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# MERGING PROCESS ROLE PROFILES WITH PERSONNEL (QUALIFICATION) PROFILES

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## 1. Introduction

The development of a product is not a routine activity but a unique activity, which is therefore undertaken in a project. Beside the workflows (processes) the project organization (persons) has a substantial influence on success. The generation of these and respectively the selection of staff members for appropriate tasks took place so far predominantly not systematically but due to experiences of the respective responsible persons. Thus this could lead on the one hand to wrong selection and to the failure of projects on the other hand to dependence of the organization on individual persons. The requirements of potential project workers are derived from the processes and their activities and are summarized in roles, whereby also appropriate rights and obligations are assigned. All this data is stored and handled generally in PDM systems. These systems offer themselves now to cause a linkage of already deposited abstract personal requirements with concrete abilities of staff members and thus to support setting of the qualitative beside quantitative personnel planning. By a systematic procedure section, which is represented in the following, finally, the entire product development can be affected both in financial and qualitative as well as temporal view positively.

## 2. Role Profiles – Starting points of view

Product development of today is affected by different aspects:

- **Globalization of development:** In automobile industry product development and manufacturing distribute themselves over several locations. In the course of globalization many enterprises built production plants in other countries or took over local supplier. A continuous data supply at the different locations is a precondition for success.
- **Consideration of the entire product life cycle***:* Product data management means the view of the entire product life cycle, this from its concept phase up to its disposal. This causes different sights on the product in the individual phases of the product life cycle.
- **Reduction of time to market***:* Rising competition pressure leads to a ever stronger reduction of the development times, an efficient supply of the individual departments with the relevant information is a key to success.
- **Virtual products:** The development of a complex product is no longer conceivable without support by various CAx systems. Many systems replace the expensive setup of real prototypes by the use of virtual prototypes in the individual development steps. This causes however an enormous amount at data, which describes the virtual product.

In order to be able to deal with this quantity of heterogeneous data, in the last years PDM systems has been established. By PDM one understands the management of product defined data (product model)

in connection with the illustration and the management of technical/organizational business processes (processing concept) both within the range "Discrete Manufacturing" (producing industrial range: Automotive manufacture, machine and equipment construction, aerospace, consumer goods...) and in the so called "Non Discrete Manufacturing" range (chemical, power supplier, utility and facility management of municipalities and banks...). Product and process management together permit the complete reconfiguration of arbitrary construction and manufacturing conditions over the entire product life cycle [Eigner, 2005].
For optimally running data management within an enterprise, relevant processes have to be implemented into the system, which are to be supplied with the data. Further a description of those roles that are linked with the processes and activities is necessary. A role model describes the entity of roles used during the processes.

### 2.1 Implementation of role profiles in PDM systems

An activity consists of one or several tasks, which must be solved from the assigned roles. Each activity is assigned a process thereby. Definitions of a role in the context of the data modeling are: "a role describes, which function holds a entity in an association [Balzert 1996]. " and "a role describes the connection between aggregated object and component in an aggregation" [Iso91]. Note that a person can have several roles and also several persons can hold the same role. In the PDM context a role is described by the three characteristics:

- **Tasks:** Those obligations, which must be fulfilled for a successful completion ("must").
- **Competence:** Those role capabilities, which are needed for the fulfillment of the task ("can").
- **Responsibility:** Clear definition and allocation which roles can be taken into obligation for the completion of a task or the production of a result. Conditions for the fulfillment of the responsibility are sufficient authorizations ("may").

#### *2.1.1 Deficits of current role profiles*

Present role models permit a fundamental implementation, what a role has to, may have or must do in the context of an activity. In the range of competences however only capabilities are shown, which are indispensable for the fulfillment of the task, personal "skills" in the modeling are not yet included. Empirical values, which the respective person in the course of several projects collected, remain at present unconsidered with a PDM role model.

## 3. Personal profiles: State-of-the-Art

Personal profiles integrate the different individual-related abilities. These abilities (or competences) describe the qualification of a person. Those enable him to execute an activity which can be caused by himself or someone else. Therefore he needs tacit knowledge, skills, but also the motivation to fulfill the task. Besides, he needs options to act. As a result, individual-related abilities can be called as the competence to fulfill tasks [Lösche, 2005].

