Submission to the International Journal of Innovation Management (IJIM)

Ref.: Ms. No. WSPC-IJIM-D-11-00038

14 September 2011 (submission)
03 August 2012 (revision)


Andrea Fried¹, Ronny Gey¹, Agnieta Pretorius², and Lars Günther¹

¹Chemnitz University of Technology, Germany
²Tshwane University of Technology, South Africa

Corresponding Author:

PD Dr. habil. Andrea Fried, Chemnitz University of Technology, Faculty of Economics and Business Administration, Department Innovation Research and Sustainable Resource Management, D-09107 Chemnitz, Germany, phone: +49 371 531 35381, fax: +49 371 531 835381, e-mail: fried@wirtschaft.tu-chemnitz.de

Abstract:

The article explores process management standards in software development organizations. It centers on the question how organizations manage the compliance with process standards as well as the need for ongoing technical innovation at the same time. It refers to former studies where it was concluded that process management standards tend to crowd out technical innovations in organizations. By reconsidering the coupling approach of Orton and Weick (1990) we show based on four case studies that it does not apply to those organizations which allow innovating activities being loosely coupled or decoupled from the reigning standard script. These organizations sustain their chances for incremental and fundamental technical innovations. Dealing with loosely coupled or decoupled innovating activities implies a dialectical standard management. It means that potentially contradictory and conflict-ridden activities like standardized practices and innovating activities are manageable by specific institutional, temporarily limited and formal/informal solutions. Furthermore, we scrutinize in this paper the decoupling discussion of some parts of the standard management literature. Standard decoupling is often seen as an unfortunate, but necessary solution to cope with external pressure for internal standardization. In contrast to this, we develop an understanding where standard decoupling is not defined as a set of activities without affecting the ‘technical core’ of an organization. Rather, decoupling is seen as a temporary and locally limited situation of an innovating subsystem within an organization where it is allowed to detach from reigning standardized practices and to test and develop innovative ideas under less formalized conditions.

Keywords:

# Table of Contents

1. Introduction
2. Theoretical Approach
   2.1 Defining Standards
   2.2 Defining Technical Innovation in Software Development
   2.3 Process Standards, Technical Innovation and the Loose Coupling Concept
3. Research Design
   3.1 Case Selection
   3.2 Data Inquiry
   3.3 Content Analysis
4. Case Analysis
   4.1 Case A-Suppliers and its Diesel/Gasoline Platform
   4.2 Case B-Aviators and its New Aircraft’s Demonstrator
   4.3 Case C-Retailers and its ‘Try out’ Projects
   4.4 Case D-Bankers and its Credit Card Processing Platform
   4.5 Cross-case Analysis
5. Discussion
6. Conclusions
Acknowledgement
References
Notes
1 Introduction

This paper is going to find an answer to the question how companies can manage the compliance with process standards as well as the need for ongoing technical innovation. From our point of view the relation between innovation and standardization is potentially contradictory and conflict ridden. On this basis we are interested in exploring empirically how organizations assure standard compliance while staying innovative. Our results shall encourage organizations to scrutinize standard compliance from an innovative point of view and to develop organizational solutions to balance both exigencies – standard compliance and innovation.

From a theoretical point of view we will refer to the decoupling discussion (Bromley and Powell, 2012). In the classical open system view (Pfeffer and Salancik, 1978; Thompson, 1967) organizations often respond to external pressure by decoupling of formal policies from internal practices. The significance of the decoupling phenomenon will be investigated in terms of process management standards as a formal policy on the one hand and innovating practices on the other hand. In this way the theoretical discourse decoupling will be enhanced by a process perspective and a more unbiased understanding of coupling activities in organizations.

By definition, process management standards we are referring to in this article are written rules for the stabilization and regulation of organizational processes. In this context, software development organizations are of note in particular because, spearheaded by the ‘software crisis’ of the 1960s (Dijkstra, 1972), the software development sector is a dynamic sector when it comes to standardization and technical innovation. Furthermore, software engineering projects are often considered as difficult to manage. Brooks (1987) identifies four ‘inherent properties of this irreducible essence of modern software systems’ that distinguish software engineering projects from other (more tangible) engineering projects, namely complexity, conformity, changeability, and invisibility. These properties are often
answered by standardization of software development projects. Due to official auditing and certifications that prevail, standards put pressure on software development organizations. They serve as external credentials for customers of organizations. Moreover, standardizers like the Software Engineering Institute (SEI) of the Carnegie Mellon University, Pittsburgh, argue for the implementation of their standards from a perspective of attaining success in software development projects. For instance, with the CMMI (Capability Maturity Model Integration) standard they claim to have a comprehensive solution for quality challenges and innovations by providing a pre-defined catalogue of organizational instruments that can be attained, such as project management, risk management or failure management (see www.sei.cmu.edu).

In contrast, many authors argue that the principles employed in standards reflect the “rationale of reification and reproduction of work processes as well as underlying power relationships” (Boiral 2003, 722) which can lead to extensive bureaucracy that is inflexible and alienating (Anderson et al., 1999; Beattie and Sohal, 1999; Boiral, 2003; Seddon, 1997). Furusten (2000), for instance, subsumes standards under Frederick Taylor’s scientific management paradigm. This paradigm has been more than once disapproved as comprising bureaucratization and formalization of organizational processes, entailing the drawback of reducing entrepreneurial, innovative spirit (e.g. Adler, 2005; Adler and Borys, 1996; Osborne and Gaebler, 1993). This is supported by the empirical investigations of Benner and Tushman (2002) on how the ISO 9000s standard affects technical innovation that have been done. In their study they focus on patenting activities in the photography and paint industries. For a ten years period they found that fundamental technical innovations had a significantly lower level after an ISO 9000 certification of the organization. Independently from size, age and other characteristics of the organization it appeared that the ISO 9000 certification crowded out fundamental, variance-increasing innovations in favour of more incremental ones.
Beyond these findings, Benner and Tushman also argue that obviously some organizations adopt process management and can leverage existing capabilities towards innovation. However, they and other authors like Bisbe and Otley (2004) do not clarify in detail how organizations deal with standards and which practices notwithstanding enable or constrain technical innovations after process standard implementation. It is for this reason that we intend to explore empirically how organizations assure compliance of their development processes with specific standards at the same time they enable technical innovation.

The existing literature hardly offers answers how organizations deal with the external pressure that comes along with standard certifications. *Decoupling* is mentioned as one theoretically possible way to handle external pressure. If organizations decouple they “follow a standard while not doing so in practice” (Brunsson and Jacobsson, 2000b: 130) and detach standard activities from the organization’s internal technical core (Meyer and Rowan, 1977). This assumes that an organization has “dual systems which are de-coupled from each other” in order to fulfill external demands of standardization (Brunsson and Jacobsson, 2000b). According to the Two-domain-model (Thompson, 1967), the technical core is specified as this part of an organization where efficient productive activity is ensured and where uncertainty is eliminated. This technical core is sheltered by a domain of uncertainty resolving activities. In view of process standards this uncertainty resolving activities are described in the existing literature on process standards as relabeling or renaming existing practice in order to protect actual operations. By relabeling or renaming existing practice managers quite often engage in “language games” without “affecting activities at the technical core of the organization” (Zbaracki, 1998: 603f) or establish for this purpose specialized, de-coupled units for quality development (Brunsson and Jacobsson, 2000b: 129; see also Boiral, 2003; Reger et al., 1994).

