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Motivational and structural prerequisites of knowledge man- agement

Uwe Wilkesmann

Ingolf Rascher

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**MOTIVATIONAL AND STRUCTURAL PREREQUISITES OF KNOWLEDGE MA-
NAGEMENT**

von

Uwe Wilkesmann und Ingolf Rascher

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Korrespondenzanschrift:

**PD Dr. Uwe Wilkesmann
Ruhr-Universität Bochum
Fakultät für Sozialwissenschaft
Sektion Sozialpsychologie und Sozialanthropologie
GB 04 / 146
D-44780 Bochum**

Telefon 0234 - 32 25416

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Uwe Wilkesmann and Ingolf Rascher
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PD Dr. Uwe Wilkesmann
(during the summer semester: stand-in chairmanship at the University Hamburg)

Ingolf Rascher

Ruhr-University Bochum

Faculty of Social Science

GB 04/146

44780 Bochum

Germany

Uwe.Wilkesmann@ruhr-uni-bochum.de

www.Uwe-Wilkesmann.de

Ingolf.Rascher@ruhr-uni-bochum.de

www.Ingolf-Rascher.de

Motivational and structural prerequisites of knowledge management

Our main question in this paper is: Which motivational and structural prerequisites supports knowledge management? We will develop a theoretical model to answer these questions and illustrate it with three case studies.

1. What is knowledge?

First of all we have to define the term “knowledge management”. The talk about knowledge management has become popular, because knowledge is a fourth element of production. Most modern products incorporate a lot of knowledge. Knowledge has become a competitive advantage. But could we manage knowledge like fund or work? Knowledge is an intangible asset and needs other management tools than tangible assets.

For the further discussion we define the following terms:

Data is the basic material of these process. It is the hard fact: for example the numbers in a balance sheet.

Information puts the data in a sensible context. The person, who perceives the balance sheet, has to know, what the numbers stand for. He has to know, what e.g. 5% profit means. Therefore he has to learn, how to read a balance.

Knowledge perceives the information in a second relation of sense. Is that good or bad, when the company z yields 5% profit? Therefore I have to know the history of company z. Which profit it yield last year? Is it an increase or a decrease? Which profit yield in average with competitors? In general, knowledge is produced, when information is classified by old knowledge. The production of new knowledge is related to the cognition of people and the interaction between people. No software system could create new knowledge.

Another popular differentiation was found by Polanyi (1966). He distinguished between **tacit** and **explicit knowledge**. Explicit knowledge is cognitive, can be expressed in formal speech and exchanged by data. Tacit knowledge is individual, context related, analogous, practice related knowledge. Tacit knowledge can be exchanged only in face-to-face situations.

With regard to knowledge one more distinction is relevant. Hansen, Nohria and Tierney (1999) distinguish between a personalization approach and a codification approach. Knowledge could be exchanged in face-to-face situations or personal knowledge from many individuals could be captured and stored in database for reuse by many others.

Knowledge management is analysed in different ways and functions. At our point of view there exists two *main* functions of internal knowledge management in organizations¹:

1. Development and implementation of new knowledge
2. Storage, use, and reuse of new knowledge.

2. Development and implementation of new knowledge

First of all new knowledge has to be developed in organizations, therefore a model of collective innovation-learning in organizations is presented. In this model conditions of possibility concerning games of innovation are discussed. Thus structural conditions are analysed which have to be fulfilled, if organizations are to succeed. The main thesis of this model can be shown with the help of the following figure (fig 1)²:

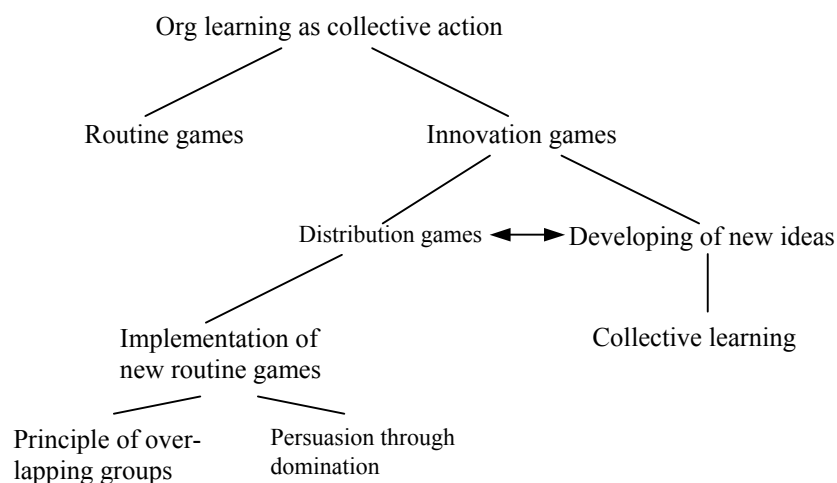


Fig 1

Organizational learning is first of all neither individual learning nor learning of a „super subject“. It's a form of collective action. When we think about generating new knowledge, we primarily think about the individual learning process. Mrs. Smith is learning, when she is learning how to use a new software program. But this is totally irrelevant for the whole company.

Individual learning is described in the psychological concepts of classical conditioning, operante conditioning and social learning. For organization studies only the last two concepts

¹ The model we discuss makes only sense in big companies.

² For the first chapter see Wilkesmann 1999.

are relevant. In a classical hierarchy the superior has to evaluate the inferior. If I want to make a carrier, I better do what my boss wants, despite of what I think about his assignments. Thus learning routines will be established. This is not only the case in a classical hierarchy but also true with all selective incentives. For example pay by performance will produce the same learning routines. If there exists incentives for the number of insurance policies I have sold, the only action that counts is to reach a high number of sold insurance policies, nothing else, not the quality nor the information or communication with the customer. With individual learning only simple problems are solved.

