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for KWM in Business, Research and Politics**

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| 1 | 06-05-24 | Spath, Karapidis, Hermann, Ganz, Rieger (all IAO) | Monitoring activities and developments concerning their relevance and importance in the key issue areas of the KWM model |
| 2 | 07-09-30 | Pack | Draft version of Recommendations and Guidelines for KWM in Business, Research and Politics (Draft Version 7.5 reworked) |
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Abstract:

This draft deliverable provides recommendations for future activities and developments in the field of knowledge work management. It is based on the gap-analysis of the research field (Draft 7.1 06-30-05) and gives first recommendations for the future focus in the field of knowledge work management for Politics, Research and Business.

Additional an international internet-survey on "KWM and Competence Management in European Business" has been launched and analyzed.

107 enterprises (valid replies) participated in this survey (78% German, 22% other EU). The survey cannot be representative because the data base is not strong enough, but you never will get a really representative survey because you will always have a positive selection of repliers that are interested on the subject of the survey. So the results mirror the opinion of enterprises that are open-minded for KWM. Nevertheless this survey strengthens the empirical base and evidence of the recommendations for the final report and so set a stronger focus on industrial needs.

The survey instrument and the frequencies of the results per item are part of the ANNEX. The main results of the specific data analysis are implemented in chapter 3.1 to 3.4.

Contents

| | | |
|------------|---|-----------|
| 1 | Framework for Deriving Recommendations | 5 |
| 2 | State of the Art in KWM | 6 |
| 2.1 | Key Gaps in the Field of Knowledge Work Management | 9 |
| 3 | The Contribution of the ProLearn-Project and the Business-Survey for KWM | 11 |
| 3.1 | Results for A1 Management Control | 11 |
| 3.2 | Results for A2 Job Design of Knowledge Work | 12 |
| 3.3 | Results for A3 Knowledge Workers | 16 |
| 3.4 | Results for A4 Knowledge Management | 17 |
| 4 | Recommendations | 18 |
| 4.1 | Recommendations for Business | 18 |
| 4.2 | Recommendations for Research | 19 |
| 4.3 | Recommendations for Politics | 20 |
| | Annex | 21 |
| | Survey on Competence Management and Knowledge Work | 22 |
| | Literature | 33 |

1 Framework for Deriving Recommendations

The derivation of recommendations and guidelines for the field of Knowledge Work Management affords a structure that is based on the empirical state of the art of this research field. This base structure is founded on the results of a gap analysis (see Draft 7.1 06-30-05) in form of the key gaps A1 to A4.

The results (December 2007) from the Prolearn-Project and the results from an international business survey were analyzed and attached to the key-gap structure.

The recommendations for business, research and politics were – if possible - derived from already existing results. They were actualized for the final report and completed with the results of the business survey.

Deriving Recommendations for Knowledge Work Management

| State of the Art in the Field of KWM | The Contribution of Prolearn to KWM | Recommendations |
|--|-------------------------------------|--|
| Key-Gaps | Preliminary and expected Results | |
| A1 Management Control A1.1 to a1.8 | Results A1 | Business Recommendation A1 to A4 |
| A2 Job Design A2.1 to A1.6 | Results A2 | Research Recommendation A1 to A4 |
| A3 Knowledge Workers A3.1 to A3.7 | Results A3 | Politics Recommendation A1 to A4 |
| A4 Knowledge Management A4.1 to A4.7 | Results A4 | |

2 State of the Art in KWM

Knowledge Work is an upcoming and ongoing “hot topic” in research and industry. Many activities and developments in recent years have been done to gain a better understanding of this research field. There were research activities on technological aspects as well as on management aspects. This was done under the perspective of the employees, of the organisations, of different branches / markets and of the political actors. Unfortunately, there are still huge gaps in:

- different understanding of knowledge work that can be seen, e.g., in different labels, sub-themes in other thematic areas,
- lack of knowledge about work design to avoid burn-out processes for the knowledge-workers
- only some scientific indicators about the correlation between multitasking work and performance e.g. losses in performance
- lack of tools to support the learning activities of knowledge workers,
- shortage of generally accepted theoretical frameworks in this research field and
- lack of learning strategies in knowledge work.

As a result, the research field knowledge work and its relation to learning activities is still unstructured and general accepted.

The objective of PROLEARN or other TEL supporting initiatives is to support the implementation of Technology Enhanced Learning (TEL) within the professional education and continuing training in the companies to become more successful. The perspective of knowledge work management requires the connection, combination and integration of findings in the field of educational, management and work related research. Especially the volatility and the intensive continuous change of conditions and requirements at work and the demands and possibilities for learning@the workplace have to be considered. In the research area of knowledge work management and Learning Arrangements is the aim to generate the fundament for considerations illustrated above. The specific focus is directed to the knowledge based work, which essential for the competitiveness of the companies but not enough is known on behalf of its implications for management and formation / composition.

Knowledge Work Management (KWM) should be understood as a cluster of balanced activities that intent to create optimal circumstances in a company for effective, efficient and human adequate conditions for knowledge based work and performance. In the ideal case the Knowledge Work Management will be a holistic approach of management, which starts with the conscious decision on a strategic level about the question, which kind of knowledge based work will be realised internal and which should be outsourced. It should end with concrete activities on the operational level that supports the individual realised work / efforts by organisational, technical and qualification-related procedures / services.

Learning Arrangements are intentional initiated constellations that enable options to make the process of learning transparent and configurative and to address the development of competence for action. Characteristic for Learning Arrangements is that the learning takes place in non-formal contexts directly connected with the work itself and that the process of learning is steered by the learner himself or herself (cf. Ballin & Brater 1996; Wilke-Schnauffer et al. 1998; Schiersmann & Remmler, 2002). We see that especially Web 2.0 environments have a large

potential to support learning activities of knowledge workers by creating communities of interest and of specific learning demand. The guidelines should therefore also look on the activities in this upcoming field.

