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Maturity of IS-based Financial Consolidation for Large International Enterprises: Requirements, State of the Art, and Development Directions

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Abstract

Grounded in legal and management requirements, information system (IS)-based financial consolidation is a central component of financial reporting and decision making for large international companies. Currently, financial consolidation applications are confronted with a variety of new requirements: higher change rate of (semi-) legal reporting standards, higher internal dynamics, increased report frequencies, and higher demand of software usability. Despite its importance, financial consolidation is underrepresented in accounting information systems (AIS) research. This paper aims at systemizing (new) requirements from an external and internal perspective as well as from a consumer and supplier perspective. The analysis of six leading consolidation applications identifies three gaps concerning functional incompleteness, an unclear profile of applications concerning stand-alone solutions or integrated modules of a Business Intelligence (BI) suite, and missing flexibility. In order to overcome these gaps, this article recommends a distinction between core, advanced, and shared capabilities, a situational design in front existing BI capabilities and organizational demand, and a flexible architecture concept.

Keywords: Legal consolidation, financial statement, financial reporting, information systems, design science

1 Introduction

The rationale for financial consolidation is grounded in the purpose to represent the company and its divisions as one single entity. This means to eliminate capital interests, internal transactions, and internal results between legal entities and business segments in order to present a true and fair view of the wealth of the corporation [Anandarajan et al. 2004; Weissenberger et al. 2004]. Despite its origin in the internationally accepted accounting principles (IAAP) and other local accounting standards [Ernstberger, Vogler 2008], complex organizational structures, internal markets, and the harmonization of financial reporting have also turned financial consolidation into a needed component of internal management reporting [Mayer, Krönke 2010]. In consequence, this leads to more dynamic (e.g. by new reports, in-depth analysis, and organizational restructuring), which is fairly new to financial consolidation (departments). In addition, the rules of IAAPs are also much more changing compared to their local predecessors and are also demanding ongoing modifications of financial consolidation [Fisher 2007].

Based on legal requirements, financial consolidation applications have developed into an established part of the corporate center IS environment [Duh et al. 2006; Rom, Rohde 2006]. The consolidation software market has long been dominated by some strong local vendors providing dedicated solutions for their home market, such as SAP in Germany, Hyperion in the US, Cartesis in France, and Frango in Scandinavia [Fuchs, Bange 2010]. The ongoing development of those solutions has led to a mature capability level. However, driven by the internationalization of accounting standards, the local perspective of the applications has been given away, leading to internationally applicable consolidation applications and in consequence to an international market for the latter. This has also been forced by the acquisitions in the vendor landscape of Business Intelligence (BI) (e.g. the acquisitions of Hyperion by Oracle, Business Objects by SAP, and Cognos by IBM) [Fuchs, Bange 2010]. In the following, single isolated consolidation applications become now branded as parts of broader BI suites and are sold by promises of higher integration into data warehouse environments and the sharing of advanced reporting capabilities, front-ends, access rights, and workflow capabilities [e.g. Sap 2010].

On the customer side, various studies report trends to streamline financial and management accounting, e.g. into highly automated shared service centers and analytical competence centers [Cooper, Dart 2009]. Among other things, this results in

approaches of enterprise-wide ERP systems with harmonized financial master data and financial data warehouses. Furthermore, BI and web technologies have established for management and financial accounting [van der Walt, du Troit 2007; Wixom, Watson 2010], which in turn leads to higher expectations regarding timeliness and quality of data, and software convenience [Vasarhelyi, Alles 2008]. Practitioners still often report dissatisfaction with the capabilities of their consolidation application: Consolidation runs are too slow. The applications are incomplete and not flexible enough to cope with the changing requirements. The promised integration into BI suites has not taken place [Krönke, Marx 2008; Mayer, Krönke 2010].

Despite their importance, the mentioned challenging new requirements, and the reported dissatisfaction of practitioners, research on accounting information systems (AIS) does not yet focus on consolidation applications and analytical applications [Rom, Rohde 2007]. Scientific research focuses on accounting standards from a legal perspective [e.g. Ernstberger, Vogler 2008; Wagenhofer 2009], on ERP systems, and on whole BI suites [e.g. Duh et al. 2006; Rom, Rohde 2006]. Only selectively, features of consolidation applications are discussed, e.g. using the extensible business reporting language (XBRL) for electronic financial reporting [Debreceny, Gray 2001; Spies 2010] or temporal IS capabilities to cope with changing meta data and master data [Fisher 2007; Koncilia 2003]. On the other hand, practice-oriented research, mostly of BI consulting firms and the software vendors itself, provides white papers and books regarding software capabilities, but often neglects a critical perspective [e.g. Fuchs, Bange 2010; Sap 2010].

