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Implementation Process of a Knowledge Management Initiative: Yellow Pages

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1. Introduction

Knowledge management has often been identified as an important challenge for sustained organizational success and as a prerequisite for the productivity and flexibility of corporate and non-corporate organizations. Due to the global interconnectedness of markets today, the scope and quality of individual employees' knowledge have taken their place alongside more traditional organizational resources such as work and capital. Knowledge of employees is considered as the most important knowledge source within organizations. Therefore, it is necessary to explicitly plan and manage the development, consolidation, representation and application of the knowledge of organizations and individuals to support a learning organization. Above all, knowledge communication between employees is essential for growth of learning. When employees share knowledge with other colleagues within their organization, that knowledge can become a source of competitive advantage (Solano, 2010). The issue is finding the colleagues within an organization who can provide the knowledge and skills needed in a given situation. This is particularly true in large organizations, such as an international corporation with geographically distributed departments. Within the domain of knowledge management, the problem of finding a suitable expert is usually solved with the help of expert finding systems such as company yellow pages or similar tools. This article presents a case study in a biotechnological company concerning the implementation of yellow pages. The implementation process included four phases. Phase 1 comprehends a knowledge management diagnosis, including a differentiated needs analysis concerning knowledge management domains. Phase 2 is concerned about the design and phase 3 is comprehends the realization of this intervention; and in phase 4 the rollout of the intervention takes place (Tarlatt, 2001; Winkler & Mandl, 2007).

2. Knowledge management in organizations

Especially in the global situation of competitive pressure, organizations acknowledge the importance of developing innovative concepts for using their own resources and existing synergies to have an optimum effect while simultaneously minimizing costs. Innovative knowledge generation and utilization in for-profit and non-profit organizations are essential for the future and therefore require an intelligent, responsible and human knowledge management.

Among the precursors of knowledge management is the engineering approach, in which technology is of great importance. Even today, technologies are an integral part of modern knowledge management. Until now, most knowledge management strategies could be categorized under the approach of business administration. In this approach, especially organizational aspects are important, such as knowledge for business goals and strategies as well as the role of staff development for knowledge management.

Another approach, the recent line of development, is concerned with the psychological approach to knowledge management. Here a central role is given to human and its individual handling of knowledge through tools and strategies (Reinmann & Mandl 2010). Finally knowledge management has a social logical sense, covering topics such as knowledge society, organization development and system theories.

In connection to these approaches, knowledge management is referred to as the systematic and reasoned dealing of knowledge concerning economic, employment or human resources. Dealing means both the supply and design of frameworks, methods and technical tools as well as the optimization of technical, organizational and mental processes (Reinmann & Mandl 2010, p. 1050). In this sense, human, organization and technology together form the three key components of knowledge management, considering also the relation to society (Mandl, 2010; Reinmann-Rothmeier & Mandl, 2000).

- The first component *human* is about the promotion and creation of knowledge, skills and competencies of the organization members, which form the carrier of relevant knowledge and the core of all knowledge management as the actual "driving forces" of continuous learning.
- The second component *organization* implies the development of a knowledge- and learning-friendly environment and culture in the organization and creating a framework that will facilitate the management of knowledge resources.
- The third component *technology* deals with the implementation and design of information and communication infrastructures and tools, supporting the knowledge-based processes in an efficient and user-friendly manner.

2.1 Knowledge management models

Knowledge management models are intended to support knowledge and decision-making processes by depicting "actions that are intended to result in anticipated business outcomes; and actions that emerge as a result of the many complex activities that are undertaken within an organization" (Callaghan, 2000). Knowledge management models can represent goals, measures, structures, and processes to provide roadmaps for how to document, communicate, generate and utilize knowledge. They have useful functions such as providing a framework amongst the multitude of possible knowledge management methods and tools and helping to prevent unreflective practice. Models also act as a potential anchor for knowledge to analyze issues in organizations and act as a starting point for organization-specific knowledge management concepts and their implementation or help to highlight the ultimate integrative role of knowledge management to better coordinate different tasks (Reinmann, 2009).

Several diverse models have been developed to conceptually describe the processes involved with knowledge management. One of the most well known models is the model of the Geneva School. This model is based on setting goals relative to the individual processes of knowledge identification, knowledge acquisition, knowledge development, knowledge

dissemination, knowledge utilization, knowledge retention and knowledge evaluation and concludes with an evaluation of these processes. The evaluation serves as a basis for reformulating the knowledge goals (Probst et al., 2010). Nonaka and Takeuchi's (1997) knowledge spiral has also achieved widespread recognition. In this model, the processes of socialization, combination, externalization and internalization are described. These processes involve the transformation of implicit and explicit knowledge within organizations.

When examining each of these approaches more closely, it becomes clear that they are often quite complex to apply in practice or as Callaghan (2000) states "knowledge strategies are often inflexible and unable to cope with the emergent properties that characterize the complex and dynamic environments of the 'knowledge age'". In addition, most models do not allow for conclusions to be drawn about individual knowledge management processes. However, some aspects can be identified that are relevant both for individuals and organizations and which also integrate the process models that have been formulated to date. These relate to aspects of goal setting and evaluation, knowledge documentation, knowledge communication, knowledge generation and finally knowledge utilization, for example, as described in the Munich reference model of knowledge management (Reinmann-Rothmeier et al., 2001; Mandl & Schnurer, 2007).

- **Knowledge Documentation**

The aspect of knowledge documentation includes all methods and processes that can be implemented to make knowledge transparent. From an organizational perspective, databases, knowledge cards and strategies for the dissemination of information within an organization play a key role. From an individual perspective, it is possible to externally represent knowledge by using elaboration strategies that relate to internal representation and mapping techniques or other visualization techniques. The presentation of knowledge, both internal and external, forms the basis for the communication of knowledge.

- **Knowledge Communication**

This aspect includes all processes and methods for sharing and disseminating knowledge. On an organizational level, these involve incentives and career structures that may be designed to promote or hinder the dissemination of knowledge. These processes may also involve the use of technical support tools such as, for example, the Intranet, E-mail or Business TV. On an individual level, it is important to consider the competence, motivation and volition of the knowledge communication. In this context, the organization also needs to train its employees in these key competence areas and must also offer structures that are likely to facilitate the communication of knowledge (e.g. through suggestion schemes or the relevant career paths). This illustrates that the communication of knowledge is a key element for linking the individual to the organization. Knowledge communication not only facilitates the circulation of information, but also leads to the generation of new knowledge.