But much more relevant is **collective learning in groups**. There we can solve complex problems. Complex problems are defined as problems

1. which could not be solved with the information of only one person,
2. without criteria for a „right“ solution,
3. without a well known solution-path and
4. if the necessary adaptation steps are unknown.

Complex problems could only be solved in collective learning situations. Collective learning is defined as a situation, where all persons exchange different perspectives and afterwards integrate into one solution. Therefore input and process variables are relevant. An input variable is for example knowledge or skill, the process variable is the group-interaction.

The structural conditions under collective learning succeed are: small groups, low power differences between the actors, long-range interactions and second-level-communications.

A well known example for that is a project-group.

The assumption of low power differences means not, that all members are equal. But all members have to gain recognition as experts. Collective learning needs interaction between group members. Communication problems have to be solved by second-level-communication. In different types of project-groups we analysed, project-groups with second-level-communications about the claims of truth and legitimacy³ reached more often a consensual solution than the ones without second-level-communication (Wilkesmann 1999).

The main prerequisite for collective learning is the development of a leeway, where members could learn together.

The term **organizational learning** doesn't tell us anything about a super person, a cognitive brain of the organization. We define organizational learning as the implementation of new routines through new selective incentives, new structures or new organizational culture.

³ Communicative action (Habermas 1981) generates through the three types of validity claims of the speech acts (truth, legitimacy, truthfulness).

How are the three terms of learning linked together?

Collective and organizational learning is part of an *innovation game*. Organizations mostly produce goods or services and not innovations. The production is structured by the *routine games* (that is what organization do most of the time). All members know, what they have to do. Routine games reproduce the organization structures. As aforementioned routine games structure the individual learning process. They also define the frames of every day negotiations, because they assign power resources to members. These rules of every day negotiations are defined by the top management. The frames or constraints of routine games are caused by that rules. Innovation games rearrange these rules (Courpasson 2000). They develop new rules for new routine games.

The innovation games must be differentiated in *distribution games* and *developing new ideas*. Collective learning is mostly developing new knowledge, like scientific discourses. In the collective learning situation we develop new ideas for organizational problems (for example: How can we produce faster? How can we drop in the market of e-commerce?). But new solutions can change the power and domination relation in the organization. If a new product is launched, the skills for producing the old product are superfluous. All members who own that old skills will lose their power resources.

The relevant factor in distribution games is power. Power of actors is related to the control of valuable resources, which other actors are interested in (Coleman 1990). The more power an actor owns, the more interest he enforce. If all actors in a group are (more or less) equally powerful, a cooperative solution could be reached. If one actor has more power, a strategic bargaining process will occur. A cooperative solution of the distribution game is impossible. Nevertheless, theoretically there is a win-win-solution possible, but the costs of the solution have to be paid by the powerless actor.

We can recap under the structural prerequisites of collective learning is a cooperative solution of a distribution game possible too.

All we have discussed up to now belongs to small groups (for example task groups). The solutions of the collective learning process has to be transformed in organizational learning. The new solutions (created in a project group) have to be implemented in the whole organization. Two ideal type forms of implementation of new routine games are possible, that transform collective into organizational learning: the principle of overlapping groups and persuasion through domination. The first principle describe a set of project groups, where the main group distribute tasks to subgroups. The subgroup leaders a members of the main group. There exists a hierarchy of the groups: the main group define the problems and control the schedule

(for example the milestones and the deadline). Implementation through domination means: the hierarchy of the organization enforces the solution. The members have no voice-option.

3. Motivational prerequisites of developing and implementing new knowledge:

The structural prerequisites render possible collective and organisational learning. To sustain the process, members have to be motivated too. How could we manage the motivation of the members in collective learning situations?

There exists three main problems of motivation in collective learning situations:

1. Collective learning could not be perceived from an **external point of view**. The superior can't monitor the learning process in a project-group. Are the skills of member A more important to attain the goal than the skills of member B? Is member A as a moderator more involved in the group interaction than member B? Is member C a free-rider? Nobody from an external point of view can decide these questions.
2. The problem of **multiple tasking**. In working tasks with complex problems all employees have to do a lot of tasks. Every selective incentive rewards only one task. A rational actor will than only reach that single task, all other tasks will be neglected (Frey/Osterloh 2002). On the other side you can't confer on 15 incentives. It's too complex and every action will than be rewarded.
3. The **free-rider problem**: Why should I share my knowledge with other people? My knowledge is my power-resource. Despite of all cheap talk about knowledge management, I'm not interested in sharing my knowledge. I need my knowledge to develop my own carrier and I'm not interested in developing the carrier of my co-workers. I would only share my knowledge, if I expect rewards. Thus let the others develop new knowledge, I'm free-riding.

These problems could only be overcome by intrinsic motivation. Intrinsic motivation is defined by Heckhausen as follows:

“Action is intrinsic if the means (the act) thematically corresponds to its ends (the action goal); in other words, when the goal is thematically identical with the action, so that it is carried out for the sake of its own objectives. For example, achievement behavior is intrinsic if it is engaged in merely to accomplish a desired outcome, because it solves a problem or leads to a self-evaluation of competence. Here, the outcome, a particular accomplishment, is not a means toward some other nonachievement-related end.” (Heckhausen 1991: 406)

Considering that intrinsic motivation is no selective incentive, nobody can induce it. Even though structural prerequisites can be arranged in order that probably intrinsic motivation is induced. The work psychological research can be summarized that there exists a positive correlation between a wide leeway of action and intrinsic motivation. A wide leeway is defined as work enrichment, to do a task from the beginning to the end, and to decide by yourself over the work schedule (self-supervision).