### 3.1 The work with personal profiles

To create a personal profile the individual-related abilities have to be categorized based on a description model. Then the competences have to be measured and they must be illustrated in the right way.

#### *3.1.1 Description model*

To describe the abilities of a person or a group they are separated in their different parts. The most common way to do this is shown in the following classification:

- **Professional competences**: These contain all profession-specific abilities which are necessary for fulfilling job-related tasks.
- **Methodical competences**: These are all abilities to use job-related knowledge goal-orientated in complex work processes. Methodical competences are often termed as from the the work task independent key competences.

- **Social competences**: All social-communicative competences of a person or a group are counted among these. Those refer to a creative arrangement of social relationships and processes within a group or an organization.
- **Personal competences**: These are abilities to act in a self-organized way. Besides, it enables a person to fulfill a self-development process and a learning process in a creative way.

*3.1.2 Measurement of individual-related abilities*

There are a lot of methods to describe competences in a quantitative and qualitative way which include an objective or subjective measurement. Those methods focus either on the present situation or on the future view.
One possibility consists of a three-step evaluation which is shown in the following:

- **Classicist**: This person has theoretical knowledge with little practical experience. He is able to use already structured problem solutions to solve practical problems.
- **Master**: This person has multiple experiences to use his knowledge in concrete practical situations in a professional way.
- **Expert**: This person is able to anticipate problems, is self-organized and intuitive. He has also the ability to find innovative problem solutions with his profound professional knowledge. He can manage complex and novel tasks and he delivers contributions for the development of the company.

*3.1.3 Methods to document individual-related competences*

Different methods to reproduce the competences of the employees and to make them transparent within the organization can be used. Some of them are shown in the following:

- **Knowledge map**: This method visualizes which knowledge is available in the organization. It includes who it has, where it is, and which form it has. For example knowledge sources or knowledge applications are shown. The knowledge map shows the way to the knowledge but it contains no knowledge itself [Wagner, 2005]. Different forms of the knowledge map can be the knowledge topographies, the knowledge portfolios and the knowledge matrices (personal profiles).
- **Yellow Pages**: That is a kind of advanced telephone book which contains the knowledge of employees. The knowledge can be pictured in given pads or can be described verbally.
- **Intellectual capital report**: That is an instrument to display and develop intellectual capital of an organization. It shows the correlations between the organizational goals, the business processes, the intellectual capital, and the business prosperity of an organization. These elements are described with indicators [BMWA, 2004].

## 4. Merging of role profiles and personal profiles

The starting point for the merging of abstract requirements and concrete individual-related competences are the determined role profiles and personal profiles (figure 1)

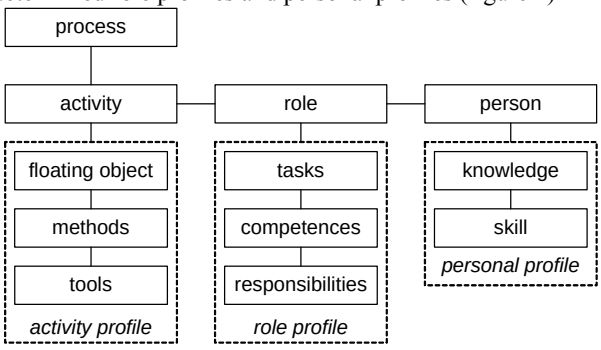


**Figure 1. Accrual model with linkage to personal profile**

### 4.1 Basics of the determination of profiles

The different requirements and competences (professional competences, methodical competences, social competences, and personal competences) are determined by the following rules:

- **Structure**: Based on an analog way of determination, professional competences and methodical competences are summed up in *knowledge aspects*. Because of the same reason social competences and personal competences are combined in *behavior aspects*.
- **Defining of characteristics**: The characteristics of the knowledge aspects and the behavior aspects are defined.
- **Way of evaluation and determination**: The way of the determination must be defined to calculate the height of the characteristics of the requirements and competences. Beside that the scale (amount of evaluation steps) must be determined.