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.

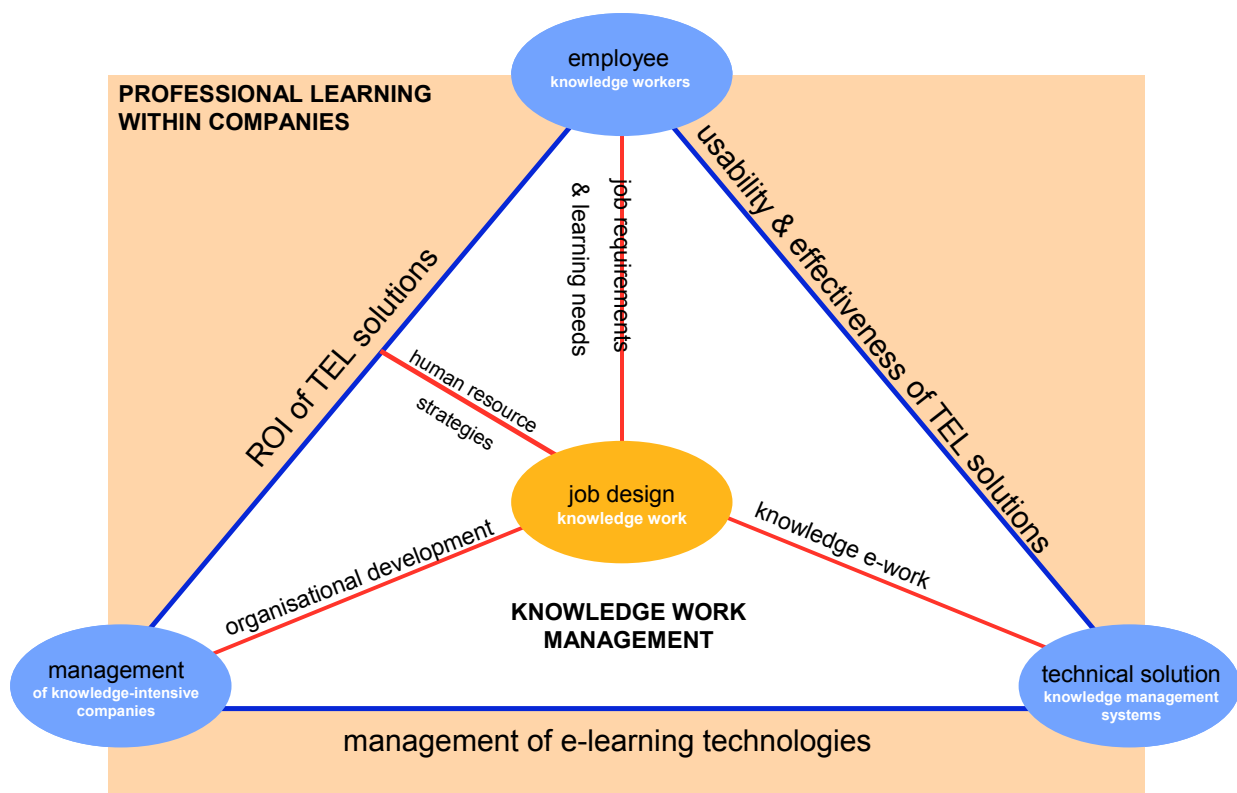


Figure 4: Relationship between knowledge management and TEL

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.

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.

2.1 Key Gaps in the Field of Knowledge Work Management

(For a comprehensive description see Draft 7.1 06-30-05)

A gap-analysis of the field of KWM identified the following key-gaps of research:

A1 Key gaps in the field of management control:

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

A2 Key gaps in the field of job design:

- 1 There is a lack of methods for "objectively" assessing the knowledge intensity of activities.
- 2 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.
- 3 There is a lack of intelligent concepts which would help to prevent permanent stress and burnout without destroying the intrinsic motivation of workers.
- 4 We do not have the tools which would enable us to reliably measure the productivity and quality of knowledge work.
- 5 We lack knowledge about the potential for and limits to the rationalisation and

automation of knowledge-intensive activities.

- 6 There is a lack of design approaches which would ensure that productivity improvements are not achieved at the cost of quality.

A3 Key gaps in the field of knowledge workers:

- 1 There is a lack of procedures and tools for assessing the type of knowledge a company will require in the future.
- 2 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.
- 3 Companies are not aware of who should be regarded as a knowledge worker.
- 4 At the present time it is not possible to catalogue the (informally acquired) skills and abilities of good knowledge workers.
- 5 We know very little about the relationship between knowledge workers' formal qualifications and their informally acquired skills and abilities.
- 6 There is a lack of available examples of sustainable personnel strategies and concepts for a knowledge-based division of labour within companies.
- 7 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.

A4 Key gaps in the field of knowledge management

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

As a result of the Gap-Analysis we can conclude that there are a lot of white fields on the scientific map of KWM.

3 The Contribution of the ProLearn-Project and the Business-Survey for KWM

Considering the large white fields on the scientific map of KWM-Research it cannot be expected that the results of a single project like Prolearn and a business-survey are able to close these key-gaps. But it is or will be possible to contribute to the theoretical and empirical explanation of some of the key-gaps in an explorative approach.

3.1 Results for A1 Management Control

A1.1 – A1.4

The result of a cluster-analysis of the business-survey data (Quick-Cluster; Cluster-Centre-Analysis) shows two clusters – one with a high level of knowledge work and one with a lower level. The differences between the cluster-items are the indicators for the level of knowledge-work for this sample.