Hackman and Oldham (1980) analysed the relation between five core dimensions and the occurrence of intrinsic motivation. The core dimensions are:

1. skill variety: "The degree to which a job requires a variety of different activities in carrying out the work, involving the user of a number of different skills and talents of the person." (Hackman/Oldham 1980: 78)
2. task identity: "The degree to which a job requires completion of a "whole" and identifiable piece of work, that is, doing a job from beginning to end with a visible outcome." (Hackman/Oldham 1980: 78)
3. task significance: "The degree to which the job has a substantial impact on lives of other people, whether those people are in the immediate organization or in the world at large." (Hackman/Oldham 1980: 79)
4. autonomy: "The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and determining the procedures to be used in carrying it out." (Hackman/Oldham 1980: 79)
5. job feedback: "The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance." (Hackman/Oldham 1980: 80)

For Hackman and Oldham there exist three individual dispositions caused by different attribution processes: knowledge and skill, growth need strength, and context satisfaction. If employees fulfil these individual dispositions and if they work in an above defined situation, they will develop intrinsic motivation with a very high probability.

The structure of collective learning (see above) fulfil the five dimension: For example a project group is defined with high task identity. Complex problems secure skill variety, the existence of the project-group is a sign of high task significance, they mostly work with a high degree of autonomy and will have job feedback, when their solution will work or not, thus intrinsic motivation is supported.

Up to now we have discussed the development of new knowledge in organizations. The face-to-face situation is here very important. Implicit knowledge could be exchanged too. The

other very important function for internal knowledge management is the storage, use and reuse of the new knowledge. It is not very efficient, when a lot of project-groups develop new knowledge, but all other employees couldn't use it.

4. Storage, use, and reuse of new knowledge

If every employee should use the new knowledge, it has to be stored and made accessible for everyone. Different types of storage and internal channels of communication exist: report papers, dossiers, personal memory, but also newspapers, bulletin boards and routines. Here a current channel is analysed, the database.

There exist two problems by using a database:

1. The free-rider-problem: Knowledge is power. And I don't share my power. These problems will be discussed in detail in the next section.
2. User satisfaction and perceived usefulness of a database.

The second problem is analysed in a treatise on user satisfaction of intranets by Phelps and Mok (1999). They hypothesize a positive correlation between user satisfaction on one side and

- the management support for the intranet,
- perception of user involvement in intranet implementation,
- perceived usefulness of the intranet,
- ease of use of an intranet,
- availability and accessibility of the intranet,
- information accuracy and reliability in the intranet on the other side.

The empirical study was based in Singapore (but with a small number of persons) and the six hypothesis were verified. Especially the perceived usefulness and the perceived ease of use are very closely related to the user satisfaction.

4.1 The dilemma of data storage

The storage of knowledge is a prisoner's dilemma. We characterize it as a two person dilemma. The cooperative strategy illustrated below means to put data in the database. The defective strategy is not to put data in the database (fig. 2). Defection could mean too, to put not all the data in, so that the user couldn't understand the document without additional information from the author.

employee I	employee II		
		puts in	does not put in
	puts in	R / R	S / T
	does not put in	T / S	P / P

Fig. 2: PD of storage knowledge in a database

The reward is: $T > R > P > S$ and $R > T+S/2$

If both players put data in the database, they could use it mutually. Both of them get new information, thus they yield a reward of R. If employee I doesn't put his data in the database, but employee II does it, the first one receives the highest reward (T), he is a free-rider: He doesn't share his knowledge, thus he could use it in strategic bargaining situations to make a career for himself and will not spend time on putting data in. Moreover he can use the information of employee II. Employee II yields the lowest reward (S), because he spent time on putting the data in, share his knowledge with employee I and thus he loses his most important resource of power. Employee I for example could use the information of employee II to create an important presentation for the board, which pushes his career further. If both defect, the database wouldn't work (P).

The prisoner's dilemma doesn't occur by all database. We have to distinguish between different types of database.

4.2 Types of database

The following types can be distinguished:

1. technical database: Here the data is necessary to control the production process. The first case study illustrates it. The production process will be structured by the data, thus no prisoner's dilemma is expected. Despite of the necessity of the data, the database in the case study isn't up to date.
2. service database: All users have to *voluntarily* put the data in. The content of the database could be for example: results from project-groups; consulting experience and solutions, so that the same consulting process could be sold twice; urgent requests from sales personnel, if a new customer solution exists or someone in other countries has developed something like that; exchange from experience in newsgroups etc. The

prisoner's dilemma will occur at this type. Case study two and three will be an example for that.

3. process database: By this type the data input is *not voluntary*. The database is only used to monitor a project. All milestones and minutes are stored. Only the project-group members can use it. The prisoner's dilemma will probably not occur.
4. meta database: This type is only a technical solution, it's a search machine over different databases, like yahoo in the internet.
5. yellow pages/skill database: This is a subtype of no. 2 (service database) which contains only personal data from all employees. I can search there for a person with special skills, which I need for example to solve my computer problems. The special problem here is, which personal data should the database contain and which not. If the data input is voluntary, the prisoner's dilemma could occur.

The prisoner's dilemma of stored knowledge in database could be solved by intrinsic motivation, external interventions and routines.

