Knowledge Barriers in CD&E Projects in the German Federal Armed Forces

Eva-Maria Kern, Michael Koch, Carolin Fiechter, Alexander Richter
(Bundeswehr University Munich, Germany
eva-maria.kern | michael.koch | carolin.fiechter | a.richter @ unibw.de)

Abstract: Project organizations make particular demands on the management of knowledge both within projects and across projects. In this contribution we present a method kit for the improvement of knowledge management in a project organization in the German Federal Armed Forces. The kit was developed in the context of a study, and serves as instrument for a target-oriented identification and removing of project specific knowledge barriers. We describe the basic elements of the method kit and present a process model for its application.

Keywords: knowledge management, knowledge barriers, project organization
Categories: H 4.3, H 5.3, M 8

1 Knowledge management in small project organizations in the German Federal Armed Forces

The German Federal Armed Forces are facing new challenges in the context of a significant shift in their responsibilities and simultaneous improvements in weapons and information and communication technology. To constantly improve and to maintain its capabilities the German Federal Armed Forces therefore have codified "transformation" as superior principle for an extensive and continuous reorientation (Schäfer 2006).

An essential core element of the transformation process is the method Concept Development & Experimentation (CD&E). The basic idea of CD&E is an iterative development process that changes between phases of (theoretical) concept development and (practical) experimental evaluation (Schäfer 2006). So, the method can be compared with different participative and prototype-based development methods in software and systems development (see Kensing and Blomberg 1998 or Holtzblatt 2002 for some examples). Following the basic idea the implementation of the method is performed in the form of projects with participation from concept developers, users from the practice and evaluators. Due to novelty and complexity of these projects an essential requirement for a successful execution of the projects is the development of new knowledge in the teams, the exchange of knowledge between team members and other involved partners across the project stages, and the purposeful usage of existing knowledge. Knowledge, which is relevant for a project, can come from already finished or parallel projects in the armed forces or from experts outside the armed forces. In summary, knowledge management plays an essential role in CD&E projects.

The Bundeswehr University Munich has worked with the Zentrum für Weiterentwicklung der Luftwaffe on the development of a modular method kit for improving knowledge management in CD&E projects.

In this development a particular focus was set on overcoming knowledge barriers. These are "*circumstances and conditions that hinder the generation of new knowledge, the representation of knowledge or the exchange of knowledge between co-workers*".

The cause for knowledge barriers can be on the level of the single team member, of the group, of the whole organization, or of the technology used or not used for knowledge management.

In this contribution we present a method kit for identifying and overcoming knowledge barriers and a process model to implement that method kit. The first step in presenting this method kit is to show how we have collected a catalogue of knowledge barriers in CD&E projects (Section 2). Based on this catalogue we then show how barriers in a particular project (organization) can be identified and removed. Therefore we introduce a process model and illustrate it with several examples (Section 3). In Section 4 we finally conclude with a brief resume and an outlook to possible usage scenarios for the method kit.

2 A structured catalogue of knowledge barriers

The starting point for the development of an instrument for addressing knowledge barriers is a comprehensive structured presentation of all knowledge barriers that are relevant in the application domain.

Bick et al. (2003, p.38) distinguish two possible methods to systematically examine knowledge barriers: The empirical examination on the basis of studies (1) and the deduction of analytic systematization approaches that try to classify the barriers in different categories (2). We have combined both methods for developing our catalogue of knowledge barriers.

First we have conducted several interviews in CD&E projects with a focus on issues of the area of organisational psychology. In those interviews with different actors working for or with CD&E projects on different hierarchical levels, 29 different barriers could be identified and later be condensed into eight interconnected classes of barriers (see Kremser 2007). Simultaneously to the evaluation of the interviews, we conducted a comprehensive literature analysis where in total more than 100 (partially overlapping) barriers could be identified (see e.g Bender and Diehl 2005, Probst et al. 1998, Rümler 2001, Lugger and Kraus 2001). These barriers were slightly aggregated, put into the context of the CD&E project organization, and reconciled with the findings of the interviews. In total, 46 particular barriers could be identified this way.