The high level knowledge work cluster is characterized by the following central item patterns:

- total turnover 2006 about 100 Mill. € (means and cluster centres)
- about 300 employees
- about 80% service production
- more than 50% share of graduates of higher education employees (knowledge-workers)
- the average salary of the personnel is 32% higher
- percentage of total turnover for annual payment of employees 67%
- highly customized goods and service production
- clear idea of the term competence management (75% compared to 25% in the second cluster)
- clear idea of the term knowledge work management (56% compared to 11% in the second cluster)

So most of the high level knowledge work enterprises are SME, while the larger companies with a traditional high share of standardized goods production can be found in the lower level knowledge work cluster.

Further data analysis (correlations and mean comparison) showed that the main selective indicator for the knowledge work level is the share of graduates of higher education. So almost all enterprises with 50% and more employees with higher education belong to the high level knowledge work cluster. Using this main selective indicator explains nearly all of the variance of levels of knowledge work.

These results don't explain the missing data and theoretical evidence in a representative way, but they give explorative hints for a qualitative representativeness.

Therefore it is necessary to anchor the empirical base by national surveys in every country of the EU. These surveys have to achieve a proportional sample of the specific national business branches. As a result of these surveys it will be possible to extract empirically based indicators for the national and EU level of knowledge work that can be used as a tool by Eurostat, may show how capable European companies are at present at implementing knowledge-intensive innovations and may build the base for the promotion of knowledge work in the European business industries.

The results so contribute to the scientific explanation of half of the key-gaps (A1.1 to A1.4).

A1.5 – A1.8

The key-gaps in A1.5 to A1.8 are methodically not a subject for a written survey. They can only analyzed with specific designed case-studies.

3.2 Results for A2 Job Design of Knowledge Work

A2.1 – A2.3

Especially overstraining by work, information overload, uncertainty on decision consequences and burn-out-syndromes are some of the most important barriers for formal and informal processes of learning on the job.

The change of work requirements, the company-areas of change and their consequences for the workers was analyzed in the business survey.

Filtered by indicators for the share of knowledge work it is possible to identify the fields and the extent of these changing requirements.

Changes of Work Requirements

The results of this panel indicate the following changes of work requirements:

| Increasing requirements | Total % | High % knowledge workers | Low % knowledge workers |
|------------------------------------|---------|--------------------------|-------------------------|
| Knowledge work | 67% | 83%** | 51% |
| Knowledge intensification | 79% | 83% (n.s) | 74% |
| Work in profit centres | 30% | 27% (n.s) | 32% |
| Project work | 55% | 58% (n.s) | 51% |
| Interdisciplinary teamwork | 60% | 67% (n.s) | 54% |
| Complexity of problem solving | 68% | 78%* | 59% |
| Specialization | 70% | 76%(n.s) | 61% |
| Density of necessary information | 72% | 81%* | 62% |
| Density of unnecessary information | 73% | 72%(n.s) | 73% |
| Multitasking | 69% | 74%(n.s) | 64% |
| Salary (% of turnover) | 60% | 67% | 50,7% |

** high significance level, better .005 *significant, better .05
n.s. not significant

More than 2/3 of all panel enterprises see an increase of

- knowledge work

- knowledge intensification
- density of necessary and unnecessary information
- specialization
- multitasking
- and the complexity of problem solving processes

The percentage of “knowledge work enterprises” (50% and more knowledge workers) that see these increases is higher for nearly all of the items.

Central trends for consequences of increasing work requirements

As consequences of the increasing work requirements the panel enterprises declare the following central trends:

Motivation

The work motivation is sinking in 46% of enterprises with lower share of knowledge workers and unchanged in 53% of high knowledge work enterprises.

Positive stress

Positive work stress is not changed in more than 2/3 of the enterprises (68% low knowledge work , 78% high KW).

Negative stress

Work overload by negative stress is seen in about 2/3 of the enterprises. The percentage is higher (74%) in low KW enterprises and lower (65%) in that with high KW .

Further training needs

More than 3/4 of the enterprises think that there are higher needs for further training (73% low KW; 81% high KW).

Information overload

More than 70% of the enterprises complain about higher information overload (68% low KW; 75% high KW).

Uncertainty on decision consequences

More than 50% of the enterprises see an increasing uncertainty on decision consequences for their employees (49% low KW; 60% high KW).

Performance standard/requirements

More than 2/3 of the low KW enterprises say there is an intensification of performance requirements, while less than a half (46%) of the high KW enterprises report this intensification (difference significant at 01.)

Loss of time through multitasking work

63% of the high KW enterprises complain about time losses through multitasking work, this percentage is only 39% for low KW enterprises (difference significant at .03)

Burn-out-syndromes

62% of the low KW enterprises report about higher rates of employees with burn-out-syndromes. This percentage has an amount of only 27% in high KW enterprises while 73% report no changes (Pearson correlation .35, Gamma .62, difference significant at .004).

Career development opportunities

Low KW enterprises see the chances for career development of their employees higher in 42% of the cases and lower in 47%. Half of the high KW enterprises see now change in career opportunities while 28% say they are lower.

Company area of changing work requirements

For the high KW enterprises the support services is the most changing area (63%), followed by R&D (60%) and production of goods/services (58%).

The low KW enterprises recognized the production of goods/services (44%), followed by R&D (34%) and support services (33%) as the most changing company areas.

The company areas of lowest change are personnel and company administration for all panel enterprises.

New forms of work organization and job design for knowledge work

More than 90% of the enterprises conclude that new forms of work organization and job-design are required by increasing shares of knowledge work. Especially nearly all of the high KW enterprises (97%) see this is necessary.

