CR2S: Competency Roadmap to Strategy

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Abstract: It is well acknowledged that Human Resources (HR) are one of the most important assets of a company; as a consequence, Competency Management (CM) became a well established approach for organizing workforce recruitment, training and development. At the same time, Competency Management is more and more moving towards a tight integration with business and knowledge management frameworks, having a crucial role in business process re-engineering, giving to competencies a central role to achieve higher performance variance, determine better return-on-investment or economic value of competency initiatives, implementing deep organizational transformation, and change market and organizational strategies. Our approach, taking inspiration from Technology Roadmaps, proposes the Competency Roadmap to Strategy (CR2S), an integrated model for organizing the competency bouquet of a company in coordination with strategic plan of business activities.

1 Introduction

The terms "Technology Roadmap" is generally used to specify alternate "roads"or procedures that a company can follow for meeting certain performance objectives. A roadmap identifies precise objectives and helps focusing resources on the critical technologies that are needed to meet those goals. This focusing is important because it allows to reduce R&D investments concentrating them to more profitable targets.

Generally speaking, the notion of competency helps to break-down jobs into their critical processes and skills, that employees must perform everyday in order to ensure safety, regulatory compliance, and productivity. Typically, competencies drive the definition of training and development programs, and they are used to assess and build team competencies.

Competency Management Systems (CMSs) are increasingly moving towards the integration into business and knowledge management frameworks, providing an integrated environment for the management of company profiles, human resources and task assignments.

In particular, such an integrated view can help companies to have a complete mapping of available competences, associated to respective workers, with specific tasks or products, in order to produce, at any moment, a snapshot of workforce assignments with respect to the specific skills. Such an approach can play an important role also in forecasting future competency needs with respect to possible new products or services, in response to the releasing of new technologies or to the emergence of new market's requirements. This mapping is of paramount importance also in the case companies want to enlarge or improve its overall knowledge and competency levels, since it allows to identify which learning activities have to be organized and supplied to fill current or future skill gaps, with respect to present active projects or future market trends.

The aim of our proposal is to introduce a framework providing an integrated view of the connections among human resource, competencies, products and services with business strategies and actions. Our claim is that an explicit representation of the above mentioned elements can fully support the accountability of competency management impact, in a business perspective. In particular, in this paper we propose the first step in the definition of the environment providing the rationale and the conceptual structure of the framework, giving a metamodel that formalizes Competency Roadmaps and defining the relation between the concepts that compose the roadmaps themselves.

The paper is organized as follows. Section 2 describes relevant literature in the field of Technology Roadmaps. Section 3 introduces the Competency Roadmap to Strategy (CR2S) approach and the rationale of our work. Then, Section 4 exposes the CR2S metamodel and Section 5 shows an example of istantiation. Finally, Section 6 gives our conclusions.

2 Related Works

Roadmaps are used in organizations as decision aids to improve coordination of activities and resources, identifying gaps and opportunities in developing programs. Technology roadmap helps to forecast technological future trends based on either exploratory methods or normative approaches [Kap01]. At the corporate level, it provides a graphical means for exploring and communicating the relationships among strategies, products, and technologies over time [MHD01] [PFMP03]. Other authors speak about Science & Technology roadmap to support research institutions or government to identify those areas that have high potential promise in the public or in the scientific community [KS02].

Other kind of roadmap made product at second level and focus on services and processes, to be more close to customers [BSEJ05]. Still another type of roadmap is the one described by the DOE Environmental Restoration and Waste Management in Revised Roadmap Methodology Document. This is an example of an issue-oriented roadmap, rather than a technology roadmap, although the availability of a required technology may be considered an issue to be addressed. This roadmapping approach is intended to identify issues and their consequences for project planning and budgeting.

3 Competency Roadmap to Strategy (CR2S)

The goal of CR2S roadmapping is to enable a company or an organization to make better investment decisions and plans, this proposal permits to improve its overall knowledge level, since the modeling gives to decision makers better information about the following situations:

- *Identify critical product or competency needs, to drive technologies selection and development decisions*: CR2S associates products and services with the related skills or competencies, giving to organization a methodology to select which technologies are currently exploitable and, consequently, which products can be developed with the available competencies.
- *Determine the competency alternatives that can satisfy critical product needs*: the complete mapping workproducts-competencies-resources allows to identify of alternatives in task assignments and, indeed, in the team creation process.
- *Define a learning plan to introduce a new competency in the company*: the introduction of a new Enterprise Competency in the company will imply the creation of a set of specific Personal Competencies to be assigned to selected users. In order to fulfill that task, specific learning plans have to be designed, executed and assigned to the users the company wants to exploit in the new product development.

