

“Standard Bibles” and Mediators as a Way of Software Development Organizations to Cope with the Multiplicity and Plurality of Standards

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ABSTRACT

This paper focuses on the appearance and implementation of process standards in software development organizations. In particular, it shows interest in the way organizations handle the plurality and multitude of process standards they are faced with in a modern working environment. The process how organizations respond to environmental challenges like the increasing demand for process standards we call metastructuring. Based on the metastructuring approach by Orlikowski et al. (1995) it explores the process of internal standard-use mediation by an in-depth single case study. The case company develops step by step a dedicated institutional entity reacting to standard complexity and customer pressure. As a result, mediators shape extensively the standard use of the employees in the case company. They develop a process library which integrates different standards. This work sheds light on how this metastructuring process is accomplished, which areas of metastructuring regarding process standards can be found and explore different types of metastructuring activities by the involved standard-use mediators.

1. INTRODUCTION

The multiplicity and plurality of standards is one of the challenging issues modern working organizations are facing nowadays. In the light of the recent economic developments and the imposed dependency of economic decisions on standards it is important to elaborate on these

challenges, changes and risks which confront organizations within an audit society of organized uncertainty (Power, 1997). In this context, the article will contribute to the question of how organizations and other actors respond to and cope with the consequences evolving from the multiplicity and plurality of process standards. We chose an exploratory study on the micro

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level within a single software development organization.

Research on standards has many facets. On the one hand, we distinguish research on standards focusing on the design mode and, on the other hand, the use mode of standards (Orlikowski, 1992). This distinction emphasizes the occurrence of social construction, both, before and after a standard is enacted in an organization. It refers to processes of setting and following standards. The *design* mode describes the process of standardization on the standard setting bodies both, before and after a standard is enacted in an organization. It refers to processes of setting and following standards. The to processes and how these bodies determine the content of standards, as well as, how they convince potential stakeholders to certify their organizations (Egyedi, 2008; Furusten, 2000; Marimon et al., 2009; Tamm Hallström, 2004).

For this paper, the *use* mode of standards is of special interest. The use mode literature on process standards is chiefly shaped by the research on the ISO 9000s and ISO 14000s process quality norms, culminating in the following two topics in the early 2000s: Firstly, there is an extensive amount of literature about the motivation and barriers of the implementation of standards (Boiral, 2003; Niazi et al., 2005; Zeng et al., 2007). This literature focuses on the influence of the implementation of process standards on product quality, on the organizational performance and the obstacles and limitations while putting a standard into effect. Secondly, there is a discussion around process standards that reflects on the requirements for a 'good' organization. According to different authors, this could be measured through customer satisfaction, defined responsibilities, the reduction of production and management mistakes, quality assurance, documentation of all processes, decisions and related audits (Lawrence and Phillips, 1998). Finally, little research has been done on the social construction of standards, in particular, on standards as a form of regulation or as a code of corporate governance and on the functioning of these code regimes (Jakobs, 2006; Power, 1997;

Seidl, 2007; Wieland, 2005). Thereby, code regimes are specific types of standards which regulate corporate behavior based on a 'comply-or-explain rule'. With it, organizations declare publicly to what extent they follow or deviate from a specific capital market mechanism. Seidl (2007) investigates code regimes in view of parameters that influence the effectiveness of a code regime. Important for our understanding of standards is here the conclusion that the de-facto content of a standard is determined to a significant extent by standard followers and not by standardization bodies.

Besides these studies, we can resume that the social construction of standards by organizations plays a minor role on the use mode of standards in the existing research. Thus, we deem it as important to elaborate on this subject since we do not sufficiently know how organizations themselves adopt multiple standards in reaction to a number of institutional pressures. With this article we intent to provide empirically insights on a micro level addressing internal issues of standard multiplicity and plurality.

The contribution of this article is threefold. Firstly, as mentioned above, we elaborate on the institutional answers how organizations deal internally with the plurality and multiplicity of standards. In contrast to standardization *by* organizations and standardization *as* organization, we are dealing with the standardization of organizations. Standardization of organizations relates to the question of "how standards are adopted, diffused, implemented, avoided, and altered in the course of their implementations" (Brunsson et al., 2012, p. 614).

Secondly, in particular, we focus on an empirical phenomenon that was not described in the standard literature before. We direct the reader: standards are adopted, diffused, implemented, standard-use mediators and their metastructuring activities (Orlikowski et al., 1995). In consequence of the development of a so called "standard bible" by the software organizations, standard-use mediators occur in organizations as a response to a multi-facet standardization pressure in the institutional environment of organizations. We consider this phenomenon as important since

we believe that the way organizations meta-structure multiple process standards has, for instance, an enormous influence on the innovating activities of an organization (Fried, 2010; Fried et al., 2013).

Finally, while referring to metastructuring we base our argumentation on structuration theory (Giddens, 1984). Local organizational structures depend on the institutional environment which is propagated by professionals and associations to promote collective goods as standards are. Likewise, mutual interferences between the local organizational actions and structures and the institutional environment can be observed. We suppose that, in order to function, process standards are structured and with it swayed by internal mediators. The structuration of standards is influenced by the mediatorsthe mediatorsstitutional environment which is propagated by to resources and the normative rules they are confronted with (Barley, 1986; DeSanctis and Poole, 1994; Weick, 1990).

For exploring the phenomenon of standard-use mediators and their metastructuring activities in detail, the article is structured as follows. The subsequent section will provide the theoretical background on metastructuring and standard-use mediation. Starting from the theory on structuration by Giddens (1984) we will present metastructuring as a phenomenon which was first introduced by Orlikowski et al. (1995) in the area of technology research. Section three describes the research design of our case study. We chose an exploratory approach within a single software development organization. In particular, process standards will be introduced as the empirical object of interest. The findings of our case study *A-Suppliers* are presented in section four. The empirical investigations will highlight the usefulness of the use mode perspective on standards. We intend to attract the readersoftware development organizationhas decided to address plurality and multiplicity of process standards. In the discussion, the paper provides insights into metastructuring as a powerful mechanism in dealing with multiple and plural process standard requirements in organizations. Standard-use mediators are explored

and investigated regarding the metastructuring *process*, metastructuring *areas* as well as the different *activity types* of metastructuring connected to these areas. The conclusion section provides supplementary notes on future research and limitations of standard-use mediation.

2. METASTRUCTURING OF STANDARDS IN THE CONTEXT OF USE

In general, standards can be understood as rules. Rules sanction social conduct and constitute meaning (Giddens, 1984). Standards focus on something “to be reached, be it in terms of quality or quantity, extent or intensity, precision or value, technique or morality”(Ortmann, 2010, p. 204). Process standards are the center of interest in our empirical investigations and represent “how organizational processes should be designed and controlled” (Brunsson and Jacobsson, 2000b, p. 4).

From our point of view, standards are solely those rules (a) which are purposefully set, which are (b) strongly formalized and written down (for instance by standardization bodies) and, finally, which (c) cover and adapt generalized, comparable occasions among organizations (e.g. processes, technical or social requirements, performance). Thus, standards are only those rules “which tend to be [...] developed and adopted through explicit procedures that historians can trace” (Timmermans and Epstein, 2010, p. 71). Moreover, standards are rules which are often connected to a certification by an organization-external party (certification body). Thereby, certification is an evaluation process of the compliance with pre-defined requirements. It results in a document (certificate) that is trusted to be an evidence for requirement compliance assuming the comparability among certified organizations. Alternatively for certification the terms *appraisal* (e.g. for the CMMI¹ standard) or *assessment* (e.g. for the ISO/IEC 15504 standard) are used for the external evaluation by a certification body respectively its assessors.