However, the limitations of the dual system logic of decoupling cannot be dismissed. Firstly, we doubt that organizations usually emancipate from standards by ‘following a standard while not doing so in practice’ or by ‘standardizing beyond the technical
core’. Barley and Tolbert (1997) similarly argue that changes in formal structures without actually affecting interaction orders “has not been seriously addressed in either social theory or research. Our intuition is that the decoupling of formal structures and actions is apt to be rare and relatively short lived” (Barley and Tolbert, 1997: 112). In the same way Bromley and Powell argue that “given the ability to control, coordinate, and measure outputs in a technical system, instances of decoupling are likely to be short-lived. (…) Any decoupling is likely to be temporary and local” (Bromley and Powell, 2012: 34). Tilcsik (2010) describes even recoupling processes where the implementation of a policy was symbolic in the beginning but became fully implemented later on (see also Espeland, 1998). Secondly, decoupling tends to be interpreted as an unsatisfactory condition or even a failure for organizations. In contrast, early scholars (Meyer and Rowan, 1977; Weick, 1976) understand decoupling not as an organizational failure but rather as a way to “adopt multiple, even conflicting, policies in response to external pressures, without unduly disrupting daily operations by trying to implement inconsistent strategies” (Bromley and Powell, 2012: 7, see also Zajac and Westphal, 2004). Given these limitations it is worth to understand decoupling as a temporary phenomenon and, hence, to investigate decoupling processes as well as to revive an unbiased understanding of decoupling activities in organizations (Sandholtz, 2012).

Against this background the question remains how companies can manage the compliance with process standards as well as the need for ongoing technical innovation. Thus, we have gathered information on how organizations organize their innovative activities while having process standards in place. We report on four software development organizations: a retail software company, a car manufacturing supplier, an aeronautical engineering company, and a financial service provider. Taking the initial decoupling idea by Brunsson and Jacobsson (2000b) more seriously, we ground our empirical investigations on the loose coupling approach by Orton and Weick (1990) and explore different forms of coupling more precisely to answer the research question.
Our paper is structured as follows. The next section considers the theoretical basis of our paper. The paper proceeds in the following sections to describe the investigated organizations and outlines the research design deployed at the sites. Section 4 is used to present the comparative case analysis. The paper ends with a discussion section and concluding remarks.

2 Theoretical Approach

This section seeks to provide a theoretical framework for the exploration of our case organizations where we aim to describe how organizations emancipate themselves from standards and assure innovating activities institutionally. To begin with, it is necessary to present our understanding of standards and innovation before we deliver the framework.

2.1 Defining Standards

Standards are “codified interpretations of rules” that are given verbal expression (Giddens, 1984: 21). Rules relate on the one hand to the constitution of meaning, and on the other to the sanctioning of modes of social conduct” (Giddens, 1984). Process management standards we are concentrating on in this paper are standards that specify how organizations should ‘behave’; with it, standards are formulated rules about what a proper organizational behaviour is, in particular, “how organizational processes should be designed and controlled” (Brunsson and Jacobsson, 2000a: 4).

From our point of view, it is important to amplify the structural as well as behavioural aspects in research on process standards (following the duality of structure by Giddens, 1984). If standards are solely seen as structure – as a set of written rules - it neglects that people are able to and do redefine and modify in an emancipatory way the meaning, purpose and ways of standard usage. Standards do not exist without human activity; they are enacted by actions. Thus, “people can do more than simply
use or resist” standards; they “construct alternative meanings for the… [standard] and use it in unanticipated ways” (on technologies: Leonardi and Barely, 2010: 19).

Therefore, we adopt the theoretical concept ‘script’. Standard regulations are not enacted one by one within an organization. According to Barley and Tolbert (1997) and Gioia and Poole (1984) these ‘realized standards’ can be called standard scripts and entail that standards are and have to be encoded individually in the organization’s own stock of practical knowledge, practices, and formal rules.

2.2 Defining Technical Innovation in Software Development

In terms of software and its development it is not a straightforward matter to distinguish between different types of innovation. Conventionally, technological phenomena are classified as product innovation or process innovation. However, when it comes to software, the majority of innovations in software development could be either product or process (Simonetti, 1995). Moreover, “both procedure and process… are aspects of process in the conventional sense, meaning all aspects of process – e.g. tools, methods, production, work organization and management” (Quintas, 1994: 8f.). Therefore, Quintas (1994) suggests to focus on technical and non-technical innovations in software development. Non-technical issues encompass managerial and organizational aspects, for instance, organizational standards like the ISO 9000s or the CMMI standards; they describe and change the ‘who does what and when’ of managing and organizing development work. They provide the frame for technical innovations and can influence them in a positive or negative way. Technical innovations refer to the techniques, tools and methods that are used by the software developers and outline the ‘how’ aspects of the development process. Beside this, technical innovations also contain intermediate or final products. To sum up, in this paper, in using the term technical innovation we refer to product and process innovation likewise, as long as they do not bear on non-technical issues like organizing and managing software development work.
2.3 Process Standards, Technical Innovation and the Coupling Approach

The literature on process management standards refers sketchy to the coupling concept (e.g. Brunsson and Jacobsson, 2000b; Sandholtz, 2012). However, we think it is worth to revive this concept since it delivers insightful results and adapt as well as expand it to process standards in the context of technical innovations.

Our explanations start with the assumption that special institutional solutions are needed for technical innovations since “a standard procedure for attaining optimal outcomes cannot be a source of distinctive advantage” (Loasby, 1999: 1234). Thus, it is needed that organizations create space for creative and innovative activities of varying scope. Therefore, subsystems “for the construction of knowledge of distinct kinds” are necessary (ibid.: 1232). It means, innovating activities call for a break with established organizational practices and claim own rules.

However, in functioning organizations there is never an absolute break between established subsystems on the one hand and those for innovating activities on the other hand. New ideas may be different or incommensurable with, for instance, existing software solutions. However, there are certain expectations of the proponents of established organizational practices against those who engage in innovative activities: subsystem for innovating activities shall feed back their practices and innovative results to the established ones. It means there is a tendency to gain and to sustain control over innovative activities (Brusoni and Prencipe, 2001) – for instance by demanding compliance with the established process standards in the organization. The extent of control by pre-scribing rules differs from organization to organization.

For describing this challenge of autonomy and dependence among subsystems in organizations, Orton’s and Weick’s loose coupling approach can be applied (Orton and Weick, 1990). It is presented as a dialectical concept that attempts “to combine the contradictory concepts of connection and autonomy” (ibid.: 216). A certain degree of being loosely coupled allows organizations to be specialized in different
bodies of knowledge in order to “follow their idiosyncratic learning processes while retaining some degree of responsiveness” (Brusoni and Prencipe, 2001: 1028). The ‘counter-rational character’ of autonomy and dependence is described by two institutional variables: distinctiveness and responsiveness.

According to the loose coupling concept we state that different bodies of knowledge and idiosyncratic learning processes are expression of the distinctiveness which can potentially lead to technical innovations. Distinctiveness can be realized through any subsystem, for instance, activities, roles, sub-units, projects and non-autonomous organizations (Orton and Weick, 1990), and for varying periods of time. In this paper we refer to specific subsystems where technical innovation are expedited; it can be a R&D department, a newly set-up project or a short-term solution for working aside the realm of standardized software development. At the same time, organizational actors try to regulate these innovating activities by means of, for instance, formalized rules like process standards. Adjusted to our empirical context, the degree of regulation over institutional arrangements for innovating activities is depicted by responsiveness. Innovative practices are compelled, to varying degrees, to conform to the reigning standard script. Responsiveness thereby encompasses the extent to which the innovating activities are monitored by proponents of the reigning standardized practices. Orton and Weick (1990) describe this as ‘compensation’ of the innovative practises for being distinctive against the reigning standardized practices.

