 CONTEXTUAL FACTORS INFLUENCING THE PURPOSEFUL ALLOCATION OF BUSINESS INTELLIGENCE COSTS

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CONTEXTUAL FACTORS INFLUENCING THE PURPOSEFUL ALLOCATION OF BUSINESS INTELLIGENCE COSTS

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Abstract

Today, business intelligence (BI) systems are recognized as a prerequisite for organizational success by providing management with decision-supportive information. Along with the pervasion of BI in organizations and its prospective benefits, BI has become widely established from a technological perspective, but remains challenging from an organizational view. Because BI causes a high monolithic cost block within an organization, effective BI cost management mechanisms need to be implemented. This study focuses on the different design situations of BI cost allocations since a one-size-fits-all approach is not supposed to be purposeful, but different situational requirements need to be considered. The design situations are characterized by relevant contextual factors, which we identify and thoroughly analyze. A set of relevant contextual factors is derived from an extensive review of prior work as well as from a focus group study with subject-matter experts. The contextual factors are synthesized in a classification scheme according to the dimensions objectives, technology-, organization-, and environment-related. Further, we discuss the characteristics of contextual factors and the impacts on cost allocation configurations in three archetypes of companies. Therefore, this publication delivers valuable insights for consideration in practice and stimulates further research on context-specific BI cost management.

Keywords: Business-IT Alignment, Cost Management, Contextual Factors, BI Management.

1 Introduction

By supporting and improving the decision-making process in organizations, business intelligence (BI) systems are widely considered to be a prerequisite for organizational success (Wixom and Watson, 2010). Even though, BI has a considerable impact on the decision capabilities of an organization’s management (Audzeyeva and Hudson, 2015) by turning the vast amount of data into decision-supportive information, the management of BI costs and value is especially difficult. On one hand, the determination of BI’s return on investment is challenging (Negash, 2004), since inherent to BI is a downstream value because the output of BI is data converted into information that leads to (probably) beneficial business decisions. On the other hand, BI causes high upfront costs in its investment phase (Bischoff et al., 2015) as well as a large monolithic cost block in its operations (Bischoff et al., 2014) that cannot be managed without transparency about the causes of the costs. While general information technology (IT) expenses only rose by 0.4% in 2013 (Gartner Inc., 2014b), BI expenses grew significantly faster in 2013 with 8% (Gartner Inc., 2014a). Therefore, purposeful cost management mechanisms are essential to realize value from BI investments and effectively control BI costs.

Information systems (IS) cost management is an interdisciplinary topic between IS governance and cost accounting, which is a sub-discipline of management accounting (Rao, 2007). Within the field of IS cost management, cost allocations (CA) that charge costs from the IS providing unit back to the IS consuming business unit are a core activity (Van Grembergen and De Haes, 2009) that offers a variety...
of prospective benefits. Effective CAs can serve multiple management purposes, e.g., providing information for product costing, performance evaluations, informing investment decisions, creating transparency or uncovering inefficiencies in the use of resources (Kaplan and Cooper, 1998, Shim and Siegel, 2000). Cost management has been widely researched in the management science of the 20th century (e.g., Vatter, 1950, Cooper and Kaplan, 1988, Shillinglaw, 1989) and a reception of CAs has taken place in IS research. A prominent example emphasizing the role of IS CAs is the widely known COBIT (Control Objectives for Information and Related Technologies) framework (Information Systems and Control, 2005) that explicitly describes a process to identify and allocate costs.

Although several publications highlight the importance of IS CAs (e.g., Karimi et al., 2001, Peppard et al., 2007) for IS management, still many facets of IS CAs remain unexplored. According to a survey by Deloitte (2011), the maturity of IS CA is still low in practice. Stefanov et al. (2012, p. 1) attest that IS CA is “still poorly understood” and a lack of successful allocation models can be observed. Several contributions on IS CAs focus on the application of CAs in dedicated domains of IS, e.g., caching services (Hosanagar et al., 2005) or web services (Tang and Cheng, 2005). One common characteristic is that there is no one-size-fits-all approach to an effective IS CA; rather a high number of differently configured CAs depending on the application-specific domain and on the organizational situation in which the CA is applied. Due to the fact that the situation can be characterized by different contextual factors, it is crucial to uncover and classify the contextual factors relevant for the configuration of a BI CA. Consequently, this paper addresses the following research question (RQ):

What are the contextual factors influencing the purposeful configuration of a BI cost allocation?

Answering the RQ closes the research gap regarding the different design situations for BI CA. Our findings are based on extensive review of prior work and extended by qualitative data from a focus group (FG). In a practical sense, our findings contribute to a better understanding of different design situations, which assists practitioners making BI CAs successful by recognizing implications of contextual factors. The remainder of this paper is structured as follows: section two introduces the conceptual foundations of our research to establish a common ground and to define the research gap. In section three, we illustrate the overall research process, in which the paper is embedded, and provide the research methods applied here. According to the introduced research methods, section four provides the results from our literature review, and section five adds the results of our FG study. In section six, we synthesize the results from the sections four and five, present a classification scheme of the contextual factors, depict exemplary combinations of contextual factors, and discuss the implications on BI CAs. We discuss our findings, their limitations, and implications on future research in section seven.

2 Conceptual Foundation

2.1 Cost allocations

Basic CA mechanisms are introduced in Table 1.

