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METHOD ADAPTATION – A WAY TO IMPROVE METHODICAL PRODUCT DEVELOPMENT

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1. Introduction – objectives

Numerous working methods in the field of product development meanwhile proved their efficiency and effectiveness in field use and the application of these methods in practice is increasing. Nevertheless, especially in small and medium-sized enterprises (SMEs) the use of product development methods isn't very established up to now. As a main reason for reserved method application we ascertained that users often are not able to independently select, adapt and apply adequate methods. Existing method approaches are adjusted to specific application areas and adaptation hints are hardly available. The objective is to improve method implementation by providing instruments for efficient and effective method transfer, especially focusing on support in flexible adaptation of methods [Lindemann 2002]. Adaptation has to be on the one hand task-oriented, and on the other hand resource-oriented particularly user-specific and situational.

2. Method adaptation

Method adaptation cannot be regarded as a single and independent unit. As already depicted in different method models, e.g. [Braun et al. 2003], adaptation is embedded in mechanisms that affect the selection of methods as well as their combination and application in the entire context of method implementation. In the following, we would like to introduce mechanisms for method adaptation, which are based on the principle of identification and adjustment of method application conditions that characterize an underlying task and corresponding method attributes of applied methods.

2.1 Method application and method application criteria

Method application in product development denotes the operative use of methods in daily business. The adaptation of methods on the one hand influences and on the other hand is influenced by selection of methods as well as by combination of them. The result from having selected a method determines adaptation boundaries. Of course, the more a selected method fits to the prevalent task, user and situation, the necessity of its adaptation can be hold down as far as possible. However, particularly with regard to method application in small and medium-sized enterprises the demand for method adaptation, especially to SME-specific conditions, concerning user and situation, is very high, as figured out in several research and industry projects (e.g. [Gausemeier et al. 2000]).
Criteria that affect method application can be allocated in numerous areas. They can be classified into different categories. In figure 1 a couple of criteria divided into different categories is shown.

