

Achieving benefits through integrating eLearning and Strategic Knowledge Management

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Abstract

In our experience, corporate eLearning initiatives are often being implemented with too little consideration of organizational issues, such as corporate strategy. As a result, potential benefits of eLearning as a tool for creating organizational competencies are usually not realized to a full extent. Thus, the focus of the present paper is on integrating eLearning and strategic knowledge management initiatives in an organizational environment. We present results of several case studies in which we implemented instruments for competency-based human resource management and intellectual capital management. These lead us to consider requirements for a competency management system that aims to support this integration on a technological basis.

1 Introduction

eLearning implementations have often been found to lack an overall business focus. Often no considerations are made of the larger organizational context in which eLearning is to take place. A Mercer Management study found that most companies using eLearning have maintained the traditional focus on "training" - education in preparation for a specific job - and have not yet expanded their vision to the broader uses and possibilities afforded by e-learning ([6]).

Especially strategic aspects, that is, how eLearning can contribute to organizational performance has often been neglected. Ismail argues in [7] that "the missing ingredients from most e-learning programs are clear and measurable objectives and cohesive strategies. Before an organization can evaluate any offerings from an eLearning provider or implement any internal initiative, it must first create a cohesive strategy that clearly defines and documents the value each program must deliver (...). The too-frequently repeated 'spray and pray' approach to web-based training programs does not work in most cases" (p. 330-331). He argues that when looking ahead, the emphasis of eLearning will have to shift to "performance support" with the integration of knowledge management capabilities.

Following the ideas in [14], it is the aim of this paper to show the benefits of connecting eLearning with other organizational efforts in the arena of strategic knowledge management and human resource (HR) management. Specifically we will present interdependencies between eLearning and competency-based HR management and the management of intellectual capital.

From a software point of view these benefits can best be realized if an IT architecture is employed that supports the targeting of training efforts at those employees and employee competencies that appear to have the largest demand for learning interventions. Thus, the aspired architecture supports development of employee competencies and at the same time supports organizational performance. We will therefore present software requirements for an IT architecture, which we call *competency management system*, and which will provide an integration of corporate education, identification of learning needs and application of strategic goals.

The general methodology employed in our research is firmly based on empirical investigations of the challenges that organizations are facing. We therefore base the requirements analysis on several case studies in which instruments for competency-based HR management and intellectual capital management were implemented. Considering the lessons learned from these implementations we derive the requirements for a software architecture that would enhance eLearning beyond its usual capacities.

2 Methodology

Especially relevant for the purposes of this paper are the results of four case studies involving different kinds of companies. The case studies were part of two industry projects that were conducted between 2001 and 2002 by the Know-Center, a publicly funded applied research institute for knowledge management in Graz/Austria. The aims of these industry projects were to implement instruments for intellectual capital management and competency-based HR management. eLearning was not a focus in these case studies, however, issues of training and HR development were always considered.

2.1 Intellectual capital management

Intellectual capital is usually referred to as the part of a company's resources that does not appear on a financial balance sheet ([13]). These intangible assets include the knowledge and competences of the employees, relationships with customers, suppliers and partners as well as organizational structure and

internal processes. All of these invisible resources can be the source of value creation within a company, and they become increasingly important as the economy becomes more and more knowledge-based. This demonstrates the importance of making these hidden resources visible for the strategic management of the firm. This is commonly achieved by finding a set of company specific indicators that show developments of the intellectual resources, such as process cycle times, customer satisfaction or employee performance.

Our implementation in the Case Studies followed a top-down approach adapted from [12], which is more thoroughly discussed in [8]. Initially, we developed a strategic model together with top management that shows the long-term goals and the critical success factors to reach these goals. In our cases, these critical success factors described the companies' intellectual resources in an abstract manner (e.g. "re-use of existing methods and procedures", "broad employee knowledge", or "large network with other knowledge carriers"). The next step was to find measurable indicators for these abstract concepts in order to operationalize the strategic model (e.g. "number of entries in company knowledge base", "number of knowledge areas per employee", or "number of knowledge carriers known to employees"). Next, indicators were measured and results were interpreted in a mutual workshop with top management and members of operational management.