<table>
<thead>
<tr>
<th>Mechanism [Synonyms]</th>
<th>Description (Source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cost allocation</td>
<td>The costs are not further allocated, but remain as overheads with the provider (Olson and Ives, 1982)</td>
</tr>
<tr>
<td>Overhead rates [assessment]</td>
<td>A key (e.g., number of users) is used as a distribution rate to allocate the costs for BI to the consumers (Verner et al., 1996)</td>
</tr>
<tr>
<td>Internal activity allocation [billing, chargeout, chargeback]</td>
<td>Prices for products or services are defined. The consumers are debited with used quantity * price (Verner et al., 1996)</td>
</tr>
<tr>
<td>Activity based costing</td>
<td>Process costs and cost drivers for the processes are calculated. Upon use, the consumers are debited with the costs (Kaplan and Cooper, 1998)</td>
</tr>
<tr>
<td>Relative direct cost calculation</td>
<td>Being a rather special type for CAs, it attributes cost to cost objects that are related to the decisions causing the costs (Ewert and Wagenhofer, 2011)</td>
</tr>
</tbody>
</table>

Table 1. Basic cost allocation mechanisms
A CA charges costs for the internal consumption of goods or services from one organizational unit (e.g., a cost center) to another organizational unit or to a cost object (e.g., a production order) by crediting costs to the provider and debiting the consumer with a certain amount of costs. A CA mechanism refers to the underlying mechanism to transfer costs from provider(s) to the consumer(s). The differentiation of CA mechanisms is crucial at this point because it needs to be considered in the configuration of BI CAs.

### 2.2 Business intelligence

The concept of BI is understood in a broad sense because it encompasses all components of an integrated decision support infrastructure (Baars and Kemper, 2008). This includes the technical and the social components, or as Herschel (2010, p. 1) puts it “today, the practice of BI clearly employs technology. However, it is prudent to remember that BI is also about organizational decision-making, analytics, information and knowledge management, decision flows and processes, and human interaction.” The comprehension of BI in the paper at hand includes the technical aspects with analytical frontend applications, a data warehouse (DWH) and the interfaces to operational data sources. Further, it encompasses the organizational process view including the sociotechnical perspective. Thus, not only the costs of the technical components of BI (e.g., hardware and software) are subject to a BI CA, but also the costs incurred in the execution of the related processes and the sociotechnical interactions (e.g., labor costs and external services).

BI appears to be of special interest in IS CAs due to a BI system’s nature. First, the usefulness of BI depends on the decisions made based on the obtained information rather than in the use of the system itself (Benbasat and Zmud, 2003), which inheres a potential downstream value. Therefore, BI is difficult to be priced for CAs since neither the cost of production nor the value of the information can be easily determined. Second, according to Ross et al. (1999, p. 232), the untapped potential of an effective CA is “to educate business units about IT while teaching the IT unit about the business.” This potential benefit of a CA is especially important for BI, due to the fact that on one hand BI systems need to be continuously meeting the ever changing information needs of the business, e.g., in fulfilling ad-hoc reporting requirements or frequent data model adaptions. On the other hand, for a purposeful use of BI business units need to better understand the set-up (e.g., the data model) and the capabilities of BI systems in place. Therefore, an effective CA contributes to the mutual understanding between IT and business units to exploit BI’s potential to a better extent. Third, in contrast to CAs in other domains, the intention of a BI CA is not a restriction of use of resources, but it needs to encourage users to use the system to the best of its capabilities. Thus, a BI CA bears the potential to regulate the economic use of a BI. On one hand, a BI CA should promote the voluntary use of BI systems and not distract users from BI use. On the other hand, a BI CA should also prevent from “over-analyzing” by critically reflecting the question “what to analyze?”. Therefore, simply implementing a for IS costs widespread (Ross et al., 1999) – usage-based CA is not purposeful for BI because it can cause a “death spiral” of decreasing utilization. Therefore, several publications can be found that particularly call for future research on BI cost management issues (Clark Jr et al., 2007, Schieder and Gluchowski, 2011, Arnott and Pervan, 2008).

### 2.3 Situational context

Van Grembergen and De Haes state that “[…] governance of IT is a very broad concept and that each organization requires a specific approach applicable to its individual context” (2009, p. 201). The origins of situational and context-specific perspectives in management can be traced back to Fiedler’s (1964) work about the contingency theory in the field of social psychology. Other scholars (e.g., Reid and Smith, 2000) argue that even earlier publications on contingency considerations exist (e.g., Burns and Stalker, 1961, Chandler, 1962). In contrast to prior theories, contingency theory emphasizes that there is no “one best way” of organizing. Instead, the contingency theory argues that there are different effective ways, depending on the organizational context, and – in other words – addresses “the multi-
variate nature of organizations and attempts to interpret and understand how they operate under varying conditions” (Wallace et al., 1980, p. 370). Thus, varying conditions are defined by internal or external contingency variables that are referred to as contextual factors (Weill and Olson, 1989). Contingency theory and research on contextual factors have become established in the IS discipline (Raber et al., 2013a) and the adoption to IS research can be found in a wide range of publications (e.g., Schonberger, 1980, Bucher et al., 2007). Weill and Olson (1989) identify seven established contextual factors in IS research: (1) size, (2) environment, (3) strategy, (4) structure, (5) technology, (6) task, and (7) individual characteristics. Contextual factors have an effect on different units of analysis in IS research such as e.g., organizations, processes, tasks. Therefore, in the following, we identify the contextual factors particularly relevant for BI CAs. These factors are informed not only by IS research, but also by reference disciplines of the given topic, which are accounting and organizational studies.