In the light of those considerations, the purpose of this article is tripartite: develop and validate a consistent set of current requirements of consolidation applications, analyze the maturity/state of the art of existing applications, and derive design guidelines to fill potential gaps.

2 Research Methodology

Developing requirements and design recommendations, this article adheres to the design science approach of research, which aims at creating innovative and useful artifacts that solve relevant design problems in organizations [Hevner et al. 2004; March, Smith 1995]. In the last decade, design science has been driven by Information Systems (IS) research [Winter, Baskerville 2010], but has also been strongly recommended for management [van Aken 2004] and accounting research [Kaplan 1998; Kasanen et al. 1993; Labro, Tuomela 2003]. Following Walls [1992] and Gregor [2006], essential results for IS design are requirements and guidelines of the meta-design or model of an IS, which are addressed in this paper. In order to design relevant, but also rigorous artifacts, the design science community proposes different research processes. Peffers et al. [2007] outline six research phases: (1) identify a problem and motivate, (2) define objectives for a solution, (3) design and develop, (4) demonstrate, (5) evaluate, and (6) communicate. As mentioned by Peffers et al. [2007], there is no expectation that researchers would always proceed in sequential order from activity 1 through to activity 6. As the central objective of this article is to define current requirements, this paper is focused on phases 1 to 3, leading to the following article structure:

- *Identify a problem and motivate*: The article is motivated by current developments that challenge existing consolidation applications (sec 1.)
- *Define objectives for a (IS) solution*: After the necessary foundations of consolidation applications, application design and requirements definition (sec. 3), this article identifies three different stakeholder perspectives in order to systematize and summarize the broad range of requirements of consolidation applications: a legal and external stakeholder perspective, an internal management perspective, and a supplier or management accounting / IT department perspective (sec. 4). In a second step, the three perspectives are merged, detailed and validated with an expert focus group, resulting in one final set of requirements. A subsequent examination of six leading consolidation applications, using in-depth interviews at large international enterprises, identifies potential gaps (sec. 5).
- *Design and develop*: For development, this article focuses on the outlined gaps and provides design guidelines for each gap. (sec. 6). This article does not

substantially evaluate the guidelines. These areas should be the subject of further research.

3 Foundations

3.1 Consolidation Applications

Consolidation applications are part of accounting information systems (AIS), which are socio-technical IS combining the capabilities of information technology (IT) with traditional accounting methods and controls [Romney, Steinbart 2009]. More specifically, AIS encompass accounting-related transactional enterprise resource planning (ERP) applications, e.g. for financial accounting and cost accounting, and analytical applications, e.g. applications for planning, reporting, and consolidation [Rom, Rohde 2007]. In general, analytical applications encompass all systems supporting the management and knowledge worker with information and needed functionality. Therefore, they need aggregated and historical data and are normally based on a data warehouse (DW) serving as data integrator, central data provider, and storage [Wixom, Watson 2010]. Incorporating functionality, the definition of analytical applications reflects the fact that more and more specialized applications can be found on the analytical layer. Incorporating knowledge workers, it reflects the fact that analytical applications are not often directly used by executives themselves, but by knowledge workers such as financial and management accountants [Chamoni, Gluchowski 2006]. Lately, the term business intelligence (BI) has gained significant popularity, integrating different aspects of IS-based managerial support [Davenport, Harris 2007]. BI is seen as "... a broad category of applications, technologies, and processes for gathering, storing, accessing, and analyzing data to help business users to make better decisions" [Watson 2009]. This definition reflects not only the growing importance of analytical applications, but also the fact that consolidation applications are no single isolated solutions, but are embedded in a BI environment.

3.2 Application Design

Modern applications are based on a layered architecture, typically consisting of a presentation layer, functionality layer, and a data layer [Alonso et al. 2004]. The presentation layer incorporates the interaction of the application with the user, e.g. using a graphical user interface. The functionality layer implements the functional logic of the application. The data layer consists of the necessary data objects and data management functions.

