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Skill Management: Searching Highly Skilled Employees for Teambuilding and Project Management Tasks

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Abstract: Efficient project planning from a human resource point of view requires project-oriented organization forms to take into account the permanent change of requirements and framework conditions during the duration of a project correctly. Skill management systems are an excellent management tool for this challenge, if in addition to default skill profiles the employees' competence and experience room is defined. This paper describes a best practice skill management model that takes into account compared with other approaches the attributes time and duration and builds up an experience tree of the employees by link technique. Further the factors are represented, which play a role during the conversion of the model in practice.

Keywords: skills, skill database, skill management, skill updating, project planning, human resource planning
Categories: K.6.1, J.1

1 Introduction

Skill management is in many enterprises in different expressions in use [see Gronau and Uslar 04a; Kreitmeier et al. 00]. A main functionality for an efficient skill management system (SMS) is the support of and improvement in knowledge intensive processes [Remus 02a] with the topics of expert finding, personnel recruitment, personnel development and project management [Gronau and Uslar 04b]. Our focus lies on the examination how resource planning and project management tasks are supported by use of skill management. Based on our founded skill model [Hiermann and Höfferer 03] these goals can be realized only by (1) a network e.g. cross-linking of skills and (2) a temporal perspective e. g. by skill attributes "last used date" and "duration". These features differentiate our SMS from comparable systems.

2 The Skill Concept

2.1 Goal-Oriented Skill Development needs Knowledge Management

The enterprise strategy and goals specified therein form the basis for skill management activities. In the context of knowledge management the relevant fields of knowledge are specified and the methods for the reaching of the knowledge

management of goals are defined. Many authors define skill management as a sub range of knowledge management [see Zobel 03, Remus 02b]. In our research we discovered some differences between the two fields [see Nonaka and Takeuchi (95), Probst et al. (97)] [see table 1].

	Skill Management	**Knowledge Management**
knowledge	implicit	implicit, explicit
definitions(s)	several	lots of
tasks	organisation, structuring, administration of implicit knowledge	knowledge goals, identification, acquisitions, development, distribution, use, storage, evaluation
statements	development of necessary skills	systematic development, supply

Table 1: Differences Skill Management – Knowledge Management

In our SMS by a systematic derivative process the enterprise and knowledge goals are transferred over different planning levels [see Zobel 03] into concrete activities for the skill development.

2.2 Knowledge

The most difficult task in the knowledge management is to illustrate the knowledge of the employees in a database in such a way that the distribution and use of the enterprise-wide knowledge potential are optimized. The approaches discussed at present are characterized strongly in the distinction between implicit and explicit knowledge [Nonaka and Takeuchi (95)]. Unlike the explicit knowledge the implicit knowledge is only very difficult to illustrate [Polanyi 85]. This leads to develop meta-information about the implicit knowledge to find possible competence potentials.

In our approach we classify competences according to knowledge, skills and behaviour. Our approach assumes that a competence represents an association (=quantity) of individual skills (see figure 1). If several skills are used for the solution of a task, then they form a relation at frequent use. These links of single skills represents the skill mapping and generate the "competence room" (competence portfolio) [Ley and Albert 03] of an employee.

2.3 Necessary Information for Project Management

One of the essential tasks in project management is the planning of the operating resources. From the information about the project such as extent of the project, project period and project requirements a project structure plan and a course of project plan are developed, which are divided into individual project requirements [Patzak and Rattay (98)]. Resources are assigned to each work package, in order to accomplish this work package and its contents and extent in the predefined time [Burke (04)]. Operating resources represent both material and immaterial resources. Material resources are operational funds, immaterial resources are the competences of the employees and person independent knowledge like proceedings or process models. Particularly at the team composition as well as the assignment of single team

members to the work packages information about the employee is necessary like: qualification profile, experience profile and the availability of the employee.

2.4 Needed Profiles

The competences of an employee are described by his knowledge, skills and behaviour. In our approach we distinguish between qualification and experience profiles. Both are needed to support anticipated tasks in project management [Deiters et. al 99]. Qualification profiles of the employee describe the employee's knowledge. Experience profiles contain verbal project descriptions and used qualifications in those. Qualification profiles are subject usually to a strong structuring. Catalogue systems were established, which serve as basis for a uniform language nomenclature in the enterprise. We subdivide qualifications into soft skills and hard skills. Hard skills are objectively judging qualifications (e.g.: by a test). Soft skill qualifications are subject to conditions of objective (own-) judgement and subjective (strange-) judgement [see figure 1].

The experience profile points out, where and into which extent (scale) the qualifications were used. Thus we receive a combination between hard skills, soft skills and project reports which defines the so-called experience room.