As described by [14], intellectual capital management is especially relevant for eLearning because it provides the goals for an eLearning strategy. For example, when the goals set forth in the strategic model are to engage in consulting projects and therefore to build up methodological knowledge or project management skills, eLearning can be a tool for implementing appropriate training. Vice versa, measuring indicators regarding employee competence is facilitated with eLearning applications, e.g. via test results or usage statistics.

2.2 Competency-based human resource (HR) management

Competency-based HR management (sometimes called 'skills management') has been used in companies to inform and improve HR processes like recruitment, selection, employee development and reward ([1]). The aim is to promote employee competence at work and to give HR applications a strategic focus ([5]).

Within this approach, critical job competencies (knowledge, skills and attitudes) are being defined by the company (e.g. "knowledge about automobile development process" or "leadership skills") and recruiting and training efforts are then being targeted at these competencies. Because of its concern with knowledge goals and goal-directed knowledge development, competency-based HR management has been taken up by knowledge management advocates (e.g. [11]) to help operationalize knowledge goals in a company.

Within our approach in the case studies, we defined critical skills together with job incumbents and their supervisors, as well as the level to which they would be required, thereby generating job profiles for each job. We then measured actual skills of the employees by means of self-report and supervisor account. This resulted in employee profiles. These two kinds of profiles could then be used to determine development needs for each employee.

2.3 Implementation process and lessons learned

The companies in which the instruments were implemented were a small consulting company and a public research institute each with less than 50 employees, a software development company with around 150 and a large engineering company with over 1000 employees. In both projects, the case studies were conducted in pilot areas of these companies, covering between 10 to 30 employees in each instance. Implementation of the instruments for both intellectual capital management and competency-based HR management took about 8 months in these pilot areas.

In order to gain insight into the process, we collected lessons learned in the implementation process. For this purpose, we kept track of the problems that arose, discussed them together within the project team and developed ideas on how to improve the process. This mutual learning contributed a great deal to our understanding of the process, thereby laying the groundwork for development of the software requirements.

3 Results of the case studies

In this section, the results of the case studies will be reported. In doing this, we will focus on the lessons learned that pertain to the development of the software requirements for the competency management system. Other lessons learned are reported elsewhere (see [8]).

In total, we have identified six areas of lessons learned. Where possible, we will give examples from our case studies and derive a short list of requirements for a competency management system.

3.1 Shaping employee development

First of all, we have identified three potential forces that drive employee development in a corporate setting. These forces are (1) the strategic management of the company, (2) operational pressures of the day-to-day business and (3) individual preferences and development aims of the employees. These forces are a result of the differing interest of three agents that aim to influence employee development. Their interests are sometimes conflicting which is evident in differing views on which training or development measure should be chosen for a specific employee at any given point in time.

The following table gives an overview of the driving forces and the corresponding agents as well as some examples from our case studies that should help to illustrate our arguments.

(1) Strategic management of the company	
Driving Force	The long-term development of the company or the department shape what employees need to learn and what competencies they need to develop. These come out of the strategic goals the company or department is trying to reach, and an analysis of what kind of competencies are needed to reach the goals. Intellectual capital management provides a framework to perform this kind of analysis.
Agent	A strategic planner. This might be top management or a head of a business unit or department who is responsible for developing the strategy for his/her unit.
Example	One of the critical success factors of the consulting company was that employees develop a large competence portfolio. A goal for the research institute was to develop marketing skills in order to improve project acquisition. These kinds of goals should influence the offering of eLearning courses and that of other development resources.
(2) Operational pressures of day-to-day business	
Driving Force	In this case, employee competencies are derived from the task requirements of the current job. This is usually the aim of training needs analyses, in which current and future tasks are analyzed in order to derive development requirements for a certain job.
Agent	Usually the direct supervisor of the employee in question who is responsible for attainment of operational goals.
Example	Within the engineering company, a competency that was termed "knowledge of car design process" which was to facilitate a more efficient project management was derived from operational task requirements. The explicit definition of competencies required to perform certain tasks was found to be very helpful since it gave direct supervisors a better basis for making training decision together with their staff.
(3) Individual preferences and development aims of the employees	
Driving Force	Employees themselves certainly have interests in their own development. They seek to pursue a certain career or maximize their employability, which makes the development of certain skills and competencies necessary. In this case, training needs are derived from a negotiation between employee and supervisor.
Agent	The employee him-/herself.
Example	In the engineering company, training was partly seen as an incentive by the individual employees. Therefore, a system that would assign trainings exclusively on the basis of needed competencies was not found to be feasible.