Consolidation applications are often in the middle between so-called concept-oriented and generic applications [Kemper et al. 2006, S. 84 f.]. Concept-oriented applications

are based on a reference model incorporating “best practice” or “best of breed” [Becker et al. 2002, S. 1295]. They are delivered with dedicated business logic, e.g. specific consolidation functions, consolidation workflow, and accounting objects which have to be customized during the software introduction. In contrast, generic applications are more or less a tool box or work bench, providing some kind of functionality for modeling data objects, functions, processes, and data models, applicable for various contexts [2008]. Concept-oriented applications are favoured in terms of fast software introduction, but also because of the certainty that they comply with reference requirements. However, the flexibility is restricted to the capabilities foreseen in the reference model [vom Brocke 2003, S. 101]. Unanticipated customization or changes within operation demand a tool box or application programming interfaces (APIs) and often result in expensive software development projects [Chamoni, Gluchowski 2006, S. 8]. For both types, traditional applications typically couple all three layers tightly [Ganczarski, Winter 2008]. In contrast, as mentioned before, consolidation applications are more and more part of whole BI suites. Beyond data integration using a data warehouse, BI suites aim at sharing application functionality incorporated into dedicated modules, e.g. for reporting, planning, workflow, and master data management etc. Therefore, modern BI suites apply further software design criteria, such as avoiding redundancies, functional reuse, and modifiability [Ganczarski, Winter 2008; Rom, Rohde 2006].

3.3 Requirements

Requirements can be defined as “prerequisites, conditions or capabilities needed by users (individuals or systems) to solve a problem or achieve an objective” [IEEE 1990]. It is common to distinguish between functional and non-functional requirements [IFPUG 2010; Landes, Studer 1995; Paech, Kerkow 2004; van Lamsweerde 2001]. Functional requirements define “what” the system should or must do [Paech, Kerkow 2004; Sommerville 2010] - “a function that a system (...) must be able to perform” [IEEE 1990]. Examples of functional requirements could be a function for debt consolidation or role-based access rights. Non-functional requirements, in contrast, define how well the IS performs within the given environment [Paech, Kerkow 2004; Robertson, Robertson 2006]. These requirements thus comprise properties and characteristics under which the system must operate. Typical examples of non-functional requirements are “reliability” and “scalability” [Chung, Sampaio de Prado Leite 2009]. Next to the user perspective, also called black-box view [Dietz 2007], some commentators suggest that requirements should also

include a supplier perspective. The latter is about “how” the IS is brought to life. This incorporates the fact that a system must be compatible with its environment, limiting the design freedom [Dietz 2007; Kotonya, Sommerville 1998]. It is also called the constructional or white box view [Hoogervorst 2009]. Examples of constructional requirements are “standardized dialogs”, “multilingual interfaces”, “service-oriented architecture”, and “client-server architecture with thin clients”.

4 Overview of Requirements

In the following, this paper derives a model of requirements from different stakeholder perspectives as proposed for information systems (IS) engineering – a so-called viewpoint-oriented requirements definition [Darke, Shanks 1996; Leité, Freeman 1991]. The paper differentiates between external and internal stakeholders [Goncharov et al. 2009] and, following the discussion of section 3.3., between a consumer and a supplier perspective [Dietz 2007]. This results in a stakeholder matrix (Tab. 1). As this paper focuses on the customer side, the vendor perspective will not be followed in terms of requirements.

Tab. 1: Stakeholders of Financial Consolidation

Requirements	External	Internal
Consumer	Investors, auditors, legal and tax authorities (sec. 4.1)	Management (sec. 4.2)
Supplier	Vendors (not followed)	Accountant (sec. 4.3)

4.1 External Consumer Perspective: Legal Requirements and Financial Accounting

The purpose of financial accounting (FA) and reporting is to provide stakeholders with reliable and traceable information about the (financial) wealth of the corporation, its legal entities and major business segments [Anandarajan et al. 2004]. Therefore, financial accounting collects, classifies, and computes quantitative, foremost financial, information about the organizational activities according to accounting standards [Horngren et al. 1999]. For large enterprises, the legal requirements for consolidation are derived from a multitude of local and fewer international accounting standards. Local accounting standards, further considered as local generally accepted accounting principles (GAAPs), are often enacted by the legislature and codified, e.g. the German GAAP or the UK GAAP, and are accompanied by court decisions and reporting practice. Together, those codified and non-codified rules have to be observed in preparing financial statements by legal entities, which are the basis for distributable income, taxes, and other provisions. Holding or parent companies having one or more subsidiaries need to prepare additional consolidated statements, leading to two sets of accounts: unconsolidated (single) accounts and consolidated (group) accounts [Ernstberger, Vogler 2008; Goncharov et al. 2009]. In most cases there are also tax accounts. These different account sets are based on different properties and are adjusted to the specific reporting needs and stakeholders.

