



# PROLEARN

---

*European Commission Sixth Framework Project (IST-507310)*

***Deliverable D7.1 Gap Report***

Identified consequences of the developments of the other WPs for design of knowledge work management

*Editor*

*Alexander Karapidis M.A.*

*Work Package*

*D7.1*

*Status*

*Reworked / Final*

*Date*

*06-30-05*

**The PROLEARN Consortium**

1. Universität Hannover, Learning Lab Lower Saxony (L3S), Germany
2. Deutsches Forschungszentrum für Künstliche Intelligenz GmbH (DFKI), Germany
3. Open University (OU), UK
4. Katholieke Universiteit Leuven (K.U.Leuven) / ARIADNE Foundation, Belgium
5. Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (FHG), Germany
6. Wirtschaftsuniversität Wien (WUW), Austria
7. Universität für Bodenkultur, Zentrum für Soziale Innovation (CSI), Austria
8. École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
9. Eigenössische Technische Hochschule Zürich (ETHZ), Switzerland
10. Politecnico di Milano (POLIMI), Italy
11. Jožef Stefan Institute (JSI), Slovenia
12. Universidad Politécnica de Madrid (UPM), Spain
13. Kungl. Tekniska Högskolan (KTH), Sweden
14. National Centre for Scientific Research "Demokritos" (NCSR), Greece
15. Institut National des Télécommunications (INT), France
16. Hautes Etudes Commerciales (HEC), France
17. Technische Universiteit Eindhoven (TU/e), Netherlands
18. Rheinisch-Westfälische Technische Hochschule Aachen (RWTH), Germany
19. Helsinki University of Technology (HUT), Finland

## Document Control

**Title:** Identified consequences of the developments of the other WPs for design of knowledge work management

**Author/Editor:** Alexander Karapidis M.A.

**E-mail:** Alexander.Karapidis@iao.fraunhofer.de

### AMENDMENT HISTORY

| Version | Date     | Author/Editor | Description/Comments  |
|---------|----------|---------------|-----------------------|
| 1       | 06-28-04 | Karapidis     | ---                   |
| 2       | 06-30-05 | Karapidis     | Reworked after review |

### Contributors

| Name                       | Institution                       |
|----------------------------|-----------------------------------|
| Till Becker Dipl.Soz-Wiss. | University of Stuttgart, Germany  |
| Sibylle Hermann            | Fraunhofer IAO Stuttgart, Germany |
| Gerd Gidion                | Fraunhofer IAO Stuttgart, Germany |
| Walter Ganz                | Fraunhofer IAO Stuttgart, Germany |
| Martin Rieger              | Fraunhofer IAO Stuttgart, Germany |
|                            |                                   |

### **Legal Notices**

The information in this document is subject to change without notice.

The Members of the PROLEARN Consortium make no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Members of the PROLEARN Consortium shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

# Table of Contents

|            |  |           |
|------------|--|-----------|
| <b>1</b>   | <b>INTRODUCTION</b>  | <b>4</b>  |
| <b>2</b>   | <b>LEARNING ARRANGEMENTS</b>   | <b>5</b>  |
| <b>2.1</b> | <b>Learning in the working environment with new technology-based media</b>                 | <b>6</b>  |
| 2.1.1      | Didaktische Anforderungen an multimediale Inhalte  | 7         |
| 2.1.2      | Further Results  | 8         |
| <b>2.2</b> | <b>Where are the gaps?</b>   | <b>10</b> |
| 2.2.1      | Literature and further readings  | 12        |
| <b>3</b>   | <b>KNOWLEDGE WORK MANAGEMENT (KWM)</b>   | <b>14</b> |
| <b>3.1</b> | <b>Identifying the gaps in KWM research</b>  | <b>16</b> |
| 3.1.1      | Research on the management of knowledge-intensive companies                                | 16        |
| 3.1.2      | Research on the design of knowledge intensive work   | 18        |
| 3.1.3      | Research on knowledge workers  | 20        |
| 3.1.4      | Research on knowledge management   | 22        |
| <b>4</b>   | <b>SME KEY RESEARCH AREAS (KIA)</b>  | <b>24</b> |
| 4.1.1      | KIA: New Work Organisation - Division of Work According an Explicit Knowledge Strategy     | 26        |
| 4.1.2      | KIA: Knowledge Product Management – Turning Knowledge Into Products and Tools              | 26        |
| 4.1.3      | KIA: Organisational Learning - Creating Appropriate Structures for Knowledge Work          | 26        |
| 4.1.4      | KIA: Competence Development - Qualifying and Supporting Knowledge Workers                  | 26        |
| 4.1.5      | KIA: Performance & Productivity - Following Adequate Objectives in Quality and Performance | 27        |
| 4.1.6      | KIA: Performance Management - Controlling Knowledge-intensive Companies                    | 27        |
| <b>5</b>   | <b>CONCLUSION AND FURTHER ACTIVITIES</b>   | <b>27</b> |

# 1 Introduction

In the last decades large amounts have been invested in the research and development of TEL solutions. However, the market for Technology Enhanced Learning (TEL) has not been developing as expected. TEL still plays a subordinate role in advanced vocational training in both companies and institutions for further education. This is especially true for SMEs.

The Network of Excellence PROLEARN has the objective to promote research in two specified key fields of TEL (personalised adaptive learning and learning with interactive media, WP1) and to find out how the implementation of TEL in advanced vocational training can be increased. The findings are discussed with representatives from research and practice, are then edited and subsequently distributed through different channels.

PROLEARN considers as a starting point for a better implementation of TEL the improvement of the interoperability and reusability of learning objects. I.e. it should be more easy to find, combine, adapt and reuse them online (WP5). That is why metadata and standards (WP4) are important topics in PROLEARN. Furthermore, it is assumed that the development and implementation of TEL solutions has to pay more attention to the real world, i.e. the specific conditions and requirements of teachers and companies with such a demand. The development of the market and business models for TEL will therefore be analysed in WP 6. Central success factors for the introduction of TEL will be identified. Development and usage processes of TEL solutions will be modelled so as to make them more efficient and more effective (WP 5).

WP 7 will add another element by shedding light on how working and teaching in (knowledge-intensive) companies can be interconnected with each other more easily on a strategic and operative level. The following theses will serve as a starting point:

- a) The world is moving towards a knowledge society. For companies this means that it is getting increasingly important to create optimal conditions for effective and efficient knowledge work. Appropriate measures will have an effect on work organisation, both internal and across companies, and hence on the question in which circumstances professional learning can and has to take place.
- b) It is just the new learning technologies which offer knowledge workers the chance for new forms of learning, which will give consideration to their special needs.
- c) If we know more about the organisation and management of knowledge work and about the design of learning arrangements for knowledge workers, it will be easier to achieve a breakthrough for TEL in advanced vocational training.

Knowledge work management and learning arrangements are relatively new concepts. We will first of all introduce them in this deliverable. Afterwards we will give an overview of the state of the discussion in both thematic fields. The objective is to point out the gaps, i.e. questions which we think have received insufficient attention in research and/or operational practice.

The result of this analysis will be the basis for the subsequent steps in work package 7 (development of an integrated model, identification of best practices, monitoring of activities and developments in these fields in Europe, ...). Task 7.1 will indeed provide some first clues on which points research and companies should focus on in the future, in order to cope more easily with the migration to a knowledge-based society.

## 2 Learning Arrangements

Operational diversification processes, process-orientated operating and labour organizations, as well as the fundamental reorganization of operational courses of action, have consequential changes in the requirements of further vocational and operational development. Similarly to the process orientation of the operating and labour organization, self-modification has been carried out in reference to the functions and occupations of further education. In effect, it has developed a process-orientated further training in which the promotion of authority plays a substantial role. This process-oriented further education suggests that strategy, work- and learning processes should be interlocked as close with one another as possible (Schiersmann & Remmler, 2002). For meaningful, action-oriented learning in the working environment, the results of recent educational research handling the overall learning situation are discussed (Lave & Wenger, 1991; Mc Lellan, 1996; Wehner, Clases & Endres, 1996), thus demonstrating a huge importance in the contextual reference to the use of learning contents.

From the research of Schiersmann and Remmler (2002), the following aspects of process-oriented continuing education are particularly stressed:

- informal learning context,
- the link between work and learning,
- the automatic control of the learning process and
- specific learning processes of groups and organizations.

As specified in the above criteria, institutionalised, curriculum-driven forms of operational and/or vocational continuing education are becoming more frequently replaced by informal learning processes such as ex. learning at work. These forms of learning, which aim more strongly on the development of decision-making and responsibility, will be systematically researched and developed further under the designation of the learning arrangement.

Ballin & Brater (1996) recognize under a learning arrangement above all the configuration of key-qualifying action contexts. In the centre is located a holistic special task, which is prepared in such a way that challenges one's specific fulfilments of decision-making and responsibility (key-qualifications). This means key-qualifications is not a question of new learning objectives, but rather of learning methods and the configuration of learning situations within specialized technical and further training (Ballin & Brater 1996, Wilke-Schnauer u.a. 1998). Learning arrangements can be regarded thus as deliberately-caused combinations, which make it possible to make the procedure of learning conscious and shapable.

After Kirchhoefer (2004) a learning arrangement consists of certain configurations of conditions of learning, which are shapable from the perspective of goals which can be achieved. The construction of shapable parts of learning arrangements is the substantial content of the controlling and organizational processes of learning. Learning arrangements develop after Kirchhoefer (2004) are typically unique for each teaching and learning culture and are determined in strong measure also by the technical possibilities.

An important element of the learning arrangement is the possibility of automatic control as a didactical dimension. The self-activities of learning should be made possible and then promoted. With this possibility, the developments in the information and communication technology open up new possibilities. Even though computer-assisted learning is still frequently to a large extent foreign-steered in practice (Schiersmann & Remmler, 2002), one is concerned with new leads in research, specifically with the development of closer working strategies, (to a large extent) self-leading learning arrangements under the use of new technical possibilities.

A short overview on the presently developed learning arrangements, which avail themselves to different information and communication technologies, is obtained in the following section. In the center is located the learning arrangements which avail themselves to Technology Enhanced Learning (TEL) and among all things the enterprise as a learning place in the sense that work-based learning in occupational education and training are considered. The following chapter (3.2) is concerned with resuming concepts and learn-theoretical origins, which are relevant for the development of learning arrangements.

## 2.1 Learning in the working environment with new technology-based media

There have been some clearly recognizable changes within the development and further training of the teaching and learning processes in regards to new Internet-based media. Since the beginning of the 1990's, Multi-media systems and CBTs have been established in the development and further training of many ranges, thus meaning that within a few years, the next level of development can be presented: learning online with WBTs. The benefits in comparison to CBT can be seen by experts, tutors and learners alike through the possibility of constant extensions and actualization of the given educational provisions. This carries particular significance in the range of information technology, where the production of knowledge takes place even more rapidly. Moreover, an unlimited number of users, independent from spatial and temporary conditions can access the virtual learning platform and communicate with one another. The next stage which is presently being developed is learning within so-called "communities". Contrary to users of classical WBTs, virtual communities are characterised by the fact that the contact between people exhibits a higher intensity and duration. Experiences are exchanged, implicit knowledge about processes are shared and the accomplishment of difficult situations is discussed together.

This form of net-based learning and the multimedia presentation of learning contents was developed, converted, tested and evaluated in Germany for example within the new working process-oriented (APO) IT Further-development systems, for the activities of the ex. network administrator. The characteristic of this learning form consists of the fact that work-integrated processes can be learned and that the two following aspects have a special relevance as well: the basis action-oriented contents are learned on the job and the learning arrangement avails itself to the use of technology-based media.

### 2.1.1 The development of work-oriented contents for learning arrangements

The producers of learning software usually orient themselves to field-specific facets of the field of activity in which they want to prepare for a certain target group. They do not pay attention to the installation course of material operational processes of learning or of the integration of varying conceivable working processes. The arranged curriculum which can be obtained through the specialized logical structure of an area is rarely given over a logical learning structure which has expected conceptual formulations which are systematically complex. In the following illustration, the generating of intervening logical arrangements of duties for a specialized systematic curriculum is symbolically is represented by the example of tasks with laser cuttings.

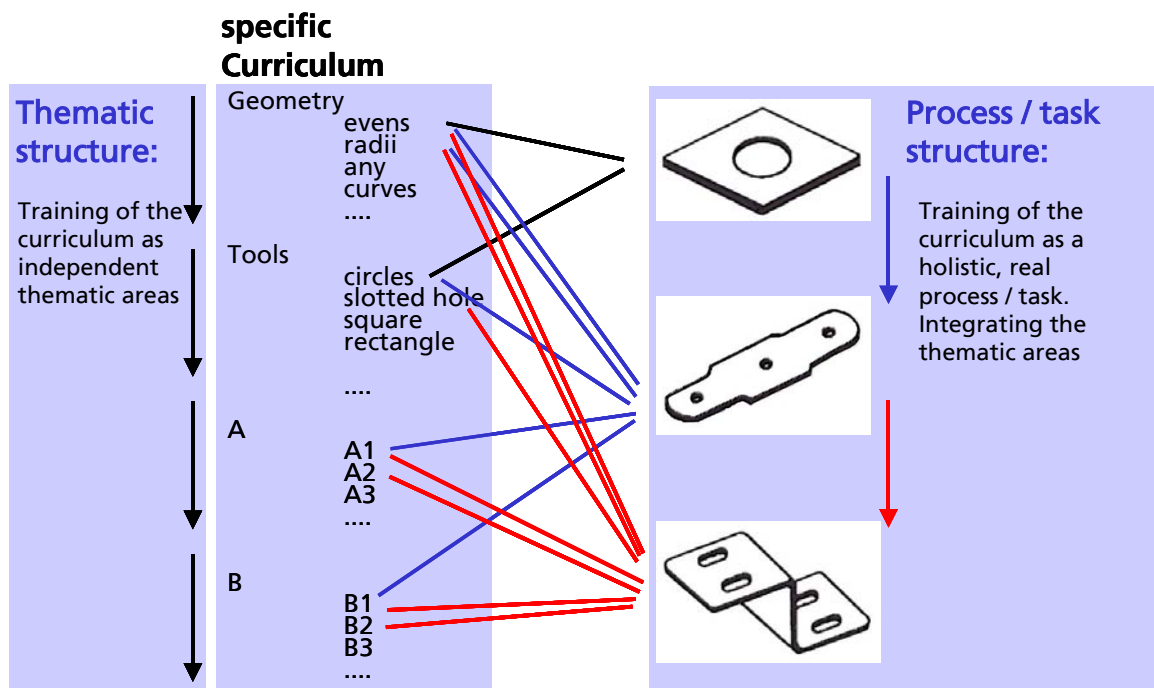


Figure 1: The intervention of a curriculum over specialized logic switching over task logic

In the surrounding field of computer games, there are introductions (e.g. edu-gaming), a game and/or a learning in almost realistic situations in order to place material connections and to increase the complexity over a selectable "level".