2.4 Research gap

In this section, we build the relations between the above-described conceptual foundations and reflect the need for research presented in the paper at hand. As described in the introduction, the measurement of BI costs and value is considered to be a difficult task, but it is crucial for justifying BI investment decision as well as for managing BI costs and resources (Lönnqvist and Pirttiaäki, 2006). Therefore, practitioners need guidance for improving BI regarding questions of BI cost management, realization of enterprise capabilities, and business/IT alignment. In cost management, BI CAs are supposed to be an appropriate instrument to trigger desired steering impacts for the management of BI costs and resources. Several basic CA mechanisms exist, but they need further adaptation to be applicable to BI systems. The adaptation of a CA mechanism to a particular subject (in our case BI) is considered as the configuration of a CA, which includes a broad variety of different settings, e.g., defining prices or keys, identifying sender-receiver relationships, or definition of BI services and cost elements to allocate. Moreover, it is important to note that a company could also simultaneously implement different CAs mechanisms for different purposes, e.g., overhead rates to allocate BI infrastructure costs combined with an internal activity allocation for defined BI services. Therefore, the configuration of a BI CA is a complex task, which has not been appropriately informed by theory yet.

In section 2.2, it is shown that BI is a special case for CAs due a BI system’s nature, which needs to be considered in the configuration of a BI CA. In section 2.3, the concept of situational context is introduced, arguing for the specific consideration of contextual factors in the configuration of a BI CA. Various sources give examples for the configuration of a specific BI or IS CA in a given situational context (e.g., Grytz, 2014, Rosenkranz and Holten, 2007, Watson et al., 2004), but a comprehensive work on the purposeful configuration of a BI CA, considering different design situations is missing.

3 Research Method

3.1 Research process

The results of the paper at hand are embedded in a research initiative with the overall research goal of: designing a method for the configuration of BI CAs that incorporates the specific design situation in order to close the existing research gap and to support practitioners with the purposeful design of a BI CA.

The overall research method of our research initiative follows the design science research (DSR) paradigm, according to Peffers et al. (2007). DSR intends to solve existing real-world problems through the design of useful artifacts (Hevner et al., 2004, Winter and Baskerville, 2010). Different artifact types need to be distinguished: constructs, models, methods, and instantiations (March and Smith, 1995, Winter, 2008) as well as design theories, design principles, and technological rules (Gregor and Hevner, 2013). For the design of the method we use the differentiation made by Bucher et al. (2007) in
our research who characterize “design situations” and “method fragments” as the central components of the situational configuration. On one hand, the configuration of a BI CA is highly dependent on the situational context in which the allocation should be implemented. On the other hand, in every BI CA, various components have to be configured (the method fragments) according to the situational context, e.g., the applied basic CA mechanism (cf., section 2.1).

The paper at hand represents an essential step towards our proclaimed overall research goal because it contributes a classification scheme for different design situations. According to Gregor and Hevner (2013), classifications are recognized as useful descriptive knowledge in DSR. Thus, in this paper, we aim at developing descriptive knowledge as part of an overall artifact – a method – that represents prescriptive knowledge. To develop the descriptive knowledge as an element of the overall artefact, we follow the steps one to four of Peffer’s proposed procedure (2007). To shed light on our RQ, a review of existing studies in the accumulated body of knowledge is an essential first step of our research. Therefore, we first conduct a literature review focusing on the identification of existing publications on relevant contextual factors, which corresponds to Peffer’s first three steps “identify problem & motivate”, “define objectives of a solution”, and “design and development” (2007). To extend the “design and development” step and to perform the “demonstration” step in order to demonstrate the usefulness of the results, we conduct an exploratory FG to collect real-world data from practice about contextual factors relevant for BI CAs. A FG is especially purposeful for our research because it offers the opportunity to explore further prevailing contextual factors that are considered relevant by BI experts affected by CA. FGs help to “achieve rapid incremental improvements in artifact design”, to “demonstrate the utility of the design” (Tremblay et al., 2010, p. 602), and they offer the possibility to encourage and seize the interactions among the participants, while biases can be mitigated and consensus can be measured (Morgan, 1997).

3.2 Literature review

In the first step of our research, we conducted a comprehensive literature review combining the systematic literature review procedure according to Rowe (2014) with the hermeneutic literature review approach according to Boell and Cezec-Kecmanovic (2014). In this section, we briefly introduce the two approaches. In section 4, we present the results identified in existing literature.

We applied Rowe’s seven-step approach (2014) as the guiding research structure because it contains appropriate steps for our purpose: selecting appropriate research questions for further investigation, selecting sources, choosing search terms, applying practical screening criteria, applying methodological screening criteria, doing the review and synthesizing the results. For further details, the readers are referred to the original contribution (Rowe, 2014). In contrast, a hermeneutic review puts emphasis on the understanding by the reader and considers the review as an iterative, creative, and ongoing technique based on interpretation by the researcher independent of the source because bias may occur due to the linear procedures of systematic approaches and the ex-ante defined search criteria (Boell and Cezec-Kecmanovic, 2011). The hermeneutic approach is structured in two intertwined circles: the search & acquisition circle and the wider analysis & interpretation circle (Boell and Cezec-Kecmanovic, 2011). The hermeneutic and the systematic approach are not mutually exclusive, but, on the contrary, the hermeneutic approach is supposed to complement and enrich the systematic steps by focusing on understanding, interpretation, and broadening the search.