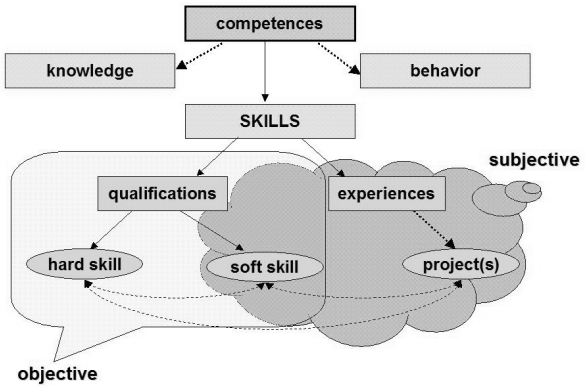

Figure 1: Skill Model

2.5 Needed Skill Attributes for Project Planning

For the composition of teams in the context of project management tasks it is imperative to get a detailed description over the topicality of the skills as well as the availability of the potential team members [Deiters et. al 99].

At the composition of teams the following attributes are absolutely required to complete complex services like consulting projects and software development projects successfully. *name*: unique name of the skill over the enterprise away; *version*: the version number is used mainly at technical qualifications and names the version number of operating systems, data bases, program languages, etc. This is necessary at predefined system environments in which the project must be realized; *function group*: describes in which role (user, programmer, coach, consultant,…) the

skill was used. It is fixed thereby how this knowledge was used; *experience*: describe the experience duration in this skill; *last used*: defines when this skill was used actively for the last time. Thus topicality is held not only on the entire qualification profile of an employee, but on the single skill himself. This attribute therefore also records possible studying duration and training plan to fix renewals of the skill; *scale of expertise*: this is a dimension about the quality of the qualification. It usually moves in a rank from 1 to 5 [Gronau and Uslar 04b]; *set of links*: the combination is held tight between the individual skills in form of links to spread the used experience room. This attribute stores the common use of skills. With these features we distinguish our model from usual approaches to skill modeling.

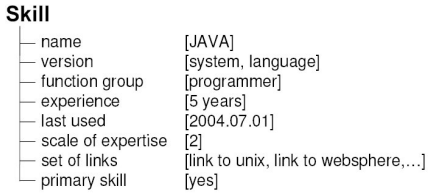

Figure 2: Skill attributes

3 Searching Process

3.1 Linked Skills for the Searching Process

In order to recognize competences as an association of qualifications, the skills must become linked with each other. This link-combination spreads the experience room of the employee and indicates the available implicit knowledge.

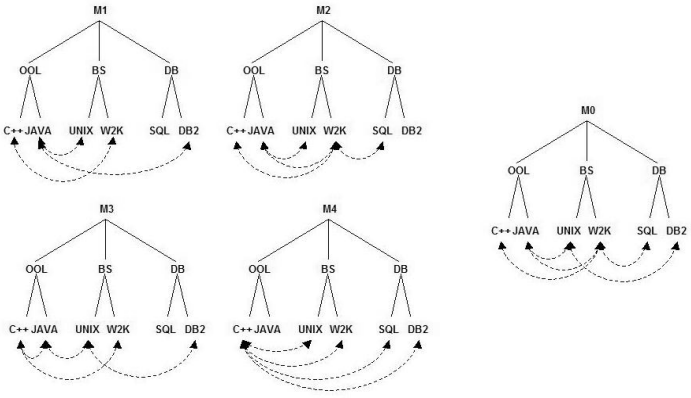

Figure 3: Qualification profiles. M_0 is the searched experience room. M_1 to M_4 represent qualification profiles of employees in form of trees with links between skills

The searched association is represented in the form of the set M_0. M_1, M_2, M_3 and M_4 represent possible qualification profiles of employees that although have the same

skills, however show a different grouping of competences. At simple matching queries all employees would be judged equally well. In the example represented below (see Figure 3) M2 must be recommended in front of M3, M3 must be recommended in front of M1 and M1 must be recommended in front of M4.

3.2 General Conditions

The pattern tree M_0 represents the sought-after experience room of the project. M is the set of all trees M_1, M_2, … , M_J. J is the number of all trees (qualification profiles of the employees). Every tree has I leaves (skills) that are occupied or not. Number I is the same for all trees and represents the universe of all possible skill entries. Applied to all trees M_1,…,M_J as well as M_0: allocation function $\eta(i,j)=1$ if leave i of the tree j is allocated, otherwise $\eta(i,j)=0$ for i = 1…I and j = 1…J,0.

The search process is divided into 2 steps. In the first step all trees are searched that contain at least all those leaves (skills) which are necessary for the project enquiry, at least all leaves of M_0.