Far more than 50% of all enterprises rated the measures for organization and work design as partly efficient or better (one exception, organized shot breaks were not efficient for 57% of the low KW enterprises)

The following measures of knowledge work design were rated as especially efficient:

by high knowledge work enterprises

- standardization of a part of activities within a job profile (66%)
- support of career planning (61%)
- technical information filters (50%)
- health prevention (47%)
- prevention of excessive specialization (46%)

by low knowledge work enterprises

- standardization of a part of activities within a job profile (46%)
- health prevention (46%)
- technical information filters (44%)
- reduction of complexity to reduce psychological strain (40%)
- support of career planning (40%)

An overall interpretation of the above shown data gives hints for following trend statements:

Enterprises with high knowledge work (50% and more knowledge workers) :

- are better adapted to increasing knowledge requirements (lower burn-out-syndromes)

- have better coping strategies (more positive stress, less negative stress)
- have a job design with more personal freedom (lower share of increasing performance, higher chances for career development)
- are more experienced in using and rating measures for organizational change (higher reply-rates)
- have still problems with higher time losses by multitasking, information overload and uncertainty of decisions

So enterprises that have to adapt to increasing knowledge work can learn a lot by the experienced enterprises.

But the still remaining problems the high KW enterprises have, show that there are missing research results and derived organizational measures to avoid multitasking time losses, information overload and problems with uncertainty of decision consequences.

A2.5

The results from D7.6 (Organization and Usage of Learning Objects within Personal Computers) show a perspective to simplify the search for information on the own desk-tops and the possible usage of desk-top-data for enriching e-Learning.

This will be possible if the following requirements are met:

- Existing tools that provide integrated access to various types of information sources like documents, email history and Web pages visited.
- Models of the internal structure of documents that cover several topics for their re-usage.
- More transparency about how users actual interact with the contents of their personal Desktops.

A2.4 and A2.6

The gaps in A2.4 and A2.6 cannot be covered by this project.

3.3 Results for A3 Knowledge Workers

A3.1

There are three sets of items in the business-survey about the use of instruments for the identification of actual and future qualifications and skills and the measures used to adapt to changing skill and qualification requirements.

Set 1 Used competence management instruments

In item set 1 there are 10 instruments that are used in enterprises for competence management.

The high KW enterprises have a broader use of the instruments for competence management than the low KW enterprises (use of 4 and more instruments high KW 65%, low KW 49%; use of 7 and more instruments high KW 40%, low KW 12%).

Every instrument of this set is more intensive used by the high KW enterprises (higher user percentage).

Set 2 Instruments for identification of future needed competences

The high KW enterprises have a broader use of these instruments than the low KW enterprises (use of 4 and more instruments high KW 60%, low KW 38%).

The intensity of instrument usage is structural similar, but the high KW enterprises use more participative instruments like internal idea workshops (48% to 37%), and more future orientated instruments like observation of trends and technology monitoring .

Set 3 Measures to adapt to changing skill and qualification requirements

The high KW enterprises have a little broader use of these instruments than the low KW enterprises (use of 4 and more instruments high KW 65%, low KW 50%; use of 7 and more instruments high KW 30%, low KW 14%).

The intensity of usage is higher for the high KW enterprises, but they especially use their better potential of high knowledge workers. So they use instruments more intensive like

- self-organized learning (65%)
- project learning (55%)
- team discussions (53%)

If these enterprises cannot find an in-house-solution they tend to recruit the necessary skills and qualifications.

The comparison between the usage of companies with high and low level of knowledge work shows that enterprises with a high share of knowledge work tend to a broader and intensive use of instruments and measures to solve problems. But they especially profit by the use of their better personnel skill and qualification equipment.

In short there are adequate instruments for competence management, identifying future needs and compensate them.

The use of these instruments must be broader and more intensive in enterprises that see an increasing share of knowledge work.

These results will increase the knowledge about the identified gap in A3.1

A3.4; A3.5 and A3.7

On-demand problem solving is one of the main requirements for knowledge workers. The results of D.6.7 Business Process-Oriented Learning (June 2007) indicate that on-demand problem solving by learning on the job is carried out along informal learning processes. These informal learning processes are unstructured, spontaneous and have an individual variance. So it is not really possible to support them by statically predefined learning processes. To bridge the gap between organizational formal and individual informal learning processes it is proposed to use the tool of business process models. The main problem in the use of such business model is that there are barriers in the inter-individual use of the models. “The identifiers of the individual elements of a business process model are added in a natural language by the modeller, irrespective of his decision for a certain modelling language” and “allows much room for interpretation (D.6.7 June 2007, page 18)”. An approach to solve this problem is seen in linking the elements of a business process model with concepts from an ontology:

“In addition to the decoupling of the semantics of an individual model element from its natural language label, the context of a model element is specified more accurately through the linkage of an ontology instance to the model element. This happens via relations, which exist between the ontology instance representing the EPC-model element and further instances of the ontology (D.6.7 June 2007, page 21 and figure 10)”. This concept allows an inter-individual understanding of semantic annotations of business process models and can serve as a support of collective and individual formal and informal learning processes.

In the draft D.6.7 (June 2007) there are too some hints about WEB 2.0 applications as enabler for informal learning processes.

One result of the business-survey will be the preferred learning methods by companies with a high share of knowledge work. This result will give hints about the design of learning and work environment and their interlinks to get good knowledge workers (A3.7).

In total hints and results for the gaps in A3.4; A3.5 and A3.7 can be given.

A3.2, A3.3 and A3.6

The gaps in A3.2, A3.3 and A3.6 are not covered by this project.

3.4 Results for A4 Knowledge Management

A4.2

The analysis of the business-survey showed no specific results for different-sized companies in different sectors of business and industry because the empirical base especially for different business sectors was not sufficient.

A4.3

The results of D6.7 (see 3.3) are too useful to support the generation of knowledge (A4.3).