- **Knowledge Generation**

In modern society, each organization must create competitive advantage through innovations, new ideas and products. Therefore, an organization that does not continue to develop and does not generate new knowledge will not be capable of surviving. Individual departments, such as pre-manufacturing, research and development, may often promote the generation of knowledge within the organization. Idea competitions or creativity workshops could also help to keep the organization flexible and innovative. For a "learning organization" it is important not to overlook the learning individual. From an individual

perspective, it is the goal of optimal knowledge generation to create knowledge structures that allow knowledge to be transferred to other contexts and used in a flexible manner. In the sense of knowledge management, this means that the organization must create structures that allow for the most practice-based learning possible within the organization.

- **Knowledge Utilization**

Only knowledge that has been previously represented, communicated and generated can be applied in practice, either at an organizational level through concrete products or services or on an individual level when applying acquired knowledge. Alone the fact that knowledge has been represented, communicated or acquired does not guarantee its application. In knowledge management models to date, knowledge utilization has been of rather undifferentiated significance. Some practice reports and empirical studies to date (Bullinger et al., 1998) have concluded that problems in implementing knowledge management are mainly due to problems with knowledge utilization. Despite this fact, there are rarely concrete instruments or strategies provided for the effective and targeted utilization of knowledge.

In a manner similar to the model of Probst et al. (2010), partial processes are initiated through setting a goal and are completed with an evaluation.

Unfortunately, the above-mentioned knowledge management models do not provide a framework of how knowledge management can be implemented in concrete business and production processes. Above all, we must emphasize that knowledge management is not one unitary vacuum that can be implemented adhoc, but that projects must emerge concerning specific knowledge management interventions and strategies which foster the idea of knowledge management by being sub-processes. Introducing knowledge management interventions, strategies or even innovations in organizations is seldom unproblematic. In many cases, the purpose of introducing a new concept, such as a knowledge management initiative, is unclear, too abstract or too generally formulated. Consequently, newly developed tools are often doomed to failure from the outset. This is either due to the fact that there is no adequate target group for utilization or it fails to win the intended users' acceptance. One reason is that many innovations do not meet the actual needs of employees (Akhavan et al., 2005 & Chua & Lam, 2005).

To overcome these shortcomings, there is a need for a systematic implementation process to ensure the sustainable acceptance and utilization of knowledge management initiatives.

3. The Implementation process of knowledge management

The term implementation can be derived from Latin and means "fulfillment" or "filling up". Implementation is understood as the accomplished conversion of solutions, which are present in the design and through conversion leading to specific action (Tarlatt, 2001). An implementation plan can be considered as transforming an actual condition into a target state, as an idea spread into new areas of application or as the replacement of an old concept by a new one (Reiss, 1995). One characteristic of an implementation process is that a part of a new concept is embedded in an existing system or environment. The aim is to compatibly integrate plans, models or concepts while taking into account different conditions in an existing system. The implementation is considered successful if, after completing all the necessary implementation measures, the desired application level takes place (Bauermann, 1988). Since implementations usually do not run smoothly, but are confronted with various obstacles, a standardized implementation process should be

developed considering various situations, influences and conditions of different organizations to ensure a successful implementation process.

In the following section, an implementation process is presented which relies primarily on the model of Tarlatt (2001) and Kremer (2003). The implementation process comprises four main phases that complement each other. Phase 1 involves a knowledge management diagnosis, including a differentiated needs analysis concerning knowledge management domains. Phase 2 is concerned about the design and phase 3 is concerned about the realization of the intervention. In phase 4, the rollout of the intervention takes place (Tarlatt, 2001; Winkler & Mandl, 2007) (see figure 1).
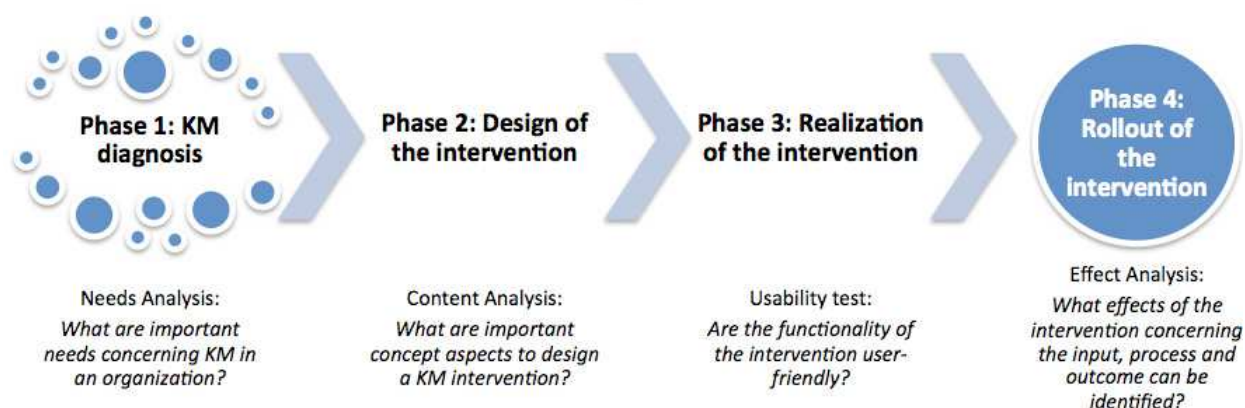
Fig. 1. Implementation process of knowledge management intervention

3.1 Phase 1: Knowledge management diagnosis

Before implementing a knowledge management intervention, it is fundamental to analyze the specific needs for such a system and to make sure that there are appropriate context conditions with regards to content, organizational and technical aspects. Based on a vision (e.g. optimization of business processes), a diagnosis of knowledge management problems should be realized. The diagnosis should take the Munich knowledge management model into consideration with its four dimensions of knowledge documentation, communication, generation and utilization. There are different methodological approaches (interviews, questionnaire) to analyze needs. The target group of respondents should include managers and employees as well as the general organizational conditions to make the actual situation visible and to clarify the desired goals for formulating goal settings for potential interventions (see figure 2).