An integrated further training work-process, which is applied in Germany for example in the context of the further training in IT occupations, takes place no longer as before via vary-hasty instruction, but has become on the basis more complex in the operational practice of embodied transfer projects. The project partners and application partner identify together on the basis of the description of the specialist profile practice-relevant contents, which are then converted in learning materials. The models are structured as reference projects on the basis of work- and business processes.

With the help of these reference projects, the individual learners are supported at the time of the execution of their transfer projects from operational practice (see Figure 2).

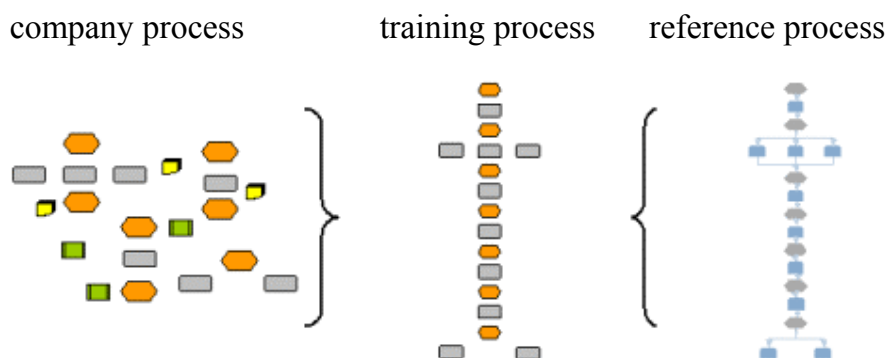


Figure 2: Curriculum (nach FhG ISST APO-IT)

The advantages of this learning form are listed in the following points:

- The tasks within a transfer project usually contain varying original documents, which are needed for the treatment of the project, which are also within the reference project. These can be placed in a net-based material pool clearly and be used effectively in the working phase. The documents can be maintained in a decentralized manner e.g. by the different manufacturers.
- It can be accessed for a solution of the tasks within the projects, without a medium-break of external data bases and Websites pertaining to the information research.
- The projects in co-operation with a coach which additionally take place with other learners, offers one the possibility of collaborative, web-based learning.
- The concept of process-orientated learning, which is the basis for the organization of the IT further training module, is planned so that the further training modules are always assigned to an operational transfer project. Therefore it is an advantage that easily changes the individual modules, one which can be easily adapted and arranged, as is the general case of electronic contents.

### 2.1.1 Didactical requirements for multimedia content

Multimedia forms and methods of the Tele-learners, in their combination (medium-mix) and the concept of the working process-oriented further training, support the self-steered and self-initiated learning personality in special way.

The project-related learning process is important for the success of vocational learning within the working process-integrated learning arrangement. This learning process is the basis of a phase model, according to which action-oriented, vocational learning becomes systematic and individually modelled.

The complete task of learning is the integration element of the working process-oriented further training. It integrates learning and working and additionally structures the learning arrangement of action-oriented

multimedia learning which can be worked on with the project-related compilation of solutions for the transfer projects (see Figure 3).

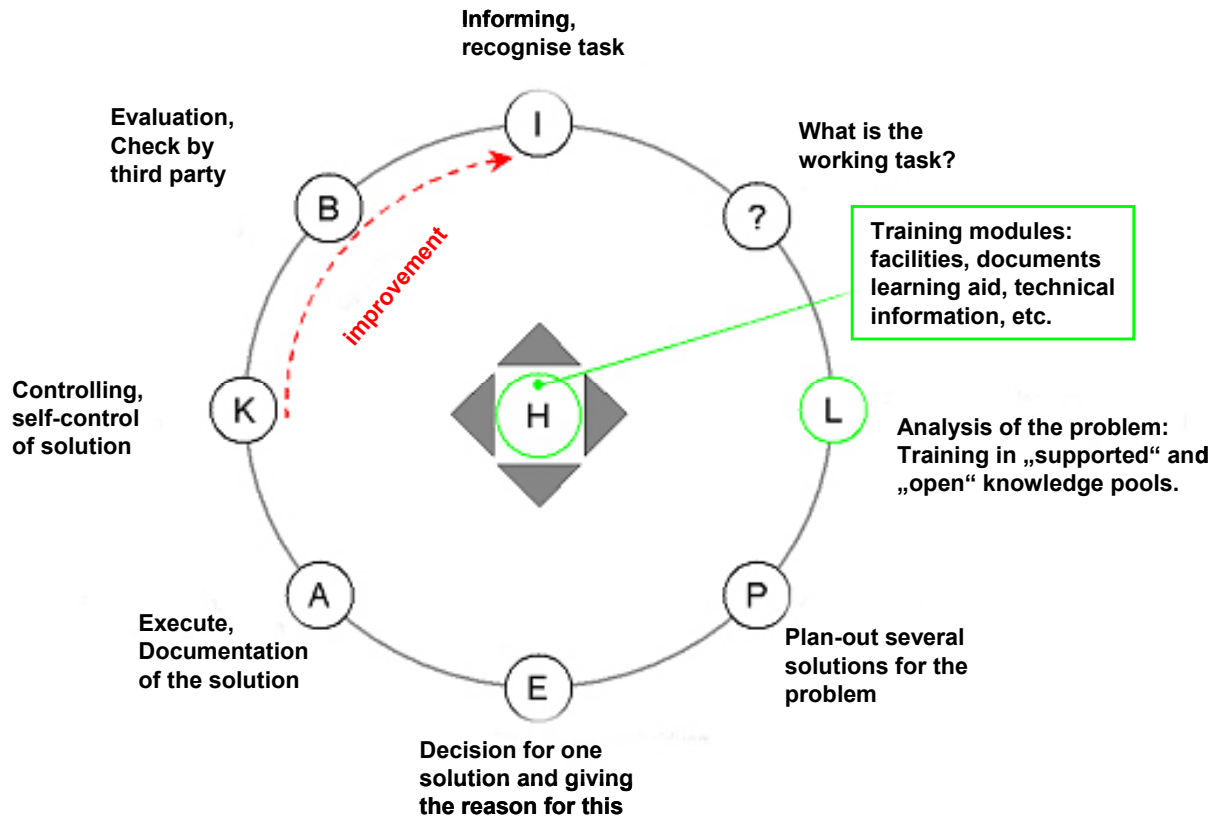


Figure 3: complete learning task

This method is claimed from the learning know-how and develops operating-specific, self-initiated vocational learning for the extension of the already available knowledge and additionally gives assistance with creating operational solution knowledge as well as with the construction of solutions to problems in the given transfer projects and beyond.

## 2.1.2 Further Results

Next to the already-described aspects for the action orientation and for didactical requirements are given further concepts, which are found for the development of learning arrangements for learning on the job with new technology-based media in the context of a Technology Enhanced Learning (TEL). These include:

- Action Learning
- Situated Cognition
- Job Task analysis and training development models
- Apprenticeship training

The concepts and learn-theoretical beginnings play different roles depending upon the objectives and purpose of work-based learning in occupational education and training. It has, however, the common direction on learning on the job and/or working –process integrated learning. Work-based learning is becoming an increasingly essential part of occupational education, whether in the form of internships, apprenticeships, cooperative education, school-supervised work experiences, practicums, or clinicals (Office of Technology Assessment, 1995). One of the three core components of the federal School to Work Opportunities Act of 1994, work-based learning is defined in that legislation as Job training and work experiences aimed at developing pre-employment and employment skills, attitudes, and knowledge. Business and industry, national government, and public educators seem to agree that strong partnerships and a larger role for employers need to be part of the reform of education, both vocational-technical and academic (Bailey, 1995). Learning in context at workplace settings is seen as a means of making education relevant to Job requirements and enhancing the transition from school to work. Work-based

learning initiatives are being used increasingly by schools and community colleges in preparing students for work (Bragg, Hamm, & Trinkle, 1995; Goldberger, Kazis, & O'Flanagan, 1994; D.S. Department of Education, 1991).

### **2.1.2.1 Action Learning**

As an alternative to classroom training, action learning has been adopted by business schools and corporations as a work-based, experiential process for managerial development (Margerison, 1989). Learning occurs through the activity of solving real problems, in the context of actual work assignments, working with a group whose members assist each other to find solutions. Cusins (1995) defined action learning as a set of activities that "create a context for creative decision making in uncertain situations" (p.1). These activities include

- (a) experiential learning, including disciplined reflection on the experience that involves reflective observations, making sense of information, and applying learning to other situations;
- (b) creative problem solving processes, involving problem definition, analysis, generation and analysis of options, and implementation of the chosen solution;
- (c) acquisition of relevant knowledge from human, print, or electronic resources; and
- (d) co-learner group support, where individuals assist each other to make decisions and add information from their own experience and resources (Cusins, 1995).

A key aspect of action learning is asking questions to develop a better understanding of the functions, skills, knowledge, and processes required to implement an activity or solve a problem. (Harnish & Wilke-Schnauffer, 1998)

### **2.1.2.2 Situated Cognition**

Cognitive scientists study how learning occurs by examining, perceiving, thinking, remembering, understanding language, solving complex problems, and other activities for making sense of our environment (Stillings et al., 1987). Recent research on how individuals acquire expertise in job tasks has emphasized the importance of the social and physical context in learning. Raizen (1989) noted that experts "call upon a range of clues provided by the environment, the practice and experience of their fellow workers, and their own situated knowledge to address the task at hand" (p. 37). Learners rely on the context in which instruction occurs to determine the usefulness and meaning of knowledge (which is culturally situated and socially constructed), and this is critical to their ability to transfer that knowledge to new situations (Brown, Collins, & Duguid, 1989). Drawing on the processes whereby novices apprentice themselves to an expert or master practitioner who can model skilled behaviors and authentic activities within a realistic work setting, Collins, Brown, and Newman (1989) proposed a cognitive apprenticeship model of teaching. This approach includes four elements: content, methods, structure, and social aspects. (Harnish & Wilke-Schnauffer, 1998)

### **2.1.2.3 Job Task analysis and training development models**

Developed to help close the gap between what workers do and what a curriculum teaches, task analysis identifies work requirements of specific jobs using information about tasks performed by workers in that occupation to develop education and training programs based on the realities of the job. Job task analysis identifies what a job includes and how to perform the job (Wolfe, Wentzel, Harris, Mazour, & Riplinger, 1991). The process of job task analysis includes developing and validating a task inventory, prioritising the tasks, and identifying training applications. Information is gathered from a review of written documentation, one-on-one interviews with expert performers, a review by a panel of expert performers or subject matter experts, or direct observations of workers. Brown (1997) identified three types of task analysis models: worker oriented, job oriented, and cognitive oriented. (Harnish & Wilke-Schnauffer, 1998)

### **2.1.2.4 Apprenticeship training**

Berryman (1995) believed that apprentice training is a "paradigm for learning" and described some of the pedagogical characteristics of apprenticeship training. In this training, activities engaged in by learners are determined by work to be accomplished on the job. The learning situation consists of a community of experts and of novices who are inducted into expert practice. Learning has immediate use and relevance, since apprentices are doing necessary tasks in actual work processes, rather than practicing for future applications in a job. Apprentice training usually begins with simple tasks and proceeds to the more difficult. It focuses on performance of skills and embedded knowledge that is not always articulated as general principles. Standards of performance success are obvious to the learner and integral to the work production process itself. Little formal teaching may occur, and apprentices take responsibility for their

own learning by observing work sequences and identifying areas where additional skills are needed. Collins, Brown, and Newman (1989) noted that "apprenticeship embeds the learning of skills and knowledge in their social and functional context" (p. 454). (Harnish & Wilke-Schnauffer, 1998) The quality of training depends on who is doing the training and how experienced the master or expert is in the job itself and in effective teaching methods (Office of Technology Assessment, 1995). In work settings, as in classrooms, the way that learning activities are organized can enhance or inhibit learning. Using the concepts and findings from the theory, research, and application discussed above, a list of characteristics of quality work based learning can be proposed as a starting point for the design of learning activities that occur in work settings and as possible criteria for future research or the evaluation of the quality of work-based learning programs.