In the classification of the different coupling degrees tight coupling, loose coupling, de-coupling and non-coupling both criteria distinctiveness and responsiveness fall together. Over the course of time the following outcomes can materialize: according to Orton and Weick, “if there is neither responsiveness nor distinctiveness, the system is not really a system and it can be defined as a noncoupled system” (Orton and Weick, 1990: 205). An organizational arrangement for innovating activities is tightly coupled if there is responsiveness without distinctiveness; then – presumably so-called – innovative practices are fully aligned to the reigning standardized script and, at the time, hardly innovative in comparison to the reigning practices. If there is both
distinctiveness and responsiveness, the organizational arrangement for innovating activities is *loosely coupled*. Organizational arrangements for innovating activities are called *de-coupled*, if there is distinctiveness without responsiveness. To compare different situations of coupling it has to be taken into consideration that only relative and not absolute classifications are possible. On this basis, we are going to compare four organizations and their solutions for standardized and innovative practices.

Having defined distinctiveness and responsiveness as variables we are able to describe the relation between innovating activities and process standards in software development organizations. On this basis we explore now empirically (i) to what extent innovating activities are having detached subsystems in place and produce knowledge of distinct kinds as well as (ii) to what extent innovating activities are forced to refer back to established standard scripts or are free to develop their own.

Before we are going to start with the case analysis, we describe our research design in the next section.

### 3 Research Design

With this paper we are going to explore how companies can manage the compliance with process standards as well as the need for ongoing technical innovation. We expect that different companies solve this challenge in differing ways. Therefore, we decided for an exploratory multi-case study.

#### 3.1 Case Selection

The Capability Maturity Model Integration (CMMI) software process improvement standard seemed to be an appropriate empirical subject since it has proven to be a comprehensive and well-thought-out system for process improvement projects and accordingly diffuses worldwide in software developing industries (Wallmüller, 2007).
We started to contact software development organizations in Germany, Sweden and South Africa in February 2010 by asking them whether they develop software according to the CMMI regulations. In South Africa we had been in contact with the Joburg Centre of Software Engineering (JCSE) (www.jcse.org.za/cmmi). JCSE is the official South African partner of the Carnegie Mellon Software Engineering Institute (SEI) (www.sei.cmu.edu/cmmi) who launched the CMMI standard regulations originally. It turned out that only four companies had been successfully certified in South Africa whereas two of them agreed to a series of interviews around our research question. The interviews we conducted in Germany and Sweden were initiated by directly contacting software developing organizations. The SEI publishes continuously a list of CMMI certified organizations. We contacted them according to their regional accessibility; one Swedish and one German company finally agreed to empirical investigations. Anonymization was requested by at least one of the case organizations so that we decided to adapt the cases by withholding company names and sites.
In total, we realized 35 interviews (see Table 1). At this initial phase, we preferred to interview a wide spread of organizations in terms of branch/ product/ number of employees in software development: an automobile supplier (A-Supplier), an aeronautical engineering company (B-Aviators), a retail software company (C-Retailers), and a financial service institution (D-Bankers). For us, it was important to interview pure ‘software factories’ who are producing software as their final product (C-Retailers and D-Bankers) as well as hardware-driven software developers (A-Suppliers and B-Aviators) in order to assess potential differences in dealing with technical innovations.

Table 1: Characterization of research sites and interviewees.
As shown in , we asked the case organizations for interviews with strategic planners, managers responsible for implementation of process management standards, team leaders and software engineers of one working context, but in one instance we only got access to the management level (D-Bankers). The interviews took place between August 2010 and February 2011. Each interview lasted between 50 and 100 minutes.

3.2 Data Inquiry

We conducted our interviews in a narrative way in order to stimulate reports about a variety of expressions and experiences in terms of process standards by open, non-assessing questions. Our team consisted of five interviewers. For the narrative interviews we composed varying groups of two interviewers. It supported the open set up of the interviews since it avoided that the interviewers focus constantly on the same aspects. Moreover, the interviewers also collected additional information about the company sites by noting their observations about the context of the interviews and, where possible, by taking part in guided tours through the production halls or product demonstrations. This information was shared among the team members; it helped to understand the background of the software development.

The interviewees were preferably brought into the position where they could compare circumstances for technical innovations before standard implementation and after. We started with picturing the cases at a particular time by asking our interviewees for an ex-post description of their experiences in order to explore the innovativeness of their working context, the subsystems for innovating activities and about the freedom they had to choose process standards. According to Flick (2002) the narrative interviews were partitioned in five phases (see Table 2).
Table 2: Phases and contents of narrative interviews.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explanations for the interviewee about the context of the interview</td>
</tr>
<tr>
<td></td>
<td>Type of interview, anonymization, permission of recording.</td>
</tr>
<tr>
<td>2</td>
<td>General introduction for the interviewee</td>
</tr>
<tr>
<td></td>
<td>Reasons for interview, invitation for narration.</td>
</tr>
<tr>
<td>3</td>
<td>Narration by the interviewee</td>
</tr>
<tr>
<td></td>
<td>Narration by the interviewee about his/ her experiences in view of the</td>
</tr>
<tr>
<td></td>
<td>following topics: innovations in software development, the history,</td>
</tr>
<tr>
<td></td>
<td>implementation and usage of process management standards, the procedure of</td>
</tr>
<tr>
<td></td>
<td>certification audits and the individual and organizational experiences</td>
</tr>
<tr>
<td></td>
<td>with process management standards.</td>
</tr>
<tr>
<td>4</td>
<td>Requests by the interviewers</td>
</tr>
<tr>
<td></td>
<td>Concerning ambiguities, technical details, time-related misunderstandings.</td>
</tr>
<tr>
<td>5</td>
<td>Conclusion by the interviewee</td>
</tr>
<tr>
<td></td>
<td>Summary in terms of the overall topic (relation between standardization</td>
</tr>
<tr>
<td></td>
<td>and technical innovation).</td>
</tr>
</tbody>
</table>

3.3 Content Analysis

The procedure of a qualitative content analysis (Krippendorf, 2004) we chose enables researchers to include textual information and to systematically identify its properties, e.g. the frequencies of most used keywords. For each of the four cases we used this procedure in our empirical analysis for identifying the reigning standard script and for selecting a subsystem for innovating activities (e.g. R&D project). This subsystem was exemplarily chosen for the description of dealing with standards and innovations in that organization.

After conducting the interviews, the recorded files were transcribed by one team member, but were coded and pre-analysed with Atlas.ti (a software tool for analysing qualitative data by keywords) by all research team members. The pre-final analysis of each case is based on a code-name schema. We agreed on it in advance but during the analysis it was constantly under change. The final code-names are listed in the following figure.
To ensure inter-subjective verifiability (Martin, 2000) an in-depth research workshop of four days was carried out where the pre-findings were mutually presented and discussed among the research team members. In iterative steps we explored the criteria distinctiveness and responsiveness as a suitable concept to compare the cases and to elaborate the emancipation idea. The discussions were guided by the assumption that words and phrases mentioned most often in all communication, particularly in the interviews we conducted (Krippendorf, 2004), are those reflecting important concerns. On this basis the subsystem for innovating activities we wanted to concentrate on in the single case descriptions was chosen for each case. Moreover,
it turned out that most of our investigated software development organizations do not follow only one process standard like CMMI. Therefore, we listed which other standards were mentioned in the interviews as having an influence on the creation of the reigning standard script.