A4.3 and A4.4

The results of D15.2 “Case Study on Social Software in Distributed Working Environments” show that the implementation of social software (WEB 2.0 applications) can be an innovative approach towards knowledge management especially in world-wide operating enterprises. “The successful use of the platform gives an indication that weblogs are accepted as an additional working tool that offers employees the possibility of connecting globally around specific topics

and of establishing social networks” (D15.2 page 25). These results give a research contribution to the gaps in A4.3 and A4.4.

The gaps in A4.1,A4.2, A4.5 to A4.7 are not covered by this project.

4 Recommendations

This deliverable contains some recommendations for business, research and politics. The recommendations and guidelines are based on the results of the ProLearn Project and the internet-survey on “KWM and Competence Management in European Business”.

4.1 Recommendations for Business

A2 Job Design of Knowledge Work

- Initiated circles for exchange of experiences between enterprises with high level of knowledge work and those enterprises that must cope with increasing knowledge work. Learning from the experienced high level companies may help to avoid wrong decision and help to introduce tested adaptation strategies.
- Fight against the high positive social image of multitasking work, because multitasking work produces a lot of time losses especially in enterprises with high knowledge work.

A3 Knowledge Workers

- The use of instruments for competence management, identification of future needed competences and measures for adaptation must be broader and more intensive in enterprises that see an increasing share of knowledge work.
- It will be very important to recruit a higher share of knowledge workers in time, so that the in-house capacities for adaptation to industrial change are available.
- A higher share of knowledge workers is combined with higher salaries, so it will be necessary to develop new innovative products/services that provide a higher turnover.
- The capacity of higher educated employees are limited therefore new recruiting strategies to scoop e.g. the target groups of well educated women and elder are obvious.

A4 Knowledge Management

Flexible Organizational Structures (Prolearn Roadmap TEPL Oct. 2007):

- Establish knowledge-based organizations with less hierarchical, less centralized, and more flexible structure enabling knowledge workers to interact outside the boundaries of the organizations and allowing different actors from different institutions to come together for a short time to solve a specific problem.

Recommendations for the implementation of Social Software in enterprises:

- There must be an immediate business need which is tackled with social software.
- The use of social software has to be integrated with the existing IT systems and work routines.

- A slow “ramp-up” and “back-staging” is necessary in order to make the new communication and cooperation structure familiar.
- The number of users has to be high enough to succeed in getting a critical mass of active users.

4.2 Recommendations for Research

A1 Management Control

The research topics:

- how well the control systems currently used, map companies' knowledge objectives
- to develop concepts which enable knowledge-intensive companies to flexibly adapt their control and benchmarking systems to new requirements
- to develop tools which enable companies to determine where established processes and structures hinder knowledge work
- show good practice examples which illuminate the relationship between organisational learning and the knowledge work productivity

can only be a result of specific designed case-studies. So this should be a subject to further research in this sector.

A2 Job Design of Knowledge Work

Intensify research

- on multitasking work (to avoid it and the combined time losses and low quality of working results)
- develop adaptation or coping strategies for information overload and problems with uncertainty of decision consequences

Increase the focus on PC Desktop specific research, one of the most recent and popular areas, which strongly influences the learning process.

Especially in the following research topics:

- Develop tools that provide integrated access to various types of information sources like documents, email history and Web pages visited.
- Develop models of the internal structure of documents that cover several topics for their re-usage.
- Research for more transparency about how users actual interact with the contents of their personal Desktops.

A4 Knowledge Management

- Increase the research for the success factors of Social Software by research in the motivational dynamics of corporate users.
- The introduction of social software changes the communication and cooperation structures. There is no research about unintended follow-ups for the enterprises, so it is necessary to accompany the introduction and implementation process scientifically until a stabile result is achieved in the enterprises.

4.4 Recommendations for Politics

A1 Management Control

- It is necessary to anchor the empirical base for indicators of knowledge work by national surveys in every country of the EU. These surveys have to achieve a proportional sample of the specific national business branches. As a result of these surveys it will be possible to extract empirically based indicators for the national and EU level of knowledge work that can be used as a tool by Eurostat, may show how capable European companies are at present at implementing knowledge-intensive innovations and may build the base for the promotion of knowledge work in the European business industries.

A2 Job Design of Knowledge Work

- Support applied research on the impact of multitasking work on quantity and quality of work performance.
- Support research on developing adaptation or coping strategies for information overload and problems with uncertainty of decision consequences.
- Build up an infrastructure for regional networks of competence in the field of KWM, especially circles for exchange of experiences between enterprises with high level of knowledge work and those enterprises that must cope with increasing knowledge work. These circles should be moderated by applied scientists.

A3 Knowledge Workers

- The demand for knowledge workers is increasing in business, so it is necessary to increase the numbers of graduates of higher education in the education system.

A4 Knowledge Management

- Support research for the success factors of Social Software in the motivational dynamics of corporate users.

ANNEX

Survey on Competence Management and Knowledge Work

107 enterprises (valid replies) participated in this survey

78% German

22% other EU

The results of the survey are added to the following questionnaire as frequencies in % and where necessary as means.

How important are the following factors for the success of your company?

| | important | partly | unimportant |
|---------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| leading position in technology | <input type="checkbox"/> 56% | <input type="checkbox"/> 24% | <input type="checkbox"/> 20% |
| open up new markets | <input type="checkbox"/> 45% | <input type="checkbox"/> 45% | <input type="checkbox"/> 10% |
| entrepreneurial thinking of employees | <input type="checkbox"/> 72% | <input type="checkbox"/> 26% | <input type="checkbox"/> 2% |
| executives, HR culture | <input type="checkbox"/> 60% | <input type="checkbox"/> 35% | <input type="checkbox"/> 5% |
| leading position in quality | <input type="checkbox"/> 73% | <input type="checkbox"/> 25% | <input type="checkbox"/> 2% |
| creativity, innovative capacity | <input type="checkbox"/> 79% | <input type="checkbox"/> 19% | <input type="checkbox"/> 2% |
| knowledge, skills, qualifications | <input type="checkbox"/> 83% | <input type="checkbox"/> 15% | <input type="checkbox"/> 2% |
| ability to adapt quickly | <input type="checkbox"/> 76% | <input type="checkbox"/> 24% | <input type="checkbox"/> 1% |
| leading position in prices | <input type="checkbox"/> 10% | <input type="checkbox"/> 50% | <input type="checkbox"/> 40% |
| international orientation | <input type="checkbox"/> 32% | <input type="checkbox"/> 49% | <input type="checkbox"/> 20% |
| focus on customers | <input type="checkbox"/> 74% | <input type="checkbox"/> 25% | <input type="checkbox"/> 1% |