These characteristics include the following:

1. Knowledge and skills relevant for an occupation are taught using learning tasks that contain essential elements of the work identified by actual workers from all levels of the production process or service area.
2. Learning activities are those typical of a profession, including social and organizational aspects (how work is structured and carried out, interactions, and teamwork) as well as the specialized technical skills.
3. Theoretical knowledge is taught effectively in connection with work tasks so that working and learning are closely integrated and knowledge is more easily transferred to new situations.
4. Teamwork, problem solving, and collaborative work skills are taught through the design of authentic work tasks and exercises used for instruction based on input from expert workers and practitioners from the field.
5. Learning involves the use of equipment, tools, and materials actually used in production and services by workers in the occupation.
6. Tasks can be seen and understood in the context of the total system and process of work, and can be related to the end product.
7. Learning activities result in real products or services of use to clients or customers.
8. Learning tasks are sequential (activities follow a logical order), developmental (student moves from simple to more complex tasks and builds on prior learning), and integrated (relation among activities and to a larger whole is made apparent).
9. Learning involves frequent interaction with workers and expert practitioners of various experience and skill level, but one experienced worker is identified and assigned to the student as mentor, coach, and coordinator of learning activities and progress.
10. Learning involves independent activities requiring student initiative and responsibility, as well as supportive coaching, advice, and demonstration by experienced workers.
11. The location of learning reflects the realistic demands of the workplace and the work contexts in which knowledge and skills have to be used.
12. Learning occurs in a way that encourages ongoing, self-organized learning and includes a balance of action, reflection, and application. (Harnish & Wilke-Schnauffer, 1998)

## **2.2 Where are the gaps?**

The discussion of learning arrangements is affected by the key words: Action Learning, Situated Cognition, Job Task analysis and training development models, Apprenticeship training, technology enhanced learning, development of practice oriented content, didactical needs for e-media content. This discussion has to be seen under respect of the characteristics of work-based learning.

There are some basic conditions which determine the success of the "new" learning arrangements. These include the characteristics of new and future working environments, the general integration of professional training and the future demands of professional training. Based on these characteristics there are some gaps that must be taken into account for the development and implementation of learning arrangements for professional training. These determining characteristics and gaps are listed below.

### **The characteristics of new and future working environments:**

- To reach the goal to be the most competitive economy in the world in a sustainable way, there must be excellent infrastructures for knowledge work and especially for knowledge work in the service sector: "The Internet-world".
- Implementation and enhancement of new flexible work organisation and competence networks
- The usage of information and communication technology for a sustainable knowledge and innovation management: „Quality of innovation“

- Lifelong learning has to be understood as a natural learning culture in companies and the society: „consistent learning culture“.

### **The general integration of professional training in economy and society:**

The work processes themselves include a variety of reasons to learn. So, they are predestined to be the basis for a learning arrangement. At present the employees are learning at the workplace informally, supported by the technology included in the work equipment. Training and the used technologies and concepts for training solutions have to differ between selective knowledge needs and a systematic competence development.

### **The future demands of professional training:**

- The sector of system related textual requirements
  - strategical changes of technology
  - situational knowledge of details and individual, specific professional competence
  - electronic documentation and decentralised cost responsibility
  - updated and complementary competence
  - virtualisation and activities in virtual environments
- The sector of social and organisational requirements
  - steering of social constellations
  - dealing with private and working times ("Work-life-balance")
  - customer development and complex services
  - coverage of structural overload
  - super soft skills

### **The three identified main gaps in the area of learning arrangements:**

- The change of the workplace to a learning place for knowledge-intensive work tasks
  - As a consequence of the change from the industrial society to a knowledge-based society there is a fundamental change in the educational system, the professional training system, the processing of knowledge and the knowledge adoption in companies.
  - Companies become increasingly aware that human resource are the most valuable resources of a company. The employees are not only considered as a cost factor.
  - Employees cannot become younger and younger in an aging society.
  - Learning at workplace will become the standard professional training concept.
- The measurement of the outcome of a training course/activity
  - Questions of human resource management in a knowledge-based company get a new meaning. Human resource development and organisational development get closer and require new concepts. The aim is to make work more productive and attractive.
  - E-Learning, knowledge management and human resource management concepts are the success critical competencies to solve the challenges of the change at work in the following years.
  - E-Learning and knowledge management are the key tasks for more competitiveness, innovations, flexibility and company value.
- Management of communities of learners
  - The use of informal knowledge become a success-critical task for competitiveness of companies.
  - The distributed working tasks for one product requires concepts for the exchange of spatially distributed employees.
  - Self-directed learning is increasingly required in the changing working society.

In general, the development of appropriate and high-quality learning activities and instructional materials that effectively use the resources of a work setting in business or industry have not been adequately

addressed. Almost no attention has been paid to the question how learning at the workplace should be designed and how to use the workplace as a learning place that includes more than placing students in jobs to gain work experience. The following research questions have to be answered:

### **What does it take to turn the workplace into a learning place for employees?**

In school, teachers use curricula, lesson plans, pedagogical methods, homework, tests, and grades as the building blocks of an instructional program with a clear structure and sequence, which can be delivered with relatively consistent quality, and which can assess what students have learned.

**How can quality and content of learning be measured**, if learning opportunities are embedded in the workplace and if they are not structured in the "classical" way (e.g. seminars, courses etc.)?

Every workplace is different both across and within industries. These industries produce different products and services, for different segments of the market, with different technologies, work organizations, and management structures.

Research on contextual learning reinforces the importance of active, experiential learning strategies that are contextually based. These serve to increase student motivation, the relevance of education, and the transfer of learning to work environments. However, learning within profit-oriented environments designed for ongoing production or service delivery presents unique challenges to educators and employers. The design of instructional activities will have to differ from those used in traditional classroom or even laboratory settings.

Accommodating the often competing priorities of business profits and educational outcomes, while making effective use of the opportunity for contextualised learning and the integration of schooling and work, is a major challenge in implementing work-based learning.

### **How can work-based learning in knowledge-intensive work settings be structured to ensure meaningful, high-quality learning experiences for students?**

Conceptual frameworks can be found in situated cognition and action learning theories, and in the task analysis models for curriculum development. Learning strategies developed in apprenticeship training programs can also contribute to an understanding of how learning works in the workplace. These conceptual theories, models, and research on contextual, workplace learning can be helpful in addressing the following questions:

- What do we know about how learning works in different kinds of work settings?
- What does this tell us about how to design learning activities and materials for work-based learning?
- What are the characteristics of high-quality work-based learning?
- How does education need to be structured at the workplace to provide students with a high-quality learning experience?

## **2.2.1 Literature and further readings**

- Applebaum, E., & Batt, R. (1994). *The new American workplace: Transforming work systems in the United States*. Ithaca, NY: ILR Press.
- Ardelt, Maximilian: Globalisierung der Telekommunikation - noch viele Aufgaben für Staat und Industrie, in: *Office Management 7/1997*, p. 9ff
- Arnold, Rolf: Das duale System der Berufsausbildung hat eine Zukunft, in: *Berufs- und Wirtschaftspädagogik 1*, 1993, p. 20
- Back, A., Seufert, S., Kramhöller, S.: Technology enabled Management Education: die Lernumgebung MBE Genius im Bereich Executive Study an der Universität St.Gallen, in: *io management*, 3, S. 36-42, 1998
- Bailey, T. R. (Ed.). (1995). *Learning to work: Employer involvement in school-to-work transition programs*. Washington, DC: The Brookings Institution.
- Bailey, T., & Merritt, D. (1993). *The school-to-work transition and youth apprenticeship: Lessons from the U.S. experience*. New York: Manpower Demonstration Research Corporation.
- Ballin, D; Brater, M.: Handlungsorientiert lernen mit Multimedia. Nürnberg, 1996 (p. 45)
- Becker, T; Gidion, G; Rickert, A.: Didaktische Modelle: Aufbereitung von e-Learning Content. In: Bullinger, H. J.; Weisbecker, A. (Hrsg.): *Content Mangement - Digitale Bausteine einer vernetzten Welt*, Stuttgart: IRB, 2002
- Berezak-Lazarus, Nadine; Vesper, Jens: Neue Wege zum Multimedia Information Highway, in: *Office Management 7/1997*, p. 11ff
- Berryman, S. (1995). Apprenticeship as a paradigm of learning. In W. N. Grubb (Ed.), *Education through occupations in American high schools* (Vol. 1, pp. 192-213). New York: Teachers College Press.
- Bloom, Benjamin S.: *Taxonomie von Lernzielen im kognitiven Bereich*, Weinheim Basel, 1972
- Bodendorf, Freimut; Langenbach, Christian: *Electornic Education Mall - ein virtueller Marktplatz für mediengestützte Aus- und Weiterbildung*, in: *Wirtschaftsinformatik 6/1997*, p. 589
- Bönsch, Manfred: *Unterrichtsverfahren*, in: Dederling, Heinz (Hrsg.): *Handbuch zur arbeitsorientierten Bildung*, München 1996
- Bragg, D., Hamm, R., & Trinkle, K. (1995). *Work-based learning in two-year colleges in the United States*. Berkeley, CA: National Center for Research in Vocational Education.
- Brown, B.L.(1997). *Task analysis strategies and practices: Practice application brief*. Columbus: Ohio State University. (ERIC Document Reproduction Service No. ED 404 571)
- Brown, j. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Bullinger, H.-J.: *Dienstleistungen für das 21. Jahrhundert - Trends, Visionen und Perspektiven*. In: H.-J. Bullinger (editor) *Dienstleistungen für das 21. Jahrhundert/Gestaltung des Wandels und Aufbruch in die Zukunft*. Stuttgart: Schäffer-Poeschel, 1997

Bundesanstalt für Arbeit, Federal Employment Office): kurs-direkt, www.arbeitsamt.de

Bundesinstitut für Berufsbildung (BIBB) (Eds. BMBF): Qualifikationsstrukturbericht (Report about Qualification Structure), Bonn, 2000

Bundesministerium für Bildung und Forschung (BMBF) (and Statistisches Bundesamt (Federal Statistical Office)): Basic and structural data 2001/2002, Bonn, 2002

Bundesministerium für Bildung und Forschung (BMBF): Berichtssystem Weiterbildung (A Reporting System of Continuing Education, a representative survey of some 4.000 to 8.000 persons by Infratest Social Research), Bonn, 2001

Bundesministerium für Bildung und Forschung (BMBF): Berufsbildungsbericht (Report on Vocational Education), Bonn, 2003

Bundesministerium für Bildung und Forschung (BMBF, Federal Ministry of Education and Research): Vocational Education and Training at a Glance, Bonn, 2000

Carnevale, A.R, Gainer, L.J., & Meltzer, A.S. (1988). Workplace basics: The skills employers want. Washington, DC: U.S. Department of Labor; Alexandria, VA: American Society for Training and Development.

Clifford, J. P. (1994). Job analysis: Why do it, and how it should be done. *Public Personnel Management*, 23(2), 321-340.

Collins, A., Brown, J.S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates.

Commission on the Skills of the American Workforce (June 1990). *America's choice: High skills or low wages*. Rochester, NY: National Center on Education and the Economy.

Courtiat, Jean-Pierre & Davarakis, Costas & Villemur, Thierry (eds.): *Technology Enhanced Learning*, 2004, SSBM

Cusins, P. (1995). Action learning revisited. *Industrial and Commercial Training*, 27(4), 3-10.

Dederling, Heinz (Hrsg.): *Handbuch zur arbeitsorientierten Bildung*, München 1996

Dostal, Werner: *Die Informatisierung der Arbeitswelt - Multimedia, offene Arbeitsformen und Telearbeit*, in *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung* 4/95, p. 527ff, IAB, Nürnberg 1995

Dowling, Carolyn; Lai, Kwok-Wing (eds.): *Information and Communication Technology and the Teacher of the Future*, 2003, Kluwer

Ellis, M. (1997). A grounded theory of essential attributes of quality education for work curriculum. *Journal of Vocational Education Research*, 22(1), 21-38.

Emnid: *Media Vision - Akzeptanz, Stand der Technik und Perspektiven ausgewählter multimedialer Anwendungen*. Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO), Emnid-Institut GmbH & Co.. Stuttgart: IRB-Verlag, 1996.

Forum Info 2000 des Bundesministerium für Wirtschaft und des Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie: *Bildung und Medienkompetenz im Informationszeitalter*, Bericht der AG4, Bonn, 1998

Fraunhofer Institut für Systemtechnik und Innovationsforschung *Technologie-Delphi 1998*, Karlsruhe, 1998

Fraunhofer Institut für Systemtechnik und Innovationsforschung: *Technologie-Delphi 1992 (Delphi-Report about Future Technologies)*, Karlsruhe, 1992

Galperin, P. J. (1979). Die geistige handlung als grundlage für die bildung von gedanken und vorstellungen [Mental action as the basis for the development of thoughts and imaginations]. In P. J. Galperin, A. N. Leontjew, & Others (Eds.), *Probleme der Lerntheorie [Problems of learning theory]* (pp. 29-42). Berlin: Volk und Wissen.

Goldberger, S., Kazis, R. & O'Flanagan, M. K. (1994). *Learning through work: Designing and implementing quality worksite learning for high school students (Jobs for the Future Report on School-to-Work Transition Project)*. New York: Manpower Demonstration Research Corp.

Hagel, John III; Armstrong, Arthur G.: *Net gain: Expanding markets through virtual communities*, Harvard Business School Press, Boston 1997.

Hanser, L. M. (1996). *Traditional and cognitive job analyses as tools for understanding the skills gap*. Berkeley, CA: National Center for Research in Vocational Education.

Harnish, D.; Wilke-Schnauffer, J.: *Work-Based Learning in Occupational Education and Training*. *The Journal of Technology Studies*, Number 2, Summer/Fall 1998

Harnish, D.; Wilke-Schnauffer, J.: *Preparing Students for a Changing Workforce: Perspectives from Germany and the United States*. In: *ATEA Journal* Oct./Nov. 1996, Hrsg.: The American Technical Education Association, Inc., Wahpeton, North Dakota, USA.