Finally, the qualitative comparison of distinctiveness and responsiveness was grounded on these discussions; we agreed on a qualitative 1-4 rating scale (very low (--), low (-), high (+), very high (++)) assessed at an ordinal level. The (--) end of the scale represents a very low distinctiveness/ responsiveness whereas the (+++) end shows a very high distinctiveness/ responsiveness.

In the next following section we present our analysis of the cases.

4 Case Analysis

Represented by the specific subsystem for innovating activities we will now describe the different types of coupling by distinctiveness and responsiveness between reigning standardized practices and innovating activities in our case organizations. On this basis we compare the four investigated organizations in order to describe construction of knowledge bodies of distinct kinds as well as the pretension they are facing to stay conformed to the reigning standard script.

4.1 Case A-Suppliers and its Diesel/ Gasoline Platform

The first of our analyzed organizations, A-Suppliers, produces electronic control units for the automotive supplier industry. They employ about 5000 system developers from which the majority is involved in software development. Evolving in an electronic product area the employees nowadays developing software have mostly an electrical engineering background. As automotive supplier they have to consider several industry-related standards (e.g. ISO 26262, ISO 16949). In general, A-
Suppliers is very experienced regarding process management. Automotive SPICE (A-SPICE) is by far the most important standard for the automotive industry. A-Spice is the standard framework for capability assessment in the Automotive Industry (e.g. www.automotivespice.com). Further, A-Suppliers practically acts on a CMMI level 3 given that they possess advanced experience due to former level 3 certifications. Managed by a dedicated process group, the different standards are all handled in a central standard script also called process library. All projects have to adhere to those centrally defined processes.

The most challenging task of the sub-unit was the merger with another sub-unit in 2007, from which they are still suffering at present. The diesel/gasoline platform project was initiated to unify the common functionality of the two subunits’ main products which was regarded as the fundamental trigger or challenge to overcome the integration problem in the future. The platform project is considered as the organizational subsystem of interest in this specific case whereas the platform itself represents both, a product and a process innovation for A-Suppliers.

The importance of the platform project for the success of A-Suppliers is reflected in a separate set-up compared to common customer projects. Whereas in customer based development barely any innovation takes place, this particular project is different:

"Rough process, nearly no boundaries, more or less. And we can really concentrate on the innovation, on our own technology, own product (...) there are only few restrictions. Really depending on the business or on the kind of product what you want to achieve, so the degree of freedom is adjusted and changed.”

(A2:423)

We consider this in fact as a high distinctiveness (D+) since the results of the temporary platform project are integrated into the ongoing activities of the Diesel/Gasoline subunit. Limitations in the distinctiveness are given by the restricted choice in terms of tools and technologies.
In terms of responsiveness, the interviewees emphasized the importance of decoupling from the strict process library in order to stay innovative and with that competitive in the market. All projects beside the common and therefore standard driven customer projects establish a 'standard free' process set-up in the early project phases. Nevertheless, the company sets a strict boundary regarding the use of software tools and major technologies:

“We have one tool department (...) And they provide the software tools (...). All divisions (...) have to use the same tools. They have to use the same operating system to make software exchangeable (...).” (A2:179)

This is necessary to stay aligned with the product landscape and further eases the coordination between the high number of developers in the organization. Regarding software development, a strict requirement for certain software technologies has a major impact on the flexibility of the development itself.

The extent of responsiveness demanded by the reigning standardized practices from innovating activities is basically “high” in A-Suppliers (R+). The strict obligation by the organization to follow for instance the industry standard A-SPICE makes it impossible not to return to the process library when the innovative part of the diesel/gasoline platform is finished:

“But the standard itself, ISO 15504 it is a must. You have to do it. If the customer writes it down into your requirements, then you have to do it somehow.” (A1:077)

As for now the project is still in its early stage while no actual influences of the reigning standardized practices could be identified. Nevertheless the interviewees affirmed that it would be the mandatory next step. Obviously, A-Suppliers assure their innovative potential with two steps. First they de-couple their processes from their process library to enhance the likeliness of technical innovations while leaving their engineers with more time to focus on the core technologies. Within this period no responsiveness to the standard script is required. After the innovative project is
completed they recouple to the standard script by aligning the de-coupled activities to fit both, the demanded standards and the need for the new product:

“We then would take the freedom to adjust the process further and not use one of these pre-compiled used and tailored process which we provide to the organization. (...) CMMI offers the possibility to tailor the process and then we would write it in the project guide that in these parts we do not follow all given processes any longer and deviate for these reasons.” (A2:419)

However, since the demands of A-Spice absolutely need to be accomplished, responsiveness is hence again given at the end of the creative phase. Thus, we still argue for a high responsiveness (R+) which is realized timely in the very last part of the project.

4.2 Case B-Aviators and its New Aircraft’s Demonstrator

B-Aviators produces aircrafts for the military and the civil sector. Since 2008 its product portfolio and in particular its software development has been affected by the way software is developed nowadays. Moreover, the need for reducing costs and building up more functionality motivated a new aircraft project. As a first step, a demonstrator project was set up to exemplify the new aircraft functions to potential users and customers. It also should provide evidence of general produceability. The demonstrator project is the subsystem where our analysis is based on.

In difference to the traditional procedure, here, the formal work is done later on. Development started in an informal fashion, giving the highest possible freedom to the developers in terms of tools and processes:

“We have a lot of freedom in this stage because it is just a demonstrator [...] nothing is really decided yet. We have lots of, sometimes too many parameters we can change.” (B7:119)

In concrete, it was decided to employ a different software modeling approach. Software engineers are now able to design the models first and then use tools for
automatic code generation. The interviewees confirmed that it is an enormous improvement to better understand the interdependencies of software design and code.

The project management approach itself had to change due to communication and planning problems in the past. The project members decided mostly to apply the Scrum method (Rising et al, 2000) to their sub-projects:

“...And one thing is that you are better on planning and to prognose how much time you have left of the work to be done and to prioritize between different tasks. SCRUM is also good for doing that [...] you have this retrospective meetings where everyone can come up with new suggestions. So that will also help to, to do a better job.” (B6:084)

Regarding technical innovations the interviewees particularly mentioned the software simulator. Instead of just looking at the software code they are now enabled to see how the whole system works since aircraft functions can be tested within a software environment:

“This software simulator is one of the biggest improvements in the new development. ’Cause in the old development you had to go to a hardware rack which is always running and always loaded with people. And it was always difficult to get a time slot. Here, every developer, basically from his own desk, can run a simulator.” (B3:267)

Furthermore, the interviewees described another technical innovation in the new aircraft demonstrator: the partitioning operating system. In comparison to the old aircraft, the idea to isolate the software of the different aircraft functions was new. They have evolved to fulfill security requirements where predictability is extremely important. It was translated to the new aircraft because:

“...In the old system, when you changed something (...) everything could be affected and (...) it all required the same level of documentation and testing.” (B3:377)
The demonstrator project can be characterized as a separate organizational arrangement for innovative activities with very high distinctiveness (D++). Right from the beginning the members of the new project – that was even started with an R&D team - were free to decide about hardware and operating systems, methodology, development tools, programming languages, and about the software architecture.