We complementarily employed the two approaches in our iterative review in the following way: after each review step, a hermeneutic classification was followed by a critical assessment, which in turn led to a refinement (Boell and Cezec-Kecmanovic, 2014) of search terms and sources applied in the following iteration. In the first and second iteration, we searched the basket of eight (Association for Information Systems, 2011), all IS as well as Finance & Accounting journals according to Harzing’s Journal Quality List (2015), top management journals according to Barreto (2010), the European Conference on Information Systems, and the International Conference on Information Systems. In the third iteration, we included specialized BI and cost management journals. We only searched English
publications. The search period was not restricted. The search was conducted for abstracts, titles and full texts. In addition, we applied forward and backward search (Webster and Watson, 2002).

3.3 Focus group

In our research, we followed Tremblay et al.’s (2010) eight-step approach of FG studies. Subsequently, we briefly present the setup of our FG.

Formulate research problem: in our FG we had the objective of exploring new contextual factors in addition to our literature review in order to collect empirical data regarding our RQ1 as well as discussing prevailing combinations of contextual factors and demonstrating implications on BI CAs.

Identify sample frame: according to Tremblay et al. (2010) the participants of the FG shall be familiar with the field in which the solution artifact is about to be designed. Thus, we defined BI specialists and BI managers, who are experienced with BI CAs, as the desired participant types in order to obtain data from participants who are directly affected and who are responsible for the subject. The ideal FG consists of three to twelve participants and takes between one and three hours (Tremblay et al., 2010).

Identify moderator: one of the researchers was chosen to take the role of the moderator. Following Tremblay et al. (2010) and Miles and Huberman (1994), it was decided that two co-researchers are employed as observers, taking minutes of the discussions to ensure objectivity.

Develop and pre-test a questioning route: prior to the FG the agenda as well as the questioning route were predefined by the researchers and reconciled with faculty members who are specialized on research in the field of BI management. The questioning route comprised questions about the general patterns of the applied BI CAs as well as direct and indirect questions to identify contextual factors.

Recruit participants: we decided to recruit the participants from the BI competence center of our faculty. In the BI competence center, regular benchmarking and knowledge sharing workshops with BI subject-matter experts from major banks of German-speaking countries take place. Table 2 provides an overview of the characteristics of the participants of the FG. The FG consisted of experienced managing BI staff with a thorough understanding of their organization and processes. The participants represented significant BI organizations or even various distributed BI units, respectively.

<table>
<thead>
<tr>
<th>#</th>
<th>Current position</th>
<th>Company</th>
<th>Employees 2013</th>
<th>Balance sheet total 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head of Enterprise Architecture Management</td>
<td>Bank A</td>
<td>approx. 50,000</td>
<td>approx. $ 600 bn</td>
</tr>
<tr>
<td>2</td>
<td>BI department manager</td>
<td>Bank A</td>
<td>approx. 50,000</td>
<td>approx. $ 600 bn</td>
</tr>
<tr>
<td>3</td>
<td>Head of BI architecture</td>
<td>Bank B</td>
<td>approx. 48,000</td>
<td>approx. $ 900 bn</td>
</tr>
<tr>
<td>4</td>
<td>DWH/BI architect</td>
<td>Bank B</td>
<td>approx. 48,000</td>
<td>approx. $ 900 bn</td>
</tr>
<tr>
<td>5</td>
<td>Head of BI competence center</td>
<td>Bank C</td>
<td>approx. 44,000</td>
<td>approx. $ 250 bn</td>
</tr>
<tr>
<td>6</td>
<td>Project manager BI competence center</td>
<td>Bank C</td>
<td>approx. 44,000</td>
<td>approx. $ 250 bn</td>
</tr>
<tr>
<td>7</td>
<td>BI competence center, reporting manager</td>
<td>Bank C</td>
<td>approx. 44,000</td>
<td>approx. $ 250 bn</td>
</tr>
<tr>
<td>8</td>
<td>Head of BI development</td>
<td>Bank C</td>
<td>approx. 44,000</td>
<td>approx. $ 250 bn</td>
</tr>
<tr>
<td>9</td>
<td>BI development manager</td>
<td>Bank D</td>
<td>approx. 30,000</td>
<td>approx. $ 500 bn</td>
</tr>
<tr>
<td></td>
<td>IT organization – Head of BI</td>
<td>Bank D</td>
<td>approx. 30,000</td>
<td>approx. $ 500 bn</td>
</tr>
</tbody>
</table>

Table 2. Focus group participants

Conduct focus group: the FG study took place in December 2014, lasted for approximately three hours, and was held in the German language, although the materials were prepared in English. The fact that the participants are familiar with each other from previous workshops made the first acquaintance part of the FG obsolete and immediately a comfortable atmosphere for open discussions was ensured. A circle-shaped seating was arranged with the intention of stimulating active participation (Stahl et al., 2011). At the beginning of the session, an impetus presentation on the research problem and the role of contextual factors for BI CAs was given by one of the co-researchers and the moderator to establish a common understanding. Subsequently, participants provided insights to the BI CAs in their banks and their organizational settings. A pleasant working atmosphere fostered proactive...
and lively interactions, granting rich insights into the participants’ practices. After the initial discussions, the moderator led the discussions to RQ1. The minutes were consolidated with the moderator’s conceptions after the session in order to avoid misinterpretations, to serve for documentation purposes, and to ensure reliability of the results (Miles and Huberman, 1994).

The steps (7) analyze and interpret data as well as (8) report results are presented in section 5.