4.3 How to overcome the prisoner's dilemma?

4.3.1. Intrinsic motivation

The first possible solution of the prisoner's dilemma is by intrinsic motivation (see the aforementioned definition from Heckhausen 1991). In the case of intrinsic motivation, the prisoner's dilemma will not occur. The cooperative strategy is dominant. At this point of view, it is fun to join the database and to put data in. The actor does not calculate the later rewards, he derives benefit from doing it. Intrinsic motivation is closely related to small groups in the organization, which are organized by specific themes, skills etc. They are well known in the literature as communities of practise (Lave/Wenger 1991) or – we will call them - knowledge communities. “A Community of Practice is a group of people who are linked together by a common ability or a shared interest, and consequently possess common practical experience, specialist information and intuitive knowledge. They share information, experience and insights and are supported by various tools” (Enkel/Heinold/Hofer-Alfeis/Wicki 2000: 87). Their primary interest is a practical solution. Therefore they need only the function of storage, use and reuse of knowledge. Knowledge communities are defined as people with a shared interest, which voluntarily generate and exchange new knowledge over long-range interactions. Their primary interest is generating new knowledge for innovation. Knowledge com-

munities are necessary for creating an efficient bottom up implementation process. Thus database has to be planned and introduced by the help of knowledge communities. Otherwise the database is not to be used because of wrong anticipated needs.

Employees could develop intrinsic motivation, even though their action doesn't support the goal attainment of the whole company, because of different goals. The individual goals do not coincide with the company's goal. The individual could be intrinsically motivated, but only for his private preferences within his job. These actions are not efficient for the company. Therefore we need external interventions too (Frey/Osterloh 2002).

4.3.2 External Intervention

The management can intervene as a third actor in the prisoner's dilemma. It could reward the cooperative strategy with an extra bonus X. The rewards for the cooperative strategy will be changed like that (fig. 3):

	employee II		
		puts in	does not put in
employee I	puts in	$R + X / R + X$	$S + X / T$
	does not put in	$T / S + X$	P / P

Fig. 3: PD of storage knowledge in a database with external intervention

The cooperative strategy will be individualistically dominant, if $X \geq T - R$. And if X is added to the rewards R and S, the order of rewards are: $R > T > S > P$. It is a mix of assurance and chicken game.

At the company's point of view it is also efficient to confer a bonus, because the dilemma is overcome and all employees put their data in the database. The function of storage, use, reuse, and perhaps of developing new knowledge is fulfilled. The company doesn't reinvent the wheel. Knowledge is there, where it is needed. Not only the contributor ("giver of knowledge") has to be rewarded but also the re-user ("taker of knowledge"; see Gibbert/Jonczyk/Völpel 2000). The evaluation and monitoring process for that can be constructed on the analogy of the evaluation process by the well known internet auction company E-Bay.

External rewards⁴ can be books, mobile phones, holidays. But there are some problems with such selective incentives:

1. They can produce an expecting cycle (see Frey/Osterloh 2002). If I receive a reward of Z this year, I will expect a reward of Z + X next year.
2. The problem of multiple tasking: “If a company pays its employees on the basis of targets (e.g. sales and customer satisfaction) and the targets in question vary in terms of the ease with which they can be quantified (for instance, sales can be measured more easily and clearly than customer satisfaction), then extrinsically motivated employees will concentrate on those areas which can best be measured. Activities which are less easily quantifiable will be neglected.” (Frey/Osterloh 2002: 19)
3. External interventions may not enhance intrinsic motivation every time. Considering the problem of crowding-out effect (over justification; see Heckhausen 1991: 408), external interventions decrease motivation. Extrinsic incentives could destroy intrinsic motivation. The hidden cost of reward are based on three psychological processes (Frey 1997: 16-17):
 - Impaired Self-Determination: When people are intrinsic motivated, the locus of control shifted by external rewards from inside to the outside. They no longer feel responsible themselves, but make the actor, who gives the rewards, responsible for the action.
 - Impaired Self-Esteem: The recognition of the action of intrinsically motivated personnel could be neglect by external rewards, because the rewards denied the primary motivation. Person could attribute, that their original action was not good enough.
 - Impaired Expression Possibility: External rewards could deprive of exhibit intrinsic motivation to other employees.

Frey (1997) recap, under which condition the crowding out effect appears: “(1) External interventions *crowd out* intrinsic motivation if the individuals affected perceive them to be *controlling*. In that case, self-determination, self-esteem and the possibility for expression suffer, and the individuals react by reducing their intrinsic motivation in

⁴ “Conversely, behavior is extrinsic when the means (action) and the ends (action goals) are thematically incongruent; when the goal is thematically different, and the action and its outcome constitute a means for bringing about a different kind of goal. The means character is merely external and essentially arbitrarily selected. For example, aggression is extrinsic if one attacks people not to do injury (that would be intrinsic) but to rob them. Aggression research calls this “instrumental” aggression, which should not be confused with actual (i.e., in our terms, intrinsic) aggression.” (Heckhausen 1991: 406)

the activity controlled. (2) External interventions *crowd in* intrinsic motivation if the individuals concerned perceive it as *supportive*. In that case, self-esteem is fostered, and individuals feel that they are given more freedom to act, thus enlarging self-determination.” (Frey 1997: 18)

The following incentives are important and do not induce the crowding-out effect:

- The **social status** (all other employees see you as an expert)
- The **perception of usefulness** (that belongs to the norm of reciprocity)

In general exists some necessities for the use of database:

- The **critical mass** of data (not to less findings)
- The **quality** of the information
- The **amounts of findings** (not to much findings)
- The **time you need** to find information
- In most organizations there exist a selective punishment, because the employees have no time to put the information in the database (the employees rewarded by performance related pay of accounts)

All these points will be supported, if the perception of user involvement in database implementation is high and thus a community of practice will be developed.

Sometimes selective incentives are useful, e.g. when a critical mass of data has to be reached.

The quantity of data can be very easily rewarded by selective incentives.