The implementation of our approach is related to the introduction of a strategic methodology into the competency management process. In fact, competencies are not treated as separate and independent elements of the company HR system, but they are organized in a structured tree allowing the application of specific analysis, which could help in the identification of missing competency and in the organization of *ad hoc* learning activities.

CR2S has been formalized in the metamodel described in Section 4 to define a flexible structure, able to model any specific company situation. The metamodel approach is of paramount importance from the point of view of uniforming different data models describing specific areas of the modeling. As explained below, all the concepts described by the metamodel are modeled exploiting specific schemata. Nevertheless, such schemata are developed independently without the aim of integrating the information. To this aim, the metamodel is used to define relations and connection between those different concepts, maintaining a conceptual integrity of the information itself.

As an example, Section 5 presents a simple instance of the metamodel describing a software house company, specialized in web design, that has to face the absence of a skill in response to the supply of a new product.

4 CR2S Metamodel

The core notions implemented by the approach introduced are described in this section. In particular, the metamodel allows to identify all the concepts that implement the methodol-

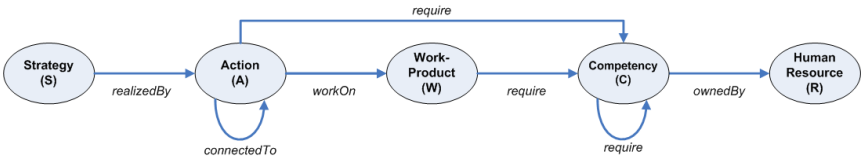

Figure 1: CR2S Metamodel structure.

ogy and all the relations that incur between them [CDF+08]. The definition of the metamodel should be formalized using the OMG's MetaObject Facility (MOF) [OMG10] procedures, and described with formalized XML Schema, ready to be exploited in integrated frameworks.

The structure of CR2S metamodel is depicted in Fig. 1. It clearly describes the hierarchy between the concepts, and the relations between them, without any constraints about the cardinality of objects and relations.

The top element represents strategies guiding the business model implemented by the company. A strategy is a plan designed to achieve a particular aim. Then the *Strategy (S)* metaclass expresses an aim and a plan. The aim is contained in the strategy itself while the plan is implemented through one or more actions.

The *Action (A)* class describes any kind of activities, precisely or broadly defined, implemented to achieve the particular aim expressed by the strategy of reference. The Action class could be followed by the *WorkProduct (W)* class, that describes the set of workproducts managed by an organization whose implementation, deploying, and maintenance requires a precise set of competencies to be present in the company. Alternatively, the Action node could also be connected directly to other Action nodes, to manage the granularity of a single action, and/or to the Competency node, with the objective to manage action not directly related to a workproduct, but aimed at improving the competency landscape of the company.

Following the hierarchy, the *Competency (C)* node represents the central notion of the methodology and describes the capabilities of a company and of the employees of that company. A competency node could be connected to another node of the same type in order to be able to define competency trees, as for instance to describe personal and enterprise competencies, as explained in the next Section. Finally, the *Human Resource (R)* metaclass identifies a component of the organization that will be associated to her personal skills; the relation could be enriched with a property that defines the level of ability in that particular competency.

5 CR2S Model and Instance

The structure proposed in Sec. 4 gives the building blocks for defining the competency roadmaps that will manage the process of stimuli at the basis of CR2S methodology. In

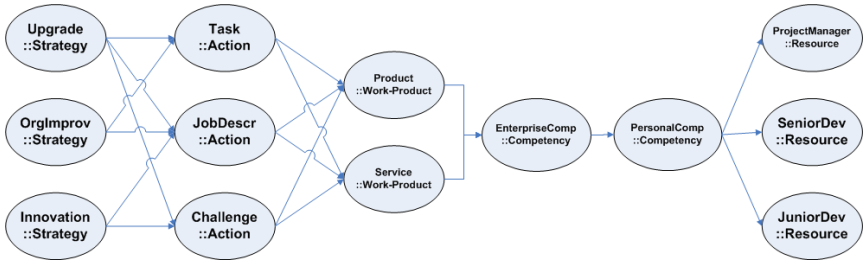

Figure 2: Example of CR2S model.

our vision a stimulus is referred to the actions implemented in a strategy. A strategy can be originated externally, by observing the market and the technological evolutions, or internally by observing a snapshot of the organization, such as in the CR2S model. In any cases, an instantiation of a CR2S model, adherent to the structure and practices of an organization, is required to identify the specific stimuli to be considered.

