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Adapting Project Management Standards – Deriving Guidance from Reference Modelling

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ABSTRACT

Project management standards provide an inventory of commonly accepted processes and tools which claim to be applicable in most cases. Project success largely depends on the suitability of the project management method and thus requires an adaptation of these standards for specific project types and contextual factors. This can be supported through the development of detailed, re-usable guidelines on how to "customize" standards. The goal of this paper is to analyse the potential offered by the field of reference modelling for this purpose. Here, design principles support the transfer and extension of knowledge from a reference model into an application model and can in principle all be transferred into project management. However, this paper shows that limitations occur due to the current design of project management standards. This topic is of utmost importance for IT projects, as they are differ from more conventional project types and thus call for larger alterations.

Keywords

Project management standard, Standard adaptation, Reference modelling, Design Techniques, IT Project Management

INTRODUCTION

Existing project management (PM) standards, such as the PMBOK® Guide by the Project Management Institute (PMI) (Project Management Institute, 2004) or PRINCE2 by the British Office of Government Commerce (Office of Government Commerce, 2005) offer generally recognised practices and tools across a wide range of processes. In recent years, project management has experienced a paradigm shift from the early assumption that projects can be handled via a uniform management approach, to the understanding that each type of project requires a specifically adjusted management style (Dvir, Shenhar and Alkaher, 2003; Shenhar, 2001). Consequently, a major challenge in project management is to adapt and customise existing standards to best satisfy particular project needs and the definition of a tailored project management approach is a central task when starting a new project. This is particularly crucial for IT projects, as current standards mostly originate in the execution of large defense and engineering projects and reflect their specific challenges and perspectives (Andersen, 2006). IT projects however are considerably different to engineering and product development projects. For example, it is difficult to define detailed user requirements at project start and thus to exactly determine the project goals (Turner and Cochrane, 1993). Guidance is required that describes how well-established standards can be customised for this specific project management situation and the concrete type of IT projects. It is the goal of this paper to analyse the potential offered by the area of reference modelling for this purpose.

Reference modelling has its roots in information systems and the essential idea is to provide information models as a kind of "reference" in order to increase both the efficiency and effectiveness of the modelling process (Becker, Delfmann, Dreiling, Knackstedt and Kuropka, 2004a). Reference models are created once and re-used within various application scenarios (vom Brocke, 2007). Following the statement that "in a sense every model can be understood as a reference model" (Lehner, 1995), the association of reference models and project managements standards can be motivated. Analogue to reference models, PM standards collect practices which have widespread consensus about their value and usefulness and provide this information with the goal of creating a foundational reference (Project Management Institute, 2004). To support the efficient re-use of models, five design techniques[1] for reference modelling have been developed in the area of information systems. They

[1] The term design technique and design principle will be used synonymously within this paper.

provide rules that describe how the content of one model is applied in constructing another model (vom Brocke, 2007). Within this paper we analyse how these design principles can be applied in project management in order to offer guided choices for adapting standards to specific project situations.

The remainder of this paper is structured as follows: Section 2 discusses existing literature on how to link project type and management style. Section 3 gives an introduction into reference modelling and introduces the design principles of configuration, instantiation, aggregation, specialisation, and analogy. Section 4 analyses the design principles from a project management perspective and discusses their applicability for special PM situations. We conclude with a summary and an indication of further research in section 5.

PROJECT SPECIFIC MANAGEMENT APPROACHES

In early years project management was characterised by the assumption of a basic similarity between projects (Dvir, Lipovetsky, Shenhar and Tishler, 1998). Project management approaches were developed with the idea of "one size fits all" and thus offering a universal set of functions and activities considered common to all projects.