Do you have a clear idea on the meaning of the term ‘competence management’?

| yes | roughly | no |
|-------------------------------------|-------------------------------------|-------------------------------------|
| <input type="checkbox"/> 45% | <input type="checkbox"/> 40% | <input type="checkbox"/> 15% |

Are there assessments of the competences of the employees and executives in your company?

| | yes, systematically | yes, but more unsystematically | no |
|-----------------|-------------------------------------|---------------------------------------|-------------------------------------|
| executives | <input type="checkbox"/> 27% | <input type="checkbox"/> 48% | <input type="checkbox"/> 25% |
| other employees | <input type="checkbox"/> 20% | <input type="checkbox"/> 52% | <input type="checkbox"/> 28% |

If yes:

Do these assessments take place regularly?

| | regularly with intervals less 1 year | regularly with intervals more than 1 y. | unregularly |
|-----------------|---|--|------------------------------|
| executives | <input type="checkbox"/> 35% | <input type="checkbox"/> 48% | <input type="checkbox"/> 25% |
| other employees | <input type="checkbox"/> 20% | <input type="checkbox"/> 52% | <input type="checkbox"/> 28% |

Which are the competence management instruments used by your company?

| | |
|---|------------------------------|
| identification of future skill and qualification needs (quantitative) | <input type="checkbox"/> 50% |
| specification of future requirements (qualitative) | <input type="checkbox"/> 35% |
| specification of current requirements | <input type="checkbox"/> 43% |
| staff performance appraisal | <input type="checkbox"/> 48% |
| specification of the knowledge necessary to perform an activity/job | <input type="checkbox"/> 32% |
| specification of the abilities necessary to perform an activity/job | <input type="checkbox"/> 33% |
| regular, structured appraisal interviews | <input type="checkbox"/> 54% |
| regular career development interviews | <input type="checkbox"/> 32% |
| regular agreements on objectives | <input type="checkbox"/> 56% |
| identification and support of "high performers" | <input type="checkbox"/> 37% |

How do you identify competences which will be needed by your company in the future?

| | |
|--|------------------------------|
| regular customer interviews and surveys | <input type="checkbox"/> 37% |
| target analyses by superiors | <input type="checkbox"/> 50% |
| development of future scenarios | <input type="checkbox"/> 39% |
| internal idea workshops, idea management | <input type="checkbox"/> 41% |
| development partnerships with customers | <input type="checkbox"/> 29% |
| observation of trends | <input type="checkbox"/> 57% |
| knowledge management | <input type="checkbox"/> 17% |
| technology monitoring | <input type="checkbox"/> 23% |
| observation of competitors | <input type="checkbox"/> 53% |

continuous market observation

59%

Which measures does your company take in case of changing skill and qualification requirements or lack of competences?

multiple responses possible

| | |
|--|------------------------------|
| self-organized learning on the job | <input type="checkbox"/> 62% |
| moderated, systematic exchange of experiences | <input type="checkbox"/> 37% |
| team or group discussions | <input type="checkbox"/> 44% |
| further training courses | <input type="checkbox"/> 62% |
| training on the job, instruction at the workplace (for less/semi-skilled jobs) | <input type="checkbox"/> 48% |
| recruiting of personnel with adequate competences | <input type="checkbox"/> 36% |
| learning in projects | <input type="checkbox"/> 38% |
| coaching | <input type="checkbox"/> 28% |
| mentoring, (one personal mentor to one definite employee) | <input type="checkbox"/> 32% |
| blended learning, CBT | <input type="checkbox"/> 17% |

How do you estimate the performance of your company regarding the following factors?

| | good | average | below average |
|---------------------------------------|------------------------------|------------------------------|------------------------------|
| knowledge, skills, qualifications | <input type="checkbox"/> 61% | <input type="checkbox"/> 39% | <input type="checkbox"/> 0 |
| creativity, innovative capacity | <input type="checkbox"/> 52% | <input type="checkbox"/> 42% | <input type="checkbox"/> 6% |
| ability to adapt quickly | <input type="checkbox"/> 47% | <input type="checkbox"/> 41% | <input type="checkbox"/> 12% |
| open up new markets | <input type="checkbox"/> 24% | <input type="checkbox"/> 59% | <input type="checkbox"/> 17% |
| leading position in technology | <input type="checkbox"/> 34% | <input type="checkbox"/> 54% | <input type="checkbox"/> 12% |
| leading position in quality | <input type="checkbox"/> 38% | <input type="checkbox"/> 43% | <input type="checkbox"/> 19% |
| focus on customers | <input type="checkbox"/> 60% | <input type="checkbox"/> 32% | <input type="checkbox"/> 8% |
| international orientation | <input type="checkbox"/> 32% | <input type="checkbox"/> 50% | <input type="checkbox"/> 18% |
| executives, HR culture | <input type="checkbox"/> 15% | <input type="checkbox"/> 66% | <input type="checkbox"/> 19% |
| entrepreneurial thinking of employees | <input type="checkbox"/> 12% | <input type="checkbox"/> 74% | <input type="checkbox"/> 14% |

How do you estimate the commitment of the company's executives regarding their own competence development?