### 4.2 Determining role profiles

Both setting up of characteristics of the different role requirements (fields of knowledge and/or aspects of behavior) and the collection method is defined by the process owner. He is supported by a team which he selects. Within the context of workshops the requirements for all roles are determined and resumed in the role profile.

### 4.3 Generating personal profiles

The personal profile is raised on evaluation stages identical to the role. The kind of the evaluation depends on the different abilities (fields of knowledge and/or aspects of behavior). In principle it can be selected here between two forms of evaluation:

- **Self evaluation**: The person evaluates his competences by himself for example with a questionnaire. The easiest way is to it on the computer (online-assessment) which can be analysed automatically. This method can be done with less effort but one must be aware that the results can be inaccurate.
- **External evaluation**: The person is evaluated by someone else. It can be done in the same way as the self evaluation (questionnaire). Besides, results can also be achieved through staff member discussions up to group-related feedback discussions.

Fields of knowledge can be determined due to facts (performance criteria such as conversion, number of projects or experience), whereas behavioral aspects are determined by subjective estimations. Thus, at least also an external estimate should be accomplished with aspects of behavior apart from a self evaluation.

### 4.4 Merging of roles and persons

In order to link roles with persons the different matrices are merged. The selection of adequate staff members for the requirements of a specific role takes place by direct comparison.

### 4.5 Merging the profiles with a matching algorithm

As shown in figure 2, the matching process merges the different profiles together and gives the best fitting person for the process requirements. In this section an algorithm is discussed, that can be used as a method in the matching process. Consider the role and the personal matrix: There are different aspects in the role and the personal profile. The idea is to compare each aspect of the role profile to the aspect of the personal profiles of staff. The algorithm for a personal matching value (PMV) for Person j is shown in equation (1):

$$PMV_j = \sum_{i=1}^{n} Role\_aspect\_weight_i \cdot Person\_aspect\_weight_i \quad (1)$$

This algorithms is to be executed over the available staff within the project. Value for the best fit gives the role itself:

$$BestFit = \sum_{i=1}^{n} Role\_aspect\_weight_i^2 \quad (2)$$

To find the best fitting person the procedure has to be done over the available staff, the person, who is nearest the best fit is the optimal person for the role profile. Persons with a lower value would be underqualified, person with a higher value would be overqualified for the job. In the next section a small example shows the algorithm within a process.

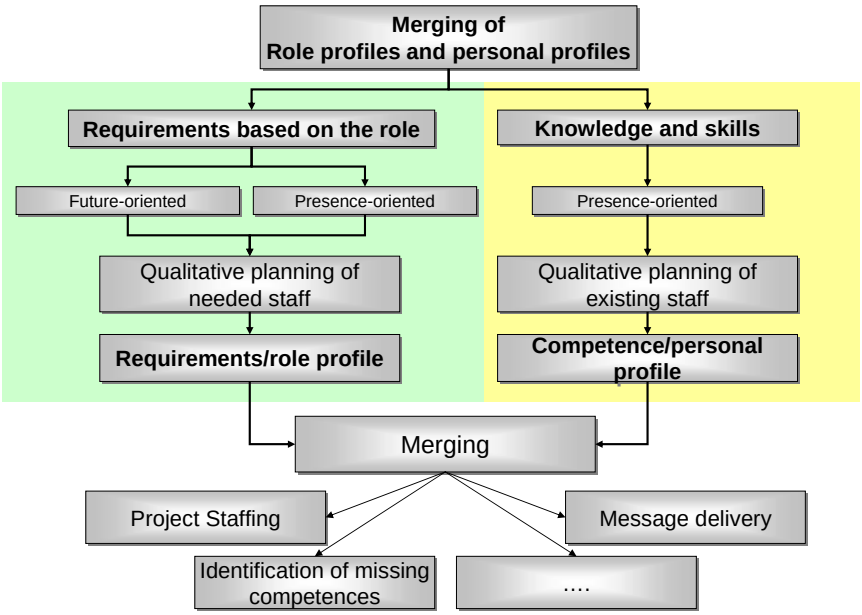


**Figure 2. Merging role and personal profiles**

## 5. Example of the usage of an enhanced role profile

To describe the usage of an enhanced role profile a process is needed. A typical process chain, which takes place in each company, is the change process. In figure 3 it is described simplified:


**Figure 3. Simplified process chain: change process**

The problem solution cycle is activated by a trigger, e.g. an incident. In a test (e.g. simulation of the drive train) a part breaks, thus the process chain described exemplarily in figure 3 is released. The process chain is however still too rough and granular for a description of the role profile. For describing a role, the process must be broken down to the level, where the activities during the process become visible. In addition the process problem solution cycle is more deeply granulated. This shows:

- different activity steps
- roles linked through the activities
- triggers of the process (floating objects)

With this compilation it can be identified, where a role selection with enhancement of personal characteristics is helpful (figure 4).

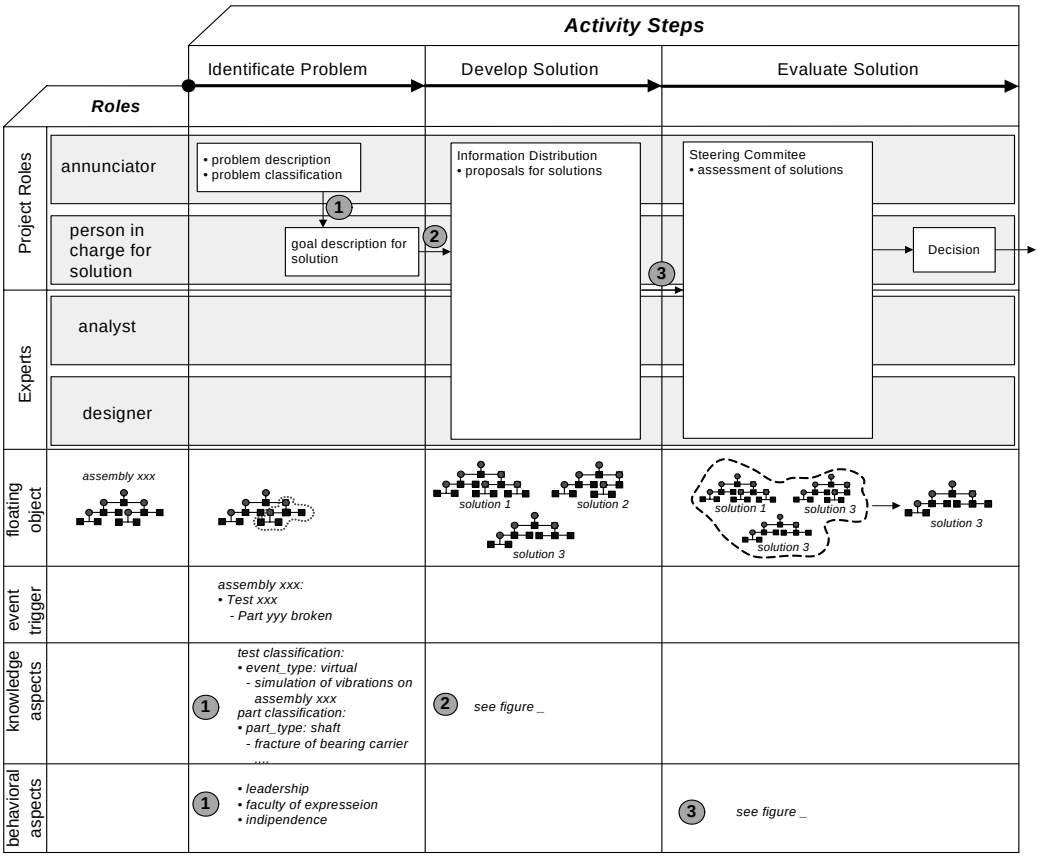


**Figure 4. Activity level of the problem solution cycle**

### 5.1 Focal Points

There are three focal points in the activities, where matching the personal profiles to the role profiles could be helpful

- **Point 1:** The annunciator is responsible for the choice of a person in charge for solutions.
- **Point 2:**At this point the person in charge for solutions demands solution proposals. In order to determine, who could supply suitable technical suggestions on the problem definition, matching on technical level is accomplished.
- **Point 3:**At this point the person in charge for solutions has to configure a steering committee. Here, above all, social aspects play a role, why the Matching is accomplished only in this range.