In recent years however, a more contingent approach in project management has developed that recognises the availability of an explicitly tailored project management style as a crucial factor for project success (Dvir, et al., 1998; Dvir, et al., 2003; Shenhar and Dvir, 2004). This is supported by various studies on the relationship of project management style and project characteristics. Payne & Turner show that project specific adoptions are rated more successful than the use of standardised approaches (Payne and Turner, 1999). However, they also stress the usefulness of company-wide standards for certain project types, such as medium-size projects. Besner & Hobbs performed a "reality check" in currently-running projects and identify the use of common patterns and standards along with project specific variations (Besner and Hobbs, 2008). Again, the perceived usefulness of standards vs. tailored approaches depended on certain project attributes, such as the application area, size, and maturity of the executing organisation. Large projects in mature organisations make greater use of standard PM methods. Bubshait & Selen evaluate which project characteristics influence the implementation of a certain management method (Bubshait and Selen, 1992). The findings highlight the influence of three major characteristics, namely project type, complexity and resource limitations. Projects with well defined tasks and deadlines tend use more management techniques. From this work it can be concluded that different categories of projects are to be distinguished which each require particular PM methods for their successful execution, depending on project type and contextual factors.

As a result, various classification and contingency frameworks have been developed with the goal to categorise existing projects, determine similarities as well as differences and to suggest corresponding management styles. A general overview of existing frameworks is given in Crawford, Hobbs & Turner and Sauser, Reilly & Shenhar (Crawford, Hobbs and Turner, 2006; Sauser, Reilly and Shenhar, 2009). For example, Shenhar divides projects according to the system scope and technological uncertainty and discusses variation of management style for each project type (Shenhar, 2001). Turner and Cochrane define four categories depending on how well the objectives and working methods are defined at the start of a project and suggest a management style that successively re-defines goals and steps (Turner, et al., 1993). Crawford & Pollak develop a seven-dimensional framework for project classification based on the assumption that hard and soft issues in projects require different, although not mutually exclusive, project management approaches (Crawford and Pollak, 2004). The given management recommendations for each framework are conversely on a high level. They concentrate on giving broad directions on how to manage each project type and to develop an appropriate management approach. As such, they miss the link to the concrete implementation and application of existing project management standards.

Looking into the standards itself, the need for tailored PM approaches has also been recognised. For example states the PMBOK® Guide that "good practice does not mean that the knowledge described should always be applied uniformly on all projects" (Project Management Institute, 2004). As a result, the Project Management Institute offers domain specific extensions, e.g. for construction and government in addition to the generally accepted knowledge and practice. However, not all domains are covered and no specific extension exists for IT projects. Here, an adaptation of the common part of the standard is necessary. For this purpose, none of the standards provides detailed directions, moreover this is solely left to the users: "…the project management team is responsible for determining what is appropriate for any given project" (Project Management Institute, 2004) and the customisation is therefore performed by a professional project manager based on personal judgement and experiences. As a result, standards are still often applied in a uniform manner without necessary modifications despite the known implications on project success.

What has been long realised in reference modelling, has still not been established in project management: Analogue to Information Systems, formalised guiding principles could significantly advance the re-use of existing knowledge and improve the efficiency and effectiveness of the customisation process.

RE-USE IN REFERENCE MODELLING

The construction of models as a means of abstraction is a central activity in Information Systems and has a tradition of more than 30 years. Reference models have been introduced in order to increase the efficiency and effectiveness of the modelling processes by providing a point of reference for the development of further models. A discussion of the term reference model, the different definitions and resulting implications can be found at (Thomas, 2005). Practical applications of reference models are for example well-spread in the domain of ERP Systems (Becker and Schütte, 2004b; Huschens and Rumpold-Preining, 2006; Kittlaus and Krahl, 2006). In this domain, reference models set the basis for general business solutions that are then individually adapted to the needs of customers.

A strong focus of research has been on designing reference models in a way that they are best suitable for leveraging the content in subsequent models. Ground work has been carried out that formalizes modelling principles, relevant model constructs and their relationships (e.g. Becker, et al., 2004a). The focus of this paper however is not on making use of this discussion and improving PM standards in this respect, but to analyse the prospect of mechanisms for re-use which have also been developed in the field. For this purpose, vom Brocke has developed a three-dimensional framework that formalises the different aspects of re-using reference models. It is based on the degree of innovation, the design principle which is used and the stage in the value chain when the model is created (vom Brocke, 2007) (c.f. figure 1).