4 Results of Literature Review

To synthesize the results of the literature review (Webster and Watson, 2002) we relate them to our research according to the dimensions: management objectives and contextual factors related to technology, organization, and environment, which can be also found in prior works (e.g., Reid and Smith, 2000, Chenhall, 2003). Generally speaking, it became apparent that in recent years a resurgence of contingency considerations took place in accounting and IS research to cope with current technical phenomena, e.g., cloud services (Stefanov et al., 2012). Several contributions (e.g., Weill and Olson, 1989, Anderson and Young, 1999) provide overviews of prior work related to our research and many publications shed light on the topic from different angles (e.g., from an organizational perspective or the influence on management control systems).

4.1 Management objectives

Several publications (e.g., Olson and Ives, 1982, e.g., Ross et al., 1999, Drury, 2000) mention management objectives influencing the effective configuration of CAs. In addition, we identified management objectives particularly applicable for BI CAs in a separate contribution (Epple et al., 2015). We plead for a separate consideration apart from the other contextual factors, due to the special characteristic of objectives. In contrast to other contextual factors, an objective has an intrinsically motivated origin rather than being internally or externally varying conditions that lie beyond the sphere of influence (Otley, 1980). Management objectives inhere a common characteristic with other contextual factors of being an object influencing the effective configuration of a CA. Table 3 subsumes the identified objectives according to the categories “use-/resource-related” and “cost-/performance-related”.

<table>
<thead>
<tr>
<th>Management objective (source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient use of resources (Verner et al., 1996, Ross et al., 1999)</td>
</tr>
<tr>
<td>Effective resource utilization (Verner et al., 1996, Ross et al., 1999, Drury, 2000)</td>
</tr>
<tr>
<td>Resource regulation (Verner et al., 1996, Epple et al., 2015)</td>
</tr>
<tr>
<td>Exploit BI’s full potential (Epple et al., 2015)</td>
</tr>
<tr>
<td>Increase user and IS staff awareness (Verner et al., 1996, Drury, 2000)</td>
</tr>
<tr>
<td>Increase user &amp; management involvement (Verner et al., 1996)</td>
</tr>
<tr>
<td>Cost-by-cause allocation (Epple et al., 2015)</td>
</tr>
<tr>
<td>Cost recovery (Olson and Ives, 1982)</td>
</tr>
<tr>
<td>Cost transparency (Verner et al., 1996, Epple et al., 2015)</td>
</tr>
<tr>
<td>Performance evaluation (Verner et al., 1996, e.g., Ross et al., 1999, Drury, 2000)</td>
</tr>
<tr>
<td>Outsourcing evaluations (Verner et al., 1996)</td>
</tr>
<tr>
<td>Better planning and budgeting (Verner et al., 1996)</td>
</tr>
</tbody>
</table>

Table 3. Overview of management objectives

It is crucial to apprehend in which way the single objectives influence an effective configuration, which we briefly discuss in the following. Except for the objective of cost recovery, all other objectives require a fairly detailed and accurate cost information in order to achieve the desired objective. In contrast, if only cost recovery is the single objective, a simple CA can be implemented (Verner et al., 1996). For the use-/and resource-related objectives, which are dependent on the acceptance by the users, an internal activity allocation based on activity prices with transparent pricing mechanisms might
be appropriate. The objectives of BI department evaluation and outsourcing evaluation cannot be successfully achieved without additional information, e.g., in terms of key performance indicators or benchmarks. In order to increase involvement or to raise awareness further governance mechanisms, e.g. accountability areas/levels, need to be in place. Further, a company might not strive to achieve only one of the above presented objectives, but rather pursue several concurrently. Certain objectives might even work mutually exclusive, while other objectives are complementary. Therefore, it is decisive to define and reflect the objectives in advance to the configuration of an appropriate CA.

4.2 Contextual factors

Subsequently, we provide overviews of identified and relevant contextual factors from our literature review in three tables according to the three dimensions technology, organization, and environment. Further, we briefly describe the impact of the contextual factors on the configuration of a CA. Following each table, we explain how the identified factors apply for BI.

Technology is discussed as a contingency of CAs already since the early era of contingency theory (e.g., Bruns Jr. and Waterhouse, 1975, Wetherbe and Whitehead, 1977, Otley, 1980) as well as in contemporary works (e.g., Chenhall, 2003, Abdel-Kader and Luther, 2008, Auzair, 2015). Table 4 gives an overview of contextual factors related to technology.

<table>
<thead>
<tr>
<th>Contextual factor (source)</th>
<th>Impact on the configuration of a CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of IS (McKinnon and Kallman, 1987)</td>
<td>Four types of IS “support, factory, turnaround, strategic”, where a support IS requires the least sophisticated CA.</td>
</tr>
<tr>
<td>Standardization and automation (Chenhall, 2003)</td>
<td>The higher standardization and automation of the IS, the more formalized is the management control system.</td>
</tr>
<tr>
<td>Task uncertainties and task interdependencies (Anderson and Young, 1999, Drury, 2000, Chenhall, 2003)</td>
<td>High uncertainties and interdependences between technologies lead to more informal controls with less reliance on standard procedures and accounting performance measures.</td>
</tr>
<tr>
<td>IS innovations (Schonberger, 1980, Reid and Smith, 2000)</td>
<td>Advancements of cost management measures are often preceded by significant innovations.</td>
</tr>
</tbody>
</table>

Table 4. Contextual factors related to technology

In BI research maturity considerations and maturity models are considered viable instruments for the purposeful management of BI (Raber et al., 2013b). Thus, we conclude that the BI system maturity is a contextual factor relevant for the appropriate configuration of a BI CA. Since BI systems can in fact be employed for different purposes, e.g., supporting monthly closing activities, for turnaround information, or strategic decision-making, the type of BI system is further considered as a contextual factor. BI includes a “broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data” (Wixom and Watson, 2010, p. 14). Therefore, we consider standardization and automation as well as task uncertainties and task interdependencies relevant contextual factor in our research. In contrast to other contextual factors, innovations are not a permanently influencing contextual factor, but rather sporadically occurring. Due to the fact that BI is continuously further developed, we consider BI innovation a relevant contextual factor, which can influence the configuration of a BI CA.