While the demonstrator project was established in a very distinct fashion during the informal phase, interviewees mentioned future changes when the project advances into the formal phase. The most influencing standard will be the DO-178B of the Radio Technical Commission for Aeronautics (RTCA):

“[…] for airworthiness, we have […] RTCA DO-178B, that is our bible. That tells us what we have to do in order for the authorities to allow this plane to fly eventually.” (B3: 159)

As airworthiness is essential for an aircraft project, the fulfillment of the standard is too. It is a must have and perceived by the interviewees as necessary but also restricting:

“[…] of course 178B is very restrictive because that says a lot of how to design your software. […] you have to be independent, when testing things and so on. And you have to do it in this way and not in that way and so on. So I think, they are quite restrictive but that is something that we have to live with because that is a very critical part of the software which would fall down on the false person if the aircraft crashes. This is not an electrical tooth brush, it is very complicated product.” (B10:185)

Further, CMMI is requested by higher management but is not seen as very influential for the daily work of the software developer. They state that they are not involved in the discussions and do not have a proper knowledge about CMMI. Consequently, they do not feel directly affected by this standard:

“I think these plans are good for the management to see how the progress is in the project. […] in the different sub-projects you don’t work with these plans continuously. You update these plans when you have an investigation of the top management.” (B1:247)
It means, persons who are responsible for CMMI in the new aircraft project translate the process of the demonstrator project into the CMMI terminology and the project management language of the old aircraft project in order to assure alignment with the maturity level.

In the demonstrator project, the already mentioned methodologies, tools and the project management approach Scrum were all established in a bottom-up procedure. The project and the associated sub-projects had the full support of top management to decide on suitable means. The sub-project managers partly chose standards based on the ones they heard most of and are convinced that their adaptation in each sub-project should be and is a bit different from adaptations in other sub-projects since every sub-project works in a different way. Progressing to the formal phase will not have any influence on the former choices. As mentioned for Scrum, the experiences are very positive:

“So we said let's try Scrum for a while and see how it works out. And I think it might not be the ideal or the best, but it is a big improvement for us. And I think almost every developer enjoys Scrum.” (B3:191)

As a consequence, the demonstrator project also had to design a new standard script which, on the one hand, incorporates the new methodologies like Scrum and the software modeling approach:

“[...] if we would like to develop in a new way, better and quicker way than earlier, we can’t adopt the process, we have to invent a new process.” (B8:325)

But, on the other hand, required standards like RTCA DO-178B or CMMI had to be reflected in the new standard script as well.

To sum up, within B-Aviators the demonstrator project shows reconnection to the reigning standard scripts of the old aircraft, foremost in terms of the mentioned industry and process standards. After an informal phase without any established process standards they had freedom to decide on their own process standards, tools
and methodologies as long as it complies with CMMI and RTCA. Therefore, we assess the responsiveness to the reigning standard scripts and processes as “low” (R-).

4.3 Case C-Retailers and its ‘Try out’ Projects

The third of our analyzed organizations, C-Retailers, is the software manufacturing subsidiary of a cluster of IT businesses focusing on the manufacturing, selling, integration and support of software and the provision of software solutions and outsourcing services to the retail market and other niche markets. They pride themselves in developing tools and technology based on continuous innovations customized to their customers’ preferred technological platforms. They boast a 90% local market share for software solutions and services to the retail sector. Their success in obtaining market share could to a great extent be ascribed to their development of modular re-usable components and successful re-use of such components in meeting their customer’s needs in a cost-effective way.

Evidence for innovating activities was found in various projects where employees are encouraged to spend a portion of their time on self-research (‘try-out’ projects).

“In the space where there is no process (...) you tend to have your heroes. The heroes are the guys that go in and do everything that fits the customer. (...) They will find a way of doing it whatever it might be: very innovative, typically, very knowledgeable, but on a broad base. (...) Those people typically operate very much outside process.” (C5:095)

During periods of self-research employees are encouraged to, for a limited period of time, look wider and experiment. For example, an employee recalled spending about two months between formal projects doing research on business processes and web services. The purpose of these try-out projects is to develop people and to explore new technologies that could be of use in future development and maintenance projects.
Innovating practices differ significantly: during ‘try-out’ projects individuals are ‘freed’ from rigidly following the steps but have to use prescribed technologies and tools. In ‘try-out’ projects innovating practices co-exist with the reigning development practices for a limited time-span. Therefore, for C-Retailers the ‘try-out’ projects can be categorized as organizational arrangements with high distinctiveness (D+).

For C-Retailers the main reason for the CMMI implementation was the decision to enter the international market. Being CMMI certified is often considered a prerequisite for acquiring major contracts, providing customers with the ‘peace of mind’ that software development was performed following structured processes and that subsequently the quality of products would be at an acceptable level. Secondary, reasons cited include increased productivity and reduction of software development life cycle. Implementation of CMMI was initiated by the CEO of the subsidiary and commenced in 2002. Care was taken to include product line principles in the CMMI script. C-Retailers reached CMMI maturity level 3 in 2005 and strive to obtain Level 4 and Level 5 certification in the future.

During ‘try-out’ projects employees are not bound by the same strict processes than during development and maintenance projects.

“That was very freestyle. You know, in the end, there was too little control in that. That was the opposite.” (C1:301)

Where innovating practices that took place outside the reigning standard script proved to be successful and were approved by the relevant bodies, the reigning standard script was even changed to incorporate these new practices.

“If it works you make it part of your process. So, it seems that these things come out of the pressure, a lot of things. That's (...) ground for process change” (C5:095)
“Once a change has been approved it does go through a little prove-of-concept within that division or project that has requested it and if that is proven it becomes company standard.” (C6:068)

Some interviewees felt that standardization was achieved at the expenses of innovation:

“What I did found: up to [CMMI] level 3 you are putting in place standardization, but it tends to be at the expense of, I think, innovation; and at the expense of agility, because it is very much a theoretical exercise up to that point.” (C5:171)

To sum up, responsiveness for the ‘try-out’ projects of C-Retailers is rated as “high” (R+): Although a standard script is in place to guide software developers during development and maintenance of software development projects, adherence to the reigning standard script is not enforced in all circumstances, leaving some room for experimentation/ informal development during periods of self-research. However, in every case once the innovating activities are completed, the informal development phase will be finished by recoupling to the reigning standard script. Thereby, the responsiveness is high (and not “very high” since in some cases the reigning standard script can be object of change due to the innovating activities).

4.4 Case D-Bankers and its Credit Card Processing Platform

D-Bankers is a financial service provider with approximately 20,000 employees. In 2000 D-Bankers started with the implementation of CMMI within one department of the IT group, the ‘development shop’. This department with approximately 300 employees implemented the CMMI standard level by level and achieved maturity level 4 in 2004.
One particular project the interviewees were proud of was the development of a new credit card processing platform (NCCPP) and their operation. In 2002 D-Bankers took part in an advertised bidding of an overseas credit card operating company. D-Bankers had placed the winning bid and have been providing programming support for this company until today. This project seemed to be prestigiously important for the top management:

“He [the CEO] said, he cannot allow [the new credit card processing platform] forever fail when it goes to production. Therefore we need to have good quality of what we are going to deliver. So we initiated a [new] unit.”
(D1:143)

The NCCPP project was the only project in view of innovating activities the interviewees mentioned. It was sort of separate from the regular development work, as it did not belong to the usual business of D-Bankers. However, employees of the NCCPP project proclaimed that they mainly referred back to existing competences and knowledge of the regular development work. Hence, the NCCPP team did not experience the opportunity to work aside the realm of standardized software development. No distinct body of knowledge emerged since the tasks were prescribed, already pre-decided in details and had only to be converted into software. The platform project was described as an ordinary subcontractor project, in which D-Bankers were required to fulfill more or less the role of an ‘extended work bench’. This means that almost all requirement-oriented and knowledge intensive areas were prescribed from the client already, which implied from D-Bankers point of view almost no technical innovation within the development project. The software developers have only been responsible for assembling and they had no authority concerning independent decisions on technologies or tools. Hence they regretted the loss of their pro-active innovating activities:

“We want to get back being prescriptive to our business to say, these are the new technologies that we would like to use. But we, you know, we lost that
(...). R&D team that’s looking at all those things because [the aim should actually be] (...) don’t tell us the solution, tell us the problem.” (D5:261)

Due to the fact that no distinct body of knowledge was developed, we assess the NCCPP project with “very low” distinctiveness (D--).