For the purposes of our study we decided not to merge similar or related knowledge barriers that are still distinguishable: Thus, our method kit allows addressing the identified barriers more precisely and more efficiently by choosing specially tailored measures.

In order to categorize knowledge barriers, several systematization approaches can be found in the relevant literature (Richter 2007, S.47ff; Eberle 2003, S.19ff.).

One well known possibility to classify the knowledge barriers is the TOM model – using the three dimensions technology, organization, and man (Bullinger 1997). Classifying knowledge barriers in these three dimensions does not guarantee full discriminatory power. However, that does not have to be a drawback, but supports the holism of the approach. The sustainable success of a technical solution is not possible without the adaptation of the organization and the willingness of the staff to adapt (Decker et al. 2005, p.22).

For our study we have taken the TOM model and have added a differentiation between individual and group in the dimension of man. This additional differentiation evolved from our analysis of the interview data, and is particularly needed to distinguish communication and motivation barriers. Hence, we distinguish four different categories of knowledge barriers:

- *Individual knowledge barriers* refer to the ability and willingness of the single project members to pass on knowledge and to adopt knowledge.
- *Interpersonal knowledge barriers* refer to conflicts in interpersonal interaction and communication.
- *Organizational knowledge barriers* originate from the organizational culture, from the organizational structure and the process organization of the company as well as from the working conditions.
- *Technology related knowledge* barriers address the relevance of the available technology and the abilities to use the technology.

In the different categories the knowledge barriers can be further divided into different sub-classes. Figure 1 shows the different categories and sub-classes we have identified in our study. For some of the sub-classes examples of the knowledge barriers comprised therein are shown.

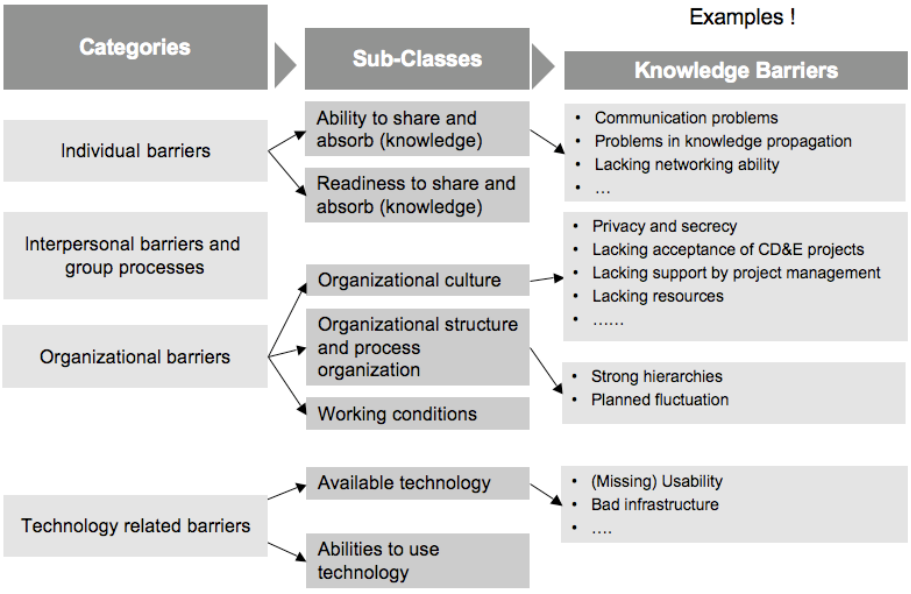

Fig 1. Knowledge barrier categories and sub-classes

With this structured catalogue of knowledge barriers, that seems to be quite generic for project organizations even though it has been derived from the application domain of the CD&E project organization, we built the basis for developing a process to address and remove the barriers.

3 Removing knowledge barriers

The basic idea for addressing problems in the knowledge management of CD&E projects is depicted in the following process: First knowledge barriers are identified based on symptoms, then the barriers that have been identified and their relationships among each other are analyzed, and finally particular measures for addressing the barriers are selected and implemented (see Figure 2).