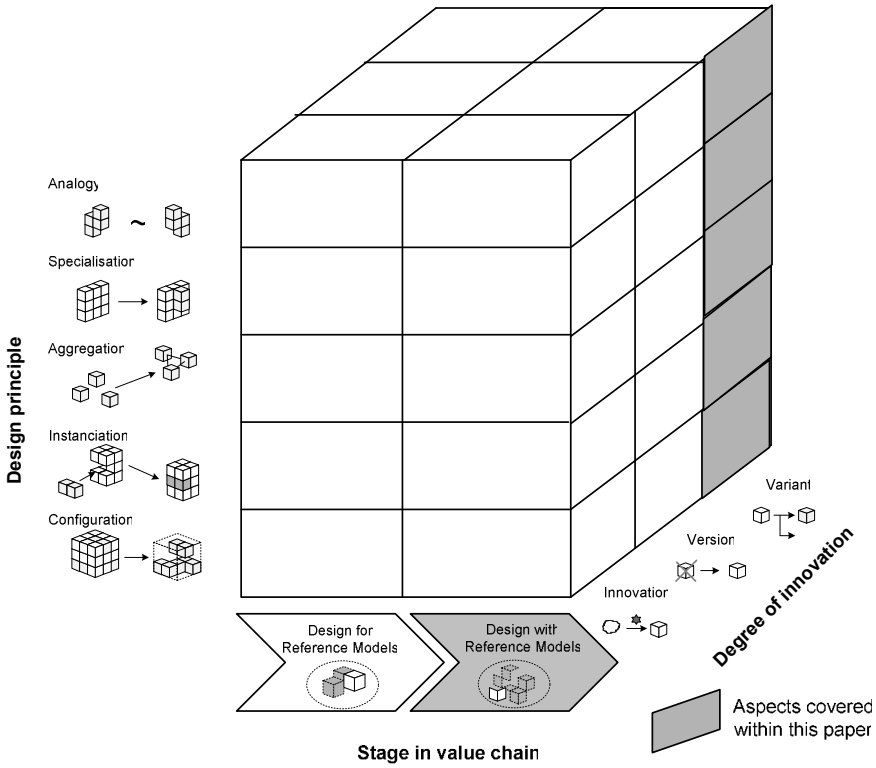

Figure 1. Aspect of re-use in reference modelling based on (vom Brocke, 2007)

The stage in the value chain distinguishes reference from application models and thus a reference-model-based reference modelling (design for reference models) from reference-model-based application modelling (design with reference models). Concerning project management standards, the development of a new standard falls into the first category. The adaptation, as dealt with in this paper, falls into the second.

The degree of innovation describes the novelty of the resulting model. It differentiates between innovation (new, accepted solutions for a new problem space), versions (new, replacing solutions for an existing problem space) and variants (solutions for an existing, modified problem space). Following this definition, the pure application of project management knowledge creates new variant of an existing standard that addresses a specific project environment. The definition of updated processes and tools to be integrated into an existing standard creates versions. Innovation occurs when a new problem in project management is addressed by new processes and tools.

Design principles distinguish analogy, specialisation, aggregation, instantiation and configuration. These techniques provide rules describing the way in which the content of one model is reused in constructing another model. In early studies on

reference models, the focus of research was mostly directed towards configuration (Becker, et al., 2004a; Rosemann, van der Aalst and Mendling, 2005). The idea behind configuration is to foresee all relevant variants of prospective applications during build-time of the reference model in order to facilitate adaptability by means of choices at run-time (van der Aalst, Dreiling, Gottschalk, Rosemann and Jansen-Vullers, 2005). However, the design technique of configuration encounters specific limitations as it is increasingly hard to take into account all requirements that may be relevant in the future, and to incorporate them into the reference model. Hence, supplementary design techniques have been developed. Based on software-engineering concepts, aggregation, specialisation, instantiation, and analogy have been added (vom Brocke, 2003; vom Brocke, 2007). With instantiation, general aspects of a domain are designed as a framework that provides generic placeholders for plugging in application specific models. Specialisation enables the transformation of the entire content of a general model into a specific model, followed by modifications and individual extending. Aggregation aims at composing content, which is delivered by various model parts, according to special requirements of application. Analogy, finally, employs seemingly similar solutions in a creative way in order to tackle new problems. For a formal definition of each principle, see figure 4.