Requirements for a competency management system that can be derived from the above arguments include:

- The system has to acknowledge the three possible agents: strategic planner, supervisor and employee
- The system has to acknowledge that there is a continuum of company policies that reflect different levels of how much each of the agents' goals is reflected in the development planning procedure. It has to provide support for defining development requirements from individual employees (e.g. by supporting employee self-service), from strategic planners (e.g. by giving room for the definition of strategically relevant competencies) and supervisors (e.g. by providing for flexible adaptation to short-term task requirements). Depending on organizational culture, the company might then chose to implement different policies of development planning.
- The explication of competencies is a good way of ensuring that the company recognizes requirements from strategic management and operational tasks.

3.2 Explicating competencies

It makes sense to explicate what people know (employee profiles) and what they ought to know (job profiles) in order to provide direction for selection of eLearning courses or other learning resources. Some problems we encountered in our case studies provide evidence for this: Supervisors and members of operational management have only vague ideas of what people should know to perform more efficiently in their jobs. Trainings and other learning resources are a scarce resource and the HR development department has no way of deciding how to distribute them among employees most effectively.

Another aspect is that employees usually don't get feedback on their potential development needs. This also can be addressed by explicating their competencies. In our case studies, this need was addressed by

having both employees (view of self) and supervisors (view of other) fill out a profile for the employee and discussing differences in the development discussion. This approach might be extended by including co-workers, subordinates or customers (360° Feedback).

We can therefore derive further requirements for a competency management system:

- The system should provide means for centrally storing competency definitions.
- It should be possible to define and access both employee and job profiles.
- It should be possible to define alternative views of an employee profile.

3.3 Individual skill gap analysis

Once competency requirements are explicated, it is possible to provide decision support for development planning by analyzing the gaps that exist between the competencies that are required and those that employees actually have. Individual skill gap analyses will help to prioritize learning interventions.

Another requirement is derived:

- It should be possible to perform a comparison between an employee profile and different job profiles in the organization.

3.4 Structuring learning resources

Development planning can then be supported if development measures are connected to competencies. One possibility to do this using a meta-data driven approach is described in [3]. By assigning to each learning resource all *competencies* that are *required* for completion of the resource and all *competencies taught* by the learning resource, the learning resources will be structured in such a way that individual curricula can be generated according to the employee's available competencies and those that are required.

This leads to the following requirement:

- The competencies defined in the competency management system should be connected to learning resources offered by the company

3.5 Analyzing the offering of learning resources

The analysis of learning requirements on a larger scale will reveal strengths and weaknesses of the offering of learning resources by HR Development. The supply of learning resources should then mirror the actual organizational requirements, instead of providing whatever is technically feasible or currently fashionable. This might lead to the realization that new kinds of learning resources have to be created to fulfill the demand. An analysis of required competencies in the engineering company showed that new kinds of learning methods would be required, such as on-the-job learning and project assignments.

As a result, the following requirements are derived:

- The system should be connected to the company's learning management system.
- Competencies should be connected to all learning resources that the company plans to offer, including "off-line" seminars, conferences, books, project assignments etc.
- HR Development should have the possibility to analyze the current offering of learning resources and compare it to actual requirements.

3.6 Providing feedback for strategic decision making

Especially from a standpoint of the management of intellectual capital, it makes sense to gain information on employee competencies. Strategic Planners need information on available and missing competencies on an organizational level in order to make decisions such as recruiting certain competencies from the job market, forging strategic alliances, developing new products and services for entering a new market or simply for communicating employee competencies to shareholders. For the consulting company, it was important to have a better way of communicating their competence to potential clients. Being able to cite indicators of employee competencies gave them a better stance in project negotiations. The research institute was interested in how employee knowledge of methods (such as presentation, project management or for analyzing certain problems) developed compared to technical know-how.

Finally, we derive the following requirement:

- The system should provide possibilities for employee skills aggregation, statistical analysis of available skills and the generation of indicators on an aggregate basis.

4 Software requirements definition

Based on the requirements listed above, we first developed a model showing what interactions and collaborations exist between the target system, human users and external software systems. Such a model

is called domain model and it has been developed according to the methodology described in [4] , using the Unified Modeling Language UML as notation language ([2] and [10]).