In order to get the mandate for the NCCPP project D-Bankers’ top management was forced by the client to ensure that the project applies CMMI compliant processes (reigning standard script) right from the beginning. Consequently, D-Bankers transferred a certain number of CMMI trained employees into the NCCPP development unit to ensure that all processes respectively innovative activities in the new unit followed the reigning standard script:

“We moved that core-group that implemented CMMI (...) to this new group.” (D1:143)

“We were part of a department where it was compulsory to follow CMMI rules and regulations.” (D6:93)

This conformity between the development activities of the NCCPP project and the reigning standard processes was furthermore ensured by bringing supervisory bodies in place:

“I was involved (...) that everything is following CMMI.” (D1:143)

Accordingly, such organizational interfaces ensured very strong control which implied that the newly established development team experienced no informal phase at all and stifled innovative activities:

“In terms of innovation it was maybe not as positive. Because you always had: This is what you do and these are the boundaries, go away and do it. (...) So from an innovation thing I think it was more stifling than creative and from a standardisation it was good because you could follow, you know what to do next. There is no, what I do now? That is just follow.” (D5:41)
The innovating activities of the credit card project have been extensively monitored by proponents of the reigning standardized practices. This demand for conformity of the innovating activities to the reigning standard script appeared to be very high since the innovating activities (development of the new platform) had strictly to follow the standard process handbook. Due to the large degree of regulation over institutional arrangements for innovating activities we assess the NCCPP project with “very high” responsiveness (R++). To sum up, due to “very high” responsiveness (R++) and “very low” distinctiveness (D--) the NCCPP project had almost no autonomy of rule setting in institutional arrangements for innovating activities.

4.5 Cross-case Analysis

In this section we compare our four cases in terms of distinctiveness and responsiveness and conclude on the resulting coupling status for each subsystem for innovating activities. Table 3 gives orientation for this comparison.
<table>
<thead>
<tr>
<th>Distinctiveness</th>
<th>A-Suppliers</th>
<th>B-Aviators</th>
<th>C-Retailers</th>
<th>D-Bankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsystem for innovating activities</td>
<td>Diesel/gasoline platform</td>
<td>New aircraft’s demonstrator</td>
<td>‘Try-out’ projects</td>
<td>Credit card processing platform</td>
</tr>
<tr>
<td>→ Extent</td>
<td>Specialized body of knowledge, no free choice in terms of tools and major technologies, but all other fields</td>
<td>Specialized body of knowledge, free choice in terms of hardware and operating systems, methodologies, development tools, programming languages, software architecture</td>
<td>Specialized body of knowledge, free choice in terms of tools and major technologies, but no other fields</td>
<td>No specialized body of knowledge, no free choice in terms of hardware and operating systems, methodologies, development tools, programming languages, software architecture</td>
</tr>
<tr>
<td>→ Temporality</td>
<td>Temporary co-existence of the innovating subsystem to the reigning practices</td>
<td>Co-existence of the innovating subsystem to the reigning practices</td>
<td>Temporary co-existence of the innovating subsystem to the reigning practices</td>
<td>Full alignment of the innovating subsystem</td>
</tr>
</tbody>
</table>

Classification

<table>
<thead>
<tr>
<th>Distinctiveness</th>
<th>A-Suppliers</th>
<th>B-Aviators</th>
<th>C-Retailers</th>
<th>D-Bankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
<td>D +</td>
<td>D ++</td>
<td>D +</td>
<td>D - -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsiveness</th>
<th>A-Suppliers</th>
<th>B-Aviators</th>
<th>C-Retailers</th>
<th>D-Bankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reigning standard script</td>
<td>CMMI, A-SPICE, ISO 15504, ISO 26262, ISO 16949</td>
<td>CMMI, RTCA DO-178B and other aviation standards</td>
<td>CMMI</td>
<td>CMMI</td>
</tr>
<tr>
<td>→ Temporality</td>
<td>Informal and formal phase of development</td>
<td>Informal and formal phase of development</td>
<td>Informal and formal phase of development</td>
<td>No informal phase and application of the reigning standard script</td>
</tr>
<tr>
<td>→ Extent</td>
<td>Recoupling to: CMMI, A-SPICE (ISO 15504) ISO 26262 ISO 16949</td>
<td>Recoupling to: CMMI RTCA DO-178B</td>
<td>Recoupling to: CMMI</td>
<td>Application of CMMI right from the beginning</td>
</tr>
</tbody>
</table>

Classification

<table>
<thead>
<tr>
<th>Responsiveness</th>
<th>A-Suppliers</th>
<th>B-Aviators</th>
<th>C-Retailers</th>
<th>D-Bankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
<td>R +</td>
<td>R -</td>
<td>R +</td>
<td>R ++</td>
</tr>
</tbody>
</table>

| Coupling status | Loosely coupled | De-coupled | Loosely coupled | Tightly coupled |

**Table 3:** Overview of the distinctiveness/ responsiveness of innovating activities and their resulting coupling status.

Following our assessments in terms of distinctiveness and responsiveness we found differing innovating activities for our cases and different space for the organizations
to act on their own behalf with respect to process standards, tools and technologies they are allowed to use. Figure 2 shows the different cases and the resulting coupling status of their innovating activities at a glance.

![Figure 2: The different case organizations and the coupling status of their innovating activities.](image)

B-Aviators' new aircraft demonstrator project is considered as *de-coupled*. It is funded as a long-term undertaking and its co-existence is assured in the long run. They have wide scope of action in terms of hardware and operating systems, methodology, development tools, programming languages and software architecture during a long and informal project phase. The responsiveness is rated as low since the management of the new aircraft project is indeed nearly free to decide about their tools and methodologies but has still to follow the airborne industry standard RCTA DO-178B when it advances into the formal phase. Further, CMMI requirements are claimed by the top management even though it was experienced by the developers as neither enabling nor constraining.

In contrast, we classify C-Retailers in the *loose coupling* sphere. The organizational members of C-Retailers are temporarily free to ‘try-out’ themselves and to find
innovative solutions. These ‘try-out’ projects develop a fairly specialized body of knowledge and co-exist with the standardized processes only for a limited time. Therefore, we rate the distinctiveness as high. During this time, C-Retailer’s innovating activities are not forced to be aligned with the reigning standard script but will be expected to be re-coupled after completion even with a small chance to re-influence reigning standard script. Thus, the responsiveness in view of the ‘try-out’ project is assessed as high.

The Diesel/Gasoline platform of A-Suppliers is also classified as loosely coupled. High distinctiveness can be stated that appeared in combination with high responsiveness. The Diesel/ Gasoline platform project carries out - like the C-Retailer’s ‘try-out’ projects - an informal phase where the organizational members could create their own body of knowledge. However, comparably to C-Retailer’s and different to B-Aviators, they are limited in terms of tools and major technologies they are allowed to use. After completion the innovating activities respectively their results will re-coupled to the reigning standard script. Therefore, we rate here responsiveness as high.