In contingency research a big variety of works on organizational aspects prevail, due to the fact that contingency theory first was applied to questions of organizations research (cf., section 2.3). Table 5 provides an overview of contextual factors related to organization.
A company’s strategy is often mentioned as a contextual factor related to organization (e.g., Weill and Olson, 1989, Langfield-Smith, 1997, Chenhall, 2003), but we neglect it here, due to the fact that strategy traditionally is broken down and operationalized in specific goals (see section 4.1). The contextual factor maturity of the IS function and IS management we consider as the maturity of BI management in our research context. Ross et al. (1999) and O’Connor and Martinsons (2006) mention several capabilities that influence the configuration of a CA, e.g., prevailing chargeback policies (consisting of sourcing policy, cost recovery policy, policy on accountability) and administrative practices (rate setting process, communication process), which are related to the maturity of cost accounting. The degree of centralization of the BI function is regarded to be a relevant contextual factor for our research, since highly centralized as well as highly decentralized BI structures exist.

Table 6 provides an overview of contextual factors related to the environment of a company that need to be considered because external factors influence IS CAs as well as internal factors.

In our research, we perceive legal or contractual obligation as a contextual factor directly or indirectly influencing the configuration of a BI CA. If the obligations regulate the cost management information the company has to provide, a direct influence prevails. If the obligations prescribe certain BI structures, the CA is indirectly influenced. Further, we consider the combined contextual factor competition and uncertainty as well as the type of industry to influence the effective configuration of BI CAs because various publication show effects of these factors related to IS cost management.

It is essential to highlight that the ensemble and interplay of contextual factors needs to be considered in the configuration of a BI CA, since organizations are characterized by different contextual factors. Further, in particular the interplay of contextual factors related to technology and related to organization appears to refer to the degree of business/IT alignment. Therefore, the degree of business/IT alignment can be regarded to as a subsuming set integrating certain contextual factors of the two categories. Consequently, a high degree alignment could allow for sophisticated BI CA mechanisms.
5 Results of Focus Group

In this section we analyze, interpret, and report the results of our FG study presented in section 3.3. On one hand, contextual factors, which we already revealed in our literature review, were confirmed in the FG. Due to space limitations we do not report details about the discussions on the confirmed factors. On the other hand, three new contextual factors were identified in the FG study. Subsequently, we discuss the newly identified contextual factors and present interesting aspects of confirmed factors.

The **phase of acceptance of BI services** was unveiled and debated by the participants as a factor influencing the configuration of BI CAs. In general, a consensus prevailed among the participants that the phase of acceptance shall be considered in a similar way like the maturity of BI services in the design of a CA. Participant #3 stated that “in lower phases of acceptance the use of BI services shall rather be subsidized to stimulate use and reach a higher acceptance.” In our analysis we agree, that a sophisticated CA might not be purposeful, and might even cause effects contrary to their intended results, if BI services are not even accepted yet. In the course of the discussion on phases of acceptance, the participants brought the aspect of BI architecture into play, since some of the participants believed decentralized architecture to enjoy higher acceptance by users. In the participants’ companies different BI architectures exist, e.g., one enterprise DWH or several functional DWHs. Therefore, the participants recognized differences in their CAs resulting from differences in their BI architectures. Dissents remained on whether decentralized BI architectures enjoy higher acceptance. In our research, we take up the phases of acceptance for further consideration. In contrast, we do not explicitly take over BI architecture, since the discussions showed that the architectural aspect is inherent to the degree of centralization as the technological aspect of centralization.

In the discussion on centralization, the participants of bank D explained that within their company the BI department is monopolistic and does not compete with other internal or external providers. As a result, a basic BI CA is set up in bank D that “does not have appropriate steering impacts due to missing accountability for the results of the CA” (participant #9). Undisputedly, in this example the monopolistic status as a result of high centralization influences the configuration of BI CA.

According to the discussions, all participating companies are organized as cost centers. Nevertheless, the participants unanimously agreed that the corporate structure of cost accounting influences the configuration of BI CAs. According to participant #7 other departments within their organization are organized as profit centers and employ more market oriented CA mechanisms. In addition, participant #5 stated that if BI is organized in a separate company, legal transfer pricing regulations influence the configuration of the CA. On one hand, the organization in cost centers, profit centers, investment centers, or separate companies is subject to the configuration of a CA. On the other hand, the BI organization is embedded in a given corporate cost accounting structure, which influences the configuration of a BI CA. Therefore, we consider the **corporate cost accounting structure** as a contextual factor.

Apart from bank C, which has a high CIO involvement, all participating companies reported about an issue between funding the original investment and bearing the ongoing operational costs. Even in bank C the funding is supposed to influence the later allocation of operational costs. According to the participants the original funder becomes the owner of the BI application and has a stake in the allocation of operational costs. Thus, in case a BI application is centrally funded all users can be equally charged with operational costs. In contrast, if a BI application is funded by one functional department, but used by several functional departments, the original funder must be able to partially recover its investment. Thus, we adopt the **form of original funding** as a contextual factor.