Hasebrook, J.: *Multimedia-Psychologie*. Heidelberg. Spektrum, 1995.

Hoppe, Uwe: *Integration von Teachware in betriebliche Instruktionssysteme*, in: *Wirtschaftsinformatik* 6/1997, p. 3ff

Impagliazzo, John; Lee, John A.N. (eds.): *History of Computing in Education*, 2004, Kluwer

Improvement. The Secretary's Commission on Achieving Necessary Skills (June 1991).

Infratest Sozialforschung, Prognos AG: *Delphi Study about Knowledge and Education from 1996-1998*, Bonn, 1999

Institut für Arbeitsmarkt- und Berufsforschung (IAB, Institute for research on labour market and professions): *IAB material 1/2001, BIBB/IAB study 1998/99, Nürnberg*, 2001

Institut für Arbeitsmarkt- und Berufsforschung: *IAB-material 1/2000, Nürnberg*, 2000

Institut für Wirtschaftsforschung: *Beschäftigungspotentiale elektronischer Medien*, in: *ifo Schnelldienst* 3/1997, p.3ff

Issing, Ludwig J./ Klimsa, Paul (Hrsg.): *Information und Lernen mit Multimedia*, Weinheim 1997

Kamamata, S. Egidardo: *Weiterbildung als Auslöser von Innovationsimpulsen für die Praxis*, in: *io Management Zeitschrift* 63, 1994, p. 30-34

Kazis, R., & Goldberger, S. (1995). The role of employers: The integration of work-based learning. In W. N. Grubb (Ed.), *Education through occupations in American high schools* (Vol. 2, pp. 171-190). New York: Teachers College Press.

Kerres, Michael: *Multimediale und telemediale Lernumgebungen*, München Wien Oldenburg, 2001

Kirchhöfer, D.: *Lernkultur Kompetenzentwicklung*. Berlin 2004 (p. 70)

Klimsa Paul: *Multimedia aus psychologischer und didaktischer Sicht*, in: Issing, Ludwig J., Klimsa, Paul (Hrsg.): *Information und Lernen mit Multimedia*, Weinheim 1997

Kloas, Peter-Werner: *Modulare Weiterbildung im Verbund mit Beschäftigung - Arbeitsmarkt- und bildungspolitische Aspekte eines strittigen Ansatzes*, in: *Berufsbildung in Wissenschaft und Praxis* 1/1996, p. 39

Krapp, Andreas / Weidemann, Bernd (Hrsg.): *Pädagogische Psychologie*, Weinheim, 2001

Krathwohl, David R.: *Taxonomie von Lernzielen im affektiven Bereich*, Weinheim Basel, 1975

Kravetz, Dennis J.: *Measuring Human Capital: Converting Workplace Behavior into Human Dollars*, Associates Publishing, 2004

Lave, J. and Wenger, E. (1991): *Situated Learning. Legitimate Peripheral Participation*, Cambridge.

Lutz, Burkhardt; Matthias Hartmann; Hartmut Hirsch-Kreienzen (Hrsg.): *Produzieren im 21. Jahrhundert, Ergebnisse des Expertenkreises Zukunftsstrategien, Band I*, Campus, München, 1996

Margerison, C. (1989). *Action learning: A short managerial guide*. *Management Bibliographies and Reviews*, 75(3, 4), 7-16. Office of Technology Assessment, Congress of the United States. (1995). *Learning to work: Making the transition from school to work*. Washington, DC: Government Printing Office.

Marquardt, Michael J.: *Optimizing the Power of Action Learning*, Davies-Black Publishing, 2004

McLellan, H.(Ed.) (1996): *Situated Learning Perspectives*. Educational Technology Publications, Englewood Cliffs, NJ .

Müller-Stewens, Günter; Osterloh, Margit: Kooperationsinvestitionen besser nutzen: Interorganisationales Lernen als Know-how-Transfer oder Kontext-Transfer?, in: Zeitschrift für Organisation 1/1996, p. 18

Münch, J.: Das berufliche Bildungswesen in der Bundesrepublik Deutschland, Luxemburg Verlag, 1987

National Center on the Educational Quality of the Workforce (1994). The EQW national employer survey: First findings. U.S. Department of Education, Office of Educational Research and

Nicholson, Paul J.; Thompson, Barrie; Ruohonen, Mikko; Multisilta, Jari (eds.): E-Training Practices for Professional Organizations, 2004, Kluwer

Passe-Tietjen & H. Stiehl (Eds.) Learning of action in enterprises and the role of the trainer, (pp. 109-123). Wetzlar Jungarbeiterinitiative an der Werner-von-Siemens-Schule, 109-123.

Passey, Don; Kendall, Mike (eds.): TELE-LEARNING The Challenge for the Third Millennium, 2002, Kluwer

Prognos; DIW: Künftige Entwicklung des Mediensektors, Berlin 1996

Raizen, S. A. (1989). Reforming education for work: A cognitive science perspective. Berkeley, CA: National Center for Research in Vocational Education.

Rauner, F.: Schaffung neuer Ausbildungsplätze. Expertise im Auftrag der IG Metall Bezirksleitung Baden-Württemberg. Hrsg. v. der IG Metall Bezirksleitung Baden-Württemberg. Bremen, 2003

Reich, R. (1992). The work of nations: Preparing ourselves for 21st century capitalism..

Reinmann-Rothmeier, Gabi / Mandl, Heinz: Unterrichten und Lernumgebungen gestalten, in: Krapp, Andreas / Weidemann, Bernd (Hrsg.): Pädagogische Psychologie, Weinheim, 2001

Resnick, L. (1987). Learning in school and out. Educational Researcher, 76(9), 13-20.

Rheingold, Howard: Smart Mobs: The Next Social Revolution, Perseus, 2002

Rosenstiel, L. von. Kommunikation und Führung in Arbeitsgruppen. In H. Schuler (editor), Lehrbuch Organisationspsychologie (p. 321-354). Bern: Huber, 1993.

Schiersmann, C.; Remmele, H.: Neue Lernarrangements in Betrieben. In: QUEM-report, Schriften zur beruflichen Weiterbildung, Heft 75. Berlin 2002

Schlotau, Walter: Verbundförderung: Anschubfinanzierung für betriebliche Ausbildungsplätze In: Berufsbildung in Wissenschaft und Praxis. Sonderausgabe 2003

Schubert, Petra: A framework for the analysis of socio-economic aspects of Electronic Markets, St. Gallen, 1998

Selwood, Ian; D. Fung, Alex C.W.; O'Mahony, Christopher D. (eds.): Management of Education in the Information Age The Role of ICT, 2003, Kluwer

Senge, Peter: The Fifth Discipline, Doubleday, New York, 1990

Skell, W. (1993). Psychische Handlungsregulation: Ein theoretisches Konzept für berufliches Lernen [Psychological action regulation: A theoretical conception for occupational learning]. In B. Paulsen & F. Worschech (Eds.), Arbeitsorientierte Weiterbildung für KMU: Strategien, Konzepte, Methoden [Work oriented continuation education for small and medium sized enterprises: Strategies, concepts, methods] (pp. 259-267). Brussels, Belgium: Eurotecnet.

Stanke, A.; Ganz, W.: Design hybrider Produkte. In: Volkholz, V.; Schrick, G. (editor) Dienstleistungen im 21. Jahrhundert, RKW "Themen und Thesen", Eschborn, 1995

Stern, D., Bailey, T., & Merritt, D. (1996). School-to-work policy insights from recent international developments. Berkeley, CA: National Center for Research in Vocational Education.

Stillings, N., Feinstein, M., Garfield, J., Rissland, E., Rosenbaum, D., Weisler, S., & Baker-Ward, L. (1987). Cognitive science: An introduction. Cambridge, MA: MIT Press.

Stolovitch, Harold D.; Keeps, Erica J.: Telling Ain't Training, ISPI/ASTD, 2002

Tatnall, Arthur; Osorio, Javier; Visscher, Adrie (eds.): Information Technology and Educational Management in the Knowledge Society, 2004, SSBM

to good practice. Englewood Cliffs, NJ: Educational Technology Publications.

Troll Lothar: Moderne Technik bringt neue Vielfalt in die Arbeitswelt, Der Computer prägt immer mehr Arbeitsplätze ohne die herkömmlichen Arbeitsmittel zu verdrängen, Institut für Arbeitsmarkt- und Berufsforschung 6/2000, Nürnberg

U.S. Department of Education. (1991). Combining school and work: Options in high schools and two-year colleges (Report on "The Quality Connection: Linking Education and Work" national conference, May 1990). Washington, DC: U.S. Department of Education, Office of Vocational and Adult Education.

van Weert, Tom J. (eds.): Education and the Knowledge Society: Information Technology Supporting Human Development, 2004, Kluwer

van Weert, Tom J.; Kendall, Mike (eds.): Lifelong Learning in the Digital Age Sustainable for all in a changing world, 2004, Kluwer

van Weert, Tom J.; Munro, Robert K (eds.): Informatics and the Digital Society Social, Ethical and Cognitive Issues, 2003, Kluwer

Volpert, W. (1985). Pedagogical aspects of the theory of action regulation. In H. Passe Tietjen & H. Stiehl (Eds.), Learning of action in enterprises and the role of the trainer (pp. 109-123).

Wehner, T., Clases, C. & Endres, E. (1996): Situiertes Lernen und kooperatives Handeln in Praxisgemeinschaften. In: Endres, E., Wehner, T.: Zwischenbetriebliche Kooperation. Die Gestaltung von Lieferbeziehungen, Weinheim.

Wetzler: Jungarbeiterinitiative an der Werner-von-Siemens-Schule.

What work requires of schools: A SCANS report for America 2000. Washington, DC: U.S. Department of Labor.

Wienand, Axel: Die Entstehung, Entwicklung und Zerstörung von Märkten durch Innovationen, Schriftenreihe der Wissenschaftlichen Hochschule Koblenz, 1988

Wilke-Schnauffer, J. (1994). Systematic on-the-job learning in medium and small scale enterprises: Description of the pilot study, Journal of Socialization Research and Educational Sociology, 4, 1-22.

Wilke-Schnauffer, J.; Schonhardt, M.; Frommer, H.; Weidhaas, H. (1998). Lern- und Arbeitsaufgabenkonzepte für die Berufsausbildung: Ergebnisse aus dem Modellversuch 'Dezentrales Lernen in Klein- und Mittelbetrieben'. Hrsg.: Bundesinstitut für Berufsbildung, Der Generalsekretär, Bielefeld: Bertelsmann.

Wolfe, P., Wentzel, M., Harris, G., Mazour, T., & Riplinger, J. (1991). Job task analysis: Guide

Zemsky, R. & Iannozzi, M. (1995). A reality check: First findings from the EQW national employer survey. EQW Issues; (no. 10), National Center on the Educational Quality of the Workforce.

### 3 Knowledge work management (KWM)

Research in the field of e-learning has traditionally concentrated on the human / technology relationship. Work is focused on increasing the functionality of technical solutions and adapting these solutions in line with the needs and requirements of learners (and trainers). Alongside usability issues, it is above all the

selection of an appropriate didactic design which is regarded as crucial in ensuring optimum support for the learning and teaching processes.

One aspect of the mission of ProLearn is to support the increased practical use of technology enhanced learning (TEL) within companies. Rather than concentrating exclusively on how new technological solutions can improve the interaction between learners and learning applications, this approach also aims therefore to shed light on management-related issues. Work package 6, for example, considers the requirements which companies expect TEL solutions to meet, how implementation processes can be optimised, and how the costs and benefits of these investments can be shown in a controlling framework.

Whether it is really worthwhile for a company to adopt technology enhanced learning or not depends finally on the contribution which this technology can make to ensuring that work is performed faster, better and more efficiently. For this reason technology enhanced learning should, in the future, be regarded more closely in the context of work or the work organisation.