By choosing a structuration theory viewpoint, we also need to address the relation between the design and the use of standards. This relation is to be seen as “recursive, i.e. that the formulation of rules (possibly) constitutes their application and vice versa” (Ortmann, 2010, p. 205). People are knowledgeable agents who can construct alternative meanings of once designed standards. They are able to redefine and modify standards in an emancipatory way and shape the meaning, purpose and ways of standard usage. Standards do not exist without human activity; they are enacted by actions (Fried et al. 2013).

In the scope of this paper, we report on a specific type of structuring activities around process standards within organizations. We focus on a process Orlikowski et al. (1995) called *metastructuring*. Metastructuring was primarily used in the context of technology research. Yates et al. (1999) observed that “a few members of the project group explicitly engaged in activities that facilitated both early and ongoing use of the new technology by the rest of the project group” (Yates et al., 1999; for technology structuring see also Okamura et al., 1994 and Orlikowski et al., 1995). These activities included (1) guidelines for the use of a new (conference) technology, (2) provision of qualification and follow-ups in using the technology as well as (3) modification of the technology according to contextual, project-specific requirements. Orlikowski et al. (1995) summarized metastructuring “as an organizational mechanism for facilitating the ongoing adaptation of technologies, their use, and organizational contexts to each other and to changing conditions” (Orlikowski et al., 1995, p. 441).

Four types of metastructuring were classified in technology research: establishment, reinforcement, adjustment and episodic change (Orlikowski et al., 1995). During *establishment* the mediators come into play and enact their roles in the organization. Mediators are a group of individuals who intervene significantly to modify and to adapt new material artifacts to the organization in an appropriate manner. They pre-shape the material artifact before the actual

users apply it; therefore this activity is called metastructuring. Moreover, in addition to other actors like promoters or trainers, mediators do not only intervene reactively in the initial stages of establishment. Mediators act pro-actively, they are institutionally recognized and play an ongoing role. Internal technology consultants or the employees of the IT department can be considered as mediators. Of course, they set up the infrastructure and implement the new material artifact. They also need to promote and to support it, write user-guides and especially convince managers or key personnel in the organization to adopt the new technology. When it comes to *reinforcement*, mediators maintain their operations and reinforce its vision. An ongoing training on the new material artifact is offered. Moreover, they ease the use of the system, collect user feedback and, as a consequence, try to intensify the usage. During *adjustment* they react on the given feedback and usage tendencies. This includes smaller and less radical modifications of the artifact in use. The most dramatic changes are considered during the *episodic change* period. Significant improvements and corrections to the functionality or the technical core of the system are accomplished.

What started in the context of technology-use, research on metastructuring has been gaining influence especially in socio-technical studies on electronic communication or collaboration. Henriksen et al. (2002) explored web based group ware, Bansler and Havn (2004) a virtual workspace and Janneck and Finck (2006) researched online communities. Clear and MacDonell (2011) analyzed email data of global virtual teams. The study of Rodon et al. (2011) portrayed the post-implementation phase of inter-organizational information systems and especially focused on managerial intervention and users' appropriation. It was reported that metastructuring might have an important impact on the structuring processes of other users while applying the different types of metastructuring activities. All in all, these authors characterized the process as very complex and rather complicated to understand. Thus, they claim for additional research on different technologies

(Bansler and Havn, 2004) and raise the question of other potential sources of mediation (Rodon et al., 2011).

In the metastructuring discourse, the scope of technology is restricted to material artifacts of various hardware and software configurations (Orlikowski, 1992). It is emphasized that there is a distinction between the material nature of technologies and the human activities designing and using these artifacts. Similarly, for standards as artifacts and their rule-like character, the need to be enacted in order to be effective in the organizational life is evident. On this basis, we ask whether the implementation of other artifacts than technologies - like standards - also trigger such metastructuring activities in organizations. Standards are powerful rules in a globalized world. The way organizations deal with them facing plurality and multiplicity of standards is an urgent matter that needs clarification. Accordingly, our interest is to observe, whether similar powerful mechanisms can be found within the 'world of standards' (Brunsson and Jacobsson, 2000c) and which influence metastructuring can have on the effectiveness of software development processes.

3. CASE STUDY DESIGN

We use a case study approach to investigate contemporary phenomena in their real-life context (Yin, 2003). As typical for qualitative studies the personal realm of experience of each interviewee lies in the center of analysis. We chose interviews as the main data gathering technique. The result is a single exploratory case study. The interview data are analyzed with a qualitative content analysis to explore qualified hypotheses (Krippendorff, 2004). It enables the researcher to include textual information and to identify its properties systematically, e.g. the frequencies of most used keywords (Kohlbacher, 2006).

Eight interviews were conducted in October 2010. Each of them lasted between 80 and 100 minutes. Later on, two additional interviews were necessary to clarify on some data and

to gain some more fine-grained information. With an emphasis on the Capability Maturity Model Integration (CMMI) as process standard all interviews were part of a larger, multi-case study undertaking (Fried et al., 2013) exploring the relationship between standardization and innovation in software development organizations. CMMI is a standard for software process improvement (Humphrey, 1992). Since 2002 it is the successor of the CMM. When we speak about CMMI in this study, we refer to either CMMI (since 2002) or to CMM (before 2002). The interviews involved strategic planners, managers responsible for the implementation of process management standards, team leaders and software engineers of one working context (see also Table 1). They were semi-structured to allow flexibility and to ensure that we focus on interesting phenomena. Further, a narrative interview style was chosen in order to stimulate reports about a variety of expressions and experiences in terms of process standards.

The subjects of the interviewees allow flexibility and to ensure that we focus on interesting phenomena. Further, a narrative, the history, implementation and usage of process management standards, the procedure of certification audits as well as the individual and organizational experiences with process management standards. The interviewees were asked to reflect on changes in the course of time.

The recorded interviews were transcribed and afterwards coded and analyzed with the software *Atlas.ti* (Muhr, 1991) for qualitative data analysis. The anonymized publication of our findings was requested by the organization. Where necessary, sensitive data were paraphrased and marked by square brackets. The analysis of the case is based on a code-name schema. The initial code-names and their mutual relations are depicted in Figure 1.

In the research team we agreed on the initial code-name schema in advance but it was constantly extended during the analysis. In the end we coded additional relational information and thus extended the code-name schema during the analysis. We ended up with 31 different

Table 1. Data of interviewees

Name	Position	Experience	
		CMMI	A-Suppliers
A1	Process Coach (PC)	10 years	>15 years
A2	Head of QM	5 years	>15 years
A3	Former CIO, now Board Member	5 years	>15 years
A4	SW Developer, Project Leader	5 years	>15 years
A5	Process Coach (PC)	5 years	12 years
A6	SW Developer, SW Architect	5 years	8 years
A7/A9/A10	Head of a PG unit	12 years	5 years
A8	Former Head of PG	5 years	13 years

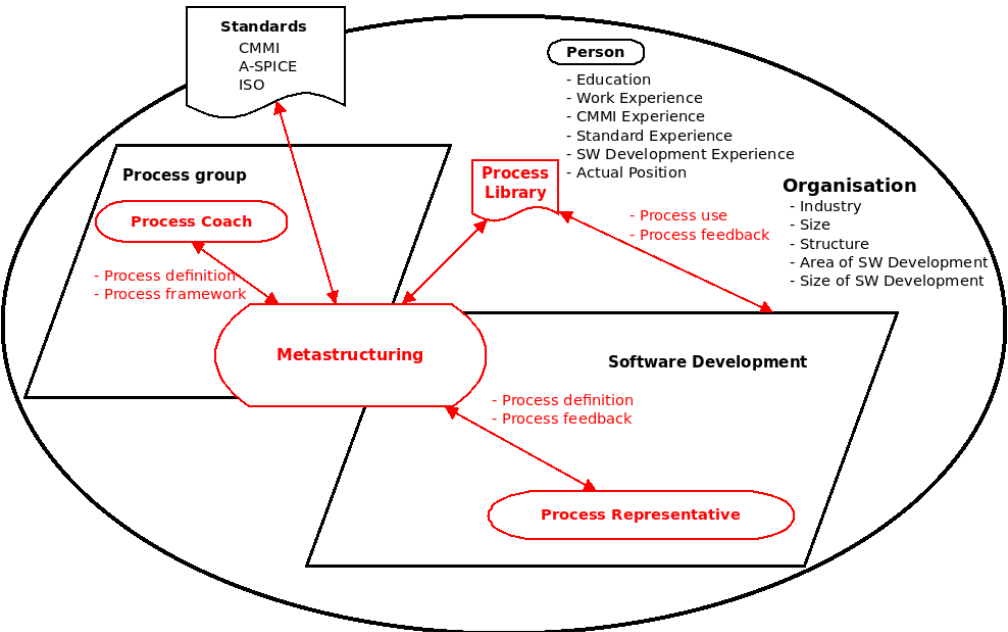
code names, which were applied about 250 times in total.