Participant #5 informed that in his perception in their company involved parties “have fun with finding the most appropriate allocation key”. A lively debate revealed different organizational cultures, e.g., a “free rider mentality” (participant #9) regarding BI costs in bank D. This discussion confirmed the contextual factor of maturity of cost accounting, which is assumed to influence organizational cultures by setting appropriate cost accounting policies.
6 Synthesis of Results

Synthesizing the results of our research we propose a classification scheme in form of a morphological box that consolidates all identified relevant contextual factors for BI CAs. A morphological analysis is an appropriate means for the synthesis of our results, since it is referred to as “a method for structuring and investigating the total set of relationships contained in multi-dimensional, nonquantifiable, problem complexes” (Ritchey, 2011, p. 7). Figure 1 shows the morphological box including all contextual factors as well as example characteristics. In fact, we used the characteristics identified with the contextual factors in our literature review. If in the literature review revealed no appropriate characteristics for a contextual factor, we derive the example characteristics from other research works related to the contextual factor. Regarding the maturity considerations exhaustive work in the area of BI exists by Raber et al. (2012), from which we adopt the denominations of the maturity levels because the focus of these work fits to our research interest. Regarding the characteristics of phases of acceptance we refer to Cooper and Zmud (1990), since it is a widely recognized conceptualization in IS research. For the newly identified contextual factors from our FG study we take over the discussed characteristics.

<table>
<thead>
<tr>
<th>Management objectives</th>
<th>Use/ Resource-related</th>
<th>Costs/ Performance-related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient use of resources</td>
<td>Initiate Harmonize Integrate Optimize Perpetuate</td>
<td></td>
</tr>
<tr>
<td>Exploit BI’s full potential</td>
<td>Support Factory Turnaround Strategic</td>
<td></td>
</tr>
<tr>
<td>Effective BI resource utilization</td>
<td>Low Medium High</td>
<td></td>
</tr>
<tr>
<td>Increase user and IS staff awareness</td>
<td>Low Medium High</td>
<td></td>
</tr>
<tr>
<td>BI resource regulation</td>
<td>No Sektor High</td>
<td></td>
</tr>
<tr>
<td>Increase user &amp; management involvement</td>
<td>Support Factory Turnaround Strategic</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Morphological box comprising relevant management objectives and contextual factors

In practice a big amount of different combinations of management objectives and characteristics of contextual factors might occur. Due to the fact that every assessment of a company according to the proposed classification scheme represents a snapshot at a certain point and objectives and factors are not stable, even for a single company several design situations might be applicable over time. Further, probably one characteristic of a contextual factor indicates a certain configuration of a CA, but at the same time the characteristic of another contextual factor suggests a different configuration. Thus, it is important to demonstrate ideas how the insights on contextual factors can be applied, wherefore the vehicle of depicting archetypical companies is often used (e.g., Miller, 1975, Reid and Smith, 2000). Reid and Smith (2000) present three archetypical companies: adaptive, running blind, and stagnant. An adaptive company dynamically operates, running blind company intuitively makes its decision, and a stagnant company is stable with conservative decision making. In the following, we draw three types of BI companies based on real-world examples from our BI research and discuss implications of the contextual factors on the BI CAs. Example 1 refers to a company from the FG of the paper at hand. Example 2 arises from a practical BI project and example 3 has its origins in a prior FG study (Eppl et al., 2015). These examples represent – in our understanding – archetypical combinations of contextual factors (characteristics are highlighted in italics) with dominating influences of certain factors.
**Example 1: the adaptive BI company.** In example 1, we refer to a large sized global bank in a highly competitive market and legal obligations require certain BI structures. A broad BI landscape is fully centralized for data storage and processing and decentralized for reporting applications. Mainly mature and accepted BI services comprising different types of BI systems exist. Maturities of BI, BI management, and cost accounting are considered on the level “optimize”. Frequent innovations are implemented. The bank is organized in cost centers and a differentiated funding model for BI components exists. Overall, high management support for BI prevails and an explicit commitment to all our identified objectives exists with emphasis on: effective and efficient use of resources, exploitation of BI’s potential to a high extent, cost-by-cause allocation, enhance transparency, and performance evaluation. The CAs of example 1 appear highly sophisticated consisting of various combined CAs for different management purposes, e.g., internal activity allocations based on defined service catalogues and different service level agreements. Further, several overhead rates with different and accurate actual and planned keys are in place. In addition, a mark-up on full cost prices is charged on certain BI consulting services to earn reserve funds for future innovations driven by the BI department without dedicated sponsors. The BI CAs are subject to continuous revision and adaption and contribute to use-and resource-related objectives, e.g., exploiting BI to its full potential, by drawing conclusions about usage behaviors. A high effectiveness of BI CAs is reached in regard to the predefined objectives. The driving contextual factors are supposed to be the mature technological and organizational aspects, the competitive environment as well as clearly defined objectives and management support. These factors also outweigh the lower requirements of legal obligations in the configuration of the BI CAs.