Due to cross-listings or a perceived need for more investor reporting, multinational companies have started to apply International Financial Reporting Standards (IFRS) and/or US-GAAP to consolidated statements. Furthermore, some stock exchanges demand IAAP within their listing regulations. This leads to a third or fourth set of accounts. In order to reduce accounting efforts, some governments have started to allow publicly listed companies to substitute IAAP for local GAAPs with regard to consolidated statements. Since 2005, all publicly traded companies in Europe have been required to prepare consolidated statements under IFRS. Non-publicly traded companies are also allowed to apply IFRS for consolidated statements [Ernstberger, Vogler 2008]. As a result, companies have to cope with a multitude of local GAAPs and even more than one GAAP at corporate level. Reclassification and currency conversions are necessary in order to transfer the single accounts to group accounts, but also to bridge the differences between the different GAAPs at corporate level.

The GAAPs not only specify accounts but also consolidation methods, the necessary calculation steps to display the company as one entity. In the following, the article focuses on IFRS, as this is the dominating accounting principle in Europe [Wagenhofer 2009]. The (1) capital consolidation is necessary to offset the parent's interest in the subsidiary entity against the apportionable share of the subsidiary company's equity. According to the share of the parent, IFRS distinguishes the methods of full consolidation, of proportional/partial consolidation, and of at-equity consolidation (IFRS 3). The (2) debt consolidation is necessary for the mutual elimination of intra-company claims and liabilities from intra-company credit and commodity transactions, so that only claims and liabilities with external customers are part of the financial statement (IAS 27.24). Comparably, the (3) consolidation of income and expenses from intra-company business relations and (4) the elimination of intermediate results from the difference between intra-company production costs and prices are necessary (IAS 25.25).

As a result, the financial consolidation requires the delivery of a balance sheet, profit and loss (P&L) statement, cash flow (CF) statement, and statement of changes in equity. Further needed reports are qualitative notes explaining different accounts (IAS 1). As a new legal requirement, XBRL is demanded by stock exchanges but also by the authorities, e.g. the Securities and Exchange Commission (SEC) of the Unites States of America (US), the German Chamber of Commerce as well as tax authorities, for delivering financial reporting using an electronic reporting standard [Debreceny, Gray 2001; Spies 2010].

As the organizational and legal structure of companies is constantly changing, the GAAPs not only specify rules for ongoing operations, but also how to display special business cases such as acquisitions, internal restructuring, and discontinued operations. Examples are special separations of discontinued operations within the profit and loss statement (IFRS 5), but also necessary two-year financial restatements backwards in order to provide external stakeholders with a comparable data base for the new (reduced) company (IAS 8). Next to business dynamics, the IAAPs are much more changing compared to their local predecessors, e.g. due to continuous updates and modifications of accounting rules [Fisher 2007]. The modification of master data, such as legal hierarchies and accounts, needs specific capabilities, known as 'slowly changing dimensions' or temporal master data [Kimball, Ross 2002, S. 95 und 201; Koncilia 2003, S. 77].

Several cases of fraud around the turn of the millennium led to an increase in legal rules (e.g. Sarbanes Oxley Act (SOX) or the German Corporate Sector Supervision and Transparency Act (KonTraG)), resulting in additional compliance or audit reports [Berry et al. 2009; Woods 2007]. Audit trails or log files are requested by auditors in order to be able to retrace all changes at the financial consolidation application.

Transferring this discussion to the three application layers introduced in section 3.2., first requirements from a legal and external perspective could be categorized and summarized as follows in Tab. 2.

Tab. 2: Legal Requirements of Consolidation Applications

Category	Requirements
Presentation Layer	Standard reports (Balance sheet, P&L, CF statement, notes), XBRL exports, audit reports, log files
Functional Layer	Special business cases: Acquisitions, internal restructuring, and discontinued operations
	Data Consolidation: Capital consolidation, debt consolidation, consolidation of income and expenses, the elimination of intermediate results
	Data Preparation: Reclassifications between different accounts and currency conversions
Data Layer	Data model: Handling of multiple accounts/GAAPs, handling of multiple currencies, handling of legal structures (legal entities and business segments), temporal master data concept, handling of qualitative data

4.2 Internal Consumer Perspective: Management Requirements

Although legal requirements provide an extensive model for financial reporting and IAAPs have a stronger internal management perspective than their local predecessors

("management approach", IAS14 and SFAF 131), internal management reporting requirements are still different from legal standards [Ansari, Euske 1995]. They differ regarding the needed information, depth of analysis, and different data categories (e.g. plan data) [Cokins 2001].