In this Section we propose an example of model as instantiation of CR2S metamodel, that describe the overall conceptual structure of competency management in a common software house. Then, the model is exploited to create a concrete instantiation of it using realistic data. It is important to hihlight the two-step procedure of CR2S methodology, where the generic metamodel, suitable for all company structure, is first exploited to generate a model that describes the conceptual structure of company organization, then the model is used as the basis to put in relation concrete data save in its specific form. In that Section an example of instantiation will be proposed describing a common Software House active in the web development field (see Fig. 2); for each level a series of objects have been defined, along with the relations between the nodes (Fig. 3).

The provided model gives a concrete overview of company competency management, showing possible execution pattern for metamodel concepts. The Strategy metaclass is instantiated in the *Upgrade*, *OrgImprov*, and *Innovation* classes, describing, respectively, strategies to upgrade the company's offer of tools and services, to improve the organization in terms of processes and figures, and to propose innovative solutions indicated by market analyses or, for example, by social networks activities. Note that those are only a possible subset of all the strategy types an organization could define, but they can give an idea of the modeling power offered by the CR2S metamodel.

The strategies classes are connected to three example of actions that realize the strategies themselves. The classes describing distinct stimuli for the process, but the set could be enlarged applying the approach in different scenarios:

1. *Task*, when a new task is created in response to a strategy and assigned to the working group; the task could be appointed by the management to the respective business function, with the goal of realizing a new product or releasing a new service.

2. *JobDescr*, when a strategy requires a new technical figure to be introduced in the organization, requiring the addition of new competencies to the company's profile.

3. *Challenge*, when the strategy identifies the emergence of new challenges or exigences from the market itself, like for instance a new product released by a competitor, or an interesting discussion on a new technology in a forum that gathered a great number of followers and that could be of interest for the Company. In that case, the action will include a subset of actions needed to realize it.

The WorkProduct metaclass is realized by the definition of two simple class, *Product* and *Service*, which describe products or services that are currently offered by the company, or that will be developed in future. Then, the competency meta-class is instancied in a hierarchical structure describing *Enterprise* and *Personal* competency. In particular, the Enterprise Competency (EC) node includes all the high level competences that describe the capabilities of the company, while the Personal Competency (PC) class describes all the single skills that could by assigned to a user or worker of the organization. The cardinality of the relation between the an enterprise and a personal competency node defines the expected number of workers owning a particular skill that has to be available in a working team, as well as the required level of competency that a user has to reach to be included in the team; moreover, the skill definition must be carried out following precise methodologies and covering all the competencies that are required for realizing the enteprise competency they are connected to.

Finally, the Human Resource metaclass is described by the instantiation of three specific class, identifying three possible roles present in the company: *Project Manager*, *SeniorDeveloper*, and *Junior Developer*.

The final step of our analysis is dedicated to the description of a possible instance of the proposed model, and it describes a snapshot of competency structure of the company with the introduction of a new Innovation strategy aimed at studying and developing new Soa-based products. This level could be represented, for instance, by one of the standards discussed in [CAG10].

At second level Actions involve products, for example, looking at the *e-Commerce Tool* node, it is possible to derive the Enterprise Competencies needed to build the tool (i.e. *Secure Transaction Management* and *Dynamic Web Design*). Such EC, in turn, requires a set of more specialized PCs such as *PHP*, *SSL*, or *Photoshop*, that are directly connected to the users (i.e. workers) that own such skill. Note that not all the PCs have to be assigned and mapped to products; as in the case of *WS-Security*, Ann has declared that she owns such a skill, but currently any active project is exploiting it.

The information delivered by an instance of CR2S metamodel are manifold, depending on the chosen analysis level, and they can give a multilevel view of Company capabilities.

In fact, analyzing the human resource and personal competencies, it is possible to have a snapshot of company available staff and the set of competencies that the team could exploit in the developing phase, highlighting, at the same time, specific competency gaps that have to be bridged organizing new learning activities or extending the existing team. At the Enterprise Competency and Product levels, the organization exposes all the competencies that realize the bouquet of offered services and capabilities, along with the set of products released by the Company.