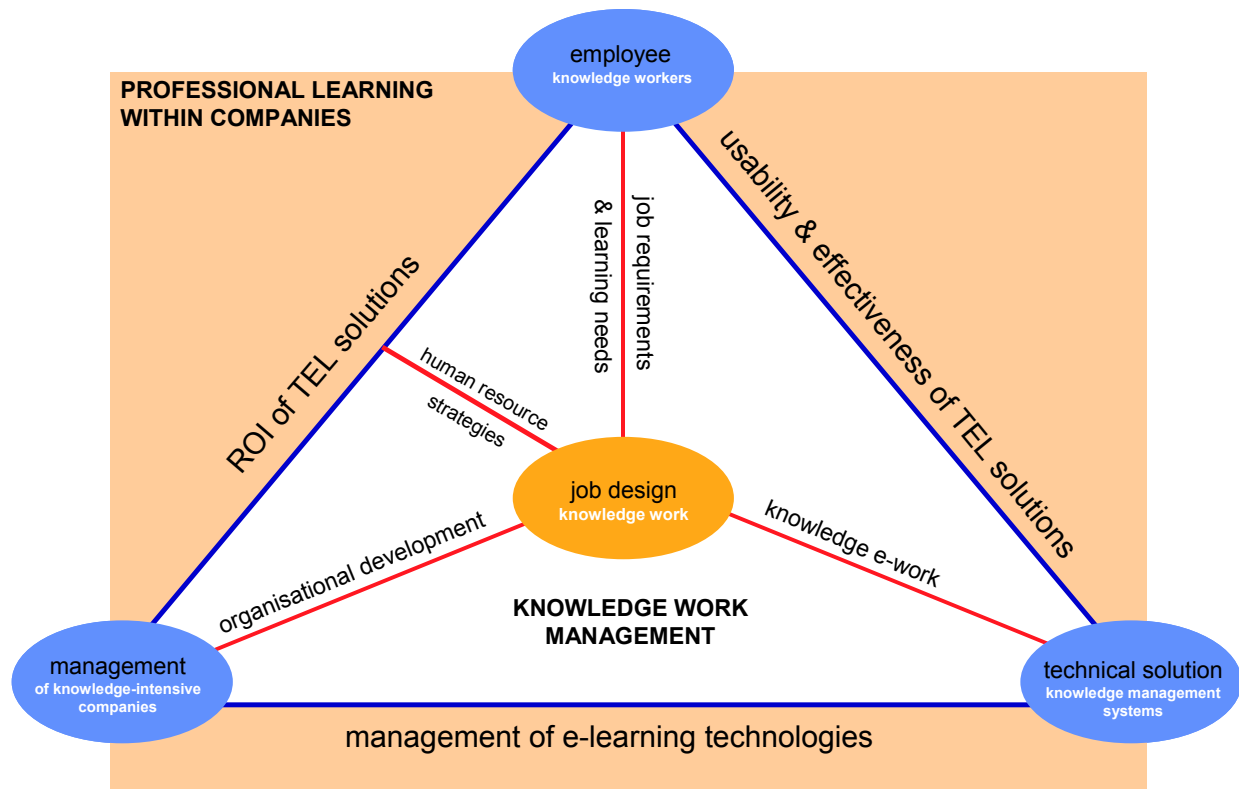


Figure 4: Relationship between knowledge management and TEL

Learning needs are generated by changes in job requirements. These changes may be triggered by management decisions which lead to changes in organizational structure and work processes (organisational development) or by the introduction of new technical solutions which automate and support work processes (e-work). In addition, decisions about who is responsible for which tasks, or whether a task may be better performed externally, (human resource strategies) also have an influence on how much learning is required.

Above all, the fact that the world of work is in a state of permanent flux has been largely ignored in discussions of technology enhanced learning, which to date have focused on finding the right solution for a static situation.

Bearing in mind the ongoing change processes in companies, it is both appropriate and necessary to enrich the insights generated by learning and training research with findings from research undertaken in the work and management field. Only when these two aspects are taken together do they produce a "rounded" picture of professional learning. Having identified the gaps in learning and training research in Chapter 1, this Chapter now explores similar gaps in work and management research in the field of knowledge work – an area on which we wish to concentrate in particular in the framework of ProLearn.

### 3.1 Identifying the gaps in KWM research

Efficiency and effectiveness are increasingly important factors for companies operating in the field of knowledge and service work. As automation and outsourcing continues to reduce the number of people employed in the production of goods in the industrialised countries, major rationalisations can now only be made in the knowledge and service areas. Increased knowledge work productivity is thus destined to become one of the biggest management challenges in the industrialised world (Drucker, 1991). This is the view now shared by many experts. However, to date there is a lack of convincing approaches to solving the problems inherent in systematic knowledge work management— in other words, a coherent set of measures aimed at creating an optimum company framework for effective and efficient knowledge work which is adapted to the needs of workers.

Ideally, knowledge work management should be an all-round management approach which begins at the strategic level with a conscious decision about those knowledge-intensive activities which are to remain in the company and those which are to be outsourced, and which ends at the operative level by implementing organisational, technical and qualification-related measures which support individual work.

However, the design of knowledge work has only become a topic of interest, both in research and business practise, in recent years (Davenport, 1998), and for this reason there are very few examples of the consistent implementation of such approaches for operational purposes in the current literature (Hermann et al. 2005). There is, however, an extensive research literature on related topics which may well provide a source of important insights for knowledge work management.

The first step in identifying relevant insights, as well gaps in knowledge work management research, is to develop a screening method which will facilitate a systematic search. In work research it is standard practice to describe work systems along the axes of technology, organisation and human factors. Work package 7 adopts this approach to a search for relevant research findings and gaps in knowledge, but differentiates organisational aspects in terms of job design (i.e. organisation of work processes) and management control (organisational structure or corporate management) such that our gap analysis is based on the following four questions:

- *Management*: What do we know about the management of knowledge-intensive companies?
- *Job design*: What do we know about knowledge work or knowledge-intensive activities?
- *Technology*: What do we know about the use of knowledge management systems?
- *Employee*: What do we know about knowledge workers?

By delving into the literature on these four fields it should be possible to determine how sensitive research, policy and business are to issues of knowledge work management, what insights and – possibly products/tools – are already available, and what unanswered questions remain in the field of learning in particular.

#### 3.1.1 Research on the management of knowledge-intensive companies

It was in the 1990s that the idea came to the fore that the factor knowledge was destined to gradually replace the classic factors of production – land, labour, capital and raw materials. This was primarily demonstrated by the enormous success of young (internet) companies on the stock market – companies which had practically no material assets to their name at all. The argument was put that the difference between the book value and share value of these companies reflected their intellectual capital.

Since then a number of tools have been created and propagated which should help to integrate intangible assets more firmly in corporate management. These include the Scandia Navigator (Edvinsson & Malone, 1997), the Intangible Assets Monitor (Sveiby, 1997) and the Balanced Scorecard (Kaplan und Norton, 1998). The latter, in particular, has begun to secure a firm place in European companies in recent years. However, the EFQM model, which has been widely used in Europe for considerably longer, also falls into this category.

A second line of research began focusing on the special characteristics and success factors of knowledge-intensive companies and elaborating relevant organisational proposals (e.g. Alvesson, Zack, Nonaka & Takeuchi, Nurmi, 1998, Nichols 2003). In contrast to traditional industrial firms, knowledge-intensive companies appear to function according to an entirely different set of ground rules. This has been ascribed to the special characteristics of their products (i.e. knowledge-intensive services). Cramer (2004) summarised this discussion as follows: "*Knowledge-intensive services evince a set of characteristics which, in combination with present changes in economic conditions and constraints, place extremely high and unprecedented demands on modern methods of business management. Complex*

*tasks which entail uncertainties and are only marginally amenable to standardisation are tackled by temporary project groups which are capable of working – on a largely autonomously and self-managed basis – across the usual internal company boundaries. The transfer of coordination tasks and the delegation of responsibility and decision-making powers to the employee level, for example, inevitably engenders a changing role for management. The individualisation of work and the high level of interaction with the customer call for new methods of marketing. And as intellectual capital and its generation are subject to entirely different natural laws, financing and controlling are consequently subject to radical change. The age of the knowledge society calls for a radical rethink at every level of management."* (Cramer, 2004, page 204)

Bearing these considerations in mind, Nonaka & Takeuchi 1998 even recommend turning the traditional hierarchical organisational structure on its head and introducing a hypertext organisation.

While this tool only appeared to be of interest to large companies initially, since Basel II it has also become indispensable for small and medium-sized enterprises to concern themselves with the measurement of their intangible assets in order to obtain loans.

With the demise of the new economy this topic has faded out of the limelight somewhat. What remains, however, are the control systems referred to above which were initially of most interest to large companies. With the advent of Basel II, small and medium-sized enterprises now have no alternative either but to record their intangible assets as allocation of credit is made dependent on the existence of corresponding control systems. A second, sustained effect is the enhanced importance attached to human resource management which comes with the integration of learning and employee-related indicators in company control systems – in fact, human resource management is increasingly perceived as a strategic factor.

Recent research and development topics include, for example:

- The development of functional variants of the balanced scorecard, such as human resource scorecards, knowledge scorecards, innovation scorecards, etc.
- The modelling of cause-and-effect relationships between strategic metrics, operative metrics, and design measures (e.g., the Competence Card).
- The evaluation of the (market) value of knowledge resources already available to a company (preparation of knowledge accounts).

There is also a whole series of unanswered questions, as the following table shows:

#### **Key gaps in the field of management control:**

- There is a lack of tools which enable "objective" statements to be made about how knowledge intensive a company is.
- There is a lack of statistics on the number of knowledge-intensive companies operating in Europe.
- There is a lack of sound studies of the specific characteristics of knowledge-intensive companies.
- We know very little about how capable European companies are at present at implementing knowledge-intensive innovations or about what the major obstacles are.
- We know very little about whether and how well the control systems currently used map companies' knowledge objectives.
- There is a lack of concepts which enable knowledge-intensive companies to flexibly adapt their control and benchmarking systems to new requirements.
- There is a lack of tools which enable companies to determine where established processes and structures hinder knowledge work.
- There is a lack of good practice examples which illuminate the relationship between organisational learning and the knowledge work productivity.

#### **Literature and further readings**

- Advisory Council on Science and Technology: Stepping Up: Skills and Opportunities in the Knowledge Economy. (c) 2000. URL: Toronto.
- Badaracco, J.: The Knowledge Link. Boston, Massachusetts: Harvard Business School Press, 1991.
- Bohn, r. E.: Measuring and Managing Technological Knowledge. In: Sloan Management Review 73 (1994) Fall, S. 61.
- Edvinsson, L. & Malone, M.: Intellectual Capital. New York: Harper Business, 1997.

- Itami, H. & Roehl, T.: Mobilizing Invisible Assets. Cambridge Massachusetts: Harvard University Press, 1987.
- Stewart, T.: Intellectual Capital. London: Nicholas Brealey Publishing, 1997.
- Alvesson, M.: Knowledge work and knowledge-intensive firms. Oxford: Oxford University Press, 2004.
- Becker, W. & Daniel, K.: Wissensintensive Dienstleistungsbetriebe. Bamberger Betriebswirtschaftliche Beiträge Nr 122. (c) 1999. URL: Bamberg.
- Buss, K. & Wittke, V.: Wissen als Ware. Überlegungen zum Wandel der Modi gesellschaftlicher Wissensproduktion am Beispiel der Biotechnologie. (c) 2001. URL: <http://www.sofi-goettingen.de/frames/publik/mitt29/buss-wittke.htm> [Aktualisierungsdatum: 10.06.2003].
- Corell, A. C.: Das Management wissensintensiver Unternehmen. 1998.
- Cramer, J.: Management wissensintensiver Dienstleistungen. Wissensressourcen strategisch nutzen. In: S. Hermann (Hrsg.): Ressourcen strategisch nutzen: Wissen als Basis für den Dienstleistungserfolg. Stuttgart: Fraunhofer - IRB Verlag, 2004, S. 177-202.
- Kurtzke, C. & Popp, P.: Das wissensbasierte Unternehmen. München Wien: Carl Hanser Verlag, 1999.
- Leonard-Barton, D.: Wellsprings of Knowledge. Boston, Massachusetts: Harvard Business School Press, 1995.
- Nählinder, J. & Hommen, L.: Employment and Innovation in Services: Knowledge Intensive Business Services. (c) 2002. URL: <http://www.tema.liu.se/tema-t/sirp/pdf/hommen&nahlinder.pdf>.
- Netzer, T.: Das Partnerschaftsmodell als Erfolgsfaktor wissensintensiver Dienstleistungsunternehmen. Lohmar, Köln: Josef Eul Verlag, 2000.
- Petit, P.: Growth and productivity in a knowledge-based service economy. In: i.a.k.i.s.:n.e.a.s.a. Productivity (Hrsg.): Cheltenham [u.a.]: Elgar, 2002, S. 102-123.
- Starbuck, W. H.: Learning by Knowledge-Intensive Firms. In: Journal of Management Studies 29 (1999) 6, S. 713-740.
- Strambach: Wissensintensive unternehmensorientierte Dienstleistungen im Innovationssystem von Baden-Württemberg. Arbeitsbericht 133. Akademie für Technikfolgenabschätzung in Baden-Württemberg: 1999.
- Zack, M. H.: Rethinking the Knowledge-Based Organization. In: Sloan Management Review (2003) Summer, S. 67-71.

### 3.1.2 Research on the design of knowledge intensive work

In our view someone can be said to be doing knowledge work when they acquire new knowledge or when they combine and transform previously available knowledge in a way which provides them with new insights and knowledge (Hermann et al., 2005). Examples of knowledge transformation processes include the abstraction and concretion of specific instances or the explanation and prediction of events (see also Karni & Arciszewski, 1997, who propose 36 elementary knowledge "transmutations"). If a particular activity typically involves a high degree of knowledge work, it is appropriate to refer to it as a knowledge-intensive activity.

For a long time work research concentrated almost exclusively on industrial work. Hard scientific methods and design principles exist for this type of work which secure productivity and work quality on the one hand and the sustained performance and enduring health of employees on the other. The ergonomic aspects involved in planning a new production system, for example, are taken into account from the moment work begins on designing the work object (product) and manual or machine tools. The process ends with a definition of the division of labour between man and machine, and between workers themselves. Work processes are subsequently structured according to spatial, timing and human resource factors. This is followed by the ergonomic design of workplaces. Finally, working hours and guidelines for measuring pay are specified and the qualification of personnel planned (Luszk).

For a long time knowledge-intensive activities were excluded from work research. On the one hand it was regarded as inopportune or unnecessary to intervene actively in the work of highly-qualified people. On the other, manual activities are much easier to rationalise than intellectual ones. Today, with attention shifting more and more to knowledge work it is becoming increasingly clear that those engaged in work research need to reconsider this position completely. Design principles which are tried and tested in the field of industrial work cannot simply be adopted in unchanged form for knowledge-intensive activities given that knowledge work is subject to entirely different conditions and constraints and places very different requirements on workers than does work in industrial production.