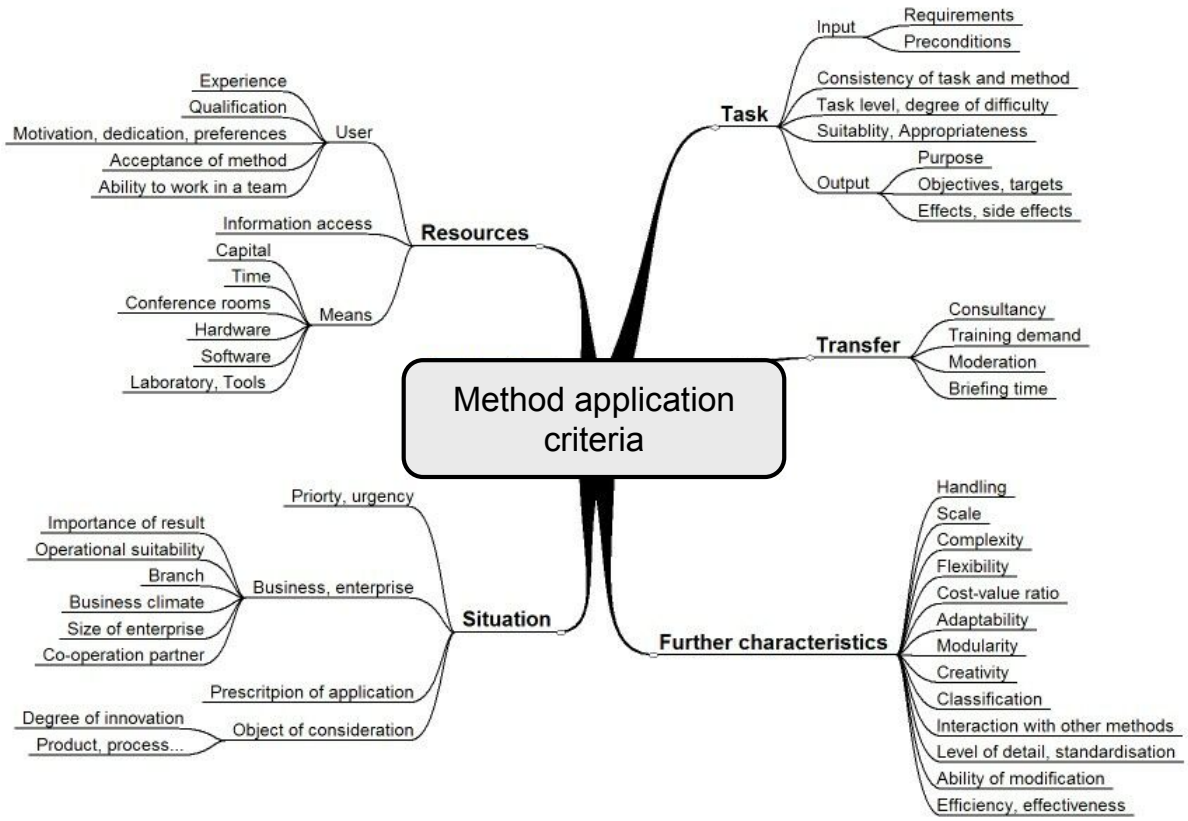

Figure 1. Mind map: Method application criteria

This set of criteria is the result of the analysis of several kinds of parameters that characterize the application of methods in product development in common. Not all of these criteria are relevant for method adaptation. If we for instance think about the motivation or acceptance a user exhibits when applying certain methods, we would confirm these parameters as undoubtedly determinant for a successful method application, respectively the implementation of the method in common. Nevertheless these criteria can barely be consulted for the selection or adaptation of a method, because, in the discussed example, the mentioned criteria are indispensable prerequisites, which are not under consideration with regard to adaptation. For this reason and as well as already apparent in the Munich model of methods [Lindemann 2003], different criteria have to be consulted when handling different aspects of method implementation.

2.2 Comparing application conditions with method attributes – starting point for method adaptation

In this approach we would like to introduce a new aspect of method adaptation which is based on the principle of comparing the underlying method application conditions with opposing attributes of methods. Method application conditions specify the characteristics of a considered task concerning its implementation by a working method for product development. As method attributes, we regard a set of characteristic information and properties which specify a method [e.g. Birkhofer et al. 2001].
Concerning the identified criteria (cf. figure 1) – particularly those focusing on method adaptation – a significant classification becomes apparent. We can distinguish between task-oriented adaptation criteria and resource-oriented criteria as main starting points for adjusting a method to a considered task and vice versa. This distinction carries on in the implementation of the comparison between method attributes and application conditions, as worked out in the following. Figure 2 gives an outline of comparison mechanisms which have to be applied in the identified areas.

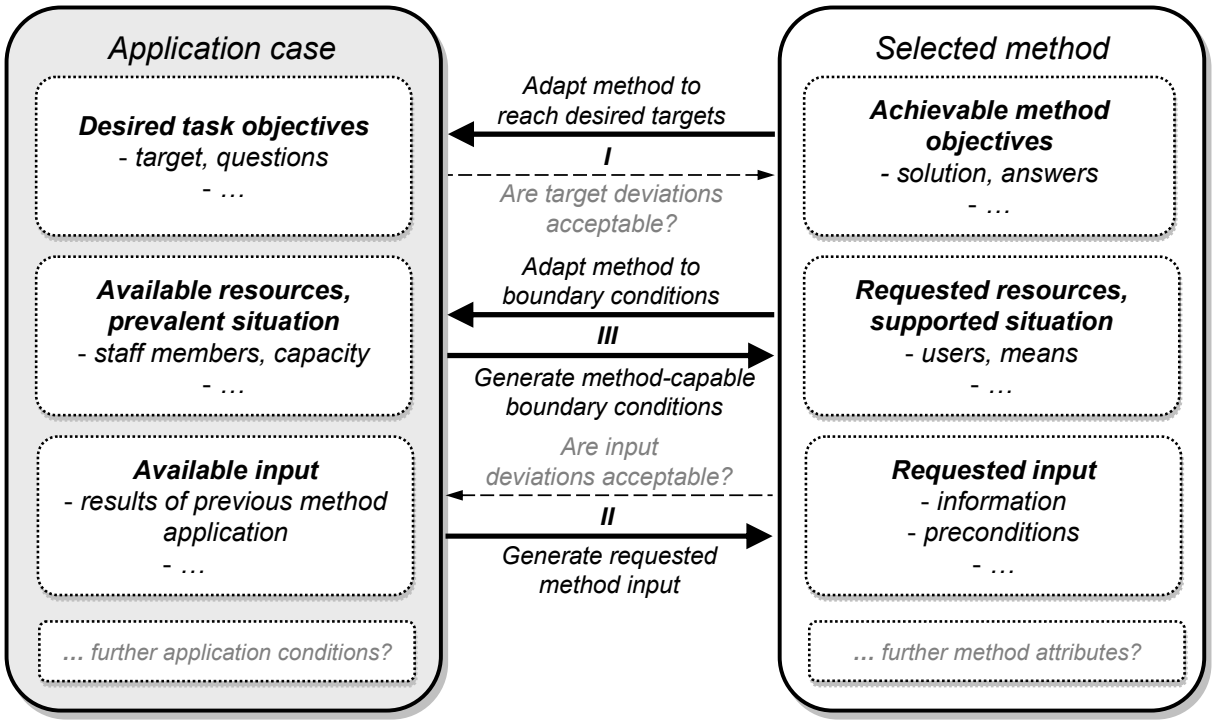

Figure 2. Comparing application conditions with method attributes

2.2.1 Task-oriented comparison

If we talk about task-orientation in this context, we consider the balance between desired target conditions of the prevalent task and achievable method objectives as well as the balance between available input conditions and requested method input prerequisites. The basic principle – already characteristic for the suitability for the achievement of task objectives of a method when selecting it – is best possible consistency between task requirements and method possibilities. Inconsistencies are the starting points for method adaptation.

