KNOWLEDGE WORK MANAGEMENT
A Framework for Web-based Knowledge Products and Instant-Qualification

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Abstract: Industry product life cycles and their technological life cycles are getting shorter and shorter. At the same time these products are getting more and more complex. In consequence, this causes faster innovation processes, new production concepts and client-oriented products. The share of knowledge work increases. There are different concepts to support companies in managing the changes and the higher part of knowledge work using new technologies. One is the idea of knowledge products. They take care of different user groups and give support to search and find of information. They help to improve the product, allow faster and smarter updates for product changes, make product presentations more effective and give the staff more orientation in their highly complex work environment. Another concept is to learn by "Instant-Qualification" just in time. The employee pools special information with his own expertise and can handle the actual specific work tasks immediately. The idea is the combination of knowledge management and learning in one real-time system. The surroundings of the employee are the interface of the learning application. It facilitates intuitive use of information. Learning is integrated into a real working process by using new technologies.

Key words: Personalised learning, individualised learning, work place learning, just in time, knowledge management.

1   KNOWLEDGE WORK MANAGEMENT – THE CONCEPT

Within the discussion about professional training, the term "knowledge work" refers to coping with work tasks which are complex or new at least to

the person concerned in professional work. Knowledge work requires a large variety of information and sound knowledge as a raw material. (Nonaka, Takeuchi, 1995; Pine, Gilmore, 1999) It generates new knowledge as a product. Davenport's definition for knowledge work is:

"In our definition, knowledge work's primary activity is the acquisition, creation, packaging, or application of knowledge. Characterized by variety and exception rather than routine, it is performed by professional or technical workers with a high level of skill and expertise. Knowledge work processes include such activities as research and product development, advertising, education, and professional services like law, accounting, and consulting. We also include management processes such as strategy and planning." (Davenport et al., 1996, p. 54).

1.1   The Goals and Visions of Knowledge Work and Learning Arrangements

It is necessary for Europe's enterprises to be more effective and efficient in their work to be more competitive. At the same time the quality of both working life and the working conditions for the employee must not suffer, and these are just some of the aims. So, the main goal is to help to improve working conditions for knowledge and e-workers (Davenport, Beck, 2002):

- **Comprehensive job content**. The job tasks are planned, performed, checked and organised fairly independently by the employees. This makes the tasks attractive and motivating.
- **High individual demand on creativity and independent problem solving**. Knowledge-intensive services are generated and provided in an interaction with the customer or co-operation partner, solutions must be developed spontaneously and on the spot. The job content, therefore, is challenging in a positive sense.
- **Situated, context-related and informal professional learning**. Traditionally, research has focused on the transfer of knowledge from those who know to those who do not know . But most of the learning takes place as informally situated and context-related learning, closely connected to the professional work. The learning arrangement will support this new view of learning.
- **New innovative types of learning**. Some concepts are just-in-time-learning, just-in-case-learning, Instant-Qualification.
- **Work in multi-disciplinary teams of experts**. Actors with different competences, thinking patterns and interests co-operate for a limited period of time. Communication problems, interpersonal dynamics and unease, therefore, have a greater influence on the working processes.

- **High degree of fragmentation and limited possibilities of planning**. Frequently, new job tasks come suddenly and without warning. This forces the employees to reorganise their work sequences. Activities must often be interrupted and resumed later.
- **Job design for knowledge work**: In the field of knowledge-intensive service work the issue is rather to counteract potential overstrain situations – for the protection of the employees as well as for the benefit of productivity.

Knowledge work does not know any frontiers. As a result of growing international co-operation, different corporate cultures and structures are bound to meet and they have to maintain their standing in industrial relations more than ever and prove their economic performance capability.

Successful enterprises, especially SMEs, depend more on their intellectual capabilities than on their physical assets, often specialising in knowledge intensive products. Strategic information and knowledge enable SMEs to recognise chances early and increase competitiveness. The ability to manage knowledge work via situated/ informal, contextualised learning arrangements and to convert it into new innovative products and services is a crucial factor for success. Current trends in European economy are:

- Shift to more and more knowledge intensive products and services
- Company cultures are becoming related to managing knowledge
- Loss of revenue due to missing knowledge exchange between manufacturing and R&D
- Companies cannot afford drain of knowledge due to staff fluctuation
- Continuous outsourcing of manufacturing capabilities opening a wide gap regarding information and knowledge transfer between engineering and manufacturing.

Expected long-term benefits from knowledge work management include cost reduction due to greater efficiency, improved business processes and products due to better use of staff knowledge and more efficient task performance. Knowledge Management methodologies, tools and best practices will be made available to a very wide audience. The results are improvements in efficiency and reduction in costs, which will improve user competitiveness. There will be new product opportunities for developers of tools or particularly software, for a further improving economy.