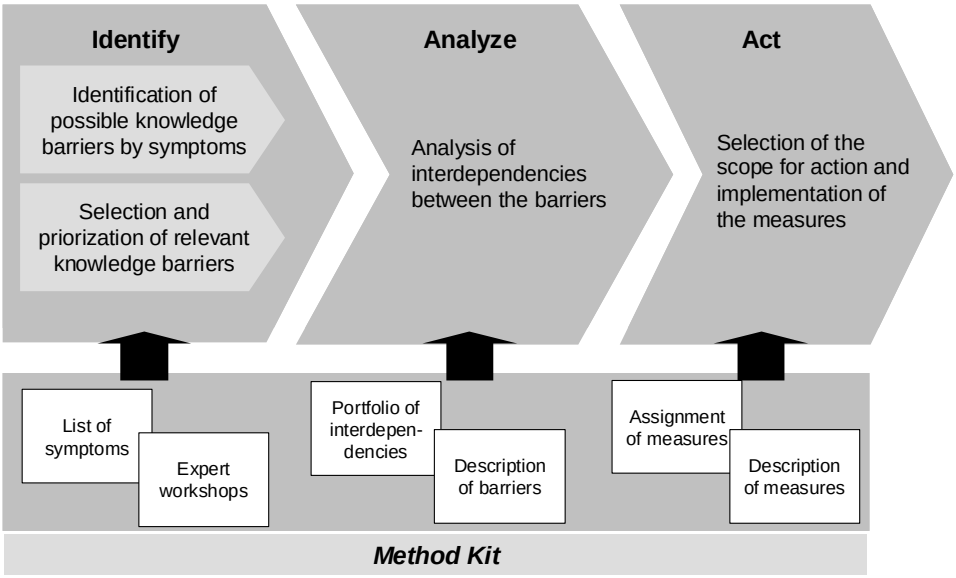

Fig 2. Overview of knowledge barrier process model

3.1 Identification of knowledge barriers

The first and crucial step to address knowledge barriers is to identify which barriers apply to a particular setting. Only when it is known which barriers really interfere with successful knowledge management effective measures can be selected and be implemented.

However, this important phase of identifying knowledge barriers has not been addressed adequately in the literature. One reason for this may be that knowledge barriers are hard to measure, and that their effect depends a lot on the particular environment and the particular organization. To allow for an identification of relevant barriers regardless of these challenges we have decided to offer the users of our kit the

possibility to identify knowledge barriers based on an extensive list of symptoms. The symptoms circumscribe particular situations and attitudes of team members in the context of their project work, and point to knowledge barriers. Thereby, not all knowledge barriers that are listed with one symptom have to be relevant for the project under examination.

The symptom “Resources required for task fulfillment a not available or not available at time” for example can point to the knowledge barriers “Privacy and Secrecy”, “Lacking acceptance of CD&E projects”, “Lacking support by superiors” or “Lacking resources”. One possibility to determine which barriers really apply is taking additional symptoms into account: “We are not informed about current developments in our organizational unit” for example also points to the knowledge barrier “Lacking support by superiors” – but also to “Lacking dialog culture” and “Leadership behavior”.

The goal is first to collect the principally possible knowledge barriers, and then to reduce the set of barriers using more detailed information (workshops, expert opinions etc.) to the really existent and problematic barriers.

The identification of knowledge barriers and the further analysis of the interdependencies among barriers is supported by a systematic description of all knowledge barriers: for every barrier the description includes a meaningful short characterization, background information, information about implications of this barrier for the handling of knowledge, references to barriers that might have interdependencies with this one and proposals of appropriate measures for removing this barrier.

3.2 Analysis of interdependencies between knowledge barriers

Even after having identified possible knowledge barriers and having narrowed these down to the few most important ones for a particular situation, removing them is not trivial. Organizations are complex systems that react to deterministic control in a very limited way. Every direct intervention into the system can have unintended and negative effects in addition to the intended and positive effects.

Because of that we have to analyze the interdependencies between the identified knowledge barriers before starting to take measures to remove them. The analysis of the interdependencies particularly can result in recommendations which barriers have to be addressed first.