In the following example the matching process is described for the focal point 2. For this activity step an analyst and a designer is needed for technical suggestions. A profile for both roles is prepared. Besides, for all employees who are available for these roles a personal profile is created as explained in chapter 4.3 (figure 5).

| | knowledge aspect | Role | |
|---|---|---|---|
| | | Designer | Analyst |
| technical knowledge | corrosion | 3 | 3 |
| | surface treatment | 1 | 3 |
| | material | 3 | 1 |
| | dynamics | 3 | 9 |
| | heat transfer | 3 | 3 |
| methods | shaft dimensioning | 9 | 3 |
| | bearing analysis | 3 | 3 |
| | vibration analysis | 3 | 1 |
| | laminar flow calculation | 3 | 1 |
| tools | CFD | 1 | 3 |
| | MBS | 3 | 9 |
| | FEM | 1 | 9 |
| | NVH | 0 | 3 |

| | knowledge aspect | Person | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Huber | Maier | Müller | Schmid | Leiner | Krainer | Gruber | Moser |
| technical knowledge | corrosion | 3 | 3 | 9 | 1 | 9 | 9 | 9 | 3 |
| | surface treatment | 3 | 9 | 3 | 1 | 1 | 3 | 3 | 9 |
| | material | 1 | 9 | 1 | 9 | 3 | 9 | 9 | 3 |
| | dynamics | 9 | 3 | 0 | 1 | 1 | 3 | 2 | 9 |
| | heat transfer | 9 | 9 | 1 | 1 | 3 | 9 | 3 | 0 |
| methods | shaft dimensioning | 9 | 9 | 0 | 3 | 9 | 2 | 9 | 1 |
| | bearing analysis | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 9 |
| | vibration analysis | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 9 |
| | laminar flow calculation | 0 | 0 | 9 | 1 | 0 | 1 | 0 | 9 |
| tools | CFD | 1 | 3 | 1 | 0 | 1 | 0 | 1 | 3 |
| | MBS | 9 | 9 | 0 | 1 | 0 | 0 | 0 | 9 |
| | FEM | 9 | 9 | 1 | 9 | 1 | 1 | 3 | 1 |
| | NVH | 1 | 9 | 0 | 1 | 0 | 9 | 0 | 9 |

Figure 5. Input for the matching process at focal point 2

In the next step, the comparison of each person to the specific role profile of the designer is calculated with the algorithms (1) for each person and (2) for the best fit (figure 6).

| | knowledge aspect | Role | |
|---|---|---|---|
| | | Designer | |
| technical knowledge | corrosion | 3 | |
| | surface treatment | 1 | |
| | material | 3 | |
| | dynamics | 3 | |
| | heat transfer | 3 | |
| methods | shaft dimensioning | 9 | |
| | bearing analysis | 3 | |
| | vibration analysis | 3 | |
| | laminar flow calculation | 3 | |
| tools | CFD | 1 | |
| | MBS | 3 | |
| | FEM | 1 | |
| | NVH | 0 | |