The bottleneck for the progress in Knowledge Work Management is that research has traditionally focused on enhancing traditional training and transfer of knowledge from those who know to those who do not know. (Becker, Gidion, Rickert, 2002) To solve this problem, the learner has to obtain his knowledge from an individualised learning support which is geared to his individual learning needs (personal and contextual). Informal and competence conductive professional learning must be supported. This

means the direction of knowledge transfer as learning is reversed to consider real needs of potential users in companies. New technologies are enablers for knowledge work management in supporting knowledge work more effective and efficient in the described way (Drucker, 1991; Hermann, 2002).

2   KNOWLEDGE PRODUCTS

Knowledge products transfer knowledge from staff and traditional media (like manuals) about "classical" products or service products into multimedia format. So, the added-value lies in supplying all different user groups with information, training and qualification needs. To understand the product at their individual working task. Because products get more and more complex and are designed in short lifecycles they have to be explained.

- Rapid change of markets requires faster introduction of new products
- Lack of developing and handling understandable products just-in-time
- Lack of target group oriented solutions in production support
- Insufficient training and qualification materials

Development of a knowledge product starts simultaneously with the production process and is integrated into the engineering processes. A knowledge product is a service offered in addition to a classic product from any branch of industry. Knowledge products get more popular because companies compete on markets that are very often turbulent. Market entrance barriers against imitators of "classic" products are often very low. Products can be adapted very fast by competitors. So, lifecycles of products are becoming shorter and companies need faster introduction of new products at every position in the supply chain. Additional companies have to face a growing complexity in products. They are getting less transparent for the users. There must be solutions to close the gap between developing and handling new products. The production of knowledge products can be described in three phases.

In the **creation phase** the concept will be defined and evaluated. Content management is the main focus. Two steps are crucial for success of appropriate content management. 1. Relevant knowledge resources must be collected, clustered and evaluated. 2. There must be a criteria-controlled selection process of relevant knowledge.

In the **engineering phase** the knowledge product is designed, produced and piloted. Content transformation and content embedding are the main focus. Four steps are relevant for success for an appropriate content transformation. 1. Content has to be (re)structured so that it fits the product. 2. Development of scenarios for each user group. 3. Knowledge has to be adapted to product requirements. 4. Usability test of embedded knowledge.

In the **management phase** the knowledge product will be delivered and positioned in the market. Content provision for training and qualification is the main focus. Training and qualification have to be provided with the product. It has to be controlled and improved continuously.

In all stages there has to be strong integrated user-producer interaction to implement customer training and qualification needs from a very early stage in product development. (Holzschuh, Karapidis, 2002; Karapidis, 2002). Using knowledge products has the following advantages:

- The product has an added-value by training and qualification sections for all user groups with a content-oriented focus.
- Training and qualification content can be used just-in-time.
- The quality of the product increases by the training and qualification sections and it is not that easy to imitate. Barriers for market entrance for competitors are higher.

3   INSTANT-QUALIFICATION

Hitherto, employees have primarily been regarded as cost factors by their employers. Nowadays, it is recognised that there is an advantage in employing highly qualified and motivated staff. The human resource is the most valuable resource of a company. Human resource management and organisational development grow together and require new concepts to make work more productive and attractive. One possible concept is to enable the employee to learn while fulfilling working tasks. This means arranging work in a way that provides learning incentives and connects knowledge management with learning by using new technologies. (Kerres, 2001)

Traditionally, research has focused on the transfer of knowledge from those who know to those who do not know. But most learning takes place as informally situated and context-related learning, closely connected to the respective activity. The Instant-Qualification supports this new view of learning. For this training form, a new communication scheme is required. (Back, Seufert, Kramhöller, 1998).

The learner cannot anticipate all possible future working tasks. With the new training concept the learner will get his information personalised to his own "position" in the workplace, contextualised in the work process and individualised to his own media competence just in time. He pools this information with his own expertise and, in this way, becomes able to fulfil specific work tasks. He gets the additional information required:

- Everywhere – at the right place,
- Anytime – in the right moment,
- Any media – intuitively usable.

Instant-Qualification makes training calculable: as it is possible to calculate a specific work task / or additional equipment for a product, it is possible to calculate training "bits" necessary to fulfil this task or to mount the equipment. Instant-Qualification provides e-learning capabilities to the individual worker directly by the working task in the actual working environment where knowledge-intensive processes take place. Instant-Qualification fits the technological developments of the future: where the surroundings of the employee is the interface, not only display, keyboard and mouse, where all senses can be used intuitively and the knowledge transfer is not only based on writing and reading; where the knowledge handling is context-based and where more than a word-based information search exists.

Instant-Qualification is a means to produce individualised/customised products with low training costs. Every specific individual working task has its specific individual training content. It is the combination of knowledge management and learning in one real-time system. Learning is integrated into a real-life working process by using new technologies to fulfil the working task effectively. The provision of content and knowledge is context-based. Both content and knowledge can be used intuitively, an instruction is not necessary. So quality of work increases because there is a high level of transparency of content and knowledge. Qualification is also calculable.