To support this analysis we provide the users of our kit with an heuristic for the division of the barriers based on two central characteristics: the influence other barriers have on this barrier and the extend of the influence this barrier has on other barriers and measures (similar to the approach of Gomez and Probst of “thinking in networks” 1997, p.72ff). This categorization results in four types of barriers:

- *Neutral barriers* are not or barely influenced by other barriers and do not or barely influence other barriers.
- *Exogenous barriers* are also not or barely influenced by other barriers, but influence a larger number of other barriers – so, the interdependencies are oriented aware from the barrier to the outside.
- *Endogenous barriers* are the direct opposite to exogenous barriers. They are influenced by several other barriers, but do not influence other barriers themselves – so, the interdependencies are oriented towards the barrier.

- *Dual barriers* finally are influenced by several other barriers and influence several other barriers themselves. The interdependencies are oriented into both directions the same time.

It is advisable to first address the exogenous and then the dual barriers to ensure that the success of the actions that are derived from the identified knowledge barriers is influenced as little as possible from not yet addressed barriers. Ideally, after addressing the exogenous and dual barriers the endogenous and neutral barriers are almost no longer existent.

One example for the exogenous barriers identified in our project is “Lacking trust”. This barrier influences the barriers “Leadership”, “Group dynamic effects”, “differences of ingroup and outgroup” or “culture of withholding knowledge”. If this exogenous barrier is present with one or more of its interdependent barriers first the exogenous barrier should be addressed. Before addressing the other barriers afterwards it should be checked if these barriers still exist.

3.3 Methods for removing barriers

When the barriers that have to be addressed have been determined, one can begin with selecting the measures to take to address them. Therefore, in our kit for each knowledge barrier different possibilities to act are proposed.

In this we distinguish three different types of possible actions based on how quick they can be implemented and which management support is needed to implement them:

- *Instruments* are the simplest kind of possible actions. They can be implemented spontaneously without longer preparation and without larger resources in the context of the daily project work.
- *Measures* are comprehensive and complex actions that need some preparation and take longer to implement.
- *Structural changes* finally represent the most comprehensive category that targets long term changes in the organizational context of the project organization (e.g. by changing the organizational structure, processes or staff reporting systems).

We have collected a list of 35 possible actions, most of them in the category of “measures” (see Figure 3). Every knowledge barrier has been annotated with a list of actions that can be used to remove this barrier. From the set of possible actions that are listed for the knowledge barriers identified and prioritized in Steps 1 and 2 an organization now can select some based on its individual needs (e.g. how quick the actions should lead to results, on which level the measures can or have to be decided, etc.). The actions are therefore checked according to the following three questions:

- How can the effectiveness of the measures be influenced or decreased by existing knowledge barriers?
- In which temporal context the results of the measures will take place?
- How can the identified knowledge barriers be addressed with a minimal (personal, financial, temporal) effort?

Concerning the third question it is important to mention that the actions can support the removing of several knowledge barriers at once. So, the action “moderated dialog” can help to address “subgroups in teams”, “differences of ingroup

and outgroup", "micro politics" and "lacking dialog culture" at the same time – all in short or medium term.

	Individual	Group	Organization	Technology
Instruments	• Professional development • Creativity and learning techniques • Moderation •	• Creativity techniques • Story telling • Skilled discussion • Moderation •		• Weblogs • Wikis • Teamrooms • Document and content management
Measures	• Leadership • Professional development • Lessons learned • Coaching •	• Leadership • Team building / Feedback Confrontation meetings • Inter group team development • Knowledge integration training • Syntegration • Lessons learned • System analysis • Development of a vision •	• Goal clarification • Syntegration • Systems analysis • Community of Practice	• Tagging • Social Networking • Instant Messaging • Mind Mapping • Knowledge maps • Participative tool introduction • Process oriented tool documentation
Structural changes	• Choice of personal • Change of team members and/or team leaders	• Team oriented staff report	• Management by Objectives • Spacial Design	

Fig 3. Methods to remove knowledge barriers

4 Conclusion and Outlook

In this contribution we have briefly presented a method kit that we have developed to address knowledge barriers in project organizations. The main ideas in developing the solution have been:

- Collecting generic barriers from the application domain and structuring the barriers using an extended version of the TOM model
- Description of the knowledge barriers by their symptoms to allow users (e.g. project managers) to identify relevant barriers
- Collecting and structuring generic actions that can be taken to remove knowledge barriers
- Assignment of measures to knowledge barriers
- Presentation of a process model to bring the different bits and pieces together

The method kit allows to identify the knowledge barriers in a particular organizational unit and to select a matching set of actions with different time horizon and different management support needed to implement. With this tool both team and project leaders can address knowledge barriers in their groups and division managers can get suggestions for possible far reaching structural measures.