In this context, it is evident that a comprehensive procedure for a purposeful and acceptance-oriented implementation must precede the introduction of the intervention. This procedure should concentrate on the needs of the end user in order to actually contribute to the optimization of their business processes. Based on the diagnosis, management makes decisions taking into account the order of priority concerning the analyzed needs as well as the financial, technical and personal resources. In addition, management should retain the business case providing the implementation project with its first written framework. The business case describes the vision of the organization concerning knowledge management, the results of the needs analysis and its goal settings as well as the detailed decision-making concerning one concrete knowledge management intervention. Concerning the knowledge

management intervention, there should be a detailed budget plan should be estimated as well as an initial draft of the cost-benefit relationship. This information is essential for getting funds from corporate financial administration (Winkler & Mandl, 2007). Furthermore, it is necessary to define a task force to distribute responsibilities concerning the implementation of the knowledge management intervention, including the design (phase 1), the realization (phase 2) and the rollout (phase 3, formed with employees from different areas, e.g. business related, IT, human resources, worker council, and management.

Fig. 2. Knowledge management needs analysis model

3.2 Phase 2: Design of the intervention

To design an acceptance-oriented knowledge management intervention, a specific content analysis should be conducted making visible the actual situation and the desired goals of the planned knowledge management intervention. The content analysis should take into account individual, organizational and technical aspects.

- Individual aspects include the participation of employees and specific qualifications. It is important to include employees in the process from the outset in order to ensure that their actual needs are met. Even during the planning and conception phase, feedback of employees should be gathered continuously (Hinkofer & Mandl, 2004). To ease the employee's introduction to the innovation, it is necessary to implement qualifications that facilitate the utilization of the intervention (VBM, 2000; Tartlet, 2001). Moreover the content of the intervention should be practice-oriented and demand-oriented to foster the use of the intervention.
- Concerning organizational aspects, management support is a basic requirement for facilitating acceptance (VBM, 2000). The importance of the project is communicated to employees when it becomes integrated into the overall mission of the organization.
- Technical aspects are considered when using technical instruments to support knowledge management measures. It is crucial to select a suitable technology that focuses on the concrete needs of employees. The technology selection must also meet the requirements for user-friendliness.

Using the results of the content analysis, a differentiated concept concerning individual, organizational and technical aspects can be developed.

3.3 Phase 3: Realization of the intervention

Based on the conceptualization, considering individual, organizational and technical aspects, the realization of the intervention should take place. The realization of the intervention often is implemented on a technical system. Defining working groups responsible for different aspects e.g. technology are helpful and promote acceptance by employee participation. A usability test should be carried out to control the new intervention. Usability is a quality attribute that assesses the simplicity in dealing with user interfaces. Usability is defined by several quality components: learn ability, efficiency, memorability, errors, satisfaction or utility (Nielsen, 1994). It is advantageous to use multiple methods to identify as many constraints as possible. This could be done by a think-aloud method with task scenarios followed by a usability test through a questionnaire (based e.g. on QUIS and IsoMetrics). The QUIS (Questionnaire for User Interaction Satisfaction) was designed to assess users' subjective satisfaction with specific aspects of the human-computer interface. It includes specific *interface factors* such as screen factors, terminology and system feedback and *learning factors* such as system capabilities, technical manuals, on-line tutorials, multimedia, teleconferencing, and software installation (Chin et al., 1988). IsoMetrics is a user-oriented approach in software evaluation based on ISO 9241 Part 10 that includes seven dialogue principles: suitability for the task, self-descriptiveness, controllability, conformity with user expectations, error tolerance, suitability for individualization, and suitability for learning (Gediga et al., 1999). After revision, the intervention will be ready for a pilot phase. Interviews and observations could identify some more obstacles that need to be solved before rollout.

3.4 Phase 4: Rollout of the intervention

The rollout of the intervention should follow a well-elaborated communication strategy, which takes into account the communication before, in-between and after the rollout. After the rollout, the intervention should be evaluated according to the goal setting with regard to the effects, including input factors on the individual, organizational and technical level, process factors concerning the implementation of the intervention and the outcome factors including the acceptance and utilization, individual and organizational effects. Moreover, a cost-benefit analysis can be taken into consideration. A summative evaluation of the project is crucial for ensuring continuous process improvements and the project's adaptation to the needs of the users.

4. Case study: Part 1

The next section presents the first part of a case study. Part 1 of the study comprises the phase 1 concerning the knowledge management diagnosis according to our implementation process model (chapter 3.1). The aim of the knowledge management diagnosis is to identify possible needs concerning knowledge management to gather potential interventions to consciously introduce and improve knowledge management processes within the company. The case study took place in the Research and Development (R&D) department of an international biotechnological company. The R&D department was widely distributed geographically with two R&D sites in Germany, one in Switzerland, two in the United States and one in Australia.

4.1 Phase 1: Knowledge management diagnosis

Concerning the knowledge management diagnosis, 163 employees from different sites of the R&D department took part in an online questionnaire study to analyze specific knowledge

management needs. The study showed highly differentiated results concerning knowledge documentation, knowledge communication, knowledge generation and knowledge utilization.

With regard to **knowledge documentation**, 50.3% of the respondents indicated a need for general improvements in this area. Specifically, the biggest need was identified for improving documentation on the specific expertise of individual employees (47.3%) and on product-specific regulatory strategies (41.8%). Moreover, respondents identified a number of needs for improving the documentation of experiences with projects (45.9%), or with external cooperation partners (42.5%). Referring to **knowledge communication**, 54.1% of respondents identified that there is an overall need for improvements in this domain. Respondents indicated that knowledge relevant for the whole site is not always made available to all colleagues (34.2%) and that there are no appropriate opportunities for knowledge communication (38.2%). Moreover there were no appropriate opportunities for networking with relevant colleagues (38.1%) and no sufficient knowledge exchange (36.7%). Concerning **knowledge generation** respondent mentioned that there are no sufficient opportunities to acquire new knowledge by job rotation. In regard to **knowledge utilization** there could be identified an overall need for improvements (47.3%). Especially respondent indicated that there are no standard operating procedures for using existing experiences (50.4%) and no standard operating procedures for using existing knowledge (45.9%).