In Figure 1 an overall view of the requirements model is given. The target system is represented by a rectangle, which defines and represents the system's boundaries to the 'outer world'. In the given diagram, the three agents who influence the development of employees are shown: The Employee and Supervisor are shown in the lower left corner of the diagram and the upper left corner of the diagram, respectively. The third agent, the Strategic Planner is shown on the right side of the diagram. Human actors normally impersonate these agents. HR Development is responsible for administering the system. The last actor shown is External Software Systems, which represents all external systems interacting with the competency management system.

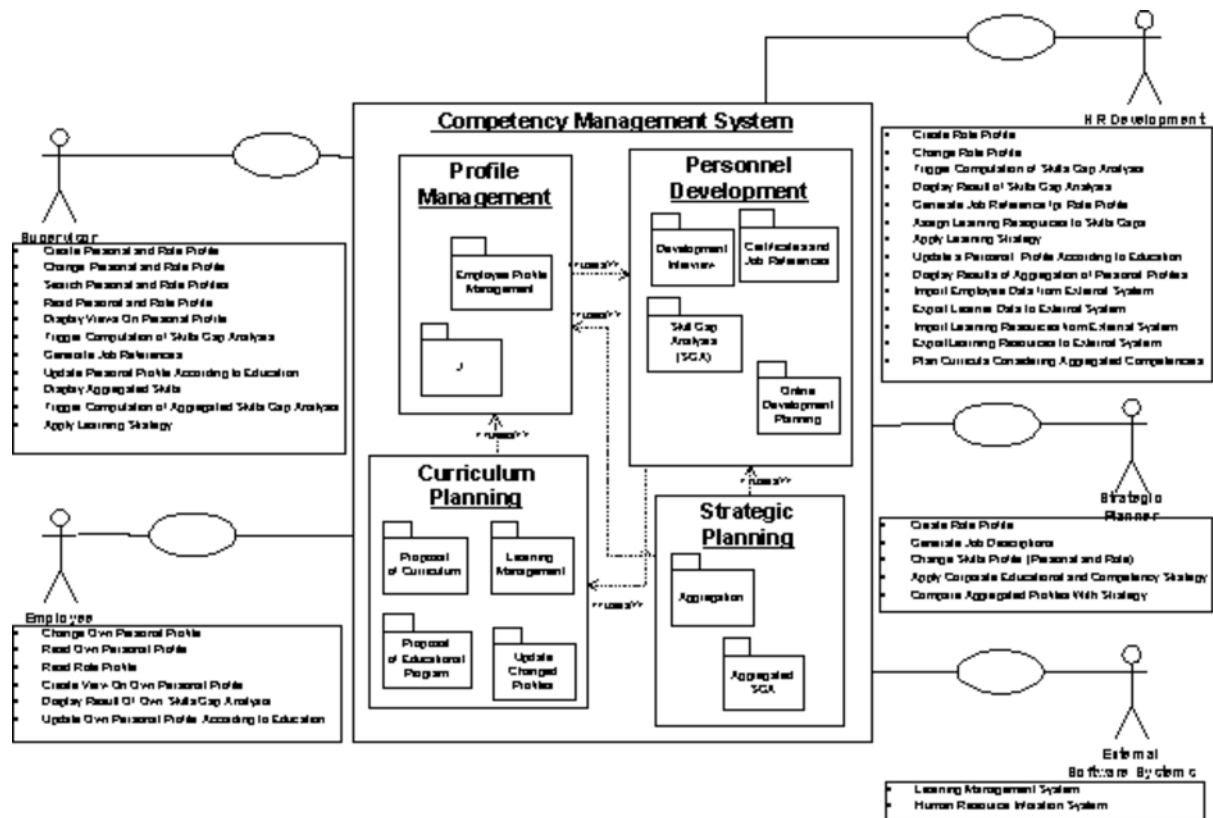


Figure 1: The requirements model of the competency management system

The rectangular boxes within the outmost rectangle represent subsystems of the target system. Each subsystem is meant to realize at least one distinguished process of a competency management system. Accordingly, the inmost boxes with a rectangle on the left side of their tops represent coherent units of functionality, which manifest themselves as interactions and collaborations among the actors. Normally, these units are expressed as use cases or sets of use cases in UML ([10]).

