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Consideration of Dynamics in Knowledge Prioritization Preparing an Efficient Company-Internal Knowledge Transfer

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Abstract

Knowledge and its retention affect strongly the competitiveness of a company. Because of rising fluctuation, the timely planned and executed transfer of knowledge between employees and their succeeding colleagues makes a heavy impact on the success and the efficiency of the knowledge retention. This paper bases on previous work in this field and shows how the dynamics in knowledge prioritization affects the priority rank of knowledge elements that are prioritized for an upcoming knowledge transfer. The work was done within a research project that was executed in cooperation with two industry companies from the German investment goods industry.

1. Introduction

1.1. Need for Efficient Knowledge Transfer

Most enterprises indicate the in-house knowledge as a decisive competitive factor. In this context, the fluctuation of employees means migration of knowledge — which has to be counteracted in order to maintain the competitive position of an enterprise. For this reason, the efficient knowledge transfer between employees represents a demanding challenge for modern enterprises.

Figure 1 shows four main causes for the increasing need of efficient knowledge transfer: Nowadays, employees accumulate more knowledge than in former times. This results from an increasing product complexity [1] and the need for inter-divisional, integrative work. Expert knowledge in one specific field is not sufficient to manage complexity; the need for inter-divisional cooperation e.g. gets obvious in the development of complex mechatronical products.

Not only the amount of accumulated knowledge objects but also the knowledge about the dependencies between these objects increases. Such dependencies are mainly stored in the mind of employees (and make part of their experience knowledge). For example, the object knowledge about a number of products, production sites and customers of an enterprise can be easily documented and transferred between employees. An experienced employee, however, knows that

the order of product A by customer B at site C typically results in severe problems. Such knowledge about dependencies increases in a cooperative working environment, does not get documented and therefore is difficult to be transferred between employees.

'Unique knowledge owners' represent another major issue for the knowledge transfer in enterprises. These employees account for important tasks and are the only ones, who possess the required knowledge. Increasing specialization and subdividing of business processes advance the existence of 'unique knowledge owners'. If the knowledge of such employees will not get transferred in time, their leaving can result in significant negative consequences for an enterprise.

The increasing fluctuation of employees intensifies the need for knowledge transfer. The fluctuation rate is higher-than-average for specialists and executive staff. At the one hand, the demographic change in most industrialized countries results in an increasing demand for well-trained staff. At the other hand the globalized working environment and the claimed flexibility of employees lead to shorter periods of affiliation with one enterprise. Life-long affiliation with one enterprise disappears. Thus, knowledge transfer will become a standard task required several times during an employee's working life.

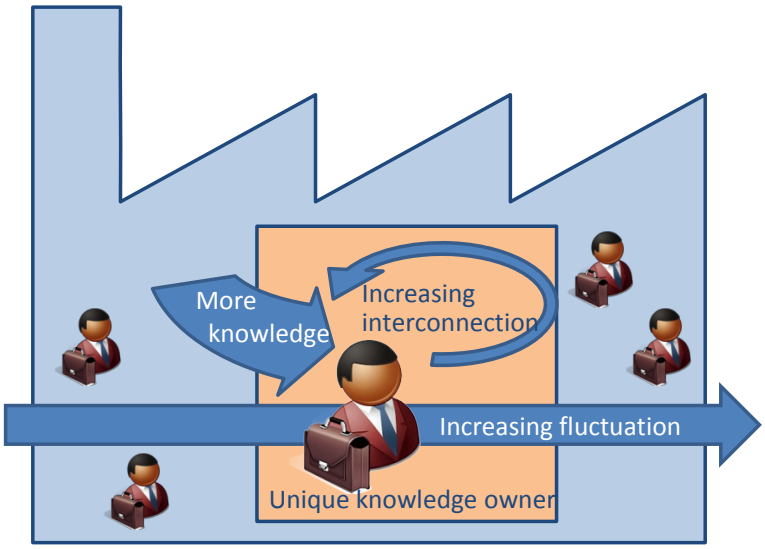


Figure1: Causes for the increasing need of efficient knowledge transfer [2]

1.2. Procedure and Objectives of the Research Project

The procedure of the whole research project was that, firstly, the institute advertised the governmental-funded knowledge transfer project and won the two industry companies for participating. During the project, the researchers developed the transfer methodology and adapted the contents of the individual work packages after periodic workshops with representatives from the industry companies. In the

last project phase, the methodology was evaluated and documented that accomplishes the two-year project.