Due to the highly differentiated needs assessment very specific needs of employees to improve knowledge management could be determined. In particular, the specific analysis of needs with regard to different knowledge management dimensions revealed that there is an explicit need for improving documentation of specific expertise and of experiences with projects. Moreover there is a need for improving the communication and availability of knowledge as well as standard operating procedures for using existing knowledge and experiences within the company and its different R&D sites. To meet these needs, the company decided to develop and implement a "corporate yellow pages" expert finding system as an initial improvement project. Corporate yellow pages are an optimal knowledge management intervention to encourage aspects of knowledge documentation and, above all, *knowledge about the specific expertise of individual employees* and *experiences with projects and external cooperation partners* by creating profiles of employees and documenting their expert knowledge, experiences or networks. In terms of knowledge communication, especially regarding *opportunities for exchanging and networking with employees from other R&D sites*, corporate yellow pages provide the opportunity to search for experts and for employees to interact by exchanging knowledge and experiences. Knowledge utilization, such as the *use of knowledge and experiences in new projects* is supported by corporate yellow pages, while exchanging knowledge between experts, expert knowledge and experiences can be transferred into new projects. The next chapter outlines the topic of yellow pages in detail.

5. Yellow pages: General issues

The following chapter will introduce general theoretical and practical approaches of yellow pages, which should serve as a basis for the further implementation phases (chapter 6). The chapter includes a definition of yellow pages, their appearance, functionalities and creation, their differences to other tools, their conceptualization and finally their potential influence on knowledge communication.

5.1 Definition of yellow pages

Expert finding systems (a.k.a. corporate "corporate yellow pages") are considered to be an effective and less time-consuming instrument, mainly used to support knowledge communication in organizations (Probst et al., 2010).

Corporate yellow pages aim to assist users in finding experts with specific knowledge, competencies, or experiences within the company. They cover the specific knowledge of all relevant organizational members, independent of their position. The goal of yellow pages is to foster knowledge communication between employees through the strategic finding of experts (Conway, 2004). The communication between the person searching for knowledge and the knowledge owner is made easier by making it transparent who knows what (Kukat, 1999). The system does not maintain the knowledge itself, but only the meta-knowledge pertaining to the available knowledge of employees (Lehner, 2008). Information about employees is saved in directories, indicating expertise such as competencies, experiences and further information about the person (Ehrlich, 2003). They are expected to help members of large, often widely geographically dispersed organizations in finding out who has specific expertise in a problem area. This is essential for finding support in complex problem-solving situations, or for obtaining critical knowledge for making decisions. Expert finding systems can stimulate learning and exchange processes in the organization (Lehner, 2009). Other potential advantages mentioned in the literature are that expert knowledge is made visible to all employees, that communities of experts can emerge, and that novice employees can find support from relevant experts more quickly. Accordingly, expert finding systems are expected to improve information searches for work processes and knowledge development.

5.2 Appearance, functionalities and creation of yellow pages

In general, yellow pages are based on a digital, Intranet-based database (Heinrich & Stelzer, 2009). The further technical components are a user interface and a search engine (Idinopulos & Kempler, 2006). The user interface can be provided through a browser and allow the employee to access the underlying yellow page database. Entries can be made and search requests can be entered with the help of the search engine (Gray & Tehrani, 2004). The results of the search are then presented through the browser. The contents of the database are the employee profiles. The main components are information about their expertise (Debitz, 2007) and options on how to contact them (Kilian et al., 2007). A profile can also be expanded in a number of ways, for example through photos, videos or other personal information (Davenport & Prusak, 1998).

There are three different approaches for filling the yellow pages with content: manual entry, automatic generation (Conway, 2004) and importing data from existing sources (Becks et al. 2004). Manual entry requires that employees create their own profile into which they enter their own relevant data through the user interface (Becks, et al., 2004). The second approach follows the basic principle that data already exists that provides information about the expertise of the individual employees, such as sent emails, presentations they have created, or project reports. Specifically designed algorithms then filter out the expert areas of the author of the data, which then become the contents of the yellow pages (Idinopulos & Kempler, 2006). Becks et al. (2004) describe the third way as importing existing data. For example, this could be from entries in the human resource databases such as contact information and other master file data.

5.3 Differences to other tools

In order to more clearly differentiate yellow pages from other tools and to identify the terms more clearly, the following section briefly describes the tools that are similar to yellow pages, but which have a different focus.

A tool that is very similar to the yellow pages is the so-called **blue pages**. Blue pages function according to the same principle as yellow pages with the difference that they do not list company-internal experts, but rather experts that are external to the organization, such as customers, consultants, suppliers or other service providers (Lehner, 2008).

Another very similar tool that is sometimes referred to as the basis for yellow pages is **knowledge cards** (Pircher, 2010). A major differentiating factor to yellow pages is, however, that knowledge cards visualize the carrier, structure, level or application of knowledge (Kilian et al., 2007). Through graphic representation in the form of nets, MindMaps or other schematic visualization, specific knowledge gaps can be identified (Schuhbauer & Schwinghammer, 2005). In addition to their use for knowledge communication in everyday business, knowledge cards also function increasingly as a tool for the human resources department. Knowledge cards are similar to yellow pages in that they do not contain the knowledge itself, but rather describe the path to that knowledge.

Additional tools which provide answers to specific questions as yellow pages do, but which use a different approach, are the so-called **question and answer systems** (Iske & Boersma, 2005) and also forums in which questions are posed and answered (Metze et al., 2007). In these tools, employees do not present a profile with their areas of expertise and do not react to specific and personal requests on the part of a person seeking information. This instrument only uses a pull strategy for knowledge communication. This means that a question is posed in a forum and then experts can provide an answer to the topics relevant to them. The communication takes place in Intranet-based forums, which has the advantage that answers are provided in written format and are therefore automatically saved for future information seekers. In that way, there are additional benefits because a type of database is created alongside the communication (Iske & Boersma, 2005).

5.4 Conceptualization of yellow pages

The following chapter describes which aspects must be considered in the concept phase of yellow pages. These can be differentiated into individual aspects, organizational aspects and technical aspects. The result is a written document, which describes and establishes the characteristics of the product that is to be developed (Döring & Ingerl, 2008).

5.4.1 Individual aspects

Individual aspects comprise the kinds of information which may be contained in a single corporate yellow pages profile and describe the conceptual points that directly affect the employee. These aspects include the knowledge itself including domain of knowledge, the quality of knowledge and level of detail of the entries, a common ground, as well as contact information that reflects the availability and accessibility of relevant employees.