The credit card project of D-Bankers we categorize as tightly coupled. The credit card processing platform was a subcontractor project and very much fixed in terms of content, process standards, tools and technologies. The project was the only innovative activity that was mentioned as such by interviewees but a development of new bodies of knowledge was not confirmed. Therefore, we rated the resulting distinctiveness as very low. Beside this, the responsiveness of the credit card project was very high since there was no informal phase or freedom to decide on an own standard script. As prescribed by the client, the project was fully aligned to the reigning CMMI standard script; this affirms the less distinct, more executing character of the project.

In terms of the relation between innovation and standardization we identified three states: (1) so-called ‘innovating activities follow reigning process standard scripts
simply via its application’ (tightly coupled subsystems without informal phase), (2) ‘innovating activities follow reigning process standard scripts via recoupling’ (tightly coupled subsystems with informal phase) (3) ‘innovating activities develop to some extent own process standard scripts’ (de-coupled subsystems with informal phase and own formalization phase).

In case of (1), we observed that organizations try to impose institutional arrangements for innovating activities to take over the existing process standard script. This implies that in these organizations it is taken for granted by the managerial level and the implementing team that one solution (one standard script) should serve for all circumstances (D-Bankers and partly also A-Suppliers). Thus, there is no or little space to explore, interpret and decide on an own standard script in institutional arrangements for innovating activities. As a consequence, in our cases higher responsiveness tends to appear with lower innovating activities: “We stifled the intuitiveness of people you know, people are not thinking for themselves (...) We didn’t give them the ability to work outside of the box. Let me call it the effect of CMMI. So, that person didn’t aspire to play in the next role, they didn’t dream, they didn’t think, they didn’t question.” (D5:139)

In case of (2) and (3), organizations provide space for informal phases. Even if our cases here show that the temporality and the extent of distinctiveness and responsiveness definitely differ, the managerial level and the implementing team try to understand process standard descriptions as a toolbox that is still to be interpreted as their own standard script by the people who use them. Where this space was specified in our cases the basis for distinct bodies of knowledge in innovating activities was given: “We still have quite a large degree of freedom to do what we have to do, to solve the problems. And I think that creates the creativity. (...) I still think... if it [the process standard] doesn't work, we would change it. So I think if it has been there from the beginning we would have been benefited a lot from it.” (B3:347)
To sum up, our findings support the general statement that process standards tend to stifle the emergence of technical innovations – if they do not find temporal and/or institutional solutions to create freedom for innovating activities – without prescribed process standard scripts and space to decide on used software tools and technologies.

5 Discussion

Dialectical View on Standardization

We started our paper by sifting the existing literature on how organizations can be compliant with process standards at the same time being technically innovative. The answers which we found in literature so far mainly offered ideas how organizations emancipate from the external pressure for standard compliance. Thereby, organizations de-couple in dual sub-systems and standardize beyond the so-called ‘technical core’ by re-labeling and re-naming of its underlying practices. According to our findings, in view of technical innovations and standards by language games in a two systems logic seems to be misleading. At best, it is a very special case which is conceivably but was not found as a general solution in the investigated organizations. Therefore, we plead with this paper for a more elaborated, dialectical view on standardization beyond a dual system logic.

The idea of two domains of governance as two separated activity domains in an organization was already criticized in former literature (e.g. Katz and Allen, 1988; Stein and Kanter, 1980). The authors scrutinize the idea of isolated, co-existing domains of governance within organizations. In contrast, Spender and Kessler follow a dialectical understanding of two modes of governance: They state that “organic knowledge seeking processes of the innovation project need protection from the mechanistic and certainty-assuming processes of the host, in the same way that the bureaucracy of the host needs protection from the seemingly unstructured activities of the project’s innovators” (Spender and Kessler, 1995: 53). We likewise argue that
innovating activities can begin when the corresponding project is released, legitimated and resourced. This is called bureaucratic release. According to Spender and Kessler (1995) there is a similar process of bureaucratic capture and re-bureaucratization as the innovating activities’ output is selected and is drawn into the organization’s predominantly bureaucratic process. However, the rigor of their bureaucratic process descriptions cannot be supported by our findings. In view of our findings, Spender and Kessler only describe one specific situation: the loose coupling case (see (1) in Figure 3). Hereby, full re-coupling of the innovating activities to the reigning standard script takes place after an informal development phase. However, Spender and Kessler did not take into account the following situation: reigning standardized practices may adjust their standard script according to the requirements of the integrated innovating activities (see (1.1) in Figure 3). For this process step we found some evidence in the C-Retailers case but it has to be supported by further empirical investigations. In our view, loose coupling supports incremental technical innovations with the freedom of a limited informal phase and takes into consideration that sometimes adjustments of the reigning standard script are needed to integrate innovating activities’ output. In view of the ‘crowding out’ effect originally described by Benner and Tushman (2002) it is also possible now to provide explanation why organizations often lower their fundamental innovating activities after process standard implementation: with the implementation of process standards they tend to frame their innovating activities in a loosely coupled way where temporary informal development phases are allowed.

In addition to that, the following Figure 3 enhances the idea of bureaucratic release/capture of Spender and Kessler by a de-coupling situation (see (2) in Figure 3). Hereby, the bureaucratic capture does not take place in a re-coupling sense. Rather, the subsystem for innovating activities develops its own standard script which is needed for very high distinctive innovate activities respectively fundamental technical innovations. In this way, organizations provide ground to adopt process management standards and can likewise leverage existing capabilities towards innovation profoundly. However, even a de-coupling situation is never a complete separation of
innovating subsystems from other subsystems (like in the non-coupled sphere, see Figure 2). Organizations find and have to find different ways of implementing innovative technical solutions beyond standard bureaucratization. This can happen via mutual learning processes like, for instance, in the de-coupling case of B-Aviators. There, employees work at the same time for innovating as well as established subsystems with the effect of mutual learning processes. However, if organizations de-couple too much than maybe learning effects will be disclosed or even the non-coupled sphere can be touched (e.g. holding-like organization without any synergy-effects).

Secondly, tight coupling is another way how organizations can deal with standard scripts and technical innovations. Hereby, organizations tend to crowd out innovating activities in general by inhibiting informal phases of development work. This situation is depicted under (3) in Figure 3.

**Figure 3:** Dialectical view on standardization and innovation – differences in informal and formal phases of innovating activities.
The figure represents the different informal/ formal phases of innovating activities which we found in our cases. Thus, it should not to be seen as a complete representation of all potentially existing coupling paths. Rather, further investigations may uncover more than the depicted ones.

**Managing Standards Dialectically**

Practically seen, our results shall encourage organizations to scrutinize standard compliance from an innovative point of view and to develop organizational solutions to balance both exigencies – standard compliance and innovation. With this paper we argue that the enactment of standards is less a language game. Rather, it is a challenge for innovating organizations to achieve the right ‘arm’s length’ autonomy for innovating activities besides existing standardized practices. A process standard management has to answer the question how much variety of standard scripts an organization needs or is able to capture. It is highly connected to the management of innovation since it delivers necessary conditions for incremental as well as fundamental innovations which are both needed in organizations at the same time.

Our findings call for a dialectical standard management which bases on different modes of formal/ informal governance seen in our empirical material (see Table 4):

<table>
<thead>
<tr>
<th>Standard Governance Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simultaneous</td>
<td>Managing the relation between informal and formal modes among innovating and non-innovating subsystems</td>
</tr>
<tr>
<td>Consecutive</td>
<td>Managing the sequence of informal and formal modes within innovating subsystems</td>
</tr>
<tr>
<td>Regenerative</td>
<td>Managing change of the reigning standard scripts</td>
</tr>
<tr>
<td>Manifold</td>
<td>Managing maintenance of the standard script ‘portfolio’</td>
</tr>
</tbody>
</table>

**Table 4:** Dialectical standard management: modes of formal/ informal governance.
With this dialectical view on different modes of governing innovating activities in standardizing organizations we are convinced to provide a better basis to understand how organizations innovate while having standards in place. However, further empirical investigations may provide more detailed insights of dialectical standard management or may prolong the list of Table 4.