Moreover, to achieve an adequate level of validity we used multiple sources of evidence. Most of the data were gathered from the transcriptions of the interviews. Besides, we participated on a guided tour through the production area as well as the software development office where the interviews were conducted subse-

quently. After each interview and during the lunch and coffee breaks we prepared protocols of the past interviews. We focused not only on context information but also on the emotional setting of the interview situation.

The next section provides our findings on metastructuring at A-Suppliers.

Figure 1. Code-names for content analysis



4. FINDINGS ON METASTRUCTURING AT A-SUPPLIERS

The investigated organization *A-Suppliers* acts in the automotive technology sector and produces electronic control units which includes systems for ABS, ESP, exhaust and engine controls. They employ about 5.000 system developers, whereas about 3.000 are directly involved into software development. The employees who worked in the department at that time had mostly an electrical engineering background. As automotive supplier they have to consider several industry-related standards (e.g. ISO 26262, A-Spice, ISO 16949). Automotive SPICE (A-SPICE) is thereby by far the most important standard for the automotive industry. *A-Suppliers* has long-term experiences in process management.

In 1999 the head of software development at this time came up with the idea of continuous process improvement, in concrete CMMI: “[...] he always had this state of the art development with a process improvement infrastructure in mind.” (A1:069). The first trigger for CMMI came from inside the company but was also motivated by external customers starting to demand the CMMI certification:

But [the customer] finally required it from [A-Suppliers]. So the pressure from outside of [A-Suppliers] came in, from the customer. (A1:069)

The software development unit set up a pilot project to accomplish a CMMI certification which can be regarded as first *establishment* step, since they are implementing a new standard, CMMI, and as well establishing their own roles as process coaches (PC):

And the project leader [...] had to build up a project team and he took some of the specialists out of various departments. And I was one of them, especially for the whole quality management stuff and subcontract management at that

time. So it was three of us, so called coaches in that role, tingling through the organization trying to establish some processes. (A1:17)

After more than three years, in 2002 they successfully got a CMMI level 3 certification. Directly after their certification, they turned the pilot project into an own department:

There have been some people assigned but it was more or less a project. And then [...] it was established as a department. So there was a budget allocated, there have been head count allocated, there was work space and everything allocated. (A8:021)

Taking this step to accumulate the process experts under one organizational unit was considered as highly important. All relevant standardization topics could now be handled in one specialized organizational unit. As a significant correction of the standard-use at *A-Suppliers* in terms of CMMI, we assess this step as an *episodic change*. After a certain time, the organization again expanded its competences since they had to deal not only with CMMI, but also with other standards:

CMMI is one of them. There is still A-SPICE and all the other models and standards, which are handled within the process group. (A1:045) And also we have to implement some ISO topics, for Safety management, ISO 26262 and 16949. (A7:39)

As a result, the process experts could now focus entirely on standardization and process related tasks - a significant and *episodic change*. They gained more expertise in the area while collaborating closely in the new department. Therefore, the time necessary to reach a new certification was reduced by more than a year:

And this makes it much easier, because if you do something you do it for all projects. It makes it much easier [...] So we reached CMM level 3 in 2002 and level 3 CMMI in 2004. (A1:101)

Whereas formerly only standards in the domain of software development were part of its work items, in 2006 the process group (PG) took over the responsibility for all the process standards, organization-wide. Again, it can be regarded as a reaction to the increased attention and importance of standardization at A-Suppliers and their environment. As well, the classification *episodic change* can be applied here. Since CMMI continuously gained influence in the automotive industry, the suppliers consequently had to suit these needs. As it seems, it reflected a general development in the relationships with the suppliers:

Today we act more on customer demands, customer requests. We have no way out. We just follow what the customer orders. (A2:371)

Since then, the PG consequently acts as a standard-use mediator for the whole organization. In fact, the engineers were faced with several standards, which made their work more complex and difficult to handle. In some cases, it led to a decreased productivity: “[...] if you use the wrong interpretation for the requirements or for the standard and then you end up with a lower productivity.” (A2:067). Thus, reducing complexity by mediating between user and standards was the main idea of a distinct process group:

[...] we are reducing complexity for the engineer. Because otherwise, we would challenge our experts for hardware or software to interpret the standard in the right way and this is absolutely not necessary. (A2:087)

Instead, the process experts now deal with the multiplicity of standards. It necessarily means that all standards “[...] are inputs to the process development. So now you have to find a process design which jointly or comparably fulfills these requirements” (A2:079). Interviewee [A9] described this process in detail as follows:

So, we have a process library where all processes for our product development can be found. And we mapped all artifacts, all work products with CMMI or A-Spice. This means, we have the models and the best practices in the database [...] We have the models in the process library and we have the processes of the different products in the library. And then, we link the artifacts or work products with the requirements of the models or standards. With that, we know about our evidences, what we cover and where we still have gaps which need to be closed. With this way, we ensure that if you follow the process library then you fulfill the standards or models. (A9:61)

The PCs are interpreting each single standard; there are several experts for each. The interpretation of standards can be seen as *establishment* as well as *adjustment*. While interpreting a new standard for the first time, they establish the standard in the company, whereas minor *adjustments* in the interpretation happen on a regular basis. Furthermore, they compare the standards among each other to find overlapping parts and keep the process descriptions as lean and therefore as user-friendly as possible - a sign for *reinforcement*. Creation (*establishment*) and maintenance (*reinforcement*) of the standard script are an immense effort, which is mutually accomplished by the PG in collaboration with the process representatives (PR).

The process library is a technology implemented by a web-based tool with a database in the background, where all the mappings between the different standards and the product processes only need to be done once. Subsequently, it can be consistently displayed. A-Suppliers even reviews the standard conformity of the process library by internal or external assessments:

[...] after we mapped A-Spice we had an A-Spice assessment by an external A-Spice principal. He reviewed how far the mapping is correct. [...] And we do it for CMMI as soon as we renew the mappings for our appraisal. [...] So, either we review or we get assessed externally. (A9:73)

For ISO 26262, we had a [technical assessment organization] doing the assessment, also for our process library. That is not even the project, that is only theory [...] and for ISO 16949 we actually had our quality surgeon in the organization. He did an ISO 16949 audit for the mapping. (A9:81)

Once the mapping is done, the different standards are themselves not explicitly specified against the user. It reduces complexity since now they only have to interact with the process library instead of all the different standards itself:

[...] this is a documentation of all the processes and you will never find a position inside all these processes, where CMMI or A-Spice is mentioned in reference to. So we hide all these frameworks, all the requirements from our engineers. They only have to follow our internal processes, process descriptions. (A2:083)

Regarding the standard script or the production process, all organizational relevant information is collected in the process library. As a result, it renders the process library to a highly valuable and also critical tool in the organization:

If you look in our process system, you see the processes and the tasks. You see the roles and linked to the roles are the requirements, the capabilities and also the trainings to achieve the know-how. (A2:211)

The interviewees confirmed that this process library dramatically eases the training on-the-job period for new employees or for the achievement of further qualifications since: “they start to work and they can be sure if they follow the process library it will be okay.” (A7:315). The process coaches now accomplish a part of the corporate training, the one regarding all process issues (reinforcement). During the interviews, all subjects demonstrated an exclusively positive attitude towards the process landscape (PL). As it seemed, some actually

expressed to be proud of what they achieved with this tool:

We built up this tool and now we are in the version 3.3 of the process library. I can show you the history. So it took nearly 3 years to set up the whole system because it is, you can imagine, it is a rather complex and consistent system. So an auditor, whatever kind he is, has no chance to detect gaps or weaknesses. He can do internal checking and so on. So at least the instruction side is complete. And the auditors give up [...] (A2:295)

In this system the operational processes are defined by the so-called process representatives that work in the relevant operational departments. This happens when the technology is established, as well as when adjustments to the relevant processes are required. The PR is linked to the PG and cooperates in all respective process tasks - an integrated and participative approach between the PG and the operational departments:

We have some process representatives [in the operational departments]. And there, we make the process definition. So the process representative is responsible for the process definition. He gets support from my side or from other people from the PG. And the developers were included in discussions in certain groups. Not all, but certain from different departments to get different opinions and different needs. So we had normally teams, the project leader was the process representative. And there was a PG coach in the process team. And there were different representatives for the different departments in the project team for this certain process group. So we had a team process definition for the requirements process, and we had teams for quality processes and things like this. (A5:113)

The user participation continues once the processes are defined and implemented. Literally, everybody in the organization can provide feedback on the processes, either reporting it

to the process representatives: *"We get indirect feedback via the process representatives."* (A2:115) or by using the process library: *"There is a feedback button for each process. And they can give feedback, change requests."* (A2:095). In this way, an organized feedback system for the users of the processes was established in order to interact about the process landscape. The PR has the responsibility for handling the feedback requests and as a main user of the process itself; he also actively produces feedback (reinforcement).

Resulting out of the organization-wide interaction with it, the process library is the central technology in the standard mediation process at A-Suppliers. Design and maintenance receives a high attention, especially from the PG. Reflecting the size of the organization and the amount of standards which need to be served, the PG decided to dedicate a single full time position to the editorial maintenance of the PL:

It is absolutely necessary, it won't be interaction with it, the process library is the central technology in the standard media somebody who is doing the formal review of the content. If everybody writes what he wants, everybody has an own style of writing. And it has to be used, it has to be understood. (A9:141)

After all, this continuous development required support and motivation from the very top of the organization:

And PQ is the successor organization of the original PG. So it is also sustainable in the organization. But without [A3] as strong mentor on the higher management level, this wouldn't. If everybody writes what he had a second mentor in the board here in [A-Suppliers], which is [the CMMI board member]. He was also convinced that it will help. So also [A3] had a backup on [the executive management level]. (A8:041)

With the backup of the higher management, the implementation of a PG at A-Suppliers became a broad change management success.

A further significant proportion of it can be ascribed to the slow implementation of CMMI and the whole process landscape at A-Suppliers:

And it depends on how you communicate it and how you work with the people. If you just send an email: 'Here is the process library, you have to use it, communicate it and how you work with the people. If you just send an email: 'Here is the process s. A further significant proportion of it can be as the best way to describe it. (A7:339)

It can also be related to another important function in the process landscape:

In the PL we have several different search functions. And they are quite eye-catching if you open the process library. You have searched this and search that. But, the people overlook it often. You have to be quite active, speaking with all the groups: 'Hello, if you are looking for this database element or this document you can use this or that search function. (A9:201)

As seen highlighted before, represented by the role of the process representatives and by the established feedback procedures, the participative and integrated approach is a crucial factor in the standardization process at A-Suppliers. Finally, citing the summary of interviewee A2, the head of the quality management department and also a sub-unit leader in the PG:

Because we want to have the experts for the products also writing proper processes for them. And we, we supply the model competence let me say. We do some coaching for the process representatives, to bring in the model competence for ISO 26262 and so on. So this is the corporation model and I think, if you want, you can call it decentralized process organization. This is distributed responsibility. So it is a little bit more difficult to control the whole organization because, after all, some kind of matrix organization. But I think it gives better results regarding processes. (A2:115)

The process group is now a fully established actor in the organization of A-Suppliers. As such, they have concrete tasks, roles dedicated to these tasks and well-defined processes for their actions. Further, they recently showed signs of confidence toward their own role and its importance to the company. They reported on a study about “process modeling for the process library of the future” (A9:209). This way they emphasize their pro-active role in the company towards processes:

[...] we as process group, we feel ourselves appointed to look ahead. We donards processes: to the compth the new product generation we are also looking at process development and how we can achieve it in the future. (A9:213)

As the interviewee mentions, the A-Supplierse mentionswe feel ourselves appointed to look ahead. We donards processes: to the compganization can be enhanced. In connection to it, they are likewise engaged directly or indirectly in the creation and maintenance of the standards they use on the side of the standard setting bodies. They not only translate to and use the different standards while creating and maintaining their process library; they also give feedback and help with designing the standards they use as members of the standardization bodies. May it be the ISO standards, A-Spice or CMMI, for each an own standardization and/or certification body is promoting and supervising the standard implementation. The process group of A-Suppliers participates in these activities:

[...] we are sitting in the standard committees of A-Spice and ISO 26262. We also have people working directly with the SEI. We have these people. These are central positions at A-Suppliers. And we do communicate directly with them. So, when someone sits in the committee of A-Spice and they discuss the next version [...] no matter which subject, then it always ends up on my desk. Then, I do check whether I have comments from my point of view. Does it fit or not for my requirements. And then, I give

feedback to our [A-Spice] committee member and this person is forwarding the information. So, indirectly we are always involved in these circles. (A9:249)

To sum up, after approximately seven years, A-Suppliers completed the journey of setting up a process group or, as one might also name it, an entire standardization department: the first debates around CMMI had been started in 1999. Later, in 2002, a pilot project was set up. Finally, in 2006 when the process group came into being it served the needs not only for dealing with CMMI in an appropriate manner but for all applied standards in the company.

5. DISCUSSION

Our findings show that the powerful mechanism of metastructuring originally described in technology research exists for software development and process standards in the same way. A-Suppliers is an example for the contextualization of standards in use and provides insights in dealing with multiple and plural standard requirements in organizations. We term this specific type of metastructuring *standard-use mediation* since it structures users of standards xtualization of standards in use and provides insights iny changing their institutional context of use and by modifying the [standard] itself” (Orlikowski et al., 1995, p. 425). We verified that standard-use mediation is an explicit, to a large degree conscious and ongoing set of activities and a powerful mechanism in dynamic environments of software development organizations. However, the process, areas and activity types of metastructuring are deployed differently in the field of standards and standardization.