Regarding information, a broader set of information has been established. Next to financial accounting, information from management accounting (MA), strategic management accounting (SMA), and value-based management (VBM) is also part of management reporting [Bowman et al. 2006; Otley 2001; Singh et al. 2002]. In contrast to FA, MA focuses on additional internal management requirements, such as cost control, pricing, and invest calculation. Furthermore, MA provides a higher transparency, as allocations not only focus on legal entities, but also on management units, customers, processes and activities as well as on products and services [Horngren et al. 1999]. Typical results of the MA system are contribution margins of most important products and results of cost and profit centers [Kaplan 1984]. SMA shifts the focus from financials to more qualitative and non-financial information, including KPIs for quality, time to market, and flexibility assessment etc. Furthermore, the point of interest has shifted to a more external perspective as well as from a historical to a forward-looking perspective [Otley 2001]. Structured external information about customers, markets, and competitors has become increasingly important [Roslender, Hart 2003].

In the early 1990s, there was a development towards corporate strategies and the shareholder value [Grant 2001]. Originated by Rappaport [1986], the VBM approach proposed new value-based KPIs, such as an Economic Value Added (EVA), Return on Capital Employed (ROCE), and Discounted Cash Flow (DCF), but also the need to measure non-tangible assets [Roslender, Hart 2003]. The plurality of needed information leads to a broad scope of data sources, information flows and computations, which finally need to be integrated into a concise set of reports.

Executives need to be provided not only with aggregate information, they also need predefined analyses, which split reports into meaningful detail level, or the ability to analyze and process the information on their own [Adam, Pomerol 2002; Crockett 1992]. Typical analyses are drill downs along the organizational and managerial hierarchies, e.g. product, regional etc. [Walls et al. 1992]. Further needed analyses are breakdowns of KPIs into their constitutional computational components, e.g. as in a value-driver tree or a strategy map [Kaplan, Norton 2004; 1998]. In order to explore developments and trends, temporal analyses and comparisons of measures are also recommended [Singh et al. 2002]. Qualitative comments or attachments shedding light

on details should also be provided [Singh et al. 2002]. Although analysis is not the key purpose of financial consolidation, the raw data needs to be prepared to be available for analysis, often within the financial consolidation application. Compared to financial consolidation, a broader set of reporting structures (basic entities and hierarchies) is necessary, resulting in the need to consolidate in multiple hierarchies, often called matrix consolidation [Krönke, Marx 2008].

The forward-looking shift and the comparison analysis point to different data categories. The as-is data needs to be compared with data from operational planning / budgeting and forecasting prompting the management to look at risks and opportunities not anticipated in the budget [Ekholm, Wallin 2000, S. 535]. In order to prepare comparable data, not only as-is data but also plan and forecast data needs to be processed by financial consolidation; this may be realized using fewer reporting units and consolidated plan accounts. For long-term planning purposes, it is necessary to provide scenarios and simulations [Gluck et al. 1980]. This means to show the financials of the corporation after restructuring, e.g. by simulating the change from product orientation to regional orientation, or significant changes in exchange rates or sales developments [Koncilia 2003].

As a result, management requirements are different from legal requirements: The impacts are different reports, additional analysis capabilities, additional accounts and KPIs, different and multiple reporting structures (products, regions etc), event-driven consolidation runs, and simulation capabilities. Transferring this discussion to the three application layers introduced in section 3.2., the requirements could be categorized and summarized as follows in Tab. 3.

Tab. 3: Management Requirements of Consolidation Applications

Category	Requirements
Presentation layer	Advanced and interactive reports, analysis capabilities, qualitative comments
Functional layer	Special functions: Simulation capabilities
	Data Consolidation: customized consolidations runs (e.g. for plan data), matrix consolidation
Data layer	Data model: Handling of individual KPIs, of multiple data categories (plan, forecast, as-is etc.), of management structures (products, regions etc.)