Based on previous work within the field of knowledge mapping and transfer, this research project had the objectives to improve and enhance the found knowledge domains and relations, to develop a way to elicit knowledge and create knowledge maps without additional staff but by employees themselves rising the transfer efficiency, to develop a holistic knowledge transfer methodology and, especially, to considerate and integrate practically relevant circumstances within the industry companies.

1.3. Procedure of the Company-Internal Knowledge Transfer

In order to realize a company-internal knowledge transfer maps, a holistic methodology to transfer knowledge from leaving employees (mentors) to succeeding ones (mentees) was developed based on knowledge maps during the research project. In short, the following steps have to be conducted:

1. Knowledge elicitation with knowledge maps and classification within different knowledge domains (according to [4])
2. Characterization and partition of knowledge elements within their structure
3. Selection of one or more suitable mentees who already have certain knowledge elements available
4. Knowledge prioritization according to relevance and effort for learning certain knowledge elements
5. Integration of already used knowledge and data bases in the company that provide documented knowledge in order to reduce the costly face-to-face knowledge transfer
6. Execution of the actual knowledge transfer between mentor and mentee(s)

2. Knowledge Map

Employees store their knowledge differently. Nevertheless, certain knowledge domains as well as relations between these domains are recognizable and recur. In the context of systematic human resource development [3], describing knowledge of individual employees within an engineering context with the help of graphical representation creates the basis for a systematic knowledge transfer based on the knowledge structure. Therefore [4] developed a meta knowledge map that provides different types of knowledge domains and relations, see figure 2. Based on the tasks, elements out of the other knowledge domains that are necessary to fulfill the particular task can be arranged in that way they are used by the employee in its daily work routines. Different relations enable to depict the particular relationship between knowledge elements and complete the knowledge structure within a knowledge map.