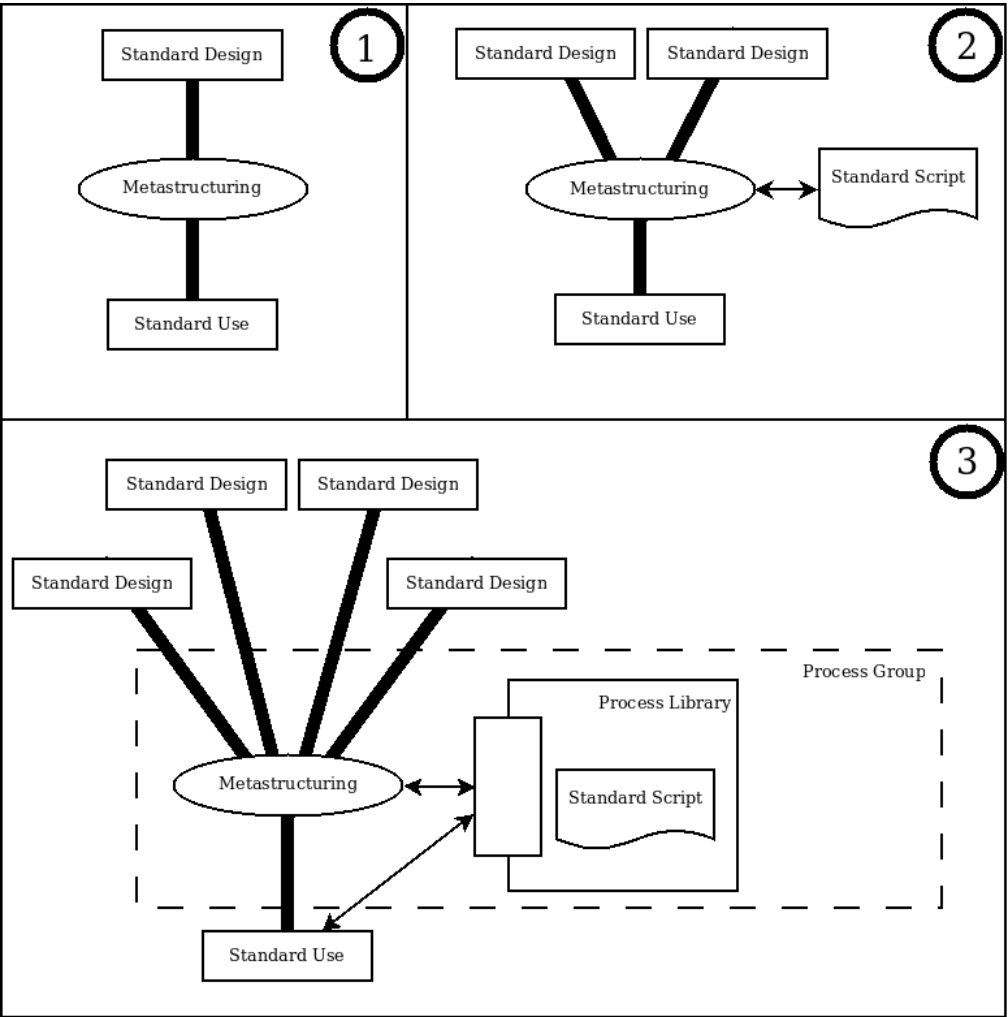
5.1. Process of Metastructuring

As depicted in Figure 2 the case organization A-Suppliers developed step-by-step an entire department as standard-use mediators and as reaction to the increasing amount of process standards they are confronted with (as mentioned in the interviews: CMMI, A-SPICE,

ISO26262 and ISO16949). Since 2000 A-Suppliers has been dealing with an increased complexity regarding its internal standard landscape due to the advent of standards like CMMI or A-Spice. In reaction to this, first, they gather initial experiences within a pilot project to learn about CMMI implementation requirements (cf. Figure 2 - step 1). Then, the number of standards required increased and the software-related standard script is developed to integrate different standard requirements (cf. Figure 2 - step 2).

After this step, the appearance of metastructuring results in a new department, the process group (cf. Figure 2 - step 3), which then handles requirements of process standards organization-wide. It means, the project group requirements of process standards organization-wide. It means the process group (cf. script is developed to integrate different standard requirements (cf. s they are confronted with re maintenance and enhancement. Within this department, the relevant positions executing these tasks are the process coaches (PC). They are supported by

Figure 2. Process of metastructuring at A-Suppliers



the process representatives (PR). In the end, a new department and its roles as well as a new artifact, the standard script, emerges.

5.2. Areas of Metastructuring

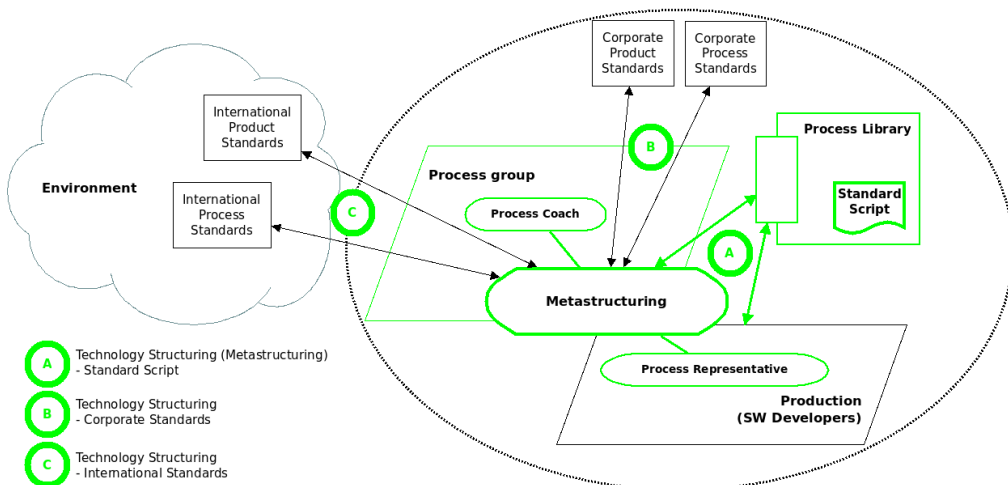
Based on our findings at this stage it is possible to distinguish now different, intertwined areas of metastructuring. At A-Suppliers there are three areas of metastructuring identifiable: (A) managing the standard script/process library, (B) handling internal/corporate standards and (C) coping with external/international standards (Figure 3). It can be considered as a standard-metastructuring with multiple standards as input. Figure 3 illustrates which *areas* of metastructuring A-Suppliers is concerned with at the time of interviews and which actors as well as which products are affected by it.

To start with C, the PG takes external standards, interpret and apply them as input for the design of the corporate standard script embodied in the process library (cf. Figure 3 C). This is mainly the task of the PCs. Little involvement of the process representatives is needed. Feedback for the creators of standards (e.g. standardization bodies) is sometime provided. For most of the applied standards, A-Suppliers is represented at least with one person in the standardization body

which is designing the standard. This could also be verified through the authors by researching the internet regarding the relevant committees. CMMI is obviously the only exception here. Influence on the design process is reduced to feedback via CMMI change requests (Software Engineering Institute, 2012). The U.S. army and a few American companies dominate the design mode of this standard.

As a second metastructuring area the process group has to take into consideration corporate standards (cf. Figure 3 B). It could be quality directives towards process, products or even corporate identity. It was mentioned that the corporate standards of course change the design of the standard script but the process itself was not described explicitly. Regardless, A-Suppliers has full control over design and usage of their own corporate standards. Taking into account the interviewees' descriptions of the approach towards standardization and process as an integrated and participative one, we can assume that this part of the metastructuring is a full and open structuring process. Again, this task is rather accomplished by the PCs of the process group, although the nature of an internal standard allows a broader participation of the process representatives in the structuring of these standards.