4.3 Internal Supplier Perspective: Management Accountant & IS Requirements

Compared to the consumer perspectives, a large part of management accountants are concerned with the report and analysis preparation, the information supply [Cooper, Dart 2009]. Confronted with the outlined multitude of information requirements,

hundreds of legal and management entities delivering data, and short report cycles (monthly up to weekly management reports), financial consolidation needs to be embedded in well-governed reporting processes and relies on an enabling and automated IS infrastructure. Various studies report that streamlining financial and management accounting, e.g. into highly automated shared service centers/reporting factories (transaction orientation) and analytical competence centers/business partners (analytic orientation), is an actual topic of CFOs [Blocher et al. 2008; Burns, Vaivio 2001; Cooper, Dart 2009]. The demand of the broad range of insights, e.g. more operational transparency, forces ERP harmonization, but also the building of central reporting platforms beside pure financial data.

Concerning the reporting process, corporate accountants need to control the whole process from data entry to data preparation, consolidation, and reporting [Cokins 2001]. Depending on the organizational degree of differentiation and the degree of harmonization of transactional data, data entry by local accountants can vary from manual data entry in the system to manual file upload and automatic file upload / extraction from transactional systems. In regard to data preparation and next to the above-mentioned support of reclassification and currency conversions, validations are necessary to prove that the accounts are balanced and no entry failures have occurred. Furthermore, rounding and inclusion differences must be handled, either using predefined functions or manual bookings. An important pre-consolidation process step is the intercompany (IC) reconciliation. This step adjusts differences in values by a buyer and a seller entity based on intercompany transactions allowing automated consolidation runs. Validations and adjustments also become necessary on group accountant level for corrections of the consolidated data (see sec. 2.1 and 2.2). In order to synchronize and streamline the local and central reporting process, IT-based workflow support becomes necessary. In order to control and manage the process, an overview of the progress and occurring problems must be given by process reports. In order to customize the process, a workflow editor must be provided.

To cope with the multitude of requirements and their changing character, the architecture of the consolidation application is critical. A central reporting platform, based on central meta data and master data definitions, helps to avoid isolated information islands in divisions and to maintain data consistency over the broad range of reports (“a single version of truth”). Furthermore, the reuse of data, functions, and front-ends promises to reduce efforts for maintenance, development, and training for accounting and IT departments [Ganczarski, Winter 2008], as aspired by CFOs. However, as the consolidation application serves not only as central component for

external reporting, but also as integrated reporting platform for top management and further business segments, the application must be flexible to be customized for different needs within the company. This demand applies not only to customizable consolidation runs, but also to a flexible report editor and data management functions. In order to allow accounting – rather than the IT department – to adjust the consolidation application quickly and reliably, it must be possible to administer the consolidation application using a flexible and graphically supported tool box rather than a programming language (‘Power User’ concept) [Hilgefort 2010, S. 42; Li et al. 2009, S. 22]. In this context, concept-oriented applications are favoured in terms of fast software introduction, as they provide predefined reports, functions and data, but also because of the certainty that they comply with legal and management requirements. Furthermore, graphical user interfaces (GUIs) and MS-Excel integration are favoured. The latter combines the flexibility of spreadsheet solutions with the consistency of larger databases [Rom, Rohde 2007]. In the same context, authorization issues arose and demand that the application must be equipped with a sufficient authorization management for administration (corporate accountant), supplier (management accountant), and consumer (executive and external stakeholder). Transferring this discussion to the three application layers introduced in section 3.2., the requirements from a supplier perspective could be categorized and summarized as follows in Tab. 4.

Tab. 4: Supplier Requirements of Consolidation Applications

Category	Requirements
Presentation Layer	Process reports, system reports
	Graphical user interface, excel integration
Functional Layer	Report Management: Report editor
	Process Management: Workflow and workflow editor
	System Management: APIs, tool box, authorization management
	Data Management: Transactional and master data management functions
Data Layer	Predefined data model and meta data

4.4 Consolidated Requirements

The discussion of the three perspectives results in a multitude of partly overlapping requirements. In order to provide a single consistent and distinct set of requirements, they have been ordered using the three categories of presentation, functional, and data layer. For each layer, useful groupings of requirements or units of analysis on two levels have been defined, resulting in a requirements map (Fig. 1: Requirements Map): On the presentation layer, there is one cluster - (A) reports and interaction -, which consists of the analysis units of management reports, audit reports, admin reports, and

the user interface. On the functional layer, the first central structuring element cluster is (B) the consolidation process, which has to be processed in every consolidation run. It demands functional capabilities in the phases of data loading, data preparation, and data consolidation. It is accompanied by the cluster (C) of advanced process und functions consisting of special business cases and advanced consolidation functionality, which are all not needed regularly but once in a while. The next important cluster concerns (D) the supplier and governance perspective, which consists of the management of master data, of transactional data, functions and systems, process, and reporting. Finally, on the data layer, (E) the data model differentiates between master data features, meta data, and quantitative information.