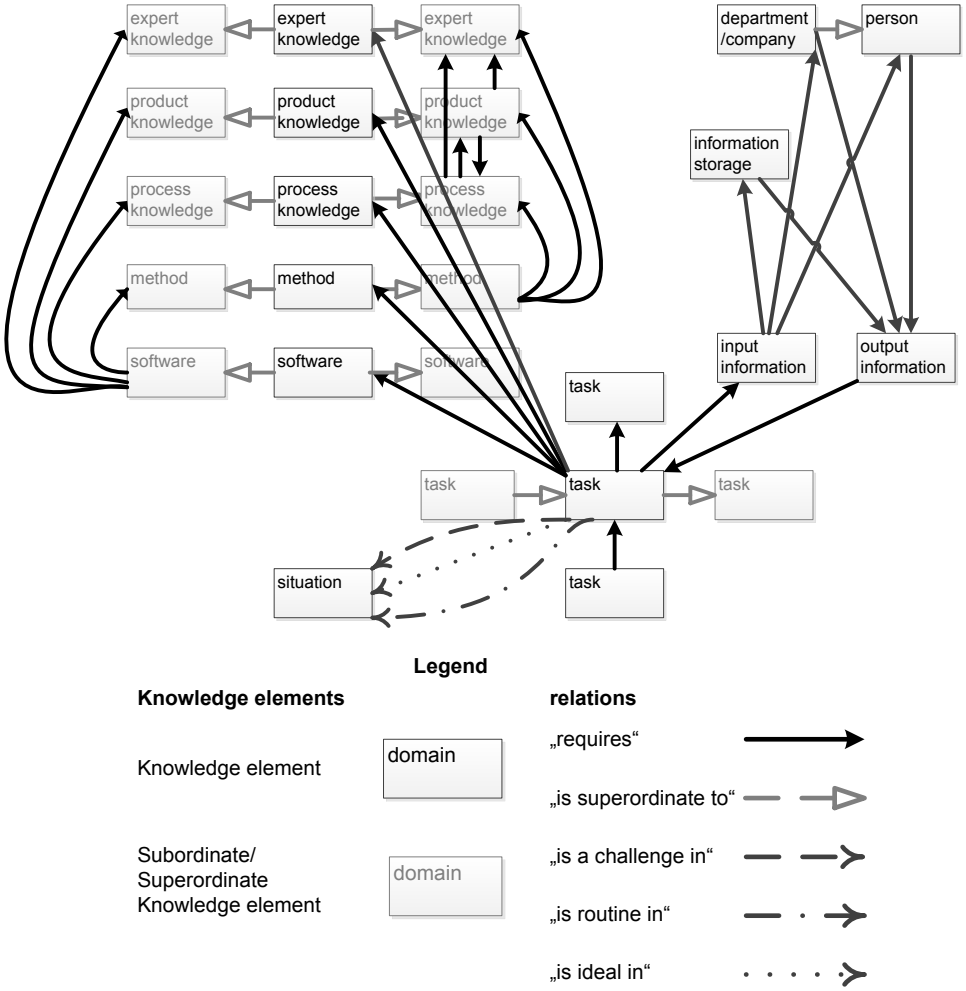


Figure 1: Meta knowledge map with tasks, different knowledge domains and relations according to [4]

During the research project, knowledge maps were created by several employees of two industry companies with which the researchers discussed and reviewed the results within the project. In order to save an additional moderator that creates the knowledge map while the particular employee explains its tasks and related knowledge elements, a software prototype based on an open-source graph visualization and analyzing software (Gephi™) and on open-source program language (Python™) is used that the employee gets empowered to create its knowledge map by its own. Figure 3 shows a real knowledge map that a employee created with knowledge of certain part of its area of responsibility. This highly interconnected knowledge map contains 100 tasks and knowledge elements and 190 relations. The knowledge map is shown in that small size to depict the whole one.

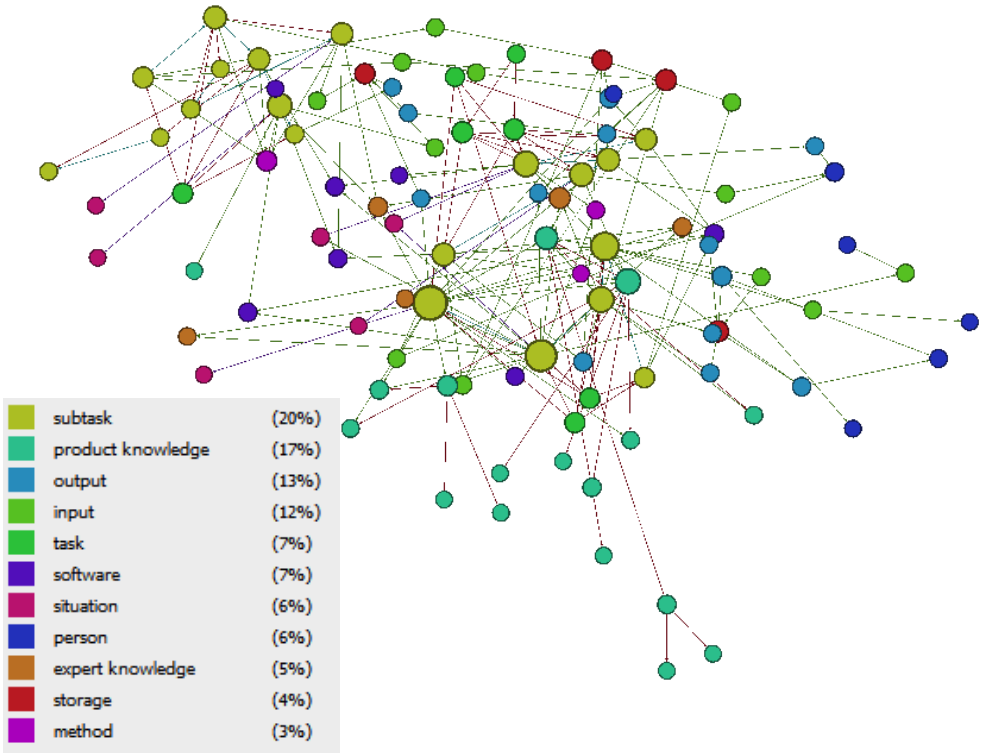


Figure 2: Knowledge map of an employee's subarea of responsibility (note that subtasks are inserted because of practical reasons during the interview dialog)