Figure 3. Areas of metastructuring at A-Suppliers



Finally, as a third metastructuring area the standard script is designed by the PG in close collaboration with the process representatives of the operational departments. In (software development) organizations, standard scripts are internally often called 'standard bible', 'process management policy' or 'process library' which contain an aggregated version of several different standards – often overlapping, sometimes conflicting. With the standard script we emphasize that standards have to be encoded in the organizational practices in order to be effective. Following Barley and Tolbert (1997) and Gioia and Poole (1984) on scripts we can describe standard scripts as *as with the process representatives of the operational departments*. In (software development) knowledge and practices (see also Fried et al., 2013). At this stage, at A-Suppliers tasks are separated: the process representatives are responsible for defining the processes in the standard script, for the training on these processes and also for the feedback and improvement of the process. While the PC is defining the broader process framework for the whole organization and further consults the process representatives in their tasks. The standard script is then used by the software engineers (cf. Figure 3 A). Different feedback loops either by using the process tool or via the process representatives were reported. Thus, the creation and use of a standard script embodied into the process library can be regarded as vital structuring process. The process library or the so-called 'standard bible' is the result of a translation process of several external and internal standards into a single internal one (cf. Figure 3 B and C as input for A).

5.3. Types of Metastructuring Activities

At A-Suppliers metastructuring is accomplished against the software engineers by an organizational entity, the PG, in order to cope with the multiplicity and plurality of standards. Nevertheless, the process of metastructuring itself is not fully separated from the software engineers. As mentioned in the interviews, A-

Suppliers set up an integrated and participative environment where structuring in respect of the different standards is executed by different roles, both, in the PG, as well as in the software development department. Whereas a process coach (PC) is working in the process group, the process representative (PR) is based directly in the operational department, acting as standard-use mediators.

In Table 2 we summarize the different mediation activities related to two PG roles - the *process representative* and *process coach* process coach representative different mediation metastructuring activities: *establishment*, *reinforcement*, *adjustment* and *episodic change* (Orlikowski et al., 1995). It is important to note that they still leave a significant part of the responsibility over standard structuring to the operational departments themselves. Furthermore, the *library editor* can be seen as a proof for this approach: the recently installed role fulfills the tasks of what can be called a process library mediator. This position is designed to streamline the process descriptions of the different authors. Literally everybody at A-Suppliers can participate in describing, maintaining or at least in giving feedback on the processes. Hence, the process library is considered as a mass media within A-Suppliers which needs to be read and understood by every employee. The process library editor can be regarded as a consequence of the integrative approach towards processes. Everybody participates but the uncontrolled growth needs to be harmonized professionally afterwards. Generally, this new role is another example for the step-by-step development of an entire mediator department and, by that, it as well reflects the complexity of the standard environment of A-Suppliers.

Looking back at the process, areas and activity types, metastructuring of the standard script is considered as a very complex task for which standard mediators as experts have to be appointed and trained. The process group, the process representatives of the software development and other production units act as standard mediators. For that, we agree with Brunsson (2000a) and Tamm Hallstr (2000)

Table 2. Mediators process coach (PC) and process representative (PR) and their metastructuring activities at A-Suppliers

Metastructuring activity	Process Coach (PC)	Process Representative (PR)
Establishment	<ul style="list-style-type: none"> — set up standard pilot project (e.g. CMMI) — defining their own role as PC — setting process infrastructure — interpretation of each standard — creation of the standard script — creation of the process library 	<ul style="list-style-type: none"> — creation of the standard script — defining the operational processes
Reinforcement	<ul style="list-style-type: none"> — lean and user- friendly process descriptions (partly passed on to the PL editor) — maintenance of the standard script — maintenance of the process library — training for standard-related tasks 	<ul style="list-style-type: none"> — maintenance of the standard script — collect, produce and treat — user feedback — training on own 'represented' process
Adjustment	<ul style="list-style-type: none"> — changing the interpretation of each standard 	<ul style="list-style-type: none"> — changing the operational processes
	<ul style="list-style-type: none"> — smaller changes of the process library 	
Episodic Change	<ul style="list-style-type: none"> — expanding responsibilities (more standards & sub-units to serve) — significant changes to the process library 	

that “many of the actors in the area of quality are so-called intermediaries; they pass the standard on to users” (Tamm Hallstr t, 2000, p. 91). However, some of these intermediaries are also users at A-Suppliers: the process representatives. The standard mediators now solve tasks, which were formerly in the hands of each software engineer: assessment of new or changed standards, interpretation of standards, definition of processes, training on processes, preparation and execution of standard appraisals or feedback for each standard. The role of the standard mediator is comparable to the role of the technology mediator since they serve as (1)

an organizational mechanism (2) to facilitate the adaptation of technologies/the interpretation of standards (3) and the organizational context (4) ongoing and to changing conditions (Orlikowski, 1992).

For dealing with standards in organizations we found comparable phenomena describable as metastructuring. Standard-use mediation is an actual and important influence of structuring activities of standards. In this specific case, the process of metastructuring occurred with conscious planning. By that, mediators hat, mediators ctupcedures, guidelines, templates, access mechanisms, applications, and physical

configurations which alter the technology itself” (Orlikowski et al., 1995, p. 437). Compared with our findings on standards, we see a similar approach at A-Suppliers.

When Orlikowski et al. (1995) first presented their theory on metastructuring they made general propositions about the specific characteristics of mediators towards the mediation process. Therefore, she called for further research on characteristics and differentiations of mediators. With our study, we show first evidence regarding the differentiation of specific metastructuring roles. In our case, over time the case company developed an organizational distinction between a rather user-centered role, the process representatives (PR), and a standard or technology driven role, the process consultant (PC). In our opinion, the differentiation of roles depends on the scope and complexity of the mediation task. In the beginning, A-Suppliers did not differentiate between PR and PC, whereas while more and more standards came into play complexity was increasing and they established a differentiation of tasks and roles (PR and PC). While we showed evidence for the standard scenario, we imagine that this distinction happens adequately in the case of new and complex technology, e.g. the implementation of a full-fledged enterprise resource planning software.

Moreover, the user-centered role of the process representative (PR) needs further explanations. As stated by Fleck (1994), the configuration of technology is highly important for a successful implementation and use of the technology and thus demands substantial inclusion of the user. Process standards can be considered as configured by nature since processes and their contexts are very much organization-specific and demand a sensible handling in situations of organizational change. This leads to the conclusion that user-centered metastructuring in the process standard context is of high importance and a necessity for software developing organizations.

As Brunsson (2000a), Tamm Hallstr, (2000) as well as Timmermans and Epstein (2010) already concluded on the relation between designer and user of a standard, there is

a sharp distinction between both: “Standards are presumed to be in the public interest, but the public to whom standards apply is usually not directly represented in standard creation” (Timmermans and Epstein, 2010, p. 77). Nevertheless, as shown in the case of A-Suppliers, this differentiation has to be considered as relative. We portrayed a situation where neither absolute distinction nor direct involvement of the users in standard creation is the case: “The trick in standardization appears to be to find a balance between flexibility and rigidity and to trust users with the right amount of agency to keep a standard sufficiently uniform for the task at hand” (Timmermans and Epstein, 2010, p. 81). In our opinion, one should not draw the line between both. The participation of A-Suppliers in the standard setting bodies and the feedback options within the company show evidence for a more specified view. It raises the question of how much “distance in time and space” (Brunsson, 2000a, p. 27) we actually speak when it comes to design and use of a standard, especially when dealing with procedural standards (Timmermans and Epstein, 2010, p. 72).

In the area of technology, structuring an analog time-space disjuncture can be found. In this respect Orlikowski (1992, p. 407) speaks about the interpretive flexibility of technology. This flexibility refers to the engagement of users of a technology in its constitution. With an increasing distance in time and space, “the likelihood that the technology will be interpreted and used with little flexibility [...]” (Orlikowski, 1992, p. 421) also increases. This phenomenon occurs for technology and as well for standards. External standards are not developed in-house. Either the organization is separated entirely from the design of the standard or, as in the case of the portrayed organization and its standards; the organization participates in the design process next to other companies, researchers or governmental/supra-governmental organizations. The influences of feedback for a technology metastructuring are diminished for the area of standard metastructuring as shown earlier.