**Example 2: the running blind BI company.** This example refers to a large sized traditional transportation company with a monopolistic market position. No contractual obligations exist, but political pressure from public shareholders questioning high expenses – also in IT. A big BI department is partially centralized (for data storage) and decentralized for (partially redundant) data processing and reporting. Various types of BI systems with widely differing maturity levels exist. The different BI services in the expedient BI landscape enjoy different phases of acceptance. The corporate cost accounting is structured in cost centers and on the lowest maturity level. The management objectives are not clearly defined, but claim to target cost recovery and creation of cost awareness. Only a rudimentary CA is implemented using overhead rates (allocation key: computers per cost center), which is a means in itself and does not have any management impact. Thus, example 2 is running blind in terms of leveraging the potential of CAs. Due to increasing pressure from shareholders urgent advancements in cost management are necessary, which will affect BI cost management and are supposed to lead to a better exploitation of BI capabilities. In the running blind BI company a broad BI landscape with lacking integration and harmonization has grown. Missing cost management capabilities, low management support, and unclear objectives are dominant factors causing an ineffective BI CA.

**Example 3: the stagnant BI company.** This example refers to a medium sized innovative IT inhouse consulting in the automotive industry in a less competitive environment. The centrally provided and centrally funded BI services have medium automation and standardization, and are – apart from report adjustments – rarely changed. BI services are in the pre-acceptance phase (between adoption and adaption) and enjoy medium top management support. The type of BI system is considered supportive to management reporting and on the second lowest maturity level (harmonize). In contrast, BI management is on the lowest maturity level (initiate) and the maturity of cost accounting is on the medium maturity level (integrate) employing a cost center structure. A vague goal definition of only cost- and performance related objectives (cost recovery of BI department, enhance cost transparency as far as possible) exists. The company is considered stagnant in two respects. On one hand, the BI services themselves are about to gain more momentum by broadening the service portfolio and gaining importance, acceptance, and maturity. On the other hand, the BI CAs are currently only rudimentary implemented. BI staff charges labor costs (based on standard cost rates) by an internal activity allocation to other cost centers. All remaining BI costs are charged by overhead rates (allocation key: planned full time equivalents per cost center) to all other cost centers. Due to the only vague management objectives, which are fulfilled by employing simple mechanisms, the CA seems stagnant, but appropri-
ate. However, if BI services are advanced in future, more costs occur, and more resources are bound, a shift to use- and resource-related management objectives, BI management and more sophisticated BI CA is expected. The predominant factors leading to stagnation are the rather low maturities in BI services and BI management as well as the vague and only cost-related definition of objectives.

7 Discussion and Conclusion

We develop a classification scheme integrating contextual factors relevant for BI CAs that is in accord with theoretical and practical wisdom. Our work provides a structured way of thinking for the purposeful configuration of BI CAs respecting situational characteristics, which shall be considered prior to configuration activities to prevent from not purposeful “into-the-blue” configurations. In contrast to a “one-size-fits-all” approach, we plead for dedicated configurations of CAs according to combinations of contextual factors to exploit the full prospects of CAs. Although we examine the subject of BI CAs, we claim for transferability of the results to other domains of IS CAs or IS CAs in general to a certain extent. By putting our research forward we contribute to IS research, since a “lack of understanding regarding the best context for an effective chargeback system contributes to a sense that chargeback systems often generate more distraction than value in organizations.” (Ross et al., 1999, p. 216). Although prior works synthesizing contextual factors exist, the contribution of our research is novel for the following reasons. First, we carry contingency research forward to a yet unexplored context: CA of BI costs. We contribute to the accumulated body of knowledge by closing the research gap regarding the effective configuration of BI CAs in various design situations. Second, prior works on IS CAs (e.g., McKinnon and Kallman, 1987) consider certain contextual factors, but are not aimed at identifying all contextual factors relevant for an IS CA. Third, in contrast to prior works synthesizing contextual factors we corroborate the results from a comprehensive review of prior works with rich insights into real-world applications from a FG study. Fourth, the synthesis of results in a morphological box with example characteristics and the illustration of examples in section 6 offer useful insights how situational context can be identified and how it affects the configuration of BI CAs in practice. Therefore, our scientifically derived classification scheme assists practitioners facing real-world design problems by delivering a compelling concept about design situations.

Our research needs to be reflected in the light of its limitations. First, due to the fact that our FG consisted of practitioners from a particular industry in a certain geographical region, a bias might slip in, which we excluded to the best of the authors’ knowledge in the interpretation of the results. The employment of two researchers independently taking notes (Miles and Huberman, 1994) is a valid countermeasure against misinterpretations and biases. Second, while we provide a comprehensive set of contextual factors accurately derived from a literature review and a FG, other relevant factors or characteristics of factors might exist. Third, we do not claim to have developed a panacea for the situational configuration of CAs, but we break a complex topic down to sizable sets. Our proposed classification scheme is standalone applicable, but especially gains significance in the interaction with other instruments. Therefore, it is crucial to point to directions of future research.

Researchers are invited to develop further context-specific BI and CA knowledge by extending our work. On the basis of our findings, future work shall particularly focus on three fields. First, the proposed classification scheme helps to depict the relevant prevailing contextual factor in a company, but it does not provide a corresponding assessment instrument, which can be used to assess the characteristics of the contextual factors in a single company. Thus, we propose that future research shall develop a scientifically valid assessment instrument. Second, by the contextual factors the design situation is defined and certain indications for the configuration of a BI CA are given. However, it does give specific enough insights on the configuration of all necessary method fragments (cf., section 3.1). Consequently, future work shall contribute to the configuration of a BI CA in an identified design situation. Third, further verification and validation of our findings in practice can contribute to the confirmation and extension of our classification scheme. Moreover, additional practical cases and quantitative data sets can give evidence about archetypical companies and dominating contextual factors.
References