Classification Schema

As a third result, based on our empirical findings we provide a generalized schema where researchers and practitioners can classify innovating activities of software development organizations according to the criteria responsiveness and distinctiveness or can adapt it with little efforts for other organizations as the following Table 5 shows:

<table>
<thead>
<tr>
<th>D and R</th>
<th>Extent</th>
<th>Temporality</th>
</tr>
</thead>
<tbody>
<tr>
<td>D ++</td>
<td>Specialized body of knowledge, free choice in terms of hardware and operating systems, methodologies, development tools, programming languages, software architecture</td>
<td>Co-existence of innovating subsystem to the reigning practices</td>
</tr>
<tr>
<td>D +</td>
<td>Specialized body of knowledge, no free choice in terms of tools and major technologies, but all other fields</td>
<td>Temporary co-existence of innovating subsystem to the reigning practices</td>
</tr>
<tr>
<td>D -</td>
<td>Partly specialized body of knowledge, no free choice in terms of hardware and operating systems, methodologies, development tools, programming languages, software architecture</td>
<td>Temporary co-existence of innovating subsystem to the reigning practices</td>
</tr>
<tr>
<td>D --</td>
<td>No specialized body of knowledge, no free choice in terms of hardware and operating systems, methodologies, development tools, programming languages, software architecture</td>
<td>Full alignment of innovating activities</td>
</tr>
<tr>
<td>R ++</td>
<td>Application of reigning standard script</td>
<td>No informal phase</td>
</tr>
<tr>
<td>R +</td>
<td>Recoupling to reigning standard script, influences on reigning standard script possible</td>
<td>Informal and formal phases</td>
</tr>
</tbody>
</table>
Table 5: Classification schema for responsiveness and distinctiveness of innovating activities customized for software development organizations.

On the basis of this classification schema and the assessment of the responsiveness and distinctiveness of innovating activities, the identification of the coupling status is then easily done by using Figure 2 and its categorization along different degrees of responsiveness and distinctiveness.

Reconsidering the Coupling Approach

With this paper we finally deliver empirical evidence for our initial postulation that the coupling approach has to be reconsidered within the standard respectively standardization discourse. To date, de-coupling tends to be seen as an unfortunate but necessary strategy of organizations to handle external pressure regarding standardization. This unfortunate interpretation of de-coupling in terms of standards is scrutinized when decoupling is seen and redefined in an alternative way: de-coupling is not a status where formal structures are changed and cemented afterwards without affecting interaction orders, for instance, interaction orders of software development processes. As Figure 2 and Figure 3 show, de-coupling rather appears to be a temporary and locally limited situation of an innovating subsystem where it is allowed to detach from reigning standardized practices and to test and develop innovative ideas under less formalized conditions. Afterwards an own standard script is developed.

Thus, on the one hand standard de-coupling or loose coupling is in our definition a necessary and fortunate condition for fundamental respectively incremental technical
innovations in organizations. On the other hand, it can be postulated that the same standard can lead to different coupling processes in organizations which can be benign or even malignant. Given these findings it is worth to understand different forms of coupling as a temporary phenomenon and, hence, to investigate coupling processes as well as to revive an unbiased understanding of coupling activities in organizations.

6 Conclusions

Our paper deals with the question how companies can manage the compliance with process standards as well as the need for ongoing technical innovation at the same time. Our results show that organizations accomplishing technical innovations scrutinize standard compliance and develop solutions to balance both exigencies – standard compliance and technical innovation – via various subsystems for different bodies of knowledge and formal/ informal phases of development work. In this way it becomes obvious how some organizations establish a more dialectical standard management for incremental or even for fundamental innovations: it happens by managing a portfolio of informal and formal modes among innovating and non-innovating subsystems, by managing informal and formal modes within innovating subsystems or even by renewing reigning standard scripts in a very flexible manner.

We gained these managerial insights by developing a dialectical view on the enactment of standards within organizations. A dialectical view hereby means that potentially contradictory and conflict-ridden activities like reigning standardized practices and innovating activities are manageable by specific institutional, temporary and formal/ informal solutions. The synthesized result is a standard landscape which combines different degrees of formality for differing innovating activities and reigning standardized practices in the course of time.
By reconsidering the coupling approach we were able to underpin its temporary character and to investigate decoupling processes. Moreover, we revived an unbiased understanding of decoupling activities in organizations: decoupling of innovating activities can be on the one hand an unsatisfactory condition for organizations if they, for instance, fail to develop their own standard script or to generate mutual learning processes with other organizational subsystems. On the other hand, decoupling can be a very fortunate situation if decoupling becomes part of an organizational paradigm where multiple, even conflicting standard management strategies (decoupling, loose coupling and tight coupling) in response to external and internal pressures are established. In this way a decoupled or loosely coupled standard management for innovating activities and a tightly coupled standard management for established organizational practices should not exclude each other within one organization. These insights also support the institutional view where organizations answer external pressure by different strategies and are never exclusively or invariably passive or active, conforming or resistant (Oliver, 1991).

For this paper, we aimed to make an ex-post description of something that is, of course, a long-term venture (Barley and Tolbert, 1997). Even if this limitation was obvious right from the beginning, in this explorative stage of our investigations we succeeded in finding an alternative view on decoupling within the standard discourse. Even if some existing assumptions about how organizations deal with process standards were challenged and could be re-formulated, the explorative study is subject to some methodical limitations. First of all, with our once-off interviews we could only make a ‘snapshot’ at a certain point in time of something that calls for longitudinal empirical investigations. To a certain degree, with the existing interview material we could retrace the origin of decisions in terms of process standards and innovative activities; however, we often could not say what is cause and effect and why some things happened in the way it was described to us. Secondly, the investigated organizations are using the CMMI (Capability Maturity Model Integration) standard as their process regime whereas not all of them are or were certified. It might have an influence on the distinctiveness and responsiveness of
innovating activities but this could not be separated in the research design. Thirdly, statements about the extent of technical innovations in relation to the innovative activities in an organization should have been covered by an additional empirical source independently of the interviewees’ statements in order to assure technical innovation as the independent variable. Finally, our material does not tell us enough about the reasons some organizations accomplish dialectical standard management and others not. We also do not know for sure which other responsiveness-mechanisms besides the request for compliance with reigning standard scripts are established and what influence standard scripts of innovating activities have on the established ones. This means that further evidences are required in order to answer the question how a bureaucratic capture actually takes place and what influences the change of the reigning standard script in general.

Acknowledgement

The empirical investigations were funded by the Deutsche Forschungsgemeinschaft (DFG), Germany, the National Research Foundation (NRF), South Africa as well as by the Wallander/ Hedelius/ Browaldh (Handelsbanken) Research Foundation, Sweden. We are most grateful for the efforts and time our empirical partners spent with us. Finally, we express our sincere gratitude to our colleague Prof Petrie F. Coetzee from Tshwane University of Technology who was the ‘elder statesman’ of the research project.

References


Notes

(1) References to, for example, A2, B3, C5 and D6 refer to transcripts of interviews held with particular interviewees (designated by the numeral) in the firms A-Suppliers, B-Aviators, C-Retailers and D-Bankers respectively.

(2) Previous states of the paper were already presented at the EGOS conference 2011 in Gothenborg, Sweden, and at the MSKE conference 2011 in Porto, Portugal.