| | knowledge aspect | Person | | | | | | | | Best Fit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Huber | Maier | Müller | Schmid | Leiner | Krainer | Gruber | Moser | |
| technical knowledge | corrosion | 9 | 9 | 27 | 3 | 27 | 27 | 27 | 9 | 9 |
| | surface treatment | 3 | 9 | 3 | 1 | 1 | 3 | 3 | 9 | 1 |
| | material | 3 | 27 | 3 | 27 | 9 | 27 | 27 | 9 | 9 |
| | dynamics | 27 | 9 | 0 | 3 | 3 | 9 | 6 | 27 | 9 |
| | heat transfer | 27 | 27 | 3 | 3 | 9 | 27 | 9 | 0 | 9 |
| methods | shaft dimensioning | 81 | 81 | 0 | 27 | 81 | 18 | 81 | 9 | 81 |
| | bearing analysis | 9 | 9 | 3 | 3 | 3 | 3 | 3 | 27 | 9 |
| | vibration analysis | 3 | 3 | 9 | 9 | 3 | 9 | 9 | 27 | 9 |
| | laminar flow calculation | 0 | 0 | 27 | 3 | 0 | 3 | 0 | 27 | 9 |
| tools | CFD | 1 | 3 | 1 | 0 | 1 | 0 | 1 | 3 | 1 |
| | MBS | 27 | 27 | 0 | 3 | 0 | 0 | 0 | 27 | 9 |
| | FEM | 9 | 9 | 1 | 9 | 1 | 1 | 3 | 1 | 1 |
| | NVH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sum** | | 199 | 213 | 77 | 91 | 138 | 127 | **169** | 175 | **156** |

Figure 6. Calculation for the designer role

In that case Person *Krainer* fits best for the designer. The other role to be matched to the persons is the analyst. Figure 7 shows the matching for him:

| | knowledge aspect | Role | |
|---|---|---|---|
| | | Analyst | |
| technical knowledge | corrosion | 3 | |
| | surface treatment | 3 | |
| | material | 1 | |
| | dynamics | 9 | |
| | heat transfer | 3 | |
| methods | shaft dimensioning | 3 | |
| | bearing analysis | 3 | |
| | vibration analysis | 1 | |
| | laminar flow calculation | 1 | |
| tools | CFD | 3 | |
| | MBS | 9 | |
| | FEM | 9 | |
| | NVH | 3 | |

| | knowledge aspect | Person | | | | | | | | Best Fit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Huber | Maier | Müller | Schmid | Leiner | Krainer | Gruber | Moser | |
| technical knowledge | corrosion | 9 | 9 | 27 | 3 | 27 | 27 | 27 | 9 | 9 |
| | surface treatment | 9 | 27 | 9 | 3 | 3 | 9 | 9 | 27 | 9 |
| | material | 1 | 9 | 1 | 9 | 3 | 9 | 9 | 3 | 1 |
| | dynamics | 81 | 27 | 0 | 9 | 9 | 27 | 18 | 81 | 81 |
| | heat transfer | 27 | 27 | 3 | 3 | 9 | 27 | 9 | 0 | 9 |
| methods | shaft dimensioning | 27 | 27 | 0 | 9 | 27 | 6 | 27 | 3 | 9 |
| | bearing analysis | 9 | 9 | 3 | 3 | 3 | 3 | 3 | 27 | 9 |
| | vibration analysis | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 9 | 1 |
| | laminar flow calculation | 0 | 0 | 9 | 1 | 0 | 1 | 0 | 9 | 1 |
| tools | CFD | 3 | 9 | 3 | 0 | 3 | 0 | 3 | 9 | 9 |
| | MBS | 81 | 81 | 0 | 9 | 0 | 0 | 0 | 81 | 81 |
| | FEM | 81 | 81 | 9 | 81 | 9 | 9 | 27 | 9 | 81 |
| | NVH | 3 | 27 | 0 | 3 | 0 | 27 | 0 | 27 | 9 |
| **Sum** | | 332 | 334 | 67 | 136 | 94 | 148 | 135 | **294** | **309** |

Figure 7. Calculation for the analyst role

In that case Person Moser fits best to the requirements of the role.

## 6. Conclusion

The model described upon enables a systematical allocation of employees and tasks within the business processes. When using this model the organization must be aware of some difficulties which can occur. On the one hand an objective determination of the individual-related competences (especially the behavior aspects) could be challenging. Therefore right evaluation methods based on the organizational background have to be found. On the other hand the employees have to agree that their competences are documented and issues of data production have to be kept. Therefore this method to merge role profiles and personal profiles should be used in combination with traditional ones.

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