| | good | average | below average |
|---|------------------------------|------------------------------|------------------------------|
| well able to assess their own skill and qualification needs | <input type="checkbox"/> 24% | <input type="checkbox"/> 66% | <input type="checkbox"/> 10% |
| conscious of the necessity to develop their own competences | <input type="checkbox"/> 44% | <input type="checkbox"/> 37% | <input type="checkbox"/> 19% |
| conscious of the necessity of "lifelong learning" | <input type="checkbox"/> 50% | <input type="checkbox"/> 35% | <input type="checkbox"/> 15% |
| pursue their own further training and education actively | <input type="checkbox"/> 24% | <input type="checkbox"/> 47% | <input type="checkbox"/> 29% |
| know about the respective future requirements | <input type="checkbox"/> 20% | <input type="checkbox"/> 63% | <input type="checkbox"/> 17% |
| look after the competence development of employees | <input type="checkbox"/> 21% | <input type="checkbox"/> 48% | <input type="checkbox"/> 31% |

How do you estimate the commitment of the company's employees regarding their own competence development?

| | good | average | below average |
|---|------------------------------|------------------------------|------------------------------|
| well able to assess their own skill and qualification needs | <input type="checkbox"/> 32% | <input type="checkbox"/> 55% | <input type="checkbox"/> 12% |
| conscious of the necessity to develop their own competences | <input type="checkbox"/> 52% | <input type="checkbox"/> 36% | <input type="checkbox"/> 12% |
| conscious of the necessity of "lifelong learning" | <input type="checkbox"/> 37% | <input type="checkbox"/> 46% | <input type="checkbox"/> 17% |
| pursue their own further training and education actively | <input type="checkbox"/> 32% | <input type="checkbox"/> 42% | <input type="checkbox"/> 26% |
| know about the respective future requirements | <input type="checkbox"/> 28% | <input type="checkbox"/> 55% | <input type="checkbox"/> 17% |

To which sector does your company belong to?

| | |
|--|--------------------------------|
| energy and water supply | <input type="checkbox"/> 3,5% |
| mechanical engineering | <input type="checkbox"/> 7% |
| vehicle construction | <input type="checkbox"/> 2,3% |
| electrical engineering, electronics (hardware) | <input type="checkbox"/> 11,6% |
| precision engineering, optics | <input type="checkbox"/> 2,3% |
| building and construction | <input type="checkbox"/> 0 |
| trade, commerce | <input type="checkbox"/> 5,8% |
| traffic and communications | <input type="checkbox"/> 4,7% |
| banking, insurance | <input type="checkbox"/> 11,6% |
| consultancy | <input type="checkbox"/> 10,5% |
| research and development | <input type="checkbox"/> 10,5% |
| IT service provision | <input type="checkbox"/> 12,8% |
| call center | <input type="checkbox"/> 0 |
| personal services | <input type="checkbox"/> 5,8% |
| public service | <input type="checkbox"/> 5,8% |
| other trade | <input type="checkbox"/> 5,8% |

| | | |
|--------------------------------------|------|--------------------|
| total turnover 2006 | mean | 5.215 Mio.€ |
| export share EU countries | mean | 28,4% |
| export share non-EU countries | mean | 18% |

| | | | |
|---|------------------------------|------------------------------|-----------------------------|
| turnover development in last 3 years | increasing | same level | decreasing |
| | <input type="checkbox"/> 70% | <input type="checkbox"/> 25% | <input type="checkbox"/> 5% |

How personnel-intensive is your company?

Annual payroll of all employees in 2006 mean **60,2%** of turnover

| | | |
|------------------------------------|------|--------------|
| number of employees in 2006 | mean | 4.740 |
|------------------------------------|------|--------------|

Does your company take a leading market position with regard to its main products or services?

| | yes | partly | no |
|------------|------------------------------|------------------------------|------------------------------|
| world-wide | <input type="checkbox"/> 14% | <input type="checkbox"/> 18% | <input type="checkbox"/> 68% |
| within EU | <input type="checkbox"/> 18% | <input type="checkbox"/> 25% | <input type="checkbox"/> 57% |
| in Germany | <input type="checkbox"/> 32% | <input type="checkbox"/> 38% | <input type="checkbox"/> 30% |

Which main change of your range of products / services do you expect within the next years?

Please, choose one alternative

| | |
|---|------------------------------|
| concentration on less products / services | <input type="checkbox"/> 6% |
| more or less no change | <input type="checkbox"/> 25% |
| further development of products / services | <input type="checkbox"/> 24% |
| supplement by new products / services | <input type="checkbox"/> 27% |
| substitution of a part of products/services by new ones | <input type="checkbox"/> 12% |
| complete restructuring of product/services offers | <input type="checkbox"/> 6% |

Is there one or are there more than one responsible persons for strategic product / services development whose job profile contains a time budget for this task in your company?

yes no
 62% 38%

Range of planning

Are there written plans for the following areas of your company?

| | no | yes:-6 months | -1 year | -3 years | for more than 3 y. |
|------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| product | | | | | |
| development | <input type="checkbox"/> 21% | <input type="checkbox"/> 21% | <input type="checkbox"/> 39% | <input type="checkbox"/> 12% | <input type="checkbox"/> 7% |
| R&D | <input type="checkbox"/> 27% | <input type="checkbox"/> 11% | <input type="checkbox"/> 33% | <input type="checkbox"/> 16% | <input type="checkbox"/> 13% |
| personnel | <input type="checkbox"/> 27% | <input type="checkbox"/> 18% | <input type="checkbox"/> 44% | <input type="checkbox"/> 7% | <input type="checkbox"/> 4% |
| further training | <input type="checkbox"/> 33% | <input type="checkbox"/> 18% | <input type="checkbox"/> 40% | <input type="checkbox"/> 3% | <input type="checkbox"/> 6% |

sales 15% 13% 46% 20% 6%

Do you have a clear idea on the meaning of the term ‘Knowledge Work Management’?