4.3.3 Routines

Another solution of the prisoner’s dilemma could be routines. A routine in this sense is habitual action⁵. It is a general decision for the cooperative strategy. For example I have made the general decision to brush my teeth and I don’t decide it every morning again. It describes the difference between constraints and choices (Elster 1979). Constraints can be rearranged and do open a new leeway of choices. Like Ulysses decided to hear the singing of the sirens. This possibility was only generated by binding himself at the mast.

Routines direct expectations into a defined path. They produce security. The general decision to put data in the database create new constraints, which relieve the actor of permanent new decisions. But that routines could only occur by one type of database: technical database.

⁵ In contrary to routine games, which describe a path of action.

Only technical data can be fulfilled in categories by routines. Creativity and innovation can't be realized by routines. In the first case study the problems by lack of routines will be shown.

5. Case studies

In this chapter, three databases from the authors' operational case studies are presented. Hereby, individual problems and possible solutions can be demonstrated⁶. We'll show, that knowledge management only succeeds, if both strategies, personalization and codification, would come together and recap, that knowledge can't be managed. Only structures and frames could be modified.

5.1 A technical database

The first case study presents a technical database which contains data of all passenger transport vehicles in one of Europe's largest transport services company. For each vehicle, the database contains information e.g. relating to its home location, its technical equipment and its operational usability. Via additional software tools, individual evaluations regarding the vehicle status as well as the planning and monitoring of maintenance and special tasks can be carried out. Through a series of interfaces the database delivers vehicle data to further systems which require these information for several planning, operating or controlling tasks. The database was established in 1995/96. The actual use of the database started in March 1999 after integration of the employees in the network and their training. Maintenance facilities and some central controlling units are connected to the network. In 1996, about 150 users (workstations) were integrated, in 2000, there were about 350. The entire system of maintenance and services is handled via the database. As soon as a vehicle undergoes maintenance services, the database has to be checked for possible specifications given by the head office (e.g. all doorsteps have to be strengthened) and any repair measures have to be entered (e.g. door replaced). Thus, the exact maintenance status of each vehicle should theoretically be available at any time. However, the service personnel is not concretely instructed to always update the entire data. For each vehicle, the database contains approx. 200 technical and operational features, thus the updating of the data is quite time-consuming. Service personnel frequently does not understand why so many data have to be updated. Therefore, most of them declare only their own maintenance services carried out.

⁶ The project is supported by the German worker union foundation.

Many superiors do not monitor the data administration. Even if they know, that tasks are not fulfilled properly within the section, sanctions are not imposed. However, the database is of technical nature - i.e. the data is necessary for the work routine of many employees in the company, therefore an unofficial database is developed besides the official one. Here, at least the most important data (which is far less than the prescribed 200 sets per vehicle) are updated on a regular basis to gain an overview on the disposable vehicles. We theoretically hypothesize, that in the case of a technical database the prisoner's dilemma will not occur, but it does. Therefore we need a routine to overcome the dilemma.

5.2 A service database from the Sales area

Within the context of an extensive organizational development concept, in summer 1998 the question of how teams can co-operate more efficiently and how exchange of information concerning its collection and improvement of quality can be organized, was discussed in the company, in which the analyzed database is located. In particular, the question was raised where one could have learned from each other if one had only known from each other. "The Boston Consulting Group" was instructed to develop an appropriate concept. The results lead to the establishment of an extensive database.

The examined database is an interactive knowledge management tool which is intended to show global available information from the focal areas marketing and sales. In a first step, the development team was instructed to create "maps" of the required sales solutions and to identify important categories of business processes. They focused on local activities on a common market. In the beginning, solution items were evaluated by local project-teams in order to forward them to the employees later on. The focusing on local activities was important, because proceedings within an industrial sector – e.g. telecommunication – in different countries are subject to different requirements and solutions.

On one hand, "best practice"-solutions are stored and put at the disposal of all other users. The database is, however, more than only a document management system. It is deemed to be an interactive medium for the current daily work. All information about markets, customers, competitors, technologies, partner knowledge and strategic alliances is made available to all users in a functional, technical system. The analyzed database serves also the purposes of finding necessary experts world-wide and giving appropriate context-related recommendations for further actions. The system can be used world-wide by approx. 12000 users. Additionally, 58 different discussion boards for special problems from the department existed at

the time of the first evaluation. The database's most frequently used function is the urgent request. Hereby all employees, in particular external sales personnel attending to customers, can place the urgent requests which are answered by colleagues within the shortest time possible. For example, a salesman can ask if technical specifications requested by a customer can be developed at all or have already been developed in another country.

Regarding the question we discussed here, this database comprises of three special features:

1. The input of documents and questions into the database is rewarded by a special incentive system.
2. In addition to computer-based communication, the knowledge community is directly promoted by face to face communication.
3. The efficiency of the database is monitored by a controlling tool.

To ensure sufficient input of data, information and inquiries into the database and to encourage the answering of questions and the use of data, an incentive system was developed. This incentive system is intended not only to reward the use of the database, but also to enable ratings on the quality of the stored documents and responses on urgent requests⁷. Therefore, credits are assigned in accordance with a determined guideline. In principle, urgent requests are rewarded by three credits.

The content quality of a response can be rated by the questioning person with up to additional five credits which presently are multiplied by two to emphasize the meaning of the quality rating. Within the rating of stored documents, the credits achieved are even multiplied by 10. If an object has twice received a zero rating, it is removed from the current data stock and moved to a file archive where it remains available. The document's author is informed about this measure. At a certain point of time, the collected credits are converted in prices. Depending on the credit amount, the following prices are issued: Technical/economical literature, various new mobile phones, job training offers and trips to colleagues in other branch offices with whom larger amounts of information have been exchanged. Face-to-face communication is hereby intended to be encouraged in addition to the purposes of a vacation.