The first iteration of the requirements map has been presented to a focus group consisting of five group controllers and two consultants for financial consolidation applications. According to Tremblay [Tremblay et al. 2010], focus groups are an established means to investigate new ideas and to check the applicability of a research object by practitioners. They are used to gain feedback for refining the design of an artifact [Tremblay et al. 2010], here, the requirements map. The basic structure and the selected requirements have been approved and iterated slightly. Especially non-functional requirements (F) have been raised, e.g. the performance and ease of use of the application, vendor support and strategy. The proposed changes have been incorporated into the requirements map. The final result is presented in Fig. 1

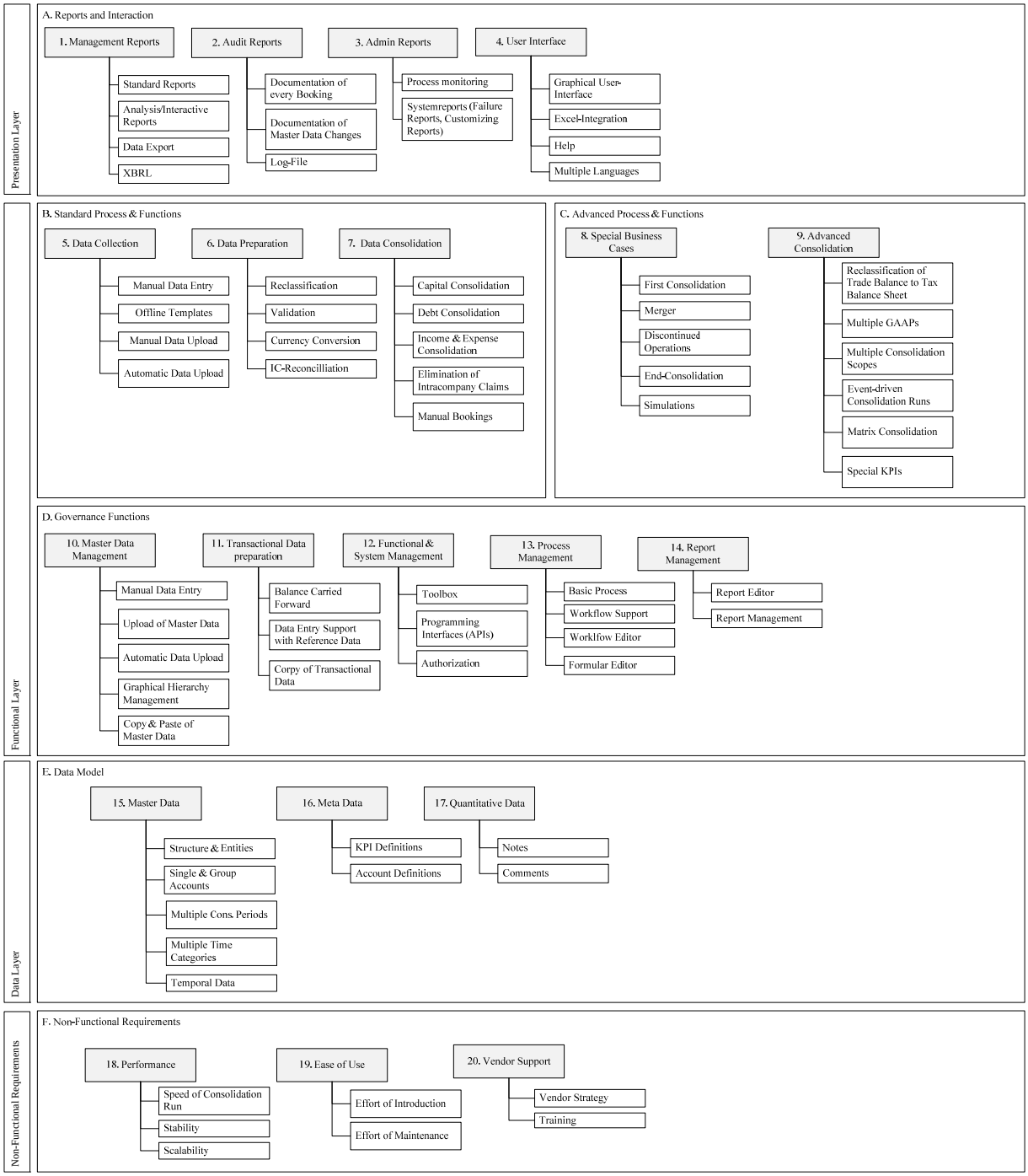

Fig. 1: Requirements Map

5 Current State of Existing Consolidation Applications

5.1 Overview and Research Approach

A 2010 overview of financial consolidation applications is provided by Fuchs and Bange [Fuchs, Bange 2010]. They list no less than 19 different applications. This article focuses on those six consolidation applications which are branded for large enterprises and which obtained the highest market share (see Tab. 5). This selection has to cope with the highest requirements regarding complexity in terms of consolidation units, special business cases, and reporting requirements etc. The market success promises a high level of maturity. Within this selection, the dominating role of SAP is explained by the recent acquisitions of Outlooksoft and Business Objects by SAP, leading to a portfolio of four consolidation applications from SAP.

Tab. 5: Leading Consolidation Applications

Name	Enterprise Consolidation (EC-CS)	Business Consolidation (BCS)	Financial Consolidation (FC)	Business Planning and Consolidation (BPC)	Financial Management	Cognos Controller
Version	4.7	6.0	10.5	7.5	9	8.3
Vendor	SAP	SAP	SAP	SAP	Oracle	IBM
History			Cartesis Magnitude Business Objects	Outlooksoft	Hyperion	Frango

Following Adomavicious et al. [Adomavicius et al. 2008] and Hevner et al. [Hevner et al. 2004], the tools have been assessed by in-depth interview sessions at large enterprises in Germany and Switzerland, each using one of the selected applications (see Tab. 6). As interviews are an observational method for capturing extremely rich data [Adomavicius et al. 2008], they allow to analyze the real capabilities of the tools and not vendor promises.

Tab. 6: Interviewed Companies

Industry	Manu-facturing	Energy	Chemical	Automotive	Chemical	Logistics
Employees	120.000	10.000	105.000	150.000	40.000	20.000
Revenue	€ 35 bn	€ 10 bn	€ 50 bn	€ 20 bn	€ 9 bn	€ 2 bn
Consolidation Units	2600	500	320	300	220	60