yes roughly no
 35% 33% 32%

In which way did the following requirements change during the last years?

| | increasing | same | decreasing |
|--|------------------------------|------------------------------|-----------------------------|
| knowledge work | <input type="checkbox"/> 67% | <input type="checkbox"/> 29% | <input type="checkbox"/> 4% |
| knowledge intensification | <input type="checkbox"/> 79% | <input type="checkbox"/> 19% | <input type="checkbox"/> 2% |
| work in profit centres | <input type="checkbox"/> 30% | <input type="checkbox"/> 61% | <input type="checkbox"/> 9% |
| project work | <input type="checkbox"/> 55% | <input type="checkbox"/> 45% | <input type="checkbox"/> 0 |
| work in interdisciplinary teams | <input type="checkbox"/> 60% | <input type="checkbox"/> 40% | <input type="checkbox"/> 0 |
| complexity of problem solution processes | <input type="checkbox"/> 68% | <input type="checkbox"/> 28% | <input type="checkbox"/> 4% |
| specialization | <input type="checkbox"/> 70% | <input type="checkbox"/> 28% | <input type="checkbox"/> 2% |
| density of necessary information | <input type="checkbox"/> 72% | <input type="checkbox"/> 25% | <input type="checkbox"/> 3% |
| density of unnecessary information | <input type="checkbox"/> 73% | <input type="checkbox"/> 20% | <input type="checkbox"/> 7% |
| multitasking | <input type="checkbox"/> 69% | <input type="checkbox"/> 27% | <input type="checkbox"/> 4% |

Which are the consequences of these requirement changes?

| | higher | unchanged | lower |
|--------------------------------------|------------------------------|------------------------------|------------------------------|
| motivation | <input type="checkbox"/> 20% | <input type="checkbox"/> 44% | <input type="checkbox"/> 36% |
| positive stress | <input type="checkbox"/> 19% | <input type="checkbox"/> 73% | <input type="checkbox"/> 8% |
| negative stress (overstraining) | <input type="checkbox"/> 69% | <input type="checkbox"/> 27% | <input type="checkbox"/> 4% |
| further training needs | <input type="checkbox"/> 77% | <input type="checkbox"/> 23% | <input type="checkbox"/> 0 |
| information overload | <input type="checkbox"/> 71% | <input type="checkbox"/> 22% | <input type="checkbox"/> 7% |
| uncertainty on decision consequences | <input type="checkbox"/> 55% | <input type="checkbox"/> 44% | <input type="checkbox"/> 1% |
| performance standards / requirements | <input type="checkbox"/> 57% | <input type="checkbox"/> 36% | <input type="checkbox"/> 7% |
| loss of time through multitasking | <input type="checkbox"/> 52% | <input type="checkbox"/> 43% | <input type="checkbox"/> 5% |
| burn-Out | <input type="checkbox"/> 45% | <input type="checkbox"/> 55% | <input type="checkbox"/> 0 |

career development opportunities 32% 30% 38%

In which company areas did you recognize a prominent knowledge intensification?

multiple responses possible

| | |
|--|------------------------------|
| research & development | <input type="checkbox"/> 44% |
| (support) service | <input type="checkbox"/> 44% |
| production of goods, services production | <input type="checkbox"/> 49% |
| planning, logistics | <input type="checkbox"/> 22% |
| marketing, sales | <input type="checkbox"/> 32% |
| personnel department | <input type="checkbox"/> 20% |
| company administration | <input type="checkbox"/> 14% |

Do increasing shares of knowledge work require new forms of work organization?

| | | |
|------------------------------|------------------------------|-----------------------------|
| yes | partly | no |
| <input type="checkbox"/> 32% | <input type="checkbox"/> 61% | <input type="checkbox"/> 7% |

How do you estimate the efficiency of the following measures of knowledge work design / measures for the design of knowledge-intensive work with regard to your company?

| | efficient | partly | not e. |
|--|------------------------------|------------------------------|------------------------------|
| standardization of a part of activities within a job profile | <input type="checkbox"/> 55% | <input type="checkbox"/> 38% | <input type="checkbox"/> 7% |
| reduction of complexity to reduce psychological strain | <input type="checkbox"/> 39% | <input type="checkbox"/> 47% | <input type="checkbox"/> 14% |
| systematic change between more and less demanding activities | <input type="checkbox"/> 34% | <input type="checkbox"/> 52% | <input type="checkbox"/> 14% |
| organized short breaks (e.g., obligatory breaks, PC shut down) | <input type="checkbox"/> 18% | <input type="checkbox"/> 30% | <input type="checkbox"/> 52% |
| technical information filter (e.g., spam filter) | <input type="checkbox"/> 47% | <input type="checkbox"/> 47% | <input type="checkbox"/> 7% |
| information filtering by assistant personnel (e.g., secretary) | <input type="checkbox"/> 30% | <input type="checkbox"/> 45% | <input type="checkbox"/> 25% |
| health prevention (e.g., fitness training) | <input type="checkbox"/> 47% | <input type="checkbox"/> 40% | <input type="checkbox"/> 13% |

| | | | |
|--|------------------------------|------------------------------|------------------------------|
| offers of regular sabbaticals | <input type="checkbox"/> 17% | <input type="checkbox"/> 58% | <input type="checkbox"/> 25% |
| prevention of excess specialization (e.g., job rotation, knowledge refreshment) | <input type="checkbox"/> 37% | <input type="checkbox"/> 50% | <input type="checkbox"/> 13% |
| support of career planning | <input type="checkbox"/> 51% | <input type="checkbox"/> 49% | <input type="checkbox"/> 0 |

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