Through extrinsic incentives, the critical mass of data and a mutual quality controlling shall be achieved⁸.

⁷ The need for information in complex and dynamic competition systems is constantly growing. Therefore, information must always be recent, complete and relevant. Especially the recently developing information economy has to deal with the issues of task relevance and the target orientation of information as well as the degree of safety, reliability, verifiability and topicality.

⁸ At the congress we will present some quantitative data regarding this topic, especially regarding the relation of intrinsic motivation and extrinsic rewards.

A second instrument also serves the stabilization of face-to-face communication: These 10 to 15 employees who frequently communicated in a discussion board shall be invited to a three days workshop in the near future. Here they can continue to discuss their issues, but shall mainly meet personally in order to build up more confidence and to stabilize the interaction relations. Thus, vital issues can be furthered and knowledge communities can be strengthened. Additionally, a controlling tool for the database has been established. The turnover created by products/projects initialized via the database is recorded. In target agreements, the required turnover is newly determined each year.

We ask in an online questionnaire the users of this database about their intrinsic and extrinsic motivation and about their leeway of action⁹. The questionnaire is divided in eight parts. The first part regards to the socio-demographic data, the second and the third part is built up of items which belongs to the five core dimensions of Hackman and Oldham (see above). First we ask about the leeway of the everyday work, than about the special work with the database. Thus we can compare the values of the five core dimensions from everyday work and the work with the database. The items of the fourth part describes the organization structure, the items of the fifth part inquires about intrinsic and extrinsic motivation, the sixth part is about the work situation, the seventh part about attitudes towards the knowledge management and the last part is about some general attitudes towards the database.

First of all we have to recognize that the inquired employees are sales personnel. The sales branch excels as a branch with a culture regarding very high relations to extrinsic rewards. Therefore we ask the question: "What do you consider the primary incentive for sharing knowledge in the database? (Please choose only one)". Most of the inquired employees answered, that they share their knowledge, because their company needs their joint effort to remain competitive (see fig. 4).

⁹ It is a still ongoing questionnaire. We only present here a trend report.

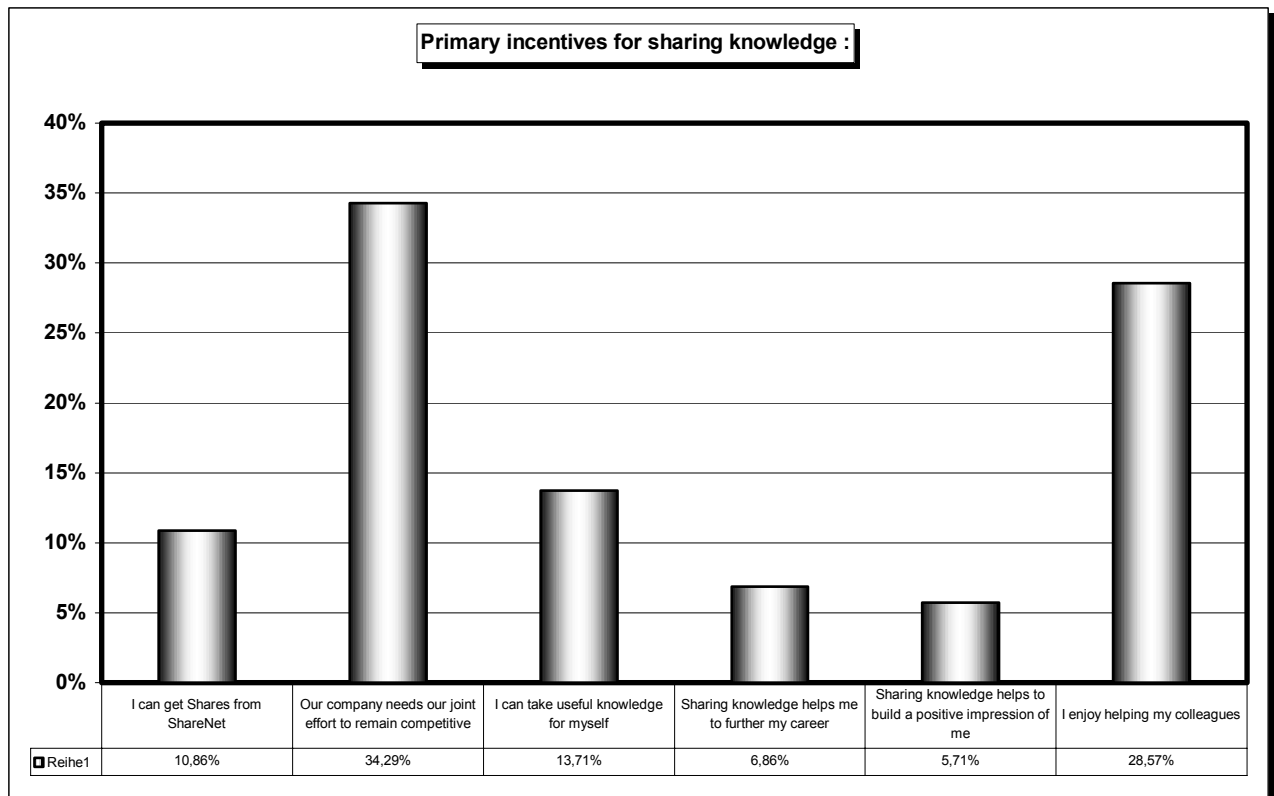


Fig 4: Primary incentives for sharing knowledge

For this trend report we used the data of 180 questionnaires. The employees who had answered the questionnaire were 87,2% male and 11,8% female. At the age of 21 to 30 years there were 36%, from 31 to 45 years 51,6% and from 46 to 60 years 12,4%. This is representative for the employees in this case study.