3. Knowledge Prioritization

3.1. Previous Work

Knowledge transfers often have to be executed within short time slots. In such cases the transfer of all relevant knowledge is impossible, and prioritizing the most important knowledge elements is helpful. [2] developed an approach for knowledge prioritization based on the structure within a knowledge map and uses 'efficiency' as a suitable rating criterion. This criterion takes into account the amount of required input and reachable output respectively benefit. Input means the need of knowledge elements for the mentee to learn tasks. Benefit means the amount of new tasks the mentee can fulfill by applying these knowledge elements. The more tasks become fulfillable by a specific knowledge element, the more important this knowledge element becomes for the knowledge transfer.

We visualize the importance of knowledge elements in the input–benefit diagram, which contains four sectors: 'quick wins', 'first to teach', 'tough wins', and 'last to teach'. Figure 4 shows a generic example for the application of this diagram. The graph at the left side shows that only Knowledge element 1 is required for Task 1.

Thus, Knowledge element 1 represents a quick win in the diagram, as one single input (transferred knowledge element) leads to one benefit (enabled task) for the mentee. Next, figure 4 displays Knowledge element 2 as required input for Task 2 and Task 3. Compared to Knowledge element 1, the same amount of input results in higher output. Consequently, Knowledge element 1 is characterized as first to teach in the input–benefit diagram.

Rating Knowledge element 3 and Knowledge element 4 is more difficult, as more than one input has to be considered in these cases. Figure 4 shows in the graph that Knowledge element 3 is required for the two Tasks 4 and 5. But even if Knowledge element 3 gets transferred from the mentor to the mentee, Knowledge element 4 is still required for Task 5. That means that transferring Knowledge element 3 only results in an output of two executable tasks if Knowledge element 4 gets transferred as well. Thus, Knowledge element 3 is characterized as tough win in the diagram, because a high benefit (two enabled tasks) can only be reached by high input (two transferred knowledge elements). Finally, the rating of Knowledge element 4 is even worse. This enabler is required for executing Task 5; but Knowledge element 3 is required in addition. So, the isolated transfer of Knowledge element 4 from the mentor to the mentee would not even allow the mentee to learn one task. Knowledge element 4 is characterized as last to teach in the input –benefit diagram.