The following are a few aspects which are typical for knowledge-intensive activities (Milz, 1996; Nurmi, 1996):

- Work tasks are for the most part planned, executed, monitored and organised independently by workers themselves. This leads to a high level of complexity. Not all sub-activities can always be mastered by the relevant person.
- Work is generated and undertaken in close cooperation with customers/cooperation partners. Solutions must be developed spontaneously – mostly on site where the customer is. In many cases actual final results can only be negotiated and specified in precise terms with the customer during the project lifecycle. These factors all demand a high level of flexibility and improvisational skills on the part of workers.

- Work is often undertaken by internal and inter-company teams of experts. People with different abilities, ways of thinking and interests often work together for limited periods of time. Mutual incomprehension, interpersonal dynamics, and conflicts of interests all need to be overcome.
- One person is often responsible for several projects at the same time. This places very high demands on workers' self-organisation skills. Activities need to be split up and interrupted and it is often only possible to resume work hours, days or even weeks later. Every interruption costs time and reduces productivity.

All these aspects contribute to the attractiveness of knowledge-intensive work. At the same time, however, they are also one possible cause of low productivity. What is more, these characteristics can also be partly responsible for health problems. Signs are accumulating which suggest that burnout as a result of permanent stress and unpaid (voluntary) overtime is set to take over from physical exhaustion as the main cause of lost working time. Knowledge-intensive work can be a cause of ill health (Brödner, 2001). However, very little is known about the relationships between these phenomena.

### Key gaps in the field of job design:

- There is a lack of methods for "objectively" assessing the knowledge intensity of activities.
- We do not have any clear ideas about the specific demands and stresses which knowledge work imposes nor do we have any tools for measuring the extent of such demands and stresses.
- There is a lack of intelligent concepts which would help to prevent permanent stress and burnout without destroying the intrinsic motivation of workers.
- We do not have the tools which would enable us to reliably measure the productivity and quality of knowledge work.
- We lack knowledge about the potential for and limits to the rationalisation and automation of knowledge-intensive activities.
- There is a lack of design approaches which would ensure that productivity improvements are not achieved at the cost of quality.

### Literature and further readings

- Alfs, S.: Accenture's new operating model: meeting the needs of the knowledge worker. New York: AMACOM, 2003.
- Brödner, P.: The future of work in a knowledge-based economy; contribution to the International Seminar on 'Economy and Work in the Knowledge Society', Barcelona, February 24-25, 2000, ICT/CIREM. Manuskript. (c) 2000. URL: [www.iatge.de/personal/ps/bruedner/future\\_of\\_work.pdf](http://www.iatge.de/personal/ps/bruedner/future_of_work.pdf) [Aktualisierungsdatum: 10.6.2003].
- Brödner, P.: Macht Arbeit wieder krank? Flexibilität und nachhaltige Gestaltung von Arbeit. (c) 2001. URL: [www.iatge.de/personal/ps/bruedner/trendreport\\_sw\\_kurz.pdf](http://www.iatge.de/personal/ps/bruedner/trendreport_sw_kurz.pdf) [Aktualisierungsdatum: 11.06.2003].
- Brödner, P. & Knuth, M. (Hrsg.): Nachhaltige Arbeitsgestaltung. Trendreports zur Entwicklung und Nutzung von Humanressourcen. München, Rainer Hampp Verlag: 2002.
- Carlisle, Y. & Dean, A.: Design As Knowledge Integration Capability. In: Creativity and Innovation Management 8 (1999) 2, S. 112-121.
- Carlsen, A., Klev, R. & von Krogh, G. (Hrsg.): Living knowledge: the dynamics of professional service work. Basingstoke, Hampshire [u.a.], Palgrave Macmillan: 2004.
- Davenport, T. H.; Jarvenpaa, S. L. & Beers, M. C.: Improving Knowledge Work Processes. In: Sloan Management Review (1996) Summer, S. 53-65.
- Davenport, T. & Prusak, L.: Working Knowledge. Boston Massachusetts: Harvard Business School Press, 1998.
- Davenport, T. H.; Thomas, R. J. & Cantrell, S.: The Mysterious Art and Science of Knowledge-Worker Performance. In: Sloan Management Review (2002) Fall, S. 23-30.
- Dove, R.: Knowledge Work and Trust - The Key Relationship in Relationship Management. (c) 1999. URL: <http://www.parshift.com/Essays/essay058.htm> [Aktualisierungsdatum: 7.7.03].
- Dove, R.: Outsourcing Knowledge Work - Why Not? (c) 1999. URL: <http://www.parshift.com/Essays/essay057.htm> [Aktualisierungsdatum: 1.2.01].
- Drucker, P. F.: The New Productivity Challenge. 1991.
- Fourth Wave Group: Paradigm of Knowledge Work managing Content Intelligently: The Environment of Knowledge Work. (c) 2001. URL: [www.fourthwavegroup.com](http://www.fourthwavegroup.com) [Aktualisierungsdatum: 16.09].
- Gadrey, J. & Gallouj, F.: Produktivität, Innovation und Knowledge in Services. Cheltenham UK, Northampton: Edward Elgar, 2002.
- Grant, R. M.: Prospering in Dynamically-competitive Environments: Organizational Capability as Knowledge Integration. In: Organization Science 7 (1996) 4, S. 375-387.
- Hellström, T.; Maömquist, U. & Mikaelsson, J.: Knowledge Brokerage in a Software Engineering Firm-Towards a practical model for managing knowledge work in social networks. 2001.
- Hermann, S.: Produktive Wissensarbeit - Eine Herausforderung. Wissensressourcen strategisch nutzen. In: S. Hermann (Hrsg.): Ressourcen strategisch nutzen: Wissen als Basis für den Dienstleistungserfolg. Stuttgart: Fraunhofer - IRB Verlag, 2004, S. 205-224.
- Jackson, S. E.; Hitt, M. A. & Denisi, A. S. (Hrsg.): Managing Knowledge for Sustained Competitive Advantage. Designing Strategies for Effective Human Resource Management. San Francisco, Josse-Bass: 2003.
- Kalkowski, P. & Mickler, O.: Zwischen Emergenz und Formalisierung - Zur Projektifizierung von Organisation und Arbeit in der Informationswirtschaft. In: SOFI-Mitteilungen 30 (2002) S. 119-133.

- Konrad, W. & Schumm, W.: Wissen und Arbeit. Neue Konturen von Wissensarbeit. Münster: Westfälisches Dampfboot, 1999.
- Lohr, S.: Knowledge Review. Does Nick Carr Matter. In: Strategy + Business (2004) Summer, S. 127 - 135.
- Lucier, C. E. & Torsilieri, J. D.: Beyond Stupid, Slow & Expensive: Reintegrating Work to Improve Productivity. In: Strategy + Business 17 (1999) 4, S. 10-13.
- Lucier, C. & Dyer Torsilieri, J.: Steal This Idea!. In: Strategy + Business 20 (2000) 3, S. 21-24.
- Mohrman, S. A.: Designing Work for Knowledge -Based Competition. In: S. E. Jackson & M. A. D. A. S. Hitt (Hrsg.): Managing Knowledge for Sustained Competitive Advantage. Designing Strategies for Effective Human Resource Management. San Francisco: Jesse-Bass, 2003, S. 94-123.
- Nählinder, J. & Hommen, L.: Employment and Innovation in Services: Knowledge Intensive Business Services. (c) 2002. URL: <http://www.tema.liu.se/tema-t/sirp/pdf/hommen&nahlinder.pdf>.
- Nickols, F.: The Shift to Knowledge Work. 2003.
- Pepitone worldwide: Knowledge Leadership; Knowledge & Service Work. (c) 2004. URL: [www.pepitone.com](http://www.pepitone.com) [Aktualisierungsdatum: 29.02.2004].
- Peter, G.: Wissenspolitik und Wissensarbeit als Gesellschaftsreform: Ausgewählte Beiträge zur Arbeitsforschung 1972-2002. 1. Aufl. Münster, Westf. LIT Verlag Dr. Wilhelm Hopf, 2003.
- Pfiffner, M. & Stadelmann, P. D.: Arbeit und Management in der Wissensgesellschaft: Konzeptualisierung, Problemanalyse und Lösungsansätze für das Management von Wissensarbeit. 1995.
- Quinn, J. B.: Organizing Around Intellect. In: Harvard Management Update (1998) Reprint U9803B, S. 1-6.
- Rao, R. & Sprague, R.: Natural Technologies for Knowledge Work: Information Visualization and Knowledge Extraction. December. 1998.
- Shire, K. & Bienzeisler, B.: Methoden und Konzepte wissensintensiver Dienstleistungsarbeit. 2002.
- simplerwork.com: Knowledge Management/ A Knowledge Work Crisis is Brewing. (c) 2001. URL: [www.simplerwork.com](http://www.simplerwork.com).
- Skyrme, D.: Knowledge Networking: Creating the Collaborative Enterprise. Oxford: 1999.
- The European Work Organization Network (EWON): Challenges of Work Organization Development in the Knowledge-Based Economy - With a Special Reference to E-Commerce. Thematic Paper Presented to the DG Employment & Social Affairs. (c) 2001. URL: [http://europa.eu.int/comm/employment\\_social/pub\\_chall.pdf](http://europa.eu.int/comm/employment_social/pub_chall.pdf) [Aktualisierungsdatum: 28.05.2003].
- Töpsch, K.; Menez, R. & Malanowski, N.: Ist Wissensarbeit regulierbar?: Arbeitsregulation und Arbeitsbeziehungen am Beispiel der IT-Branche. In: Industrielle Beziehungen 8 (2001) 3, S. 306-332.
- Töpsch, K.: Regulation und Organisation von Arbeit wissensintensiven Unternehmen. 2001.
- Trautwein-Kalms, G. & Ahlers, E.: Innovative Dienstleistungen und die Suche nach neuen Gestaltungsansätzen in der Leistungspolitik. In: WSI-Mitteilungen 55 (2002) 9, S. 524-531.
- Von Krogh, G.; Ichijo, K. & Nonaka, I.: Enabling Knowledge Creation. Oxford: Oxford University Press, 2000.
- Vopel, O.: Wissensmanagement im Investment Banking - oder wie 'Expertokratien' mit Wissen umgehen- (c) 2001. URL: [http://www.community-of-knowledge.de/cp\\_artikel.htm?artikel\\_id=13](http://www.community-of-knowledge.de/cp_artikel.htm?artikel_id=13).
- Willke, H.: Organisierte Wissensarbeit. In: Zeitschrift für Soziologie 27 (1998) 3, S. 161-177.
- Willke, H. et al.: Wissensarbeit in intelligenten Organisationen. In: Vorabdruck, Bielefelder Universitätszeitung 27 (1998) 195,.
- Winslow, C. & Bramer, W.: Future Work; Putting Knowledge to work in the knowledge Economy. New York: The Free Press, 1994.

### 3.1.3 Research on knowledge workers

Machlup was one of the first people to undertake empirical studies of knowledge workers. He investigated the impact of automation on the labour market and, in the early 1960s, proposed doing away with the distinction in statistics between blue-collar workers and white-collar workers. Instead he suggested dividing workers into knowledge-producing and knowledge-utilizing professions. As defined by Machlup, knowledge production workers are all those persons whose activities consist of transporting, processing, interpreting, analysing or producing messages (i.e. data and information) and include typesetters, typists or insurance brokers, but not dentists, chiropractors or nurses (cf. Machlup, 1998) whose work - while it depends on knowledge - does not primarily involve data processing. Drucker, in contrast, refers explicitly to knowledge as a raw material and defines "anyone who works for a living at the tasks of developing or using knowledge" as a knowledge worker (Drucker, 1959).

These days it is highly-qualified activities which are mainly referred to as knowledge work. Davenport, for example writes on the subject of knowledge work: "*Characterized by variety and exception rather than routine, it is performed by professional or technical workers with 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, page 54).

Specialist professionals and knowledge workers should not be regarded as synonymous, however. According to Scarbrough (1999) these two groups differ in that the work of the first group is based on knowledge - i.e. draws upon a defined fund of specialised knowledge which is acquired, to some extent, in the framework of the relevant workers' training and education - while knowledge workers, in contrast, work with knowledge itself - their own and that of others.

According to Scarbrough, knowledge workers work in an interdisciplinary and cross-organisational way and/or across hierarchical boundaries and, as a result, fall between several stools:

- Firstly, knowledge work only functions if the relevant workers have access to diverse sources of knowledge. However, this contradicts the largely discipline-oriented division of labour which is promoted by knowledge creating and transferring institutions (universities, training and professional development institutions, professional associations, etc.) and which erects invisible (departmental) boundaries and barriers within companies. At the same time, the exchange of knowledge is also hindered by companies' own interest in exploiting existing knowledge for themselves. Knowledge cannot be exchanged entirely freely with (external) colleagues if a company wishes to protect its knowledge head start over its competitors. Crossing organisational boundaries is consequently a problematic task for knowledge workers.
- Secondly, because knowledge workers must work in a problem-oriented and interdisciplinary fashion they forfeit the ability to orient themselves towards the paradigms, methods, standards and values of their own discipline. In contrast to specialist professionals, knowledge workers are not able to stick to the pure doctrine of their own disciplines, and their contributions receive only scant recognition among groups of experts as a result. This applies to people with intermediate-level qualifications as well as to university graduates and is one of the reasons why so many young professionals experience a "reality shock" directly after completing training and beginning work for the first time.
- This problem is compounded by the difficulties people experience with prevailing hierarchical structures. Knowledge workers are, for example, often required to lead internal or even inter-company teams of experts. The legitimation for this management role is derived exclusively from the requirements of the job task, however, and not from the person's formal position. And although 'getting things done when you are not the boss', or lateral leadership, (Fisher & Sharp, 1998) is especially challenging, the managers of such projects do not enjoy anything like the same status within their own organisations as do the "real" line managers.