First the items of leeway of actions for everyday work and the work with the database are compared. It is shown that the leeway of everyday work is recognized a little bit greater than the leeway of the work with the database (see fig. 5)¹⁰.

¹⁰ In average they differ about 0,6 points.

Item No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Everyday work													
mean	6,17	4,80	5,57	6,04	4,16	5,90	4,12	4,20	5,91	5,35	5,81	4,33	4,45
Stand. derivation	0,89	1,67	1,01	1,1	1,65	0,95	1,66	1,46	0,97	1,28	0,99	1,8	1,57
Signifikanz (2-Seitig)	0,870	0,000	0,000	0,011	0,000	0,001	0,521	0,854	0,323	0,087	0,009	0,000	0,000
Work with the database													
mean	6,17	3,42	3,13	5,79	2,98	5,42	4,19	4,19	5,84	5,27	5,5	3,85	3,74
Stand. derivation	0,89	2,12	1,97	1,1	1,93	1,64	1,48	1,41	0,95	1,33	1,3	1,76	1,64

Items (work with the database – the everyday work items are nearly the same):

- 1) I need a variety of specific knowledge and skills for my activities
- 2) I was well trained with the database.
- 3) I feel sufficiently involved in the development of the database.
- 4) I feel responsible for my assignment.
- 5) I am involved in the efforts to improve database which effects my working place.
- 6) How significant or important do you consider your position at the database for the company.
- 7) My superiors or colleagues rarely give me feedback concerning the quality of my work.
- 8) I feel payed off fairly for my contribution to the database.
- 9) I can decide to manage my tasks in a certain order.
- 10) I have a clearly defined job description.

Fig 5: Leeway of action for everyday work and work with the database

Another interesting result is the verification of the well known phenomenon that the employees who feel sufficiently involved in the development of the database are highly intrinsic motivated.

In a next step the answers of the items towards the leeway of action working with the database and the answers to the motivation items are analyzed. Therefore a factor analyze reduced the complexity.

The factor analysis over the items of the leeway of action working with the database forms other dimensions than the core dimensions of Hackman and Oldham (see appendix fig 1). By only a mediocre KMO-value of 0,63 and an explained variance of 60%, the first factor loads very high over the items of identity, feedback, autonomy and a fair pay. The second factor loads over the items of autonomy and significance for the company. The third factor explains only that there is no feedback and the fourth factor describes an expert in the database.

The factor analysis over the items of motivation also produces four factors by a mediocre KMO-value of 0,6 and an explained variance of 69%. The first factor describes very good the

extrinsic motivation. The second factor can be called an adaptive motivation. These persons never hesitate sharing their knowledge with colleagues and agree with the policy how the extrinsic rewards are assigned and there are the only ones who strongly disagree with the assumption that with rewards superiors had a better control over their performance. The third factor describes employees who are as well intrinsic as extrinsic motivated and the fourth factor describes intrinsic motivated people who fear about control from superiors through the incentives.

To analyze the relation between the leeway and the motivation the factors are correlated with each other. It is shown that the extrinsically and intrinsically motivated employees also agree on one side to the assumptions of identity, feedback, autonomy and fair pay and on the other side to autonomy, significance of their work with the database for the company. Thus there is a positive correlation between the Hackman and Oldham core dimensions and the extrinsically and intrinsically motivated people. Experts are extrinsic motivated and – as we expect too - the extrinsic factor is negatively correlated to the autonomy and significant factor. Only the adaptive motivation is not easy to explain. The factor is positively correlated to the factor of identity, feedback, autonomy and fair pay, but negatively correlated to the factor autonomy and significance for the company. The negative correlation belongs mostly to the item that these employees attribute their work as *not* important for the whole company. These are employees which are not very highly motivated and their attitude towards their own work is not very high. They adapt to the situation without being highly engaged (see fig. 6).

		identity feedback autonomy fair pay	autonomy significance for company	without feedback	expert
extrinsic motivation	Pearson	-,098	-,214**	,142	,213**
adaptive motivation	Pearson	,365**	-,398**	-,182*	-,128
extrinsic and intrinsic motivation	Pearson	,464**	,371**	,067	,007
intrinsic motivation	Pearson	-,068	-,058	,182*	-,022

** The correlation is significant at the level of 0,01.

* The correlation is significant at the level of 0,05.

Fig 6: Correlations between the motivation factors and the leeway of action factors

5.3 A service database from the consulting business area

The examined consulting company was looking for a way to put information at the disposal of all employees. Thus, the company founder started a project in which solutions were investiga-

ted. As a result the analyzed database came into existence. In the first phase of the project, all of the company's data were collected in the base. Now, in the second phase, the database is intended to be continuously improved. As a goal, the company shall be transformed into a learning organization.

A further product of the Knowledge Management Initiative was the obligation to adhere more strictly to the rules of the Project Management Method. At present, it is an integral part of project work that project-related documents are stored in the database. The further development of the database in the context of the Knowledge Management Initiative looks as follows: The single areas must store old data in the database on a self-responsible basis. Persons in charge have to be assigned for this.

The database has been developed by the company itself and only a browser is necessary on the clients side. Therefore, only low software costs incurred for the company. The database has already been used for several years and is constantly improved¹¹. In order to ensure an effective use of the database by the German subsidiary, adjustments were necessary at several times. One result of our investigation was, that German employees had difficulties to adopt their data to the structure created by employees from other countries. The structure very much adhered to American conditions. Also, the majority of all documents had been stored by Americans. Nevertheless, the special problems of a Texas company's consultant are of little interest for a German consultant. German employees rather look for transferable concepts from similar economical and legal contexts which can be applied to German companies only with small modifications.