The study has been done for the CD&E project organization in the German Federal Armed Forces and has been adapted to this particular field. However, the approach and the sub-results are applicable for other organizations in the same way.

Since the support for the analysis of the interdependencies is only an heuristic that has been derived from relevant literature and from the experience in the application domain, in this area an empirical validation seems to be especially sensible. Also the other lists in the kit have to be validated and improved in the practical usage.

Acknowledgements

The study we are reporting about was funded by the German Ministry of Defense (via Zentrum für Transformation der Bundeswehr) - SKZ: CE 41F 7 209 X. In addition to the authors our colleague Sonja Sackmann from Bundeswehr University Munich and her team and several students have contributed to the results. We would also like to thank our project partners at Zentrum für Transformation der Bundeswehr in Ottobrunn and at Zentrum für Weiterentwicklung der Luftwaffe in Köln (Dez Ib).

References

[Bender and Diehl 05] Bender, H. F.; Diehl, J. F.: Wissensmanagement im Wandel. Wissensmanagement, 4, 10-13 (2005)

[Bick et al. 03] Bick, A.; Hanke, T.; Adelsberger, H.H. (2003): Prozessorientierte Analyse der Barrieren der Wissens(ver)teilung. In: Industrie management vol. 3, no 3, 2003, pp. 37-40.

[Bullinger et al. 97] Bullinger, H.-J.; Wörner, K.; Prieto, J: Wissensmanagement heute: Daten, Fakten, Trends (1997)

[Decker et al. 05] Decker, B.; Finke, I.; John, M.; Joisten, M.; Schnalzer, K.; Voigt, S.; Wesoly, M.; Will, M.: Wissen und Information 2005, Fraunhofer IRB Verlag, Stuttgart (2005)

[Eberle 03] Eberle, M.A.: Barrieren und Anreizsysteme im Wissensmanagement und der Software-Wiederverwendung. Studienarbeit, TU Kaiserslautern, Fraunhofer IESE (2003)

[Gomez and Probst 97] Gomez, P.; Probst, G.: Die Praxis des ganzheitlichen Problemlösens: Vernetzt denken, unternehmerisch handeln, persönlich überzeugen. 2., revised Ed. (1997)

[Holtzblatt 02] Holtzblatt, K.: Contextual Design, The Human-Computer Interaction Handbook, Jacko, J.A. and Sears, A. (eds.), pp. 941-963 (2002)

[Kensing and Blomberg 98] Kensing, F.; Blomberg, J.: PD meets CSCW - Issues and Concerns. In Computer Supported Cooperative Work - The Journal of Collaborative Computing, vol. 7, no 3-4,(1998)

[Kremser 07] Kremser, S.G.: Wissensbarrieren bei Projektorganisationen der Bundeswehr aus organisationspsychologischer Sicht. Diplomarbeit, vorgelegt an der Universität der Bundeswehr, Neubiberg (2007)

[Lugger and Kraus 01] Lugger, K.-M.; Kraus H.: Mastering the human barriers in knowledge management. In: Journal of Universal Computer Science 7(6): S. 488-497 (2001)

[Probst et al. 98] Probst, G.; Raub, S.; Romhardt, K.: Wissen Managen. Wie Unternehmen ihre wertvollste Ressource optimal nutzen. 2. Ed. Wiesbaden (1998)

[Rümler 01] Rümler, R. Wissensbarrieren behindern effektives Wissensmanagement. In: Wissensmanagement 5/2001, 24-27 (2001)

[Richter 07] Richter, A.: IT-gestütztes Wissensmanagement. Theorie, Anwendungen und Barrieren (2007)

[Schäfer 06] Schäfer, S.: Concept Development & Experimentation (CD&E) - Eine Einführung. Informationsbroschüre der Luftwaffe (2006)