Step 1:
Target set M_Z is a subset of M. For all trees from M_Z must be valid:
$\eta(i,j) \geq \eta(i,0)$ for all i=1…I, j=1…J

This means that profiles of the set of M_z must have at least the same allocation stand or additional occupancies, it is therefore valid that:

$$\sum_{i=1}^{I}\sum_{j=1}^{J}\eta(i,j)\cdot\eta(i,0)=\sum_{i=1}^{I}\eta(i,0)$$

Step 2:
For the assessment of the trees of the target quantity M_Z the following combination function ξ is introduced which a ranking fixes between the result profiles. For $\xi(i,k,j)$ it is imperative: i = 1…I (numbering of the leaves); k = 1…K (numbering of the links) and j = 1…J,0 (numbering of all trees + pattern tree). In addition we define that the pattern tree M_0 contains K(i,0) links (combinations).

The weighted assessment B arises for the tree j from the set M_Z:

$$B_j=\sum_{i=1}^{I}\sum_{k=1}^{K(i,j)}\xi(i,k,j)\cdot\xi(i,k,0)$$

For the assessment Bj for the tree j from the quantity M_Z it is imperative to the assessment B_0 of the tree M_0: $0 \leq B_j \leq B_0$

4 Case Study

An IT enterprise with more than 600 employees which is internationally working in numerous lines of business was examined in the case study. This enterprise applies a skill management system that grew empirically since 1990 and is predominant in use for the project management and project planning tasks. The ontology of the skill database contains currently approx. 2500 different skill entries. This is necessary for

highly specialised IT projects as well as different system environments on the customer's side. It is unusual that the definition of the origin ontology for the enterprise resulted from the customers project enquiries and not from the job descriptions.

The ontology and the skill entries are managed in form of a tree. The categories of the first level of the enterprise ontology are: program languages, data bases, operating systems, transaction monitors, tools, certifications, software, methods, languages and technical knowledge. The maximum depth of the tree is currently 4 and can be enlarged any time.

Beeing processed approx. 550 customer demands and converted approx. 200 projects per annum.

4.1 Employee Factors

One of the success factors of the Skill management system is the transparency over the stored data. The qualification profile of an employee has approx. 500 skill entries and about 50 links. With the help of a personalized access in the intranet every employee can retrieve all data stored over him. The employee can retrieve his personal data, data concerning labour law, qualification profile but as well his experience profile. Thus also protection of data privacy legal regulations are considered [Hüneke and Zimmermann 00].

Another success factor is the possibility that the employee can provide single skills with the identification "primary skill". Primary skills are those skills the employee wants to use preferentially. At maximum five of skills may be allocated with the identification "primary skill". The employee decides with the primary skill in which projects he prefers to work. This self-determination is an essential motivation factor for the employees [Armstrong (03)] and represents a part of the suitable humane resource strategy.

4.2 Management Factors

After the introduction of the skill management system the next step that was needed was a position for the administration of the ontology. The position of the skill manager was established and is responsible for the enterprise-wide definition of the ontology. This expert tunes the affiliation or deletion of single skill definitions with the operating departments of the enterprise ontology. For this process of coordination of the base ontology of the enterprise, a department ontology (=a special view of the enterprise ontology for the department) is most suitable.

The skill manager is also responsible for translating the project enquiries from the customers which are recorded in the language of the customers into the language of the enterprise ontology.

The direct supervisor of the employee is responsible for the topicality of the single qualification and experience profile. This manager has the order to carry out an update of the individual profiles at least twice a year or at project end. Approx. 30 project managers or executives have direct access to the skill database.

4.3 Project Management Factors

Approx. 5 project managers which operate in the project office have the possibility of questioning the skill management system. The present employee data like project employment, planned vacations, time compensations, status of employee's illness, training or other absences are also important for the resource planning besides the query to skills and project experience. In this project office enquiries from the customers and advertisements are edited. The fast search for experts besides the resource planning has a high place value be processed in this office.

The following advantages have proved in the course of the introduction of the skill management system: (1) By the ontology a standardization of the skill names was reached, which are unique for the whole enterprise; (2) easier, faster and more exact team and resource planning. The practice has shown us that the number of recourse cases has primarily declined. The values in the project controlling (cost, time, quality) have improved; (3) breaking off projects tends downward; (4) customer satisfaction achieve rapidly a high level; (5) quick access to implicit knowledge by the expert search. By the simple expert search a quick reaction is guaranteed in project escalation cases; (6) more exact training planning; (7) support at staff development and career planning; (8) coordination of the company strategy based on the available qualifications.