4   EXAMPLES OF APPLICATION FIELDS

4.1   Knowledge Product: Considering an Example in Thermo Technique Production

The example is the transfer from a contemporary gas furnace of a global acting company into a knowledge product to satisfy information, training and qualification needs. It shows a new multimedia training and qualification solution for all user groups to support the use of or maintain the gas furnace. In the example, the knowledge products aspects from the maintenance staff are outlined. The maintenance of a gas furnace is hosted by the company's own staff and by third parties. Maintenance staff has to know the functionality of the furnace, the different options for normal operation, the different errors that can occur and has to acquire problem solving competence. One barrier especially for maintenance is different product update releases (up to 40 a year). The challenge of a knowledge product especially for maintenance service staff lies in a rapid and effective mobile support application.

In the creation phase of the gas furnace knowledge product the first step was to identified all relevant knowledge resources. That means, not only the use of manuals or product sheets, also use of experience knowledge of alpha staff and end-users. Second, relevant content was evaluated and selected together with maintenance staff with respect to their specific work processes. The main selection criteria was work process support, not overall information of the gas furnace. Also, the realisation techniques were selected according to the needs of staff with respect of their work situations.

In the engineering phase of the knowledge product the content collected in phase one was restructured in a way that it fit the technological environment and the needs of maintenance staff to support their work. This was the main challenge and most critical for success. Together with the maintenance staff, problem solving scenarios were worked out and the suitability of content for their needs was tested iteratively by different usability tests. At the same time, first mock-ups, such as 3D furnace software trial, error trees, first modules, etc. were prototyped. After the embedding of the restructured content, the embedding of content in the technology platform started. In the final phase, the user-producer interaction was critical for success. By testing usability during the adaptation of the content to media elements, different items were tested such as navigation concepts, integration of different content modules and technical reliability.

4.2 Instant–Qualification: Considering an Example in the Lorry Production

The example is the certification of lorries at the end of a production line. It offers a perspective on new educational environments. The "surroundings" of the employee is the interface. The input is the position of the employee – physically as well as in the working process. The output is a sound instruction on what to do at the lorry at the respective place in the working process. The worker can use all senses intuitively. The learning task is not based on writing and reading. In the example the information is given to the employee as if an expert were standing by his side. It is a work process that provides context-based knowledge. In this section the employees fulfil repetitive work tasks, with differences regarding details. A requirement is to solve critical situations in a more professional way.

The initial situation for the development of a new training method was the launch of a new lorry product line. The employees of the section had to handle certification of the new production line and discontinuation of the old one at the same time. In addition, they had to handle changing instruments and tools for production control, quality control and personnel management. Within the pilot installation the following challenges were identified:

- In the work process, knowledge is more and more important. The need of specific knowledge also expands to manual work processes.
- More individualised products are demanded; therefore the work process gets more complex.
- To manage the complexity, an assistant system for the employee is helpful. But PC-based systems are often unsuitable. The required knowledge has to be integrated into the work process with a suitable media format.
- Cost pressure with production increases. It is not possible to finance expensive preparatory trainings for every product modification.

The solution to this problem was found with the concept of Instant-Qualification. With the new training system the employee receives the required information by a spoken audio signal, generated for the specific lorry model that is handled at the respective moment. This is made possible by technology of cross-media publishing. The checker follows these instructions. If there is a problem with handling a task, he can watch a reference video for that specific task. For the user, in the course of time, the training system develops from an instruction instrument into a routine operating control. The activities of the worker can be controlled by himself by using the inspection sheet. This sheet is also rendered by spatial identification and sound during checking process. While the checker follows all given instructions, the system generates a complete inspection sheet.

5   BENEFIT

The main result of the knowledge product concept is that it works! Installing a prototype of a training and qualification (knowledge) resource for the gas furnace enables workers in maintenance to improve their effectiveness. Yesterday, even alpha teams had problems to find solutions for unusual errors. Today, with access to this work process-oriented knowledge resource with anytime – anywhere accessibility, the service performance of maintenance staff has been much improved. So for the company, the gas furnace knowledge product was a milestone to improve quality and effectiveness of their staff by on-work process-oriented qualification of staff.

The advantages of Instant-Qualification are: Special working tasks can be fulfilled effectively when they occur. There is no learning content "lost". Provision of content and knowledge is context-based and just in time. Content and knowledge can be used intuitively. Instruction is not necessary. The quality of work increases, because there is a high level of transparency of content and knowledge, both can be used in an optimal way. In the end,

qualification and training become calculable. It is possible to calculate training "bits" necessary for a specific work task on an individual product.

6   LITERATURE

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