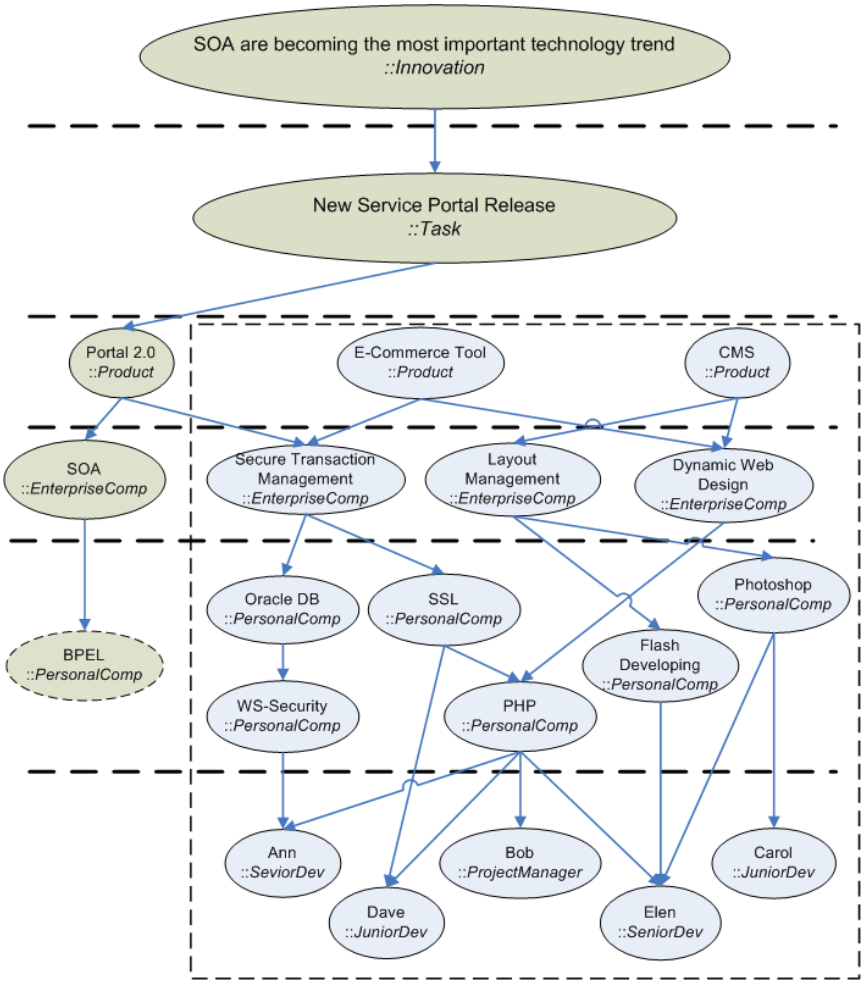

Figure 3: Example of CR2S instance. Nodes enclosed by the dashed square describe the competency and resources managed by the company before the introduction of the new strategy.

Such analysis is important in case that the goal is to describe the reaction of the company in response to specific strategy. In particular, as depicted in Fig. 3, we assume that a market analysis performed by the organization found that the Service Oriented Architectures (SOA) are the most emerging technological trend; since the organization does not have any product based on SOA, it is important to design and propose a new service/product that could bridge this gap. As presented in the example, the company identifies a new task assignment (*Service Portal*) as a response to the identified task.

The implementation of the new framework will imply the exploitation of PCs that are already present in the company, such as all the competencies connected to the *Secure Transaction Management* node together with *WS-Security*, and a new skill (*BPEL*) that

is not already included in company skill map. Indeed, to start the development of the new product filling this competency gap, the company can follow two ways, that could be followed with respect to the product time to market. First of all, it can start *ad hoc* learning activities in order to give the BPEL skill to one (or more) of its workers; this solution can be followed when the time to market is not a strict requirement and the company could wait until the learning activities are successfully concluded. Otherwise, the organization can enlarge the working team staffing new figures that have experiences with BPEL; respect to the previous one, this solution is quicker and allows to include in a shorter time the new competence. In both the cases the CR2S approach gives a methodology that could help in the handling of the innovation process, giving immediate and accurate snapshots of company capabilities and suggesting solutions for unexpected competency lacks.

6 Conclusions

In this paper we proposed a new framework to integrate competency management and strategic design. We described a metamodel providing the constructs to implement such an integrated approach. In section 5 we shortly illustrated which kind of analysis can be implemented on the basis of the information provided in the framework. Our final aim is to make this framework a tool for supporting quantitative analysis in competency management, enriching it with techniques to construct learning and training plans or to evaluate the specific impact of actions and strategies. To achieve this objective several open issues must be treated. In the following the list of the future works scheduled in our research plans:

1. Methodology to compose and aggregate the PCs and ECs. To express the conditions of activation of ECs, depending on the PCs available and their level of adeptness.
2. Instances of metrics for gap analysis. To define techniques to identify gaps with exact or soft matchers.
3. Learning Plan construction. To use gap analysis in the definition of the learning activities adapting to user requirements.
4. Team Creation. To use gap analysis in team construction maximizing the capability of teams.
5. Cost-benefits analysis of the impact of a strategy, distinguishing among short, medium and long term effects.

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