gathered so far help decide what has to be done to improve or keep best practices in organisations.

This sketches a complex process which changes over time. We claim that a knowledge life-cycle can help researchers and the organisations to understand the multilayered impact factors in an organisation and its dynamic elements (Figure 3):

1. The model starts with the identification of the organisation as a time-, product-, or service-based one. This leads to a first definition of business processes and related artefacts and coordination protocols. This is something which happens anyway, sometimes intentionally sometimes implicitly by just starting with work processes.
2. The next step is to find out and reflect on knowledge generated in the organisation. What types of individual knowledge is created and shared? What are the characteristics of the content knowledge related to products, services, or processes? To which degree is the content knowledge explicit or implicit, internal or externalised, formal or informal?
3. After a certain period of time it is important to capture the volatility factors in the organisation. How can the organisations' culture, infrastructure, purpose, and strategy be described? What artefacts are used to manage this schema knowledge? Is there enough information to analyse risks and create possible contingency plans? Is a certain change needed? If yes, where and to which degree?

4. Knowing the change requirements and the current organisational context, the organisation can start to establish knowledge management processes. Are there differences between parts of the organisation with respect to knowledge management? If there are, what can be the appropriate knowledge management practice for each of them? What are the socialisation, externalisation, internalisation, and combination processes needed?
5. Now, it is time to reflect on all issues and possible answers gathered so far on organisational level. How is the knowledge management currently provided in the organisation? Is knowledge management efficient, accepted by individuals, and successful? Is there a need to change knowledge management processes? Are there emerging reasons to modify knowledge management practices in the organisation? What parts of knowledge management (i.e., knowledge generation, codification, transfer, or application) do need adaptations? What are the impacts of changes planned on business processes? What are the consequences of changes so far?

So then the circle continues with the step 2 described above. Each time it is a little bit different, depending on all the factors changing over time.

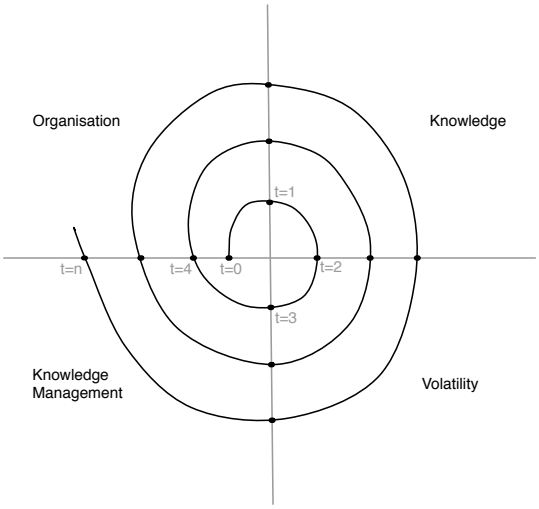

Figure 3: The spiral model for knowledge management in organisations.

To show the dependencies between the factors questioned above we now introduce the spiral model of knowledge management in organisations (Figure 3). The model illustrates a knowledge life-cycle which is relating different types of organisations (time-, product-, service-based) with knowledge, volatility, and knowledge management. Business processes and the structure of organisations are considered. Special focus is given to specific individual and organisational knowledge created and shared within and outside organisational boundaries, impacts of different volatility factors to knowledge, knowledge management processes, as well as change processes triggered by knowledge management practice in organisations.

In our spiral model, we see a pattern in organisational life-cycle if it comes to knowledge management. Depending on the organisational type (time-, product-, or service-based) certain amount of knowledge is created and exchanged. The type, quality, and characteristics of knowledge used in an organisation changes in the course of work processes, depending on products or services it provides, circumstances under which work processes are carried out, economic and technical factors having impact on activities and processes.

Another important factor which causes changes or risk for organisations is the volatility factor. Volatility has impact on the amount and lifetime of knowledge managed in an organisation, which again is dependant on the dynamics in product or service development, or the temporal constraints given to a project. The degree of volatility influences the ways how knowledge is created and handed over between actors involved. If the product is an innovative one with components which are new or delivered by others like suppliers, the volatility is assumed rather high. In such settings, problems can occur, e.g., related to delivery time, quality, and compatibility of the components of a product. On the other hand, there are companies offering products of which production and maintenance are predictable. An organisation with its schema knowledge and the certain degree of volatility for a representative period of time needs knowledge management for codification (externalisation) or personalisation (internalisation) or combination of individual and collective knowledge.

5 CONCLUSIONS

In this paper we showed how knowledge management can be approached in an organisation considering the business processes, structure, specific individual and organisational knowledge created and shared within and outside the organisational boundaries, impacts of different volatility factors to knowledge, knowledge management processes, change processes triggered by knowledge management practice, etc. This is a first step to approach knowledge management in organisations by being aware of the dynamic character

of knowledge management, especially in high volatility environments. We want to show that time plays a crucial role in knowledge management practices, that it is important to reflect on and adapt knowledge management processes in an organisation regularly by actively analysing the different types of knowledge created, modified, and shared in an organisation as well as cultural, infrastructural, social, and strategic changes happening in an organisation.

This spiral model can be seen currently as an approach or a framework that presents factors to consider if it comes to establishing best practice knowledge management processes in organisations. We know that organisations need more than just a framework. They need tools utilising different steps of the model as much as possible integrated in the daily work processes. With a minimum effort they should be able to capture, analyse, plan, communicate, and change knowledge management processes in their organisations. That is exactly what we plan to further design and develop.

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