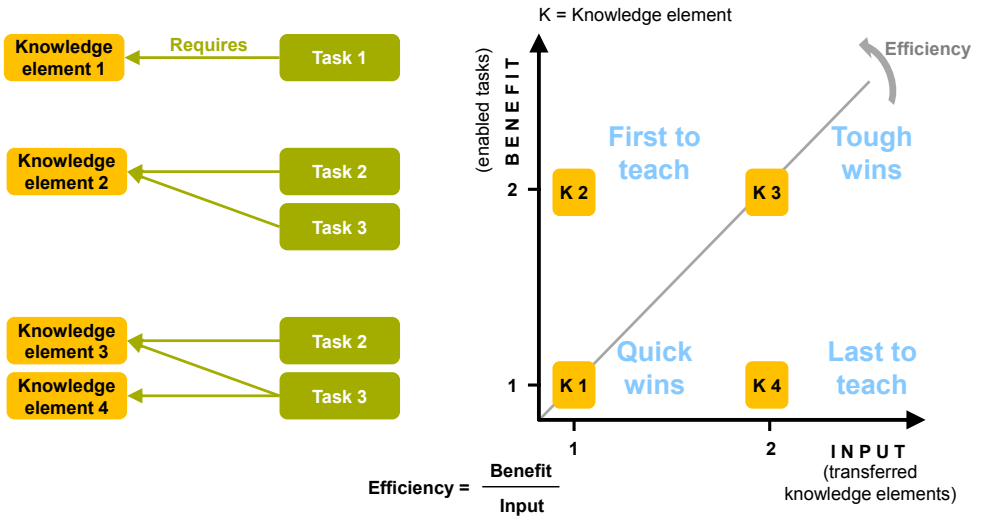


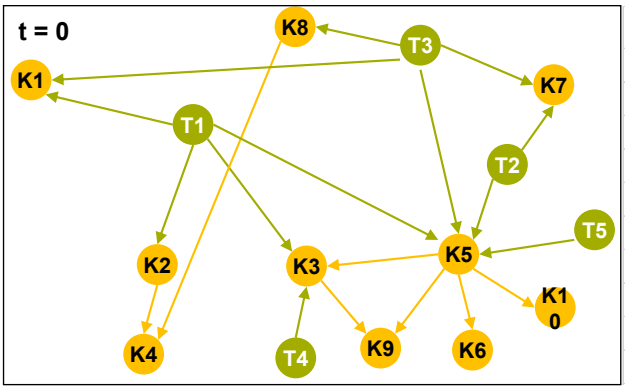
Figure 3: Input-benefit diagram: Rating the importance of knowledge elements

3.2. Consideration of Dynamics in Knowledge Prioritization

Several authors criticize that evaluating certain objects within a portfolio matrix as described above lacks a dynamic consideration, e. g. [5, 6]. Because of the interrelations between elements, here the tasks and knowledge elements within a knowledge structure, transferring the highest prioritized knowledge element doesn't have to but can lead to the cause that the prioritization order of the remaining

knowledge elements is no longer up to date and has to be reworked. Figure 5 shows an exemplary knowledge map in which Knowledge element 5 is highest prioritized. The priority rank results from the computations on the right side. Additionally to the approach of [2], there are considered not only direct paths between a certain knowledge element and the particular task. However, the whole lengths of paths are considered that appear between a knowledge element via possible other knowledge elements to the final task. The benefit of 4 comes about the Tasks 1, 2,3 and 5 for which Knowledge element 5 contributes. In order to fulfil these tasks, besides Knowledge element 5 itself Knowledge element 1, 2, 3, 4, 6, 7, 8, 9 and 10 are required for transferring. Within this exemplary knowledge map this means fortuitously all knowledge elements 1 to 10.

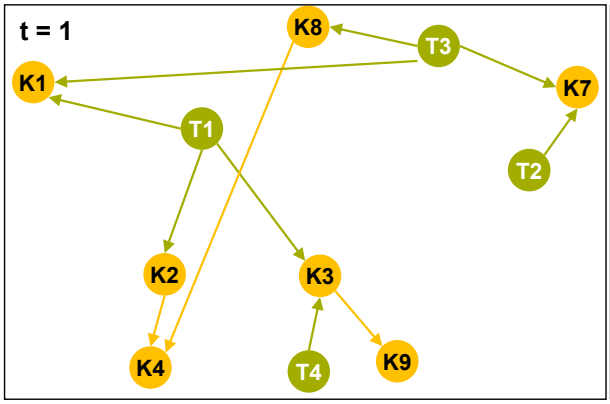
At this point of time (t = 0), Knowledge element 3 and 7 are the second and the third highest prioritized elements regarding the efficiency listed next to the knowledge map.



	INPUT	BENEFIT	Efficiency	Priority Rank
K1	10	2	0,20	4
K2	8	1	0,13	5
K3	8	2	0,25	2
K4	0	0	0,00	7
K5	10	4	0,40	1
K6	0	0	0	7
K7	9	2	0,22	3
K8	9	1	0,11	6
K9	0	0	0	7
K10	0	0	0	7

Figure 4: Exemplary knowledge map before transferring the highest prioritized knowledge element (t = 0)

After transferring Knowledge element 5 which includes the transfer of Knowledge element 6 and 10 that are only related to Knowledge element 5, there is a change within prioritization. Regarding the input and benefit data as well as the efficiency, Knowledge element 3 is no longer the next transferable knowledge element. At this point of time, figure 6 shows that Knowledge element 7 becomes the highest priority rank and Knowledge element 3 lines up as second highest prioritized. This demonstrates that transferring the highest prioritized knowledge element can lead to a change within the priority ranks within the remaining knowledge elements.