In the following, the subsystems of the competency management system are specified in more detail. The roles and actors (agents) involved are listed as well as the related processes, which are implemented by the subsystem. The uses cases comprised by any distinguished subsystem are given and the agent's responsibility in a use case is outlined. Additionally, general descriptions of the functionality realized by the subsystem are documented as well as remarks for the subsystem in case there are some.

Profile Management	
Description	This subsystem aims at giving the employees themselves, her supervisors and the HR manager in development access to employee profiles and job profiles. Focus is on enabling employees to manage and maintain their own profiles and finally most of the operations related to their employee profiles such as updating profiles related to changes caused by corporate education.
Process to be realized	Explicating competencies , see 3.2
Roles and actors involved	Employee Supervisor HR Development

Use Cases	<p>Managing employee profiles</p> <ul style="list-style-type: none"> • The Employee specifies and maintains her own employee profile • Supervisor and/or others specify alternative views to employee profile (For example profiles reflecting results of a 360° feedback or a development discussion) <p>Managing job profiles</p> <ul style="list-style-type: none"> • The Supervisor specifies job profiles • The HR (manager in) Development supports specification of job profiles
Remarks	In [9] , there is a thorough description of a system, which automatically locates expertise of employees. In case of using such a system the human actors do not collaborate with the system for determining the personal skill profiles but collaborate for defining job profiles, defining strategic goals and selecting learning interventions for closing skill gaps.
Personnel Development	
Description	The subsystem's aim is to provide means for computing gaps between employee profiles and job profiles and assign learning interventions to employees for closing gaps if some exist.
Process to be realized	<p>Individual skill gap analysis , see 3.3</p> <p>Structuring learning resources , see 3.4</p> <p>Analyzing the offering of learning resources, see 3.5</p>
Roles involved	<p>Employee</p> <p>Supervisor</p> <p>HR Development</p> <p>External system: Learning Management System</p>
Use Cases	<p>Development Interview</p> <p>Skill Gap Analysis</p> <p>Online Development Planning</p> <ul style="list-style-type: none"> • HR Development assigns learning resources to competency gaps • The Employee selects learning resources • The Supervisor selects learning resources • HR Development selects learning resources <p>Certificates and Job References</p> <ul style="list-style-type: none"> • HR Development creates certificates according to the employee's learning success
Remarks	The system shall provide maximum flexibility by allowing each of the human actors to select learning resources.

Strategic Planning

Description	The main goal is to support the person responsible for strategic planning in an organization, by providing information and computations concerning employee competencies.
Process to be realized	Providing feedback for strategic decision making , see 3.6
Roles involved	<p>Strategic Planner</p> <p>HR Development</p>

Use Cases	<p>Aggregation of employee profiles</p> <ul style="list-style-type: none"> • The Strategic Planner selects the organizational unit for which the aggregation has to be computed • Strategic Planner starts computation of aggregation of employee profiles • Strategic Planner statistically analyses aggregated employee profiles <p>Aggregated Skill Gap Analysis</p> <ul style="list-style-type: none"> • Strategic Planner confronts the aggregated employee profile with strategic goals • Strategic Planner and HR Development assign learning interventions to skills and skill gaps
Remarks	Please note that except for information and computations concerning employees' (aggregated) competencies, the person responsible for strategic planning is not supported by the system but merely depends on her own expertise in meeting decisions derived from the data provided by the system.
Curriculum Planning	
Description	The goal is to define learning interventions and complete curricula and course plans according to organizational requirements. These requirements are on the one hand derived from the employee's competencies and current needs in the everyday business. On the other hand these requirements are derived from goals, specifying demands and requirements on a strategic level.
Process to be realized	Structuring learning resources , see 3.4 Analyzing the offering of learning resources, see 3.5
Roles involved	Employee Supervisor HR Development External system: Learning Management System
Use Cases	<p>Proposal of Curriculum</p> <ul style="list-style-type: none"> • The Employee wishes to see a complete course plan that adapts to her employee profile and skill gap • The Supervisor wishes to see a complete course plan that adapts to a specific employee's employee profile and skill gap • HR Development wishes to see a complete course plan that adapts to a specific employee's employee profile and skill gap <p>Proposal of Educational Program</p> <ul style="list-style-type: none"> • The employee wishes to see certain learning resources, specifically adapted to her own employee profile and skill gap <p>Learning Management</p> <ul style="list-style-type: none"> • HR Development accesses external Learning Management System for including external electronic as well as non-electronic learning resources <p>Update Changed Profile</p> <ul style="list-style-type: none"> • HR Development updates employee profile

5 Outlook

With the argumentation we have laid out above, we have intended to show that the introduction of strategic management initiatives like competency-based HR management or intellectual capital management can greatly enhance eLearning effectiveness. The introduction of competencies on an individual level, as well as on a corporate level, and their connection to learning resources provides eLearning with the strategic focus so often demanded.