- **Knowledge**: Each employee's knowledge is an essential aspect, as without knowing what someone else knows, it is not possible to find a person with specific expertise (Cross et al., 2006). Knowledge domains that can be relevant include technical knowledge, experiential knowledge from previous projects, as well as knowledge on research, products, or customers. To facilitate searching for experts in specific

knowledge domains, it may be important to predefine a closed set or taxonomy of knowledge domains relevant for the organization (Helm et al., 2007). However, it is important to limit the number of predefined domains (Lehner, 2008) and keep them flexible for future additions. In addition to knowledge domains, information on the validity, credibility, or soundness of the expert's knowledge may be an important aspect of a person's entry (Woudstra & Van den Hooff, 2008). The general principle is that the size of the entry should be as detailed as necessary, but also be kept as brief as possible. The person seeking information should have the amount of information available to differentiate between entries and to make a selection. In order to prescribe the entries, which are especially relevant for manually created profiles, it is necessary to use structuring aids and to limit the input options (Twietmeyer et al., 2008).

- **Common ground:** An important factor for ensuring the successful communication of knowledge is mutual trust. When supplementary information about the expert provides some common ground between the person searching for information and the expert, this promotes trust and thereby also promotes the communication of knowledge (Davenport & Prusak, 1998). Davenport and Prusak (1998) also suggest including a photo or even a short video of the expert in their profile. This can increase a sense of closeness and trust and gives a first impression of the person (Bettoni et al., 2007). Especially in large companies, it is often the case that people recognize a face, but don't necessarily know a person's name. A photo can help jog their memory.
- **Contact information:** How to contact an expert is trivial, yet essential content for Yellow Page entries (Woudstra & Van den Hooff, 2008). Instructions about how to reach the colleague and their availability are important. The instructions tell the person searching for information if and how the expert can be contacted. Employees prefer to make contact with a colleague when that person is in close physical or organizational proximity, even if communication media such as email or telephone are used (Ehrlich, 2003).

5.4.2 Organizational aspects

Organizational aspects refer to the structures, processes, and rules associated with the expert finding system in the organization. These concern mainly the organizational climate including participation, motivation, qualification, and voluntary participation of employees, the support of management, as well as the common language; and the regulations concerning the utilization of yellow pages.

- **Organizational climate**: Trust and responsible handling of entries are important aspects for dealing with corporate yellow pages (Lehner, 2008; Soliman & Spooner, 2000). These aspects can be strengthened by participation, motivation and qualification of employees and their voluntariness to use yellow pages, which are fundamental for the successful implementation of corporate yellow pages.

Support from top management: Support from management is crucial for the success of knowledge management as they are providing time for employees to exchange knowledge. They are allocating sufficient budget for implementing knowledge management, they are introducing a "new mindset" and are acting as example by completing their own profile in the system. This demonstrates by example that they are giving priority to knowledge management (Helm et al., 2007).

Participation: Firstly, it means that the needs and the requirements of the users can be directly considered (Moser & Schaffner, 2004). Secondly, playing a part in the development process

increases their ability to identify with the new instrument (see Frey & Schnabel, 1999; Kraus, et al., 2004). It is also important to integrate other stakeholder groups within the organization. According to Böhm (1999), this includes those responsible for data security, members of the workers' council and personnel board as well as all members of the management team.

Motivation: Motivational measures could include a transparent and comprehensive communication strategy, measures of qualification, management support, as well as participation of employees (Finke & Will, 2003). Stimuli can be used (Ehrlich, 2003) to keep employers motivated to continuously make updates. These could include monetary rewards (see Chap. 2.5.1) or be as simple as reminder systems.

Voluntary participation: Entering one' own profile should be voluntary. Participation in the system should reflect a sincere readiness to exchange knowledge and to support one's colleagues (Hofmann et al., 2010). Even if the creation of profiles for the yellow pages is obligatory, this does not mean that motivation is generated by the mere requirement to create them. This could lead to profiles of poorer quality. All employees should also be aware of the personal benefits they can gain by utilizing yellow pages (Below, 1999).

Qualification: When introducing new instruments, it is important to make sure that employees are sufficiently trained to use them (Winkler & Mandl, 2007). If the technical and methods-related skills or the willingness to use the tools are lacking, trainings may be helpful (Helm et al., 2007). To ensure acceptance, the specific purpose of the training and the needs of the individual target group determine which training is suitable for meeting individual needs (Tarlatt, 2001).

- **Common language:** In general, developing an appropriate taxonomy is a task that is not to be underestimated. Ample time should be planned for this activity during the conception phase of the yellow pages (Ehrlich, 2003). In each case, it is recommended that a function-based and a cross-hierarchy work group be created to work on the development and specification of a company-specific taxonomy. This approach has the positive secondary effect that a common language can be developed through this teamwork. The team has to agree to certain formulations and develop a common understanding of the chosen terms. A common language amongst the employees is ultimately essential for the successful utilization of yellow pages (Ehrlich, 2003).

- **Regulation for using yellow pages:** There are basically three different methods for creating profiles in yellow pages. First of all, there is the approach of using specific software from existing data sources to generate the profiles automatically. Secondly, there is an option for a person to manually create and complete the profile. The third method utilizes existing data sources and exports them to the yellow pages profile. Entries and updates of personnel profiles within the corporate yellow pages system should be entered by employees themselves, as they are the ones who are most competent to do so (Lehner, 2008). Including information on how recently an entry has been checked for being up to date helps in rating the entry (Woudstra & Van den Hooff, 2008). Keeping the yellow pages profile current is seen as one of the most critical success factors (Ehrlich, 2003). This is because older or even incorrect data would taint the results of the search. This then defeats the purpose of the yellow pages which is to find a competent contact to help with a specific problem.

5.4.3 Technical aspects

Technology facilitates the necessary processes, but is not the driving force behind the project. Davenport and Prusak (1998) refer to the one-third rule. If more than a third of the

numbers of resources are used for technology and design, the project runs the risk of no longer serving knowledge management, but rather technology. Despite this fact, it is necessary to consciously and purposely include information and communication technologies. These form the infrastructure for knowledge communication and enable important information to be accessed quickly (Gray & Tehrani, 2004). Technical aspects refer to design features of the hard- and software of the platform used to realize the expert finding system including user interface, design and user friendliness.