There are thus a whole range of special issues which human resource management still needs to adjust to in its dealings with knowledge workers in many companies.

#### **Key gaps in the field of knowledge workers:**

- There is a lack of procedures and tools for assessing the type of knowledge a company will require in the future.
- There is a lack of criteria for deciding when a company should create and sustain special knowledge itself and when it would be better to source such knowledge from outside the company.
- Companies are not aware of who should be regarded as a knowledge worker.
- At the present time it is not possible to catalogue the (informally acquired) skills and abilities of good knowledge workers.
- We know very little about the relationship between knowledge workers' formal qualifications and their informally acquired skills and abilities.
- There is a lack of available examples of sustainable personnel strategies and concepts for a knowledge-based division of labour within companies.
- There is a lack of examples and criteria for determining how learning and work environments can be designed and interlinked in a way which turns employees into good knowledge workers.

The literature mainly focuses on the optimum design of incentive systems for knowledge workers (e.g. Horibe, 1999). These recommendations originate from the new economy boom period, however, during which salaries and bonuses shot up astronomically. Many of the conclusions regarding the management of knowledge workers therefore urgently need to be reviewed and updated where appropriate.

#### **Literature and further readings**

Alfs, S.: Accenture's new operating model: meeting the needs of the knowledge worker. New York: AMACOM, 2003.  
 Amar, A.: Managing Knowledge Workers. Unleashing Innovation and Produktivity: Quorum Books, 2002.  
 Austin, R.: Managing Knowledge Workers: Evolving Practices and Trends. Next Wave - Austin, 2002 - 04 - 26, United States.(c) 2002. URL: [nextwave.sciencemag.org](http://nextwave.sciencemag.org) [Aktualisierungsdatum: 29.02.2004].  
 Consulting Alliance: Knowledge Worker Productivity: A Process for Partnering. (c) 1998. URL: <http://www.consulting-alliance.com/knowworker.pdf> [Aktualisierungsdatum: 03.07.03].

- Cortade, J.: Rise of the Knowledge Worker. Boston, Oxford, Johannesburg: Butterworth-Heinemann, 1998.
- Drucker, P. F.: They're Not Employees, They're People. In: Harvard Business Review (2002) Reprint R0202E, S. 3-8.
- Horibe, F.: Managing Knowledge Workers. Toronto, New York, Chichester, Weinheim: John Wiley & Sons, 1999.
- Jackson, S. E.; Hitt, M. A. & Denisi, A. S. (Hrsg.): Managing Knowledge for Sustained Competitive Advantage. Designing Strategies for Effective Human Resource Management. San Francisco, Josse-Bass: 2003.
- Pepitone worldwide: Knowledge Leadership; Knowledge & Service Work. (c) 2004. URL: www.pepitone.com [Aktualisierungsdatum: 29.02.2004].
- Scarbrough, H.: Knowledge as Work: Conflicts in the Management of Knowledge Workers. In: Technology Analysis & Strategic Management 11 (1999) 1, S. 5-16.
- Zucker, B.: The knowledge worker as the new problem solver: abilities, competencies, and needs. In: A. J. Beerli; S. Falk & D. Diemers (Hrsg.): Knowledge management and networked environments: leveraging intellectual capital in virtual business communities. New York, NY [u.a.]: AMACOM, 2003, S. 195-208.

### 3.1.4 Research on knowledge management

In recent years knowledge management has experienced a boom in the world of business and industry as well as among researchers. Enormous efforts have been made to promote developments in this area and to put technical and organisational solutions of varying degrees of complexity into practice. The spectrum of approaches adopted extends from data mining through to content management, the provision of knowledge maps, the establishment and support of communities of practice and the use of low-tech solutions such as setting up teams in which experienced employees work in tandem with novices, or the use of storytelling methods. It would be beyond the scope of this deliverable to undertake a critical appraisal of all these different developments and in this context we can only touch briefly on the subject of knowledge management:

Taking stock of knowledge management projects it becomes apparent that two very different approaches exist: Some projects concentrate on a codification strategy involving the attempt to externalise, store and preserve the knowledge which exists in employees' heads. The alternative approach is a personalisation strategy which, rather than accessing knowledge directly, focuses on networking people who have exclusive knowledge (Hansen et al., 1999). Although it is generally accepted that building a functioning knowledge infrastructure is not a pressing technological problem (at least as much time and money must be invested in organisational and human resource measures as in the development of the tool), both approaches are nonetheless strongly geared to what is technically feasible. The codification strategy has deeper roots in information technology and draws on experiences gained from the development of expert systems and database solutions. The personalisation strategy, in contrast, owes more to communications technology and makes substantial use of the internet as the basis for the creation and support of communities of knowledge.

What both approaches - usually combined in practice - have in common is that they concentrate primarily on one aspect of knowledge management: the storage and distribution of knowledge. Knowledge management entails more than just this task, however. There are in fact four basic problems for which adequate solutions need to be found.

- Firstly, access to knowledge which is already available needs to be optimised. In other words, steps must be taken to ensure that knowledge is available in an appropriate form, at the right time, and in the right place.
- Secondly, existing knowledge must be preserved and available to the company even if people who have acquired important knowledge in their area of work leave the company – in other words, building an organisation memory.
- Thirdly, knowledge use must be optimised. Knowledge must not be allowed to go to waste, but must, for example, find its way into the product development and service provision process.
- Fourthly, knowledge management must concern itself with the generation of new knowledge and the ongoing development of skills and abilities.

The last point in particular still poses a considerable challenge.

The initial euphoria in this field has subsided in other respects as well, however. Many companies have found that knowledge management solutions which cost a great deal to develop and introduce are insufficiently used and maintained by employees. In many cases system "acceptance" can only be increased by adopting extreme methods such as linking knowledge management to target agreement and remuneration systems.

This is not only due to the systems themselves. A number of mistakes have also been made in the past in terms of the implementation of knowledge management projects (cf. for example Lucier & Torsilieri, 1997). Many promising knowledge management activities have failed because:

- They have not been linked to specific business objectives (it is not enough to maximise intellectual capital; a knowledge management project must demonstrably contribute to the speeding up of the natural process in which added value is created for target customers).
- They have not been fully thought through (knowledge generation and organisational change are mutually reinforcing. Many knowledge management programmes fail because innovation and learning processes are not reinforced at the same time).
- They are too unfocused (knowledge management programmes must be designed to achieve precisely defined objectives)
- Top management is not actively and permanently committed. (Sponsorship is not enough. Top management must play an active role in the entire process. In other words, it must provide the lead for the project launch, set aggressive objectives, change the organisation and control and, where appropriate, re-focus the project).

Despite disappointing experiences in many cases, there is still a great deal of interest – as a recent study has shown – both in the research community and in the world of business and industry in knowledge management (Fraunhofer-Gesellschaft, 2005). However, the purely experimental period is now over. Those who are interested in knowledge management in a business context today must, above all else, be able to provide convincing answers to two questions:

1. Will employees make active and sustained use of the planned knowledge management system?
2. Is it possible to demonstrate that an investment in knowledge management activities will really pay off in financial terms?

In the meantime development work is continuing. Current trends include:

- The integration of various tools and systems (creativity tools, CSCW, content management, e-learning, etc.)
- The interlinking of knowledge management activities with business and work processes as well as corporate strategies.
- Illuminating corporate culture and motivational aspects (such as incentives for employees to share their knowledge).
- Support for the integration of highly-specialised expert knowledge or experience-based knowledge (tacit knowledge).
- The development of solutions which are tailored to the needs of small and medium-sized enterprises in particular.
- The ongoing development of technical (software-based) means (ontologies, system integration, etc.) in order, amongst other things, to relieve users of tiresome work steps and to increase the flexibility of systems.

#### **Key gaps in the field of knowledge management**

- We do not know enough about the special requirements which knowledge workers expect knowledge management systems to fulfil.
- We do not know enough about the specific challenges confronting different-sized companies in different sectors of business and industry.
- There are no solutions available which support the generation of knowledge.
- Companies have not implemented sustainable strategies for dealing with knowledge.
- There is a lack of procedures and tools for reliably assessing the exclusivity and quality of knowledge resources.
- There is a lack of criteria for evaluating whether it would be worthwhile to invest existing knowledge in actual products.
- There may be a lack of systematic procedures for the efficient development and successful use or marketing of knowledge products.

#### **Literature and further readings**

- Alfs, S.: Accenture's new operating model: meeting the needs of the knowledge worker. New York: AMACOM, 2003.  
 Badaracco, J.: The Knowledge Link. Boston, Massachusetts: Harvard Business School Press, 1991.  
 Brown, J. & Duguid, P.: Dem Unternehmen das Wissen seiner Menschen erschließen. In: Harvard Business Manager 3 (1999) S. 76-88.

Bryan, L. L.: Making a market in knowledge. In: The McKinsey Quarterly (2004) 3, S. 101-111.

Davenport, T. & Prusak, L.: Working Knowledge. Boston Massachusetts: Harvard Business School Press, 1998.

Davenport, T.: Knowledge Management: Where It's Going, Where It's Been. 2003.

Dixon, N.: Common Knowledge. Boston, Massachusetts: Harvard Business School Press, 2000.

Döring-Katerkamp, U. & Trojan, J.: Motivation und Wissensmanagement - eine praktische Perspektive. (c) 2002. URL: [www.ifem.org/perspektive.pdf](http://www.ifem.org/perspektive.pdf).

Endres-Niggemeyer, B.: Grounded theory methodology for knowledge engineering.

Foote, N.; Matson, E. & Rudd, N.: Managing the knowledge manager. In: The McKinsey Quarterly (2001) 3, S. 120-129.

Fourth Wave Group: Paradigm of Knowledge Work managing Content Intelligently: The Environment of Knowledge Work. (c) 2001. URL: [www.fourthwavegroup.com](http://www.fourthwavegroup.com) [Aktualisierungsdatum: 16.09].

Garvin, D.: A Note on Knowledge Management. In: Harvard Business School (1997) November, S. 1-19.

Götz, K. S. M.: Praxis des Wissensmanagements. München: Verlag Franz Vahlen, 2004.

Hansen, M.; Nohria, N. & Tierney, T.: What's your strategy for managing knowledge? In: Harvard Business Review (1999) March April, S. 106-116.

Hansen, M. T.; Nohria, N. & Tierney, T.: Wie managen Sie das Wissen in Ihrem Unternehmen? In: Harvard Business Manager 21 (1999) 5, S. 85-96.

Hauschild, S.; Licht, T. & Stein, W.: Creating a Knowledge Culture. In: The McKinsey Quarterly (2001) 1, S. 74-81.

Howaldt, J.; Klatt, R. & Kopp, R.: Interorganisationales Wissensmanagement im Kontext wissensintensiver Dienstleistungen. Die Praxis des Wissensmanagements. Münster: S. 169-195.

Howaldt, J.; Klatt, R. & Kleinsimlinghaus, K.: Gestaltungsaufgaben und Probleme des Wissensmanagement in Netzwerken - Ergebnisse der Expertenbefragungen. (c) 2002. [Aktualisierungsdatum: 2002].

Huber, B. & Heinz, K.: Wissensmanagement in Bezug auf Stellenwechsel. Wissensmanagement.(c) 2003. URL: [http://mypage.bluewin.ch/eb-connection/Thema\\_1](http://mypage.bluewin.ch/eb-connection/Thema_1) [Aktualisierungsdatum: 30.10.2003].

Kopp, R. & Malik, F.: Wissensmanagement oder Management von Wissensarbeit. Interview, 13.

Körber, S.: Wissensmanagement in der Unternehmensberatung. In: Wissensmanagement (2000) Sommer, S. 18-19.

Liedtka, J.; Haskins, M. & Rosenblum, J.: The Generative Cycle: Linking Knowledge and Relationship. In: Sloan Management Review (1997) Herbst, S. 47-58.

Lucko, S.; Trauner, B. & Lembke, G.: Wissensmanagement bei der HypoVereinsbank. In: Wissensmanagement (2000) 5, S. 20-24.

Myers, P.: Knowledge Management and Organizational Design. Boston, Oxford: Butterworth-Heinemann, 1996.

Nonaka, I. & Nohiguchi, T.: Knowledge Emergence. Oxford: Oxford University Press, 2001.

Novak, J.: Learning, Creating, and Using Knowledge. Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers, 1998.

Risch, W. & Zimmermann, U. (Hrsg.): Wissensmanagement als Lösungsansatz zur Erweiterung von Innovationspotenzialen. Gewinnen durch den Mitarbeiter. Chemnitz, Eigenverlag ATB: 1999.

Schmidt, M. P.: Knowledge Communities. München, Boston, San Francisco: Addison-Wesley, 2000.

Schütt, P.: Wissensmanagement bei IBM: von der Datenbank zur ganzheitlichen Lösung. In: Wissensmanagement 3 (2000).

Skyrme, D.: Knowledge Networking: Creating the Collaborative Enterprise. Oxford: 1999.

Smith, D.: Knowledge, Groupware and the Internet. Boston, Oxford, Auckland: Butterworth, Heinemann, 2000.

Kurtz; Thomas; Katenkamp,; Thomas; Katenkamp, & Katenkamp, O.: Professionen und Wissensberufe. Quo vadis Wissensmanagement. In: Arbeit (2003) 1, S. 5-36.

Tissen, R.; Andriessen, D. & Deprez, F. L.: Value-Based Knowledge Management. Amsterdam, Auckland, Bangkok: Longman, 1998.