(I) Comparison of target conditions with method objectives:
As the result of a detailed clarification of a considered task the objectives of a potential method application have to be identified. What is the characterisation of the task? What problems have to be solved? What goals want to be attained? These questions have to be opposed to the answers a selected method can give: What objectives can be reached when applying the method? What kind of problem can be solved with the aid of the method?
Of course this adjustment of application conditions and method attributes should already be treated, when selecting a method. However, methods usually are not selected in case of partial tasks or problems. For the elaboration of superior tasks guidelines are often deployed, that consist of diverse process steps. That way, method-sets are built by assigned methods, which work out certain process-steps. (Particularly with regard to small and medium-sized enterprises, which often refuse to deal with the selection of single method building blocks, there is a demand for entire method sets to work out superior tasks). For this reason deviations between desired and achievable task objectives often can be observed.
The question now is how to deal with this identified target deviations. Certainly the easiest way would be to be content with the elaboration of achievable objectives if this is roughly reconcilable with desired perceptions. In accordance to method adaptation it is desirable in most cases to try to adapt a selected method to reach requested outputs. Anyway the definition of method-specific achievable objectives is not as easy. Method output can be multifaceted. For this reason, we avoid arguments of the advantages and disadvantages of methods. In fact we have to deal with effects and side effects of

method application. For instance a side effect of the application of a method in one case (potential disadvantage?) can be an explicitly desired effect in another case.

(II) Comparison of available input conditions with method input prerequisites:
In accordance with target criteria (I) another field of interest is to achieve consistency of available input conditions of a considered task and the requested input of a dedicated method. In this context we consider task-oriented input prerequisites in opposition to resource-oriented input requirements as addressed later on. What information has to be available to successfully implement a method? What results of previously applied methods are requested? Within a detailed clarification of a prevalent task, the actual available input information, as maybe results of an already worked out method, has to be identified and compared with those method attributes concerning its requested input. Thus coordination of the possible output of one method with the requested input of a following method is an important aspect for the combination of methods to guidelines as mentioned above.
How can input deviations be treated? Possibilities of method application are undoubtedly limited in this case. Nevertheless elementary method building blocks from other methods (if not jet applied in a predefined set of methods) can be added to compensate input deviations. Under these circumstances method adaptation strongly focuses on the addition of required methods or method building blocks. In any case, required input information should be acquired as far as possible.

2.2.2 Resource-oriented comparison

Whereas task-oriented method adaptation mainly has to be treated in a qualitative way, the adaptation of methods with regard to resource-orientation should be carried out more quantitatively.

(III) Comparison of boundary conditions with method application requirements:
The available resources have to be opposed to those resources the application of a method requests. This in particular concerns manpower, financial resources and time capacities as well as qualification of staff or availability of hard- and software or other supporting tools. Criteria in this third field of consideration are the main starting point for method adaptation at all.