Already the old version of the database was prize-winning several times in America. Our experts' meetings and interviews with the users, however, revealed that German employees (autumn 2000) nevertheless did not use the system, because they could not get familiar with the structure. Despite this the extensive innovations, which at present are not yet completed, already show that also for German employees an information database is now made available, which meets their requirements. Also in this company, knowledge management is regarded rather from a technical point of view.

The purpose which the "knowledge" is needed for, is the focus of attention. The functions of the database embody this aspect: Recording of dispositions, procurement of the data required for production proceedings, management and storage of data, organization of applications of the information as well as the transfer of the data to the employees. Special incentives for the

¹¹ Our first investigations and the interviews were based on the version from autumn 2000 which has been replaced meanwhile.

input of data and use of the database have not been created so far. Data or documents from German consultants can hardly be found in the database. Even the stored documents are partially subject to defection strategy since the data or documents are only stored incompletely. One can frequently find non-commented PowerPoint presentations in the database which cannot be understood without special comments. An inquiry regarding the author is always necessary to understand the documents.

6. Summary

The initial question can clearly be answered with “no”: Knowledge cannot be managed. But it is possible to create context conditions which enable and further the exchange of information. For the development of knowledge exists structural conditions under collective learning succeed. These are small groups, low power differences between the actors, long-range interactions and second-level-communications. Management could create such leeways. For the function of storage, use, and reuse of new knowledge, databases fulfil an assisting function; they are tools for the transmission and collection of information. To ensure the fulfillment of this function, organizational and motivation-related prerequisites must be observed. This is the only way to overcome the dilemma of data input. Intrinsic motivation and routines can be previous solutions to the dilemma. Extrinsic incentives are partly able to further the providing of a critical mass of data.

Although the dilemma of data input should not occur in a technical database, it exists - in a reduced form, though. The maintenance service personnel from example one only takes notice of the non-recompensed expenditure of time for data administration.

Appropriate incentives which compensate this additional expenditure or clear responsibilities do not exist. The employees who strongly depend on the data in processing their orders accept the additional work to run their own database which provides a more reliable data quality.

Extrinsic motivation factors are used in the example of the service database from the sales department. However, these factors are mainly used to ensure the providing of a critical mass of data to the database to help the users in finding useful information. In addition, the rating of quality is supported by incentives. This is the only possibility to prevent the storage of documents without any content.

The last case study gives evidence of the fact that the structure of a database must correspond to the reception habits of its users. The collection of data alone is not helpful to a user. He must also be able to find data aiming to the purpose of their intended use.

However, the structure of the database and the incentives for data input must necessarily be influenced by the users. Otherwise, data is worthless or the adhering incentives do not have any effect. Consequently, structures which encourage the establishment of knowledge communities have always to be included in the implementation process. Only by setting up such structures, a context-related control of knowledge via databases will be possible. Otherwise, databases will remain data graveyards - even if they are operated by the best technical equipment.

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Appendix

Komponentenmatrix^a

	Komponente			
	1	2	3	4
I need a variety of specific knowledge and skills for my activities	,121	,340	-,345	,510
I was well trained with ShareNet.	,595	,181	,136	,494
I feel sufficiently involved in the development of ShareNet	,767	-,408	-3,56E-02	7,284E-02
I feel responsible for my assignment.	,462	,346	-,596	7,204E-02
I am involved in the efforts to improve ShareNet which effect my working place.	,704	-,462	8,009E-02	,144
How significant or important do you consider your position at ShareNet for the company.	,242	,614	,454	,167
My superiors or colleagues rarely give me feedback concerning the quality of my work.	-,128	,186	,585	,359
I feel payed off fairly for my contribution to ShareNet.	,422	,197	,296	-,544
I can decide to manage my tasks in a certain order.	,443	,328	-,517	-,282
I have a clearly defined job description.	,301	,490	1,085E-02	8,516E-03
I'm able to manage all activities, which belong to my assignment to ShareNet.	,359	,473	,204	-,335
I am included in specifying goal-agreements.	,572	-,341	-1,13E-03	,149
Working with ShareNet shows me how well I did - independently of my coworker`s and superior`s feedback.	,719	-,204	,280	-,214

Extraktionsmethode: Hauptkomponentenanalyse.

a. 4 Komponenten extrahiert

fig 1: factor analysis over the items about the leeway of action

Komponentenmatrix^a

	Komponente			
	1	2	3	4
Co-workers are rewarded with Shares, if they pass on knowledge.	,207	-,321	,742	8,754E-03
I never hesitate helping colleagues with my experiences.	-,419	,367	,425	-1,45E-02
I agree with the policy of how the Shares are assigned.	-3,31E-02	,497	,706	-7,97E-03
For stronger motivation the Shares should be increased regularly.	,794	,219	-6,80E-02	,146
Additional Shares encourage me to set higher goals.	,814	,283	,115	5,896E-02
I believe that Shares motivate my colleagues to be more concerned about their own benefit.	3,300E-02	-,827	7,644E-02	2,384E-02
Instead of giving Shares my superiors should let me know how satisfied they are with my performance.	-,546	-,231	,168	,563
I am happy with receiving Shares as an additional reward, but however do not find it necessarily to motivate me.	-,127	,495	-,239	,663
If Shares are assigned, the superiors have better control over my performance.	,456	-,447	,147	,481

Extraktionsmethode: Hauptkomponentenanalyse.

a. 4 Komponenten extrahiert

fig 2: factor analysis over the items of motivation