It is the goal of the remainder of this paper to analyse the potential of each principle and derive guidelines for the adaptation of PM standards to certain project needs. Hereby we focus on the creation of variants of existing standards with the standards being considered and referred to as reference model and the project specific adaptation as resulting application model.

GUIDANCE DERIVED FROM DESIGN TECHNIQUES FOR REFERENCE MODELLING

Selecting suitable design techniques

In general, all design techniques for reference modelling can be applied in project management to support the adaptation process of current standards. In this section we discuss this statement in more detail, especially by evaluating how far each technique may well be used and which rules can be derived and by showing current limitations. Design techniques can be grouped along two dimensions: the flexibility concerning possible content changes and the underlying building principle (vom Brocke, 2003). A discussion of each dimension in the light of project management serves as a first filter in analysing the five principles.

Dimension 1_ Flexibility concerning content changes: Each design principle offers a different degree to which existing content can be modified. Configuration is the least flexible as it only permits the selection of variants specified in the reference model. Instantiation, specialisation and aggregation permit limited, less restricted changes. With the techniques of analogy, finally, unlimited ways of using and altering existing reference content are given. The usage of more flexible design principles consequently allows for the adaptation of standards to less conventional project types and the inclusion of additional, individual techniques, whereas configuration only permits for the selection within a given standard. However, with each degree of freedom, also the costs for adapting the project management method are increasing. Looking at the derivation of costs, it becomes apparent that configuration and analogy form two opposite techniques. Whereas configuration implies that most of the work is done when building the reference model, using analogy this work needs to be performed when creating the application model. Consequently, configuration comes along with relatively high costs for building the reference model on one hand, but with low costs for applying it on the other. The principle of analogy, on the contrary, causes a minimum cost for building the model and yet a maximum for applying it. The other techniques gradually lay in-between. With the existence of project management standards, the reference model has already been created and these costs have already occurred. Costs can be decreased when creating the application model by re-using as much of the standard as possible. From a cost perspective, a simple configuration of any existing standards to given project needs would be most recommended.

Dimension 2_Underlying building principle: Two basic, underlying building principles can be distinguished, namely composition and adaptation. Using composition, a model is created by combining or plugging in existing model (parts) to generate a new model. Hereby, the content of single model parts remains untouched and solely the novel combination allows for changes in the application model. However, application specific models can be added to the repository of model parts. Instantiation and aggregation fall into this category. Using adaptation, a new model is created by modifying the original model to fit the requirements of the application domain. In this case, model content is altered to create the new model. Configuration, specialisation and analogy follow this principle. When utilising a project management standard, the usual approach is to select relevant parts that are needed to manage the specific application domain and to customize these to fit a specific project situation. As an example for selection, the existence of a project charter and a communication plan are perceived as crucial. The structure of the project charter then needs to take into account certain external factors and the communication plan should specify information distribution models most appropriate to the specific project, adding in both cases individual aspects if necessary. Using principles that follow the approach of composition, this would either require the standard to offer placeholders where more specific methods and tools can be included (instantiation) or to offer a concept of

combining selected parts into a new project management method (aggregation). However, as of today, standards do not offer such modelling constructs and thus limit the usability of design principles to the adaptive principles (analogy, specialisation and configuration).

In summary, only design techniques that follow the underlying building principle of adaptation can be used to adapt current PM standards to a specific project situation. From a flexibility point of view, analogy offers the most potential while also being the most costly option. Configuration can be described as being opposite. Applying a standard using configuration is significantly cheaper and less time-consuming; however options in addressing the application domain are already limited at the design-time of the reference model. We will now take a closer look at analogy, specialisation and configuration by analysing the situation in which each principle may be most useful and deriving explicit rules for the project management domain.