Uni. Dortmund: Knowledge management für verteilte, lose gekoppelten Gemeinschaften von Wissensarbeiten. (c) 1999. URL: <http://www.uni-dortmund.de/~wsm/> [Aktualisierungsdatum: 27.04.].

Vopel, O.: Wissensmanagement im Investment Banking - oder wie 'Expertokratien' mit Wissen umgehen- (c) 2001. URL: [http://www.community-of-knowledge.de/cp\\_artikel.htm?artikel\\_id=13](http://www.community-of-knowledge.de/cp_artikel.htm?artikel_id=13).

Weggemann, M.: Wissensmanagement. Bonn: MITP-Verlag, 1998.

Wilke, H.: Systematisches Wissensmanagement. Stuttgart: Lucius & Lucius, 1998.

Zack, M.: Developing a Knowledge Strategy. (c) 2002. URL: [web.cba.neu.edu/mzack/articles/kstrat/kstrat.htm](http://web.cba.neu.edu/mzack/articles/kstrat/kstrat.htm) [Aktualisierungsdatum: 08.03.2002].

Zühlke-Robinet, K.: Wissen, Wissensmanagement und Beschäftigung - ausgewählte Ergebnisse aus der Forschung und aus BMBF-geförderten Vorhaben. LIKE-Infotag 'Wissen und Kreativität', 04.02.2004, Stuttgart. 2004,.

#### 4 SME key research areas (KIA)

Drawing on the gaps in the four topic areas, it is possible to pinpoint the concerns which need to be dealt with in more depth in the six key issue areas (KIA) as follows:

- The focus in the Competence Development KIA is on the interrelationships between changes in work and the learning requirements of and options available to knowledge workers.
- The New Work Organisation KIA concerns the relationship between internal and outsourcing strategies or internal personnel deployment planning and the knowledge intensity of work.
- The Organisational Learning KIA should shed light on the interdependencies between a company's capacity for change and issues relating to job design.
- The Knowledge Product Management KIA is primarily concerned with the way in which economic use can be made of knowledge resources and how knowledge products can be used to generate rationalisation effects for knowledge-intensive activities.
- The Performance & Productivity KIA focuses on the relationship between job design and the productivity or quality of knowledge work.
- The Performance Management KIA relates to the impact of management decisions and controlling strategies on knowledge work and learning.

The emphasis of each KIA is substantiated briefly in the following. Figure 5: WP7 in the ProLearn framework

shows how the KIA relates to the four dimensions (knowledge worker, management of knowledge intensive companies, knowledge management systems und knowledge work). It also shows how these topic areas fit into the overall ProLearn project.

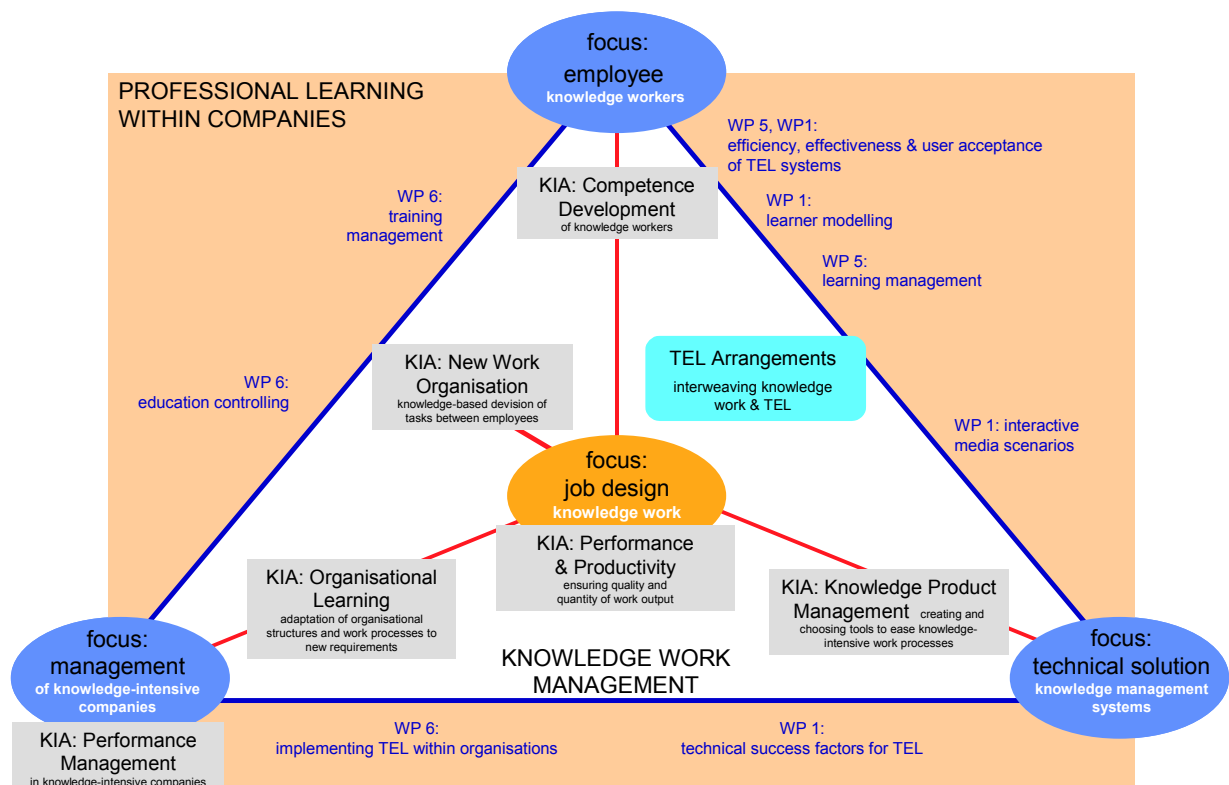


Figure 5: WP7 in the ProLearn framework

Summarising the insights provided by expert interviews and the findings generated by the research into the relevant literature undertaken during the project it is apparent that – as things stand – there is an information deficit in all six KIAs.

### Key gaps in the field of knowledge work management

- There is a lack of an overview of activities (press releases, publications, etc.) according to the key issue areas (KIA) that show research activities in all EU countries and products and services offered in this area.
- There is insufficient data available about future activities and trends in the key issue areas described.
- There is an absence of a common European-wide information and database portal for research and industry that covers issues described above.
- There is a lack of conferences, workshops, seminars, etc. taking a holistic approach to knowledge work management and learning arrangements.
- There is a mismatch between industry requirements and suppliers in KIA tasks that should be solved. This mismatch is caused by non-appropriate offers and unclear cause-and-effect of expected increase of performance.
- There is a gap in the disaggregate data about the knowledge work management market (e.g. how many knowledge workers are there? In which branches do they mainly work?).
- There are no benchmarks for the evaluation of the key indicators of the service performance of knowledge workers.

#### **4.1.1 KIA: New Work Organisation - Division of Work According an Explicit Knowledge Strategy**

Since the creation of value is being achieved increasingly on the basis of knowledge, it is crucial for the survival of companies to position themselves correctly in relevant networks, and besides to be guided by a foresighted knowledge strategy as far as internal work division is concerned. There are only few areas now, in which single companies would be able to offer complex products and services by their own efforts. Many knowledge-intensive companies are integrated into networks, in which the end product is produced by a multitude of partners. The media industry is a very good example for this. There are specialists for every single step in the digital production procedure, while another company takes on the task of coordinating and offering the end product to the customers. With this kind of divided production, knowledge work mainly occurs at the interfaces of the single steps of the process and at the integration of the single parts into the complete product. To what degree a specialist does knowledge work depends on how intensely he concentrates on his core areas. The narrower the area of his tasks and the more he is detached from the overall process, the smaller is his share of knowledge work. Therefore, new forms of work division have to be found – both inplant and interplant – which guarantee that a company can optimally put to use its knowledge resources and which at the same time allow to continuously complement and update the existing knowledge.

#### **4.1.2 KIA: Knowledge Product Management – Turning Knowledge Into Products and Tools**

Knowledge exists in people's heads. But it can also manifest itself in processes, tools and other artefacts. It is one challenge in a knowledge-intensive company to use those so-called knowledge products purposefully, and another one to develop them for themselves or to market them. There is a great need for action, especially concerning the question of how to turn knowledge into products. Often it suggests itself to pass on knowledge to others, which in the course of work has been turned into checklists, procedural models, e-learning modules or software tools, instead of merely using it oneself. Many business segments have been created this way. However, many companies have problems estimating of what quality their knowledge is, which knowledge can be turned into products and services and if the effort is not worthwhile. Furthermore they lack systematic procedures for developing and marketing knowledge products. Not only the development of knowledge products but also their implementation in the company is still a challenge. There are countless tools and consulting services in the market, which makes the very choice difficult, and later usage is often not optimal. Part of successful knowledge management, therefore, is the definite identification of knowledge transfer tasks as is the choice, implementation, and the organisational implementation of adequate solutions, where applicable.

#### **4.1.3 KIA: Organisational Learning - Creating Appropriate Structures for Knowledge Work**

A considerable freedom in arranging one's work content and processes is characteristic for knowledge work. Often, however, it is in conflict with the – sometimes very strict – regulations and administrative procedures in a company, for which the relevant person works. Friction and losses in productivity are inevitable. An increase in knowledge work therefore entails some rethinking in many companies.

Someone setting up machines, for example, works on location at the customer's, and basically relies on himself only. He has to arrange things with representatives of other companies, make sure that they make their contributions, and coordinate them. When unexpected obstacles and problems occur, he spontaneously has to develop new solutions. And quite often, he has to make decisions with enormous consequences. No matter what happens, it is his responsibility that the deadlines are met. How to achieve this end is in his hands. This kind of work has hardly anything to do with the traditional skilled work in a manufacturing company anymore. The existing structures and processes offer only little orientation and support for knowledge workers and thus have to be altered. In any case, there is more to organisational learning than just a one-off adaptation of the organisation to the requirements of knowledge work. Rather, the company's ability to implement knowledge-intensive innovations has to be strengthened by new concepts of organisational and human resource development.

#### **4.1.4 KIA: Competence Development - Qualifying and Supporting Knowledge Workers**

In future, a company's success will increasingly depend on competent and efficient knowledge workers as personnel. The employees have to be enabled to "work across borders" and they have to be given the opportunity to systematically build up and develop the competences that their job requires. Especially

knowledge workers working in projects fall between two stools (Scarborough, 1999): On the one hand they work multidisciplinary and therefore cannot simply rely solely on the knowledge and standards of their own field. On the other hand they work at the interface between different departments, organisations and hierarchies. So they do not really fit anymore in the organisation structure of the company where they are employed. For this reason they often excluded from both a career in their field as a skilled worker and in the management. And since they can profit little from the classical offers in further training – due to the diversity and complexity of their tasks – they rarely acquire formal qualifications that are generally acknowledged. It is necessary to have new concepts of human resources development, which enable knowledge workers to systematically build up and exchange qualifications. Some companies have identified this problem and are developing project careers as a third possibility beside professional and management careers. All other companies still adhere to the principle “hire smart people and leave them alone” (Davenport et al., 2002).

#### **4.1.5 KIA: Performance & Productivity - Following Adequate Objectives in Quality and Performance**

Just as in industrial production, it is necessary in knowledge work too to control the “magical triangle” consisting of time, cost and quality. As such this task is not an easy one. In the case of knowledge work there are two additional difficulties: On the one hand, it is not easy to standardise knowledge-intensive operation processes. On the other hand, it is no easy task to assess the quality of work results.

These two additional challenges can easily be exemplified with the help of consulting projects. At the beginning of a consulting project there often is just one rough objective (e.g. increase of customer retention, acceleration of innovative processes, etc.). It is part of such projects - in agreement with the customer – to make the project’s objectives more and more precise until a solution has been worked out. Therefore, it is not easy to plan and rationalise knowledge-intensive jobs in advance. Furthermore, neither the quality to be achieved nor the specific worksteps are certain. This too is negotiated with the customer in the ongoing process. For quality levels can be agreed upon only if the objectives are clear. But new solutions have to be developed since it cannot be left to the employees to decide which criteria they adopt for their own work. One solution, for example, is to generate performance-guiding principles, which present objectives for quality and performance to the knowledge worker on a rather abstract level, which serve as guidance.

#### **4.1.6 KIA: Performance Management - Controlling Knowledge-intensive Companies**

Knowledge-intensive companies need controlling systems so as to cope successfully with knowledge-intensive work processes. A problem that arises with performance management in knowledge-intensive companies is that quite different criteria for performance may exist within the same trade, depending on the company philosophy. This can be illustrated by two types of school. In a school for mentally handicapped children the objective is to convey as much information as the children can take in. An elite school has a completely different objective: to educate “the best.” Therefore it would be a mistake to assume the same performance criteria for both types of school (Drucker, 2000). It is necessary for knowledge-intensive companies to become aware of their own “mission.” Only then can controlling systems be developed, which take into consideration not only the “hard facts” (above all financial key data) and common “soft skills,” but which really do justice to the character and objectives of the organisation.

### **5 Conclusion and further activities**

The best way of ensuring that technology enhanced learning is more firmly embedded in company practice is to demonstrate how and to what extent TEL contributes to improving company competitiveness. This will not be possible, however, if our perspective is restricted to learning and training research. While insights generated from management and work research help to round off the picture, this has been inadequate to date.

Deliverable 7.1 should demonstrate where, from the point of view of the ProLearn partners involved in WP7, there is a need for further action and research in the topic areas of "Design of action-oriented learning arrangements", and "Knowledge work management". The next work step will be to take an integrated view of both areas (Deliverable 7.3) and to develop a method of screening for and identifying good practice examples in research and design projects.