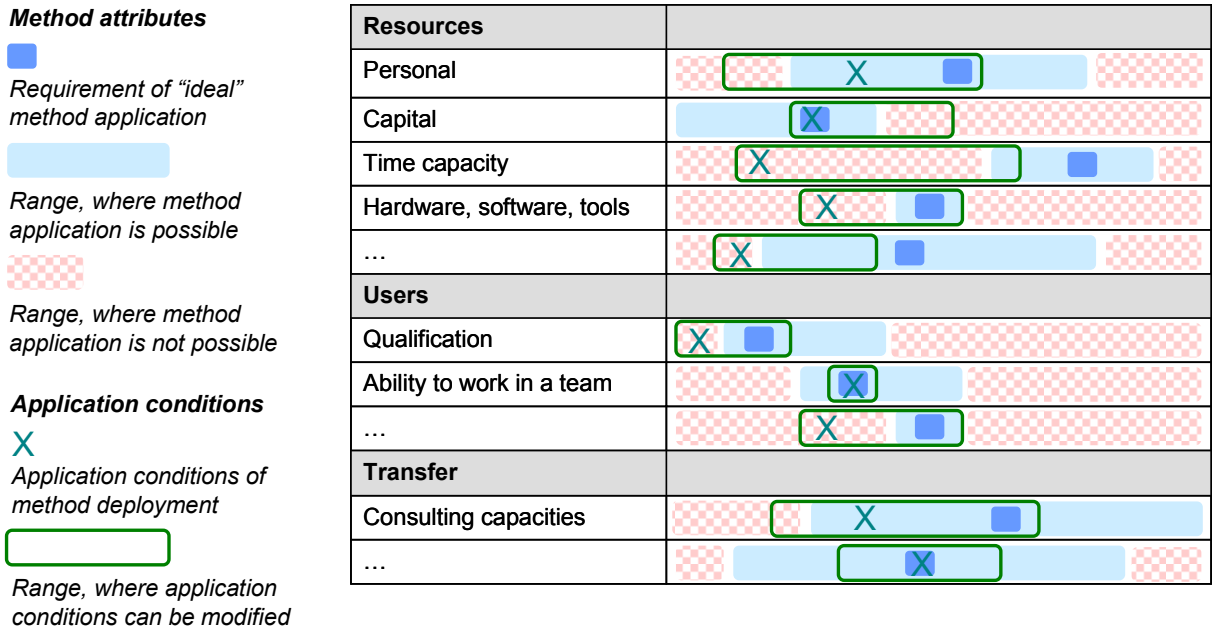

Figure 3. Comparison of resource-oriented criteria in detail

To elaborate this comparison in detail we would now like to introduce comparison mechanisms which are applicable for the adaptation as well as for the selection of methods. To obtain a significant comparison of the conditions of a considered task with the opposed method attributes it is necessary to

clarify the task in detail on the one hand. On the other hand methods have to be classified concerning their resource-oriented attributes. As experiences in this field show, a hard job has to be done, because exact values of method attributes can be hardly determined. By the way, valuation of methods is another field of research – its results would be useful input in this context. If we think about "brainstorming" for instance: How many actors ideally should perform the method – Five, seven, or even ten persons? To escape from this "never ending discussion vicious circle" we pragmatically defined a default value and installed a range of values around the default value (as indicated in figure 3). Between these specified boundaries the application of the method should be possible. In cases where it is not possible to assign quantitative values to method attributes, specification has to be done qualitatively.
Further on the principle is to compare the underlying conditions with opposing method attributes. First of all best possible consistency already is the decisive factor for the selection of an adequate method. Concerning adaptation demand, those attributes where major deviations are identified highlight the starting points for the adaptation of a selected method.

2.2.3 Implementation of identified adaptation demand

Adaptation direction
As already indicated in figure 2 different directions of adaptation are conceivable. Existing approaches assume the underlying task in a product development system to be less variable than the method to be implemented [Zanker 2000]. Anyhow we suggest finding out in which cases it is easily possible to adapt boundary conditions to the needs of method application at first. Then method adaptation has to be elaborated in that direction that characterizes the underlying situation. In this way method adaptation becomes resource-, situation and user-specific.

Adaptation of means of method transfer
The adaptation of a method mainly concerns the adjustment of instruments and tools that are used when the method is implemented. These means of method transfer concerning the support in method implementation are addressed as adaptation attributes in the Munich model of methods [Lindemann 2003]. One main objective of the adaptation of supporting tools is to make the method an integral part of the product development system [Stetter 2000]: This can be assured by providing flexibility to method accompanying tools to support the users' individual working styles.

Adaptation profiles
For further support in method adaptation profiles can be defined which characterize specific adaptation needs (especially in regard to SME-specific boundary conditions), mainly in the field of resource-oriented criteria (III). In cases where it is not practicable to work out each single adaptation a company-specific profile – once created – can be applied in every adaptation case. The elaboration of a profile can be supported by creating an adaptation checklist. Adaptation guidelines have to be installed to realize adaptation requirements.

3. Key Conclusions – outlook

This approach introduces mechanisms for method adaptation which are based on the principle of comparing method application conditions that characterize an underlying task with corresponding method attributes of eligible methods. In this way the adaptation possibilities of a method become a criterion for method selection. Method adaptation is necessary where major deviations between task conditions and values of method attributes are detected.
The adaptation of working methods for product development should not be considered as an algorithmic operation where parameters can be exactly justified for a successful support in method application. User experience and knowledge about limits and possibilities of methods play a decisive role for an efficient and effective support of product development. Nevertheless and just for this reason pragmatic support in method adaptation which is embedded in mechanisms of selection, combination and application of methods forms an important part in improving method transfer especially in regard to small and medium-sized enterprises.

In this approach we elaborated theoretical basics concerning method adaptation. For further progress in this field, we started transferring the described construct of ideas and mechanisms into practice. First of all, investigations concerning the comparison of application conditions and methods attributes will be carried out in application cases of product development methods particularly in small and medium-sized enterprises. Typical adaptation profiles will be developed. Another field of interest concerns the transfer of product development methods to other disciplines as for instance civil engineering.

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