The interviews were structured using a questionnaire in which criteria have been defined for each (sub-) cluster of the requirements map. For the assessment, a 3-point Likert [Likert 1932] scale has been used, differentiating between “not available”, “to some extent available”, and “fully available”. The category “to some extent available” aims at covering capabilities which are not directly supported but could be realized using other features of the application. Additionally, each assessment has been supplemented by a qualitative remark justifying the assessments. On the one hand, this allows calibrating the assessments of the different applications by comparing qualitative statements. On the other hand, this allows to react flexibly to explore interesting lines of research [Myers, Newman 2007]. The questionnaire was sent to the participants in advance. Each interview lasted about 4.5 hours and was conducted by two researchers and two or three practitioners. In order to cover the needed knowledge, the set of practitioners always consisted of one participant from the FA and MA department and a second participant from the relevant IT department. After documentation, the documented results have been validated by the interviewed company within two weeks after the interview. In order not to offend the different vendors, the analysis has been anonymized in this paper, and the order of the following application analysis is not following the structure in Tab. 5.

5.2 Tool Evaluation – Results

The results are structured according to clusters A-E (section 5.2.1 to 5.2.6) and subsequently to analysis units 1-20.

A.1.1.1 Reports and Interaction (A)

In terms of (1) *management reporting*, only two applications (see D and F in Fig. 2) provide sufficient predefined reporting templates. The others provide only basic or no reporting templates at all. In the following, they need to be enhanced with dedicated reporting applications. Despite its importance, XBRL is supported by only one application (B). Here, secondary tools also become necessary. Concerning (2) *audit reporting*, there is a differentiated result. Transactional data is stored either in single data sets (receipt principle) or in a log file. Master data changes are only stored by three applications (C, D and F). Special audit functionality is provided by three of six applications (D, E and F). In the case of (3) *admin reports*, process and system reports are not sufficiently supported. Only two applications allow monitoring the progress of the consolidation run in detail (A and B). Information on the customization or used rules, validations etc. is only fully supported by one application (F). For all other tools,

a walkaround becomes necessary in order to obtain the information. In terms of (4) *user interface*, all applications are equipped with a graphical user interface and different languages. Excel Integration is provided by five of six applications (B to F). Help functionality is not given by only one application (E). An overview of capabilities of each application is provided by the diagrams in Fig. 2 displaying the share of supported requirements according to the three questionnaire categories.