Analysis of selected, adaptive principles: Analogy, Specialisation and Configuration

Configuration:

Configuration is the most known and discussed design principle in reference modelling. Configuration resembles adaptation by choice of various alternatives in the reference model. Hereby it is a pre-requisite that the reference model provides all possible options that might occur in an application domain. To be exclusively used for the adaptation of project management standards, this implies that as many processes, tools and techniques are offered as are necessary to manage all possible project types. In other words, the project management standard would need to encompass the full range of existing and upcoming project management methods to enable adaptation solely by choice. By definition, no project management standard is complete, however they aim at providing processes and tools that are commonly accepted and widely usable across a wide range of projects (Project Management Institute, 2004). Within this range, certain redundant processes are offered that can be treated as alternatives. As such, re-use by configuration is possible for conventional project situations that do not call for any project specific extensions to a given standard and are satisfied with selecting from what is provided within the standard. As discussed in the introduction, typical project types would be construction or engineering projects. IT projects are less suited, as certain features call for more specific and more flexible project management methods, however certain standard development processes can be managed this way. The following figure depicts the process of adapting a current standard using configuration. As an example we have chosen the process of human resource planning in the PMBOK® Guide by the Project Management Institute. Composition results in a single step selection of relevant standard alternatives.

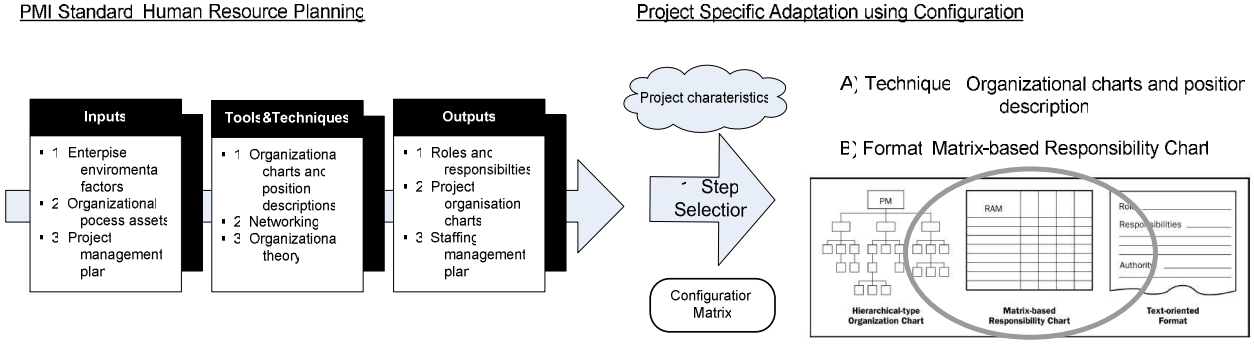

Figure 2. Project specific adaptation using configuration

It is assumed that the reference model itself offers the boundaries of re-use by including indications where choices need to be made for configuration. However, in project management standards these are not explicitly indicated, leaving the selection of relevant standard parts to the user. The choices are motivated by the project characteristics and are possible along three dimensions: Specification allows for changes in the naming of constructs in the application model by replacing general placeholders, existence offers the choice to include or exclude certain constructs, and logic defines which relationships can be changed in the application model. Which choice is to be made in which situation, can be indicated in so called configuration matrices which we propose to include into current PM standards for improved usability. Further research could create such matrix for certain project types and characteristics based on empirical data from currently running and finished projects.

Specialisation:

Specialisation can be defined as "the deviation of a resulting model "S" from a general model "G" where "the modelling messages in "G" are taken over in "S" and can be either changed or extended" (vom Brocke, 2007). As such, specialisation

enables the re-use of general model content and adjustments to specific demands. To use the principle of specialisation, it is a pre-requisite that the application domain can be covered by a core solution which is then extended and modified for each application. In section two we discussed that different categories of projects can be distinguished which require more or less flexible PM methods, depending on the project type and context in which they are executed. In some aspects they can be treated similar and allow for uniform management whereas certain features call for tailored PM techniques. To account for a uniform management approach, we have identified configuration as a suitable technique to select from the processes and tools offered by existing standards. In case a more flexible approach is needed that allows for changing certain parts to specific project requirements and adding individual methods, specialisation offers a suitable principle. A large amount of IT projects would fall into this category.