While looking at the standard mediators of the case organization and their institution-

alization in roles and organizational sub-units, researchers of technology-use can also draw conclusions from the alignment research stream, where “the question of stability and change in role relationships” is investigated and therefore “the use of a technology might alter or confirm an existing social order” (Leonardi and Barley, 2010, p. 25). The alignment to the new standards in our case company led to the creation of new roles and a completely new department. As we found out, standard-mediators stand for the transition from enactment to alignment. In the beginning, they were simple but already experienced users and therefore enacted an implicit structuring process. The transition from implicit to explicit structuring was accomplished when these users were selected to exercise the new role as standard-mediators. This argumentation is supported by the findings of Yates et al. (1999) on implicit and explicit structuring of mediators of an electronic communication media.

Another similarity can be found by comparing different *process steps*: from implicit structuring, to a pilot project and ultimately to a process group. Orlikowski (1996) and Leonardi (2007) described these steps as “a phased sequence of emergent and cumulative changes” (Leonardi and Barley, 2010, p. 28). It is fully supported by our findings.

The *process library editor* is among others a new role that could be identified in the A-Suppliers case. This position is designed to streamline the process descriptions of the different authors for the “standard bible”. Literally everybody at A-Suppliers can participate in describing, maintaining or at least in giving feedback on the library. Hence, the process library is considered as a mass media within A-Suppliers which needs to be read and understood by every employee. The process library editor can be regarded as a consequence of the integrative approach towards processes. Everybody participates but the uncontrolled growth needs to be harmonized professionally afterwards. Generally, this new role is another example for the step-by-step development of an entire mediator department and, by that, it as well reflects the complexity of the standard environment of A-Suppliers.

One of the few examples where metastructuring was described in relation to standard-usage is provided by Adler (2005). He briefly mentions the introduction of institutionalized mediators as a reaction towards conformance pressure arising from the introduction of CMMI: “organizations under conformance pressure sought to buffer their core by creating specialized staff roles”. The standard-use mediators in the study of Adler (2005, p. 417) are called ‘shepherds’ and helped the users to prepare for external process audits and, generally, to structure the use of the CMMI standard.

With our research on the micro level of standardization, we start to answer to the fact that “studies of standardization have neglected the crucial role of technical experts on the receiving end of standards” (Sandholtz, 2012, p. 670). The author of the mentioned study described two different cases of decoupling (malignant and benign) while implementing ISO 9000 standard. Both have a lot in common with our study, either the first or the second case or even both respectively for a certain feature. For instance, we have customer pressure as trigger for standardization (second case). In addition, we have political reasons (first case), the question of quality at A-Suppliers. Nevertheless, we could not detect signs of decoupling the daily work from the standard script (Fried et al., 2013). This could be interpreted as an answer to the claim for research of Sandholtz (2012, p. 676) by examining “a group of internal experts to standardize their own work processes in a manner consistent with external certification demands”. We have the internal experts: the process representatives working day-to-day in the operational engineering department. Moreover, we have the experts of the process group, the process coaches, trying to realize comparably high standardization conformity with even multiple standards as inputs.

However, whether a standard is experienced as coercive or enabling depends on various contextual factors like, for instance, support-giving or support-providing norms, the self-conception of mediators, and the concrete interpretation of a standard or, as shown in another study, the appropriation of standards

(Gey, 2011). The same line of thought can be applied to the experience of the complete standard landscape within an organization or experiences with the standard script as the organization-wide process reference and as main outcome of the standard-mediation. At A-Suppliers the support from the higher management, as well as from the board of advisers, was necessary to succeed in forming a completely new department and, by that, transferring functions. They continuously emphasized the importance of this development to them and provided adequate project budgets. We also found first evidence for a supportive and proactive self-conception of the mediators. They try to shape the process landscape in a sustainable and future-oriented manner. They consequently avoid the so-called 'level hunting' practices where standardization appears as organizational myth, mainly for certification purposes and customer attraction.

6. CONCLUSION

In this article we examined how software development organizations deal with the multiplicity and plurality of standards. We used a social constructivist viewpoint of technology-use in organizations and focused on the use-mode of standards (Orlikowski, 1992). We found that metastructuring is an important mechanism for organizations to handle complexity arising from the use of multiple process standards. Relating to Orlikowski et al. (1995) on technologies, we called it *standard-use mediation* since it has a considerable influence on how users perceive, interpret and apply these standards. We used the concept of technology structuring and applied it to standards as the artifacts to structure. The results show that the structuring of standards has a lot in common with the structuring of technologies, even though they are no technologies itself. Further, because of the increased number of standards to handle, the organization developed a process library. This software solution consists of all standards embodied in the standard script as well as options to access information, to define processes and to give feedback on processes.

We understand this exploratory study as a starting point for a more systematic examination on standard-use mediation and the process of metastructuring. We tried to adopt the metastructuring concept from the technology world for the world of standards. Therefore, it was necessary to discuss the differences between standard and technology as well as the resulting differences for the metastructuring concept. We further enhanced the metastructuring concept by a proposition towards different types of metastructuring activities. We assume that the more complex the standard landscape an organization is confronted with, the more likely is the differentiation in several mediator roles.

The scope of this study is limited and calls for further research. For instance, more in-depth research is needed regarding the specific activities of standard-use mediation. We suggest further investigation of different types of metastructuring and their coercive and enabling character. This might involve ambiguities of the different standards while asking how these ambiguities are resolved during the metastructuring process. Empirical studies could also show to what extent standard-use mediation varies with the type of standard and individuals involved.

As mentioned earlier, the question how much "distance in time and space" (Brunsson, 2000a, p. 27) should be taken into consideration when it comes to design and use of a standard could be of interest. Prospective studies could here explore the mentioned distance in time, space and other categories, e.g. social distance. Researchers in the area of standardization should always keep in mind that "differences between presentation and practice, between formal structures and actual operations, and between what people say and what they do" (Brunsson and Jacobsson, 2000b, p. 130) can be encountered.

In summary, a well-managed process of standard-use mediation represents a relevant factor for organizations introducing and using new process standards as response to changing market requirements or to an increased focus on process quality and process maturity of organizations. However, the process does not

automatically result in a successful outcome which calls for a comprehensive and careful implementation and continuous adaption to a changing environment.