- **User interface:** Knowing what someone else knows is only useful if there is prompt access to this information (Woudstra & Van den Hooff, 2008). The user interface refers to what the user perceives from the system or the software and what he/she can do with the software (Chlebek, 2006). In the case of yellow pages, this includes the profile entry, search entry, list of results and presentation of the profile. These four basic elements can be complemented by an introduction and detailed help tips. The interaction with the system can take place in several forms. One of these forms includes graphical entry tools, such as the mouse, which control the position of the cursor. Actions such as clicking, dragging and double-clicking make the entries which facilitate the interaction with the system (Raskin, 2001). Another option is using the keyboard, in which each key performs different functions (Dahm, 2006). Navigation is also an important aspect that should be considered in the concept for the user interface. It is the goal of the navigation to provide an overview of the current location, the target and the path to reach the target. Ultimately all aspects of the user interface, the forms of interaction, the actions, the input masks and the navigation should be documented in the interface description. This serves to provide the structure and is helpful for the realization of the concept during the implementation process (Chlebeck, 2006). The technical challenge is developing a search engine that meets the needs of the employees. Since it cannot be assumed that there is a significant technical difference between searching for people and searching for documents (Shami et al., 2008), there are basically three different methods available: index search, search in a constructed catalog, and a combination of these two variants. The last one provides a hybrid method that combines both of the variations we have presented. This can refine the search in such a way that the results are often more satisfactory (Twietmeyer et al., 2008). When presenting the search results, it is recommended that they are ordered logically, because in practice it is often the case that only the first search results are utilized (Strzolka, 2006). Therefore, the best results should be in the top position.
- **Design and user friendliness**: Fundamental design aspects to be considered are perception, color, typography, orientation, navigation, layout, style guide, and screen and information design (Stapelkamp, 2007; Döring & Ingerl, 2008). It is important that the design is tailored to the contents as well as to the function of the instrument and that it also supports both of these aspects (Idinopulos & Kempler, 2006). In terms of user friendliness, there are also other important concepts such as simplicity, structure, brevity and conciseness and mixing things up through motivating add-ons (Schnotz& Heiss, 2004). Requirements which are important for optimizing the usability of the system include perceptibility, operability, intelligibility, and sustainability (Stapelkamp, 2007). In order to develop user-friendly software, it is necessary to adapt the application to the skills of the users. The other and less successful way would be to use training and instruction to help the users gain the skills needed to utilize the product. However, this method is often less successful and significantly more costly (Groner et al., 2008). There

are several guidelines and design tips to provide information about the ways in which software and, in this case, yellow pages, can be designed in a user-friendly manner. Nielsen and Tahir (2001) provide a total of 112 suggestions for creating user-friendly websites. The quality management norm DIN EN ISO 9241 talks about the ergonomics of the interaction between people and systems (Stapelkamp, 2007). The large number of rules relating to user-friendliness can all be simplified into four principles: usability, learnability, efficiency and satisfaction.

Yellow pages are considered as a tool to promote knowledge management in organizations. Especially as in our case yellow pages can facilitate knowledge communication between employees which will be demonstrated in the next paragraph.

5.5 Knowledge communication through yellow pages

Within organizations, the goal of knowledge communication is first and foremost „taking existing isolated knowledge and making it useful to the organization as a whole" (Hespe, 2007, p. 27). In order to achieve this goal, Gray and Tehrani (2004) suggest the following three strategies. The first variation is based on the notion that information can be distributed to all employees through **the „watering can" principle**. This means that a central decision is made about what will be communicated and what will not (Probst et al., 2010). This so-called push strategy is attractive because all employees are provided with all of the information. However, this can also be seen as a disadvantage because a flood of information must then be processed by each individual employee (Bodendorf, 2010). A common tool that is used for communicating using the push principle is a newsletter which is sent via email. The **pull strategy** is the opposite approach. In this strategy, each employee is specifically responsible for getting the information they require (Gray & Tehrani, 2004). This is a way to prevent the flood of information. The challenge is whether each employee will receive the information they require despite a shortage of time, interest and knowledge (Hespe, 2007). For example, one tool that can be used is a database that stores all the information that can be retrieved on the initiative of the employee. The use of the pull strategy is additionally supported by information and communication technology, which makes it easier to search for specific knowledge in a cost-effective manner (North, 2011). If a person is only given the location where the information can be found and is not provided with the information directly, it is referred to as a **point strategy** (Gray & Tehrani, 2004). This approach is especially positive when dealing with complicated knowledge topics depending on the type of knowledge. For example, yellow pages support the point strategy, in which the expert does not have to make their personal knowledge explicit and log it in a database. This is because the interested party can be in direct contact with the expert, thereby facilitating knowledge communication.

In order to be able to analyze the benefits and challenges of knowledge communication using yellow pages, the following section provides a more detailed description of the process of knowledge communication with the support of yellow pages. The entire communication process that is initiated by yellow pages can be broken down into three components (see figure 3).

First, expert profiles must be created. The core and main component of corporate yellow pages are employee profiles (Idinopulos & Kempler, 2006). Employees externalize descriptions of their implicit knowledge domains by articulation of this knowledge into words, numbers and pictures (Polanyi, 1966). In general, employees are the main agents who communicate knowledge about their expertise to the tool (Conway, 2004). The