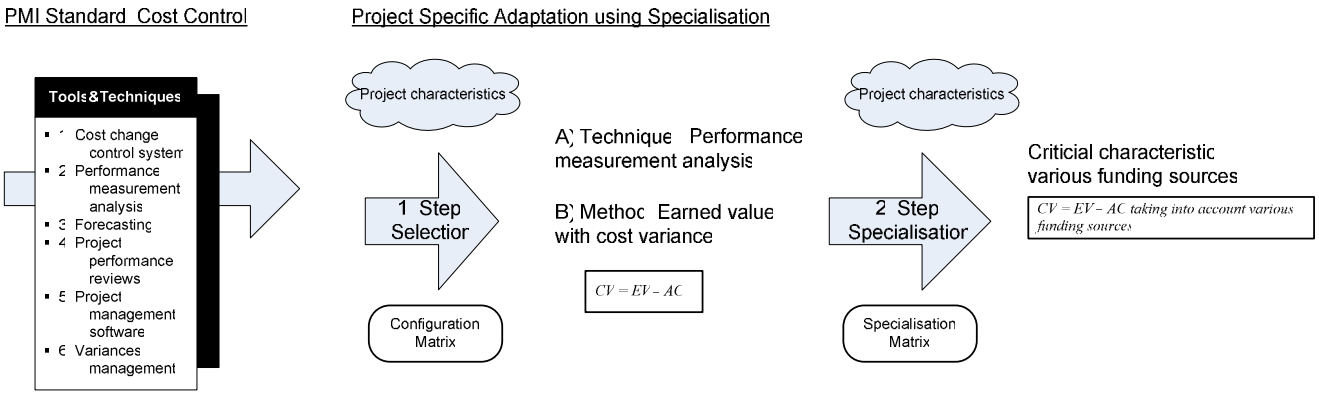

Figure 3. Project specific adaptation using specialisation

The above figure shows the adaptation process using specialisation. As a first step again a selection of relevant parts of the standard is performed. Again, a configuration matrix can support this step. As a second step now the specialisation is added in which a chosen method is specialised according to specific project characteristics that require adjustments or extensions. In this example we assume the availability of different external funding sources for a certain research and development project as such crucial project characteristic which calls for a project specific extension of the chosen performance measurement analysis method. The specialisation is mostly a manual step and again, not supported by current standards. Also here the development of certain guidelines that relate project characteristics and project management methods (specialisation matrix) can significantly contribute to improving the suitability of the PM; method for certain project situations. Concretely, for IT projects this matrix could include development methodologies, such as the Rational Unified Process or the Waterfall model and corresponding alterations to standard processes and tools.

Analogy:

Using analogy, the content of a reference model provides a means of orientation when creating an application model. The relation of reference model and application model is based on the perceived similarity of both models concerning a certain aspect (vom Brocke, 2003). The similarity is subjective and perceived by the constructor of the application model. Thus, no real means of formalisation of connecting model statements can be defined. Analogy can be used if the application domain can be described in certain patterns that reoccur in each application while describing the overall model is not possible (vom Brocke, 2007). A suitable project management situation occurs for very unconventional projects showing distinctive individual features that require and justify the development of an individual PM method. Examples are projects from the creative industry, research projects and extremely specialised software projects. In this case it is important that the specific project requirements are well understood to develop an individual PM method.

The discussion shows that the suitability of a certain principle for a specific project largely depends on the project management situation. To account for a greater variety of situations, also combinations of the principles can be explored. This is particular useful if the project domain consists of areas that show different characteristics with respect to the appropriate design principle. The level of complexity serves as an example: when looking at software engineering projects, core development steps may be rather standardised, whereas accompanying procedures, such as design steps are characterised by a high level of creativity and complexity. In other words, even in projects with a rather high average complexity, there are always some elements that can well be standardised. In these cases, the project management standard can be structured into partial models, each being applied with a different design principle.