REFERENCES

- Adler, P. (2005). The evolving object of software development. *Organization*, 12(3), 401–435. doi:10.1177/1350508405051277
- Bansler, J., & Havn, E. (2004). Technology-use mediation. Making sense of electronic communication in an organizational context. *Scandinavian Journal of Information Systems*, 16, 57–84.
- Barley, S. (1986). Technology as an occasion for structuring: Evidence from observations of ct scanners and the social order of radiology departments. *Administrative Science Quarterly*, 31(1), 78–108. doi:10.2307/2392767 PMID:10281188
- Barley, S., & Tolbert, P. (1997). Institutionalization and structuration: Studying the links between action and institution. *Organization Studies*, 18(1), 93–117. doi:10.1177/017084069701800106
- Boiral, O. (2003). ISO 9000: Outside the iron cage. *Organization Science*, 14(6), 720–737. doi:10.1287/orsc.14.6.720.24873
- Brunsson, N. (2000a). Organizations, Markets, and Standardization. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (pp. 21–40). Oxford: Oxford University Press.
- Brunsson, N. (2000b). Standardization and uniformity. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (pp. 138–151). Oxford: Oxford University Press.
- Brunsson, N., & Jacobsson, B. (2000a). The contemporary expansion of standardization. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (pp. 1–19). Oxford: Oxford University Press.
- Brunsson, N., & Jacobsson, B. (2000b). Following standards. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (pp. 127–138). Oxford: Oxford University Press.
- Brunsson, N., & Jacobsson, B. (2000c). *A World of Standards*. Oxford: Oxford University Press.
- Brunsson, N., Rasche, A., & Seidl, D. (2012). The dynamics of standardization: Three perspectives on standards in organization studies. *Organization Studies*, 33(5-6), 613–632. doi:10.1177/0170840612450120
- Clear, T., & MacDonell, S. G. (2011). Understanding technology use in global virtual teams: Research methodologies and methods. *Information and Software Technology*, 53(9), 994–1011. doi:10.1016/j.infsof.2011.01.011
- DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science*, 5(2), 121–147. doi:10.1287/orsc.5.2.121
- Egyedi, T. M. (2008). An implementation perspective on sources of incompatibility and standards' dynamics. In T. M. Egyedi & K. Blind (Eds.), *The Dynamics of Standards* (pp. 28–43). Cheltenham, UK: Edward Elgar.
- Fleck, J. (1994). Learning by trying: The implementation of configurational technology. *Research Policy*, 23(6), 637–652. doi:10.1016/0048-7333(94)90014-0
- Fried, A. (2010). Performance measurement systems and their relation to strategic learning: A case study in a software-developing organization. *Critical Perspectives on Accounting*, 21(2), 118–133. doi:10.1016/j.cpa.2009.08.007
- Fried, A., Gey, R., Pretorius, A., & Günther, L. (2013). Decoupling from standards - process management and technical innovation in software development organisations. *International Journal of Innovation Management*, 17(4), 1350012. doi:10.1142/S1363919613500126
- Furusten, S. (2000). The knowledge base of standards. In *A world of standards*. Oxford: Oxford University Press.
- Gey, R. (2011). Appropriation of Software Process Improvement Standards: An Empirical Study in Software Development Organizations. in *Proceedings of the 8th International Conference on Intellectual Capital, Knowledge Management & Organisational Learning*, 182–189.
- Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Cambridge: Polity Press.
- Gioia, D., & Poole, P. (1984). Scripts in organizational behavior. *Academy of Management Review*, 9, 449–459.
- Henriksen, D., Nicolajsen, H., & Pors, J. (2002). Towards variation or uniformity? Comparing technology-use mediations of web-based groupware. in *Proceedings of the European Conference on Information Systems*, 1174–1184.

- Humphrey, W. (1992). Introduction to software process improvement. Technical report, Software Engineering Institute, Carnegie-Mellon University, Pittsburgh.
- Jakobs, K. (2006). Shaping user-side innovation through standardisation: The example of ICT. *Technological Forecasting and Social Change*, 73(1), 27–40. doi:10.1016/j.techfore.2005.06.007
- Janneck, M., & Finck, M. (2006). Appropriation and mediation of technology use in stable self-organised online communities. in *Web Based Communities, Proceedings of IADIS International Conference*, San Sebastian (Spain), 149–156.
- Kohlbacher, F. (2006). The use of qualitative content analysis in case study research. *Forum Qualitative Sozial Forschung*, 7, 23.
- Krippendorff, K. (2004). *Content analysis: An introduction to its methodology*. Thousand Oaks, CA: Sage Publications.
- Lawrence, T., & Phillips, N. (1998). Commentary: Separating play and critique. *Journal of Management Inquiry*, 7(2), 154–160. doi:10.1177/105649269872010
- Leonardi, P. (2007). Activating the informational capabilities of information technology for organizational change. *Organization Science*, 18(5), 813–831. doi:10.1287/orsc.1070.0284
- Leonardi, P., & Barley, S. (2010). What's under construction here? social action, materiality, and power in constructivist studies of technology and organizing. *The Academy of Management Annals*, 4(1), 1–51. doi:10.1080/19416521003654160
- Marimon, F., Heras, I., & Casadesús, M. (2009). ISO 9000 and ISO 14000 standards: A projection model for the decline phase. *Total Quality Management*, 20(1), 1–21. doi:10.1080/14783360802614257
- Muhr, T. (1991). Atlas/ti - a prototype for the support of text interpretation. *Qualitative Sociology*, 14(4), 349–371. doi:10.1007/BF00989645
- Niazi, M., Wilson, D., & Zowghi, D. (2005). A maturity model for the implementation of software process improvement: An empirical study. *Journal of Systems and Software*, 74(2), 155–172. doi:10.1016/j.jss.2003.10.017
- Okamura, K., Orlikowski, W., Fujimoto, M., & Yates, J. (1994). Helping CSCW applications succeed: the role of mediators in the context of use. in *Proceedings of the 1994 ACM conference on computer supported cooperative work*, ACM, 55–65. doi:10.1145/192844.192871
- Orlikowski, W. (1996). Improvising organizational transformation over time: A situated change perspective. *Information Systems Research*, 7(1), 63–92. doi:10.1287/isre.7.1.63
- Orlikowski, W., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping electronic communication: The metastructuring of technology in the context of use. *Organization Science*, 6(4), 423–444. doi:10.1287/orsc.6.4.423
- Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, 3(3), 398–427. doi:10.1287/orsc.3.3.398
- Ortmann, G. (2010). On drifting rules and standards. *Scandinavian Journal of Management*, 26(2), 204–214. doi:10.1016/j.scaman.2010.02.004
- Power, M. (1997). *The audit society: rituals of verification*. Oxford, UK: Oxford University Press.
- Rodon, J., Sese, F., & Christiaanse, E. (2011). Exploring users' appropriation and post-implementation managerial intervention in the context of industry IOIS. *Information Systems Journal*, 21(3), 223–248. doi:10.1111/j.1365-2575.2009.00339.x
- Sandholtz, K. W. (2012). Making standards stick: A theory of coupled vs. decoupled compliance. *Organization Studies*, 33(5-6), 655–679. doi:10.1177/0170840612443623
- Seidl, D. (2007). Standard setting and following in corporate governance: An observation-theoretical study of the effectiveness of governance codes. *Organization*, 14(5), 705–727. doi:10.1177/1350508407080316
- Software Engineering Institute (SEI). (2012). Change Requests. URL <http://www.sei.cmu.edu/cmml/solutions/crs/index.cfm> (visited: 2012-05-22 at 2pm).
- Tamm Hallström, K. (2000). Organizing the process of standardization. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (pp. 85–100). Oxford: Oxford University Press.
- Tamm Hallström, K. (2004). *Organizing international standardization. ISO and the IASC in quest of authority*. Cheltenham, UK: Edward Elgar.
- Timmermans, S., & Epstein, S. (2010). A World of Standards but not a Standard World: Toward a Sociology of Standards and Standardization. *Annual Review of Sociology*, 36(1), 69–89. doi:10.1146/annurev.soc.012809.102629

Weick, K. (1990). Technology as equivoque: sense-making in new technologies. In P. S. Goodman & L. S. Sproull (Eds.), *Technology and organizations. The Jossey-Bass management series* (pp. 1–44). San Francisco: Jossey-Bass.

Weick, K. E. (1976). Educational organizations as loosely coupled systems. *Administrative Science Quarterly*, 21(1), 1–19. doi:10.2307/2391875

Wieland, J. (2005). Corporate governance, values management and standards: A European perspective. *Business & Society*, 44(1), 74–93. doi:10.1177/0007650305274852

Yates, J., Orlikowski, W., & Okamura, K. (1999). Explicit and implicit structuring of genres in electronic communication: Reinforcement and change of social interaction. *Organization Science*, 10(1), 83–103. doi:10.1287/orsc.10.1.83

Yin, R. K. (2003). *Case Study Research* (3rd ed.). Thousand Oaks: Sage Publications.

Zeng, S., Shi, J., & Lou, G. (2007). A synergetic model for implementing an integrated management system: An empirical study in china. *Journal of Cleaner Production*, 15(18), 1760–1767. doi:10.1016/j.jclepro.2006.03.007

ENDNOTES

- ¹ For a collection of reference models for process improvement see Humphrey, 1992