4.4 Costs

One of the critical factors in skill management is the topicality of the stored information. This requires that employees and the executives have time for update of the qualifications profiles as well as the experience profiles. The costs get together: (1) full time skill manager, (2) Processes of coordination of the ontologies with specialists of the respective special department. (3) executives (teamleader) with approx. 20 employees using approx. 2% of their annual working time to keep the qualification and experience profile of his employees currently. This corresponds to an expenditure of approx. 2 working hours per annum for one employee in his team, (4) employees using approx. 0,5% of their annual working time to keep the qualification and experience profile currently. This corresponds in sum approx. a working day per annum, (5) Maintenance and support of the system by the data processing service center. As a system developed further more than 15 years permanently which represents the core of the enterprise all of the investment costs cannot be reconstructed any more.

5 Conclusion and Ongoing Research

For the necessary task of the operating resource planning in project management the ordinary data in skill management systems like name and quality is not sufficient. The project risk by faulty resource planning only can be reduced if every single skill entry of an employee is stored with the last use, the experience duration, the mode of application and the combination to other skills. The combination of the skills is an arbitrary indication for the fact that implicit knowledge is existing in the searched project environment. Our experience is that the project risk is reduced.

Our research is continuing on following topics: (1) definition and development of ontology based job descriptions; (2) search for indicators to optimize skill transfer and (3) indicators for similar skills.

References

[Armstrong (03)], Armstrong, M.: "A Handbook of Human Resource Management Practice", Kogan Page United Kingdom, 9th edition (2003), 228 – 229

[Burke (04)], Burke, R.: "Projektmanagement. Planungs- und Kontrolltechniken", mitp-Verlag Bonn, (2004), 228 -243

[Deiters et. al 99], Deiters, W.; Lucas, R.: Weber, T.: "Skill-Management: Ein Baustein für das Management flexibler Teams", ISST-Bericht Fraunhofer Institut Software und Systemtechnik, 50/99, (1999)

[Gronau and Uslar 04a], Gronau, N.; Uslar, M.: "Skill-Management: Anwendungsgebiete und Erfahrungen", Personalführung, 10, (2004), 28-37

[Gronau and Uslar 04b], Gronau, N.; Uslar, M.: "Integrating Knowledge Management and Human Resources via Skill Management", Proceedings of I-KNOW '04, Graz, Austria, June 30-July 2, (2004), 136-142

[Hiermann and Höfferer 03], Hiermann, W.; Höfferer, M.: "A practical knowledge-based approach to skill management and personal development", Journal of Universal Computer Science (JUCS), Volume 9, Issue 12, 2003.

[Hüneke and Zimmermann 00], Hüneke, K.; Zimmermann, B.: "Skill-Datenbanken", Computer Fachwissen 8-9, AiB-Verlag, Deutschland, (2000), 51 – 55

[Kreitmeier et. al. 00], Kreitmeier, I.; Rady, B.; Krauter, M.: "Potential von Skill-Management-Systemen", In: Notes Domino effektiv nutzen - Groupware in Fallstudien, (2000), 72-86

[Ley and Albert 03], Ley, T.; Albert, D.: "Kompetenzmanagement als formalisierbare Abbildung von Wissen und Handeln für das Personalwesen", Wirtschaftspsychologie, (2003), 86-93

[Nonaka and Takeuchi (95)], Nonaka, I.; Takeuchi, H.: "The knowledge creating company. How Japanese companies create the dynamics of innovation", New York, Oxford Univ. Press, (1995)

[Patzak and Rattay (98)], Patzak, G.; Rattay, G.: "Projekt-Management", 3. Auflage, Linde Verlag AG, Wien, (1998)

[Polanyi 85], Polanyi, M.: "Implizites Wissen", Suhrkamp, Frankfurt am Main (1985)

[Probst et. al. (97)], Probst, G., Raub, S., Romhardt, K.: "Wissen managen", FAZ/Gabler, Frankfurt/Wiesbaden, (1997)

[Remus 02a], Remus, U.: "Integrierte Prozeß- und Kommunikationsmodellierung als Ausgangspunkt für die Verbesserung von wissensintensiven Geschäftsprozessen", in: Abdecker, A. (edt.): Geschäftsprozessorientiertes Wissensmanagement, Springer-Verlag Berlin Heidelberg New York, (2002)

[Remus 02b], Remus, U.: "Prozessorientiertes Wissensmanagement", PhD, University of Regensburg, (2002)

[Zobel 03], Zobel, J. G.: "Zielgerichtete Skill-Entwicklung braucht Wissensmanagement", pp. 23-25, Wissensmanagement, 2, (2003)