employee therefore takes on a classical sender roll. The difference is that the receiver is not clearly identified and or that potentially all colleagues will receive the information. The goal of these profiles is to give the intended searcher a basis for deciding whether someone is an adequate expert for a specific problem or not. Moreover, profiles are the basis for knowledge communication, which should be initiated through the use of corporate yellow pages (Lin et al., 2008).
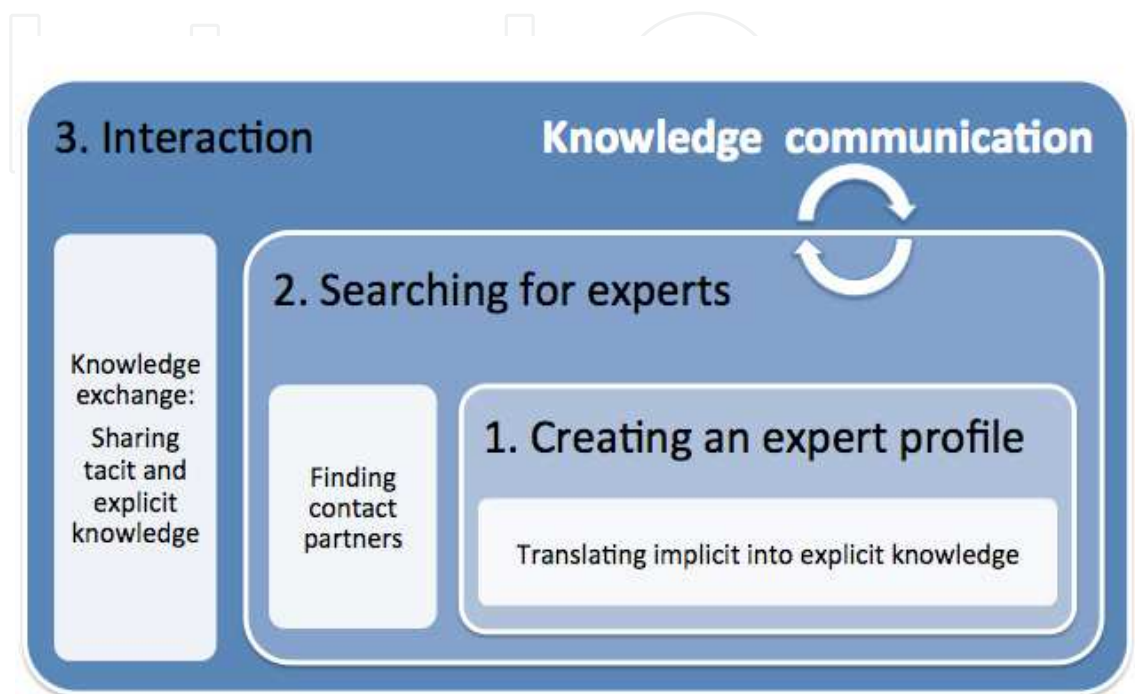

Fig. 3. Communication process with yellow pages

The second step involves searching for an expert. In this step, an employee sends his request to the system that contains the information that was input in the first step (Gray & Tehrani, 2004). The employee then receives an answer in the form of the profile that another employee had entered previously. The person who reads the results of the search is the receiver of the message sent in the first step. By using information and communication technologies, it is possible that a message only needs to be sent one time, but that can be received as often as desired.

The third step involves the interaction between the identified experts and the person searching for the information. The employee that placed the search request (second step) makes contact with one of the colleagues identified as an expert. The process thereby ends as a classic communication situation that can take place face-to-face or through another medium.

Yellow pages can encourage the exchange of knowledge and experiences, thus giving employees the opportunity to translate implicit knowledge into explicit knowledge (Eppler, 2003). Sharing tacit knowledge is only possible if the knowledge is externalized by articulation of this knowledge into words, numbers and pictures, above all during discussion and knowledge exchange (Polanyi, 1966). The exchange between experts by means of an expert finding system can provide an opportunity to exchange tacit knowledge in a highly situated context between employees and consequently help employees acquire new knowledge in a work-integrated learning environment.

6. Case study: Part 2

Based on the theoretical and practical approaches of yellow pages, this chapter will present the development and implementation of yellow pages within the R&D department of the international biotechnological company. It will refer to the implementation process concerning phase 2: design of the intervention, phase 3: realization of the intervention and phase 4: rollout of the intervention (see chapter 3).

6.1 Phase 2: Design of the intervention

According to our case study concerning the acceptance concept, a specific content analysis was conducted, including individual, organizational and technical aspects (see chapter 5.4). Thirty-five employees from different parts of R&D were interviewed concerning their needs for yellow pages. The findings of interviews gave important information about individual aspects, organizational aspects and technical aspects. Respondents confirmed the urgent need for an expert finding system. Concerning **individual questions,** respondents spoke in favor of the following aspects to be considered in corporate yellow pages: contact details (N=24), experiences with projects (N=20), knowledge domains of R&D expertise (N=19), qualifications (N=17), work experience (N=17), and experiences with products (N=11). With regard to **organizational aspects,** eight of 35 respondents mentioned that the entry should be voluntary, seven respondents were in favor of obligatory entry and five for a combination of both. 16 respondents were in favor of each employee updating his or her own profile. To ensure the acceptance of corporate yellow pages, suggestions were also collected concerning *conditions, measures* and *obstacles.* Regarding *conditions,* respondents mentioned: support by manager (N=14), communication measures (N=13), usability (N=10), and company-wide introduction of corporate yellow pages (N=9). As adequate *measures* for the success of corporate yellow pages, respondents named trainings (N=9) and the function of a knowledge manager (N=6). Six respondents were against incentives. Besides this, respondents also mentioned some *obstacles* that could influence the success if corporate yellow pages: time factors (N=8), complicated handling (N=7) or not enough communication measures from management (N=4). Finally, with regard to **technical questions**, specifications for the technical implementation and user interface design were clarified. For example, nine respondents mentioned that SharePoint could be suitable. Concerning the search form, respondents (N=15) preferred a combination of search functions, keyword search and searching by categories.

Results of the content analysis give essential information about the individual, organizational and technical aspects concerning corporate yellow pages and serve as a central basis for the conceptualization. The selection of individual, organizational and technical aspects was chosen according to the amount of entries from respondents and discussions between the task force members.

Concerning the **individual concept,** the following main content fields will be integrated in corporate yellow pages: Contact details; expert knowledge domains related to R&D, developed products, current product development projects, networks and qualifications. Above all contact details (see chapter 5.4.1) are essential for yellow pages. Concerning the individual knowledge of each employee different aspects could be determined which are important for the every day working in the R&D department. To facilitate the search for the category expert knowledge domain, it was decided to develop a closed taxonomy. This task was taken over by a working group composed of staff from different areas and regions.

With regard to the **organizational concept,** it was decided that all entries should be voluntary except for contact details to gather sincere readiness to exchange knowledge and to support colleagues (see chapter 5.4.2) This decision point was also strongly related to the claims of the workers' council. Moreover, to ensure the acceptance of corporate yellow pages, managers are obligated to support their employees concerning the utilization of corporate yellow pages (e.g. giving more time for utilization) and to carry out communication measures (e.g. company wide introduction). There is a plan to provide employees with opportunities for gaining practical knowledge about the handling of corporate yellow pages through trainings and tutorials. According to Lehner (2008) employees will enter their profile by themselves, as they are the ones who are most competent to do so. In order to keep yellow pages up to date, there will be a contact person for support and for sending up-dating reminders regularly to employees. A detailed communication strategy will be worked out supporting the motivation of employees. Moreover employees are involved in development steps, e.g. task force, technical workgroup, knowledge workgroup or several evaluations with employees, and get the opportunity to participate in the development of yellow pages.