	INPUT	BENEFIT	Efficiency	Priority Rank
K1	7	2	0,29	3
K2	5	1	0,20	5
K3	5	2	0,40	2
K4	0	0	0,00	6
K5				
K6				
K7	4	2	0,50	1
K8	4	1	0,25	4
K9	0	0	0	6
K10				

Figure 5: Exemplary knowledge map after transferring the highest prioritized knowledge element (t = 1)

The described change within the priority rank can also be observed within the input-benefit diagram. Figure 7 shows how the positions of the knowledge elements change within the portfolio matrix and how Knowledge element 7 gets the highest efficiency rate and therefore the highest priority rank from t = 0 to t = 1.

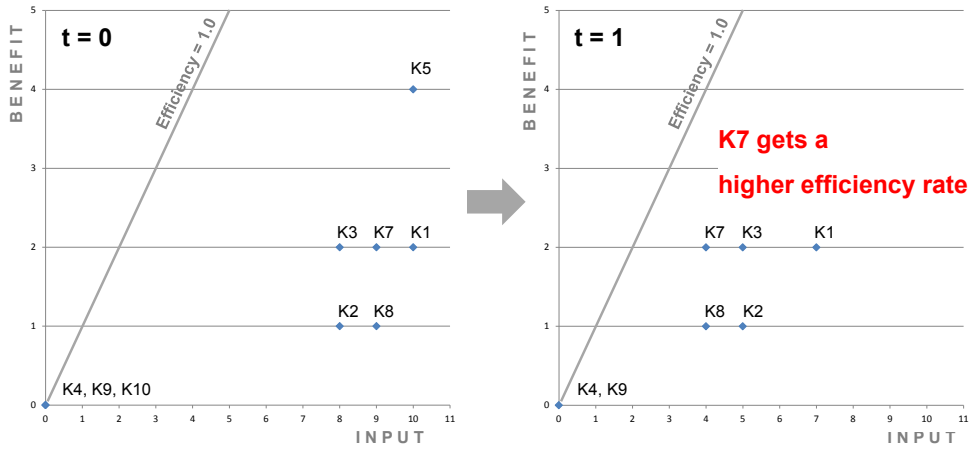


Figure 6: Observed change of priority rank within input-benefit diagram

4. Conclusion and Outlook

This work shows how the dynamics make an impact on the priority rank of knowledge elements that are prioritized for an upcoming knowledge transfer. Therefore, previous work within the mapping of knowledge and its structure as well as within knowledge prioritization is explained. Based on this, the paper furnishes proof that transferring the highest prioritized knowledge element can lead to changes in the priority ranks because of the interrelations between the knowledge elements and the tasks. That's the reason why the prioritization has to be applied anew after each transfer of a knowledge element that leads to changes within the

knowledge structure. Because of secrecy in regard of knowledge maps created with employees of two industry companies, the consideration of the dynamics in prioritization uses an exemplary knowledge map that consists of five tasks and ten knowledge elements that aren't specified further.

Beside the described dynamic knowledge prioritization that bases on mere numerical consideration of the knowledge structure, further characteristics like effort for learning certain knowledge elements and their importance within the knowledge structure can be applied during the knowledge prioritization procedure. Therefore, the software-based method for knowledge elicitation has to be enhanced by the employees' evaluation of the effort they estimate for learning specific knowledge elements. Moreover, the approach can be enhanced by the importance of knowledge elements or tasks that are the only link to a certain person or department with which the mentor cooperates. If the knowledge maps of several employees show that a certain knowledge element or task is executed only by one or another small number of employees the importance of the corresponding knowledge elements can rise as well. Also the employees' estimation of the relevance of a certain task or knowledge element within their work routines can lead to a rise of importance.

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