The following figure summarises the discussion on each selected design technique for reference modelling.

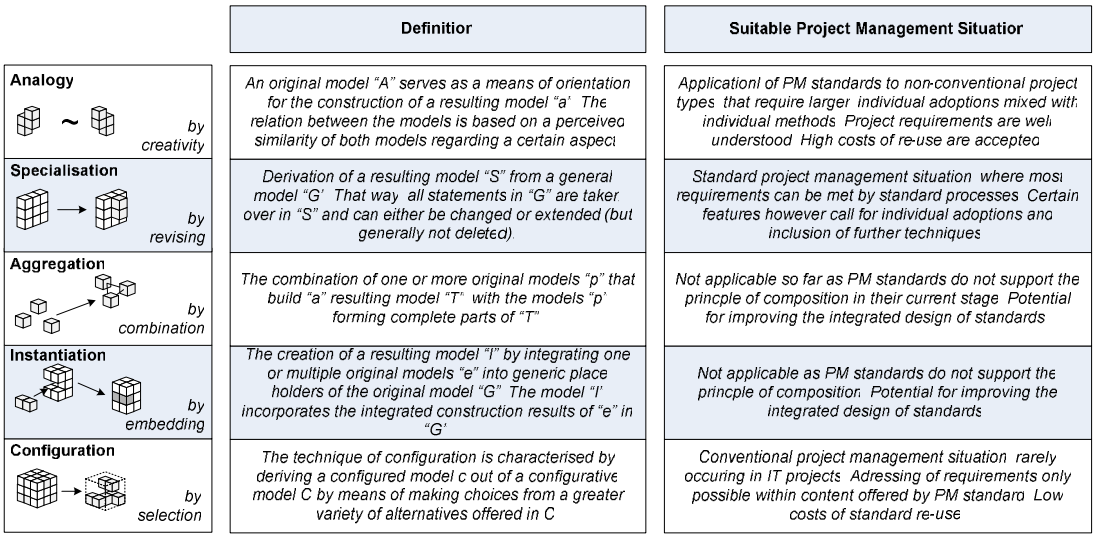

Figure 4. Findings in respect to the suitability of design techniques for reference modelling to adapt PM standards

Summing up, these findings we can learn that the design principles developed in reference modelling can offer interesting potential for the application of adaptive project management standards. Adopting these design principles could foster not only the efficiency of the application process but – due to re-use – also the quality of the content and recommendations delivered with the standard. Here, particularly potential for collaboratively designing and further developing smaller modules of project management standards come into play. Apart from detailing a standard for a special application situation, also the evolution of standards could be supported. In particular also the techniques of aggregation and instantiation could contribute nicely by composing standards from standard fragments collaboratively collected in a standard repository. This would support not only the users but also the designers of project management standards.

CONCLUSION

Within this paper we have addressed the challenge of applying project management standards to the specific needs of IT projects. We analysed to which extent design principles for reference modelling can provide more formal guidelines for this purpose. Given the current set of standards, only analogy, specialisation and configuration are usable. Adaptation by configuration and thus by choice supports standard PM situations and project types where a simple selection of existing processes and methods is sufficient. More flexibility is offered by the principle of specialisation. This principle goes beyond a simple choice and allows for subsequent changes to the standard content where necessary and is thus satisfactory for most IT projects. Here further work could support the development of configuration and specialisation matrices which relate project management methods and project characteristics. Analogy finally is the most flexible principle, however the associated costs and effort justify its use only for certain specialised project types. The limitation to those three principles occurs, as current standards only support an adaptation of provided content as opposed to the composition of required parts into a new PM approach. However, we see great research potential in exploring what is necessary to also transfer standard content by means of aggregation and instantiation. These techniques could allow for a "plug and play"-like composition of standards and making use of collaborative design. Future work should reflect on strategies on how to use design principles to re-use fragments of standards through composition.

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