Relating to the **technical concept**, a technical workgroup of R&D members and external consultants were working in collaboration to design and develop corporate yellow pages according to user interface, design and user-friendly principles. As system basis, a customized SharePoint was used that included combination of search functions, keyword search and searching by categories. Furthermore, to test if the developed technical system is user-friendly and enable the practical use usability tests was conducted. Results will be presented in phase 3.

6.2 Phase 3: Realization of the intervention

According to the conceptualization yellow pages was technical realized by a technical workgroup including internal and external IT specialists. After the technical realization of yellow pages, four task force members individually analyzed the functionality according to specific individual, organizational and technical aspects. To do this, they used a checklist and summarized the results in a discussion round. Based on their feedback, the technical workgroup updated the expert finding system.

In a second step after the technical revision of the expert finding system, an analysis was conducted regarding the usability in a multi-evaluation model. The study involved a performance and diagnostic evaluation with intended users. Ten organizational members from the R&D department tested the usability of corporate yellow pages through the think-aloud method (performance evaluation) with task scenarios followed by a usability test (diagnostic evaluation) through a questionnaire (based on QUIS and IsoMetrics). The think-aloud analysis revealed about 43 hints that may influence the usability of yellow pages in the company. In detail, 24 hints were mentioned concerning the edit of profiles, e.g. *explanations should be placed directly under the field name* or *field size should be the same everywhere*; eight hints were mentioned concerning the search functions, e.g. *link to the advanced search should be more visible*; six hints were mentioned concerning the selection of results, e.g. *hyperlinks in the text should be removed as they are confusing*; and finally five hints were mentioned concerning the refinement of results, e.g. *the title should be renamed, for example "Filter Results".* Beside the comments of open answers in the questionnaire, which were similar to those in the previous method, the results of closed answers (1=not agree to

5=completely agree) showed only few hints that should be revised, e.g. *error messages are helpful* (M=2,80); *correcting my mistakes is easy* (M=3,14) or *it is easy for me to move back and forth between different screens* (M=3,25).

Results of the usability test showed important hints concerning the user-friendliness of the system. About all the method of thinking aloud was crucial. It was very interesting that our sample of ten intended users from different positions and pre-knowledge could make 43 valid recommendations for improvement. The usability test plays a central role, as the test users are evaluating an unknown system. Taskforce members and managers involved in the development agreed about the importance of the test, and even declared they had become blinkered in their work, as they did not realize the relevant recommendations for improvement mentioned from the test user.

After the test the technical workgroup revises the expert finding system, which is currently under process, and then it will be launched according to a step-by-step communication strategy in the whole R&D department.

6.3 Phase 4: Rollout of the intervention

A summative evaluation of the project is crucial for ensuring continuous process improvements and the project's adaptation to the needs of the users. After the rollout of corporate yellow pages, a comprehensive and systematic evaluation should take into consideration the entire chain of effects from the initialization of the implementation process to the final impact of the intervention.

In doing so, different evaluation activities may refer to three main components:

1. **Input factors** comprising *individual factors* such as motivation, willingness and job relevance; *organizational factors* such as the infrastructure of knowledge management which results from the implementation process including attitude of management, support measures or organizational culture and *technical factors* as design and usability.
2. **Process factors** including any knowledge management *process* due to the intervention for example interaction among employees.
3. **Outcome factors** referring to the *utilization* as quality of support or frequency; *acceptance* of attitude and behavior; *individual effects* as time saving, problem solving or increase of employee and customer satisfaction; and *organizational effects* like improvement of decision-making processes, improvement of product developments and project realizations, reduction of mistakes or cost savings (Hanley & Malafsky, 2003; Tiwana, 2000).

In focus of interest are also potential relationships between these effects, and what the single factors and processes contribute to the intended outcomes. An important goal will be the formative improvement of the infrastructure and the implementation of knowledge management for optimizing effects.

7. Conclusion

As demonstrated, the implementation of knowledge management measures in organizations is a complex undertaking. Especially the importance of the human factor should not be underestimated. A successful implementation can be achieved through well thought-out, employee-oriented implementation processes. By using a process model, it is possible to strategically support employee-oriented implementation processes that prevent

reactance and increase employee's acceptance of the innovation (Winkler & Mandl, 2007). It is very important to integrate employees in different phases of the implementation.

At the beginning of our case study, a needs analysis was carried out, questioning all R&D members. On the basis of the results of the needs analysis, a decision was made to develop and to implement an expert finding system. A task force responsible for the project was formed and included employees from different positions and regions. To conceptualize the expert finding system, a content analysis was conducted by interviewing employees. Two workgroups with different employees were formed on the one hand for building a taxonomy for knowledge domains and on the other hand for the technical realization of the system. Moreover, a usability test with employees concerning the technical realization was executed. Finally after revision sessions, the rollout of the expert finding system is ongoing respecting a step-by-step communication and introduction strategy. We expect that the final evaluation show positive results and confirm our highly differentiated implementation approach.
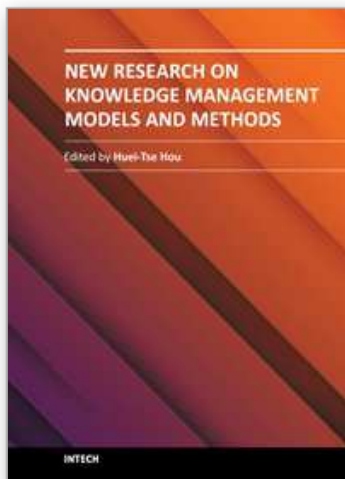
8. Acknowledgements

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New Research on Knowledge Management Models and Methods

Edited by Prof. Huei Tse Hou

Due to the development of mobile and Web 2.0 technology, knowledge transfer, storage and retrieval have become much more rapid. In recent years, there have been more and more new and interesting findings in the research field of knowledge management. This book aims to introduce readers to the recent research topics, it is titled "New Research on Knowledge Management Models and Methods" and includes 19 chapters. Its focus is on the exploration of methods and models, covering the innovations of all knowledge management models and methods as well as deeper discussion. It is expected that this book provides relevant information about new research trends in comprehensive and novel knowledge management studies, and that it serves as an important resource for researchers, teachers and students, and for the development of practices in the knowledge management field.

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