We have proposed a software architecture as means of achieving this connection. It should be clear, however, that the software itself is not the only critical component in achieving true integration. Just as much, success is dependent on the readiness of the organization. A shift to competency-based

management that explicitly lays open demands on the work-force affords a change in organizational culture that has not been addressed with this paper.

Nevertheless, it seems to be advantageous to apply a competency management system as interconnecting building block between eLearning and management of learning interventions on the one side and management of competencies and strategic goals for the development of intellectual capital on the other side. The model for the IT architecture outlined in this work adds an extra layer of abstraction to the communication of (sometimes conflicting) interests concerning employee development. Employees' competencies and organizational performance and, maybe even more important, strategies how to constantly enhance them, are thus being made measurable.

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References

- [1] Armstrong, M. (1999). *A Handbook of Human Resource Management Practice*. London: Kogan Page.
- [2] Booch, G., Rumbaugh, J., Jacobson, I. (1998). *The Unified Modeling Language User Guide*. Reading: Addison Wesley Longman.
- [3] Conlan, O.; Wade, V.; Bruen, C.; Gargan, M. (2002). Multi-Model, Metadata Driven Approach to Adaptive Hypermedia Services for Personalized eLearning. *Proceedings of the Second International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems, Malaga/Spain, 29-31 May*.
- [4] D'Souza, D.F., Wills, A.C. (1999). *Objects, Components and Frameworks with UML. The CatalysisSM Approach*. Reading: Addison Wesley Longman.
- [5] Green, P. C. (1999). *Building Robust Competencies*. San Francisco: Jossey-Bass.
- [6] IBM (2001). *The Future of e-Learning: An Expanding Vision, e-learning Whitepaper Series, Paper 2*. IBM Corp., Retrieved August 21, 2002, from <http://www-3.ibm.com/software/mindspan/distlrng.nsf/wdocs/BDECA83A173667D085256AOE007771A2>
- [7] Ismail, J. (2002). The design of an e-learning system: Beyond the hype. *The Internet and Higher Education*, 4(3-4):329-336.
- [8] Ley, T., Rollett, H., Bruhnsen, K., Droschl, G., Dösinger, G., Tochtermann, K. (2002). Implementing Instruments for Intellectual Capital Management: three Case Studies and Some Lessons Learned, In: *Proceedings of the Third European Conference on Knowledge Management (ECKM 2002)*, 24-25 September, Trinity College, Dublin, Ireland.
- [9] McDonald, D., Ackerman, M. (2000). *Expertise Recommender: A Flexible Recommendation System and Architecture*. *Proceedings of the ACM on Computer Supported Cooperative Work (CSCW'00)*, Retrieved August 9, 2002, from <http://www.ischool.washington.edu/mcdonald/papers/McDonald.CSCW00.pdf>
- [10] OMG The Unified Modeling Language Specification version 1.4. Retrieved August 7, 2002, from <http://www.omg.org/technology/documents/formal/uml.htm>
- [11] Probst, G., Deussen, A., Eppler, J., Raub, S. (2000). *Kompetenz-Management - Wie Individuen und Organisationen Kompetenz entwickeln*. Wiesbaden: Gabler.
- [12] Roos, J., Roos, G., Dragonetti, N. C., Edvinsson, L. (1997). *Intellectual Capital: Navigating the New Business Landscape*. London: Macmillan Business.
- [13] Stewart, T. A. (1999). *Intellectual Capital*, New York: Currency Doubleday.
- [14] Tochtermann, K., Ley, T., Rollett, H., (2001). Wissensmanagement, Management intellektuellen Kapitals und eLearning. Alleinstellungsmerkmale und Zusammenhänge, *Tagungsband der GI Jahrestagung Informatik 2001, Vienna/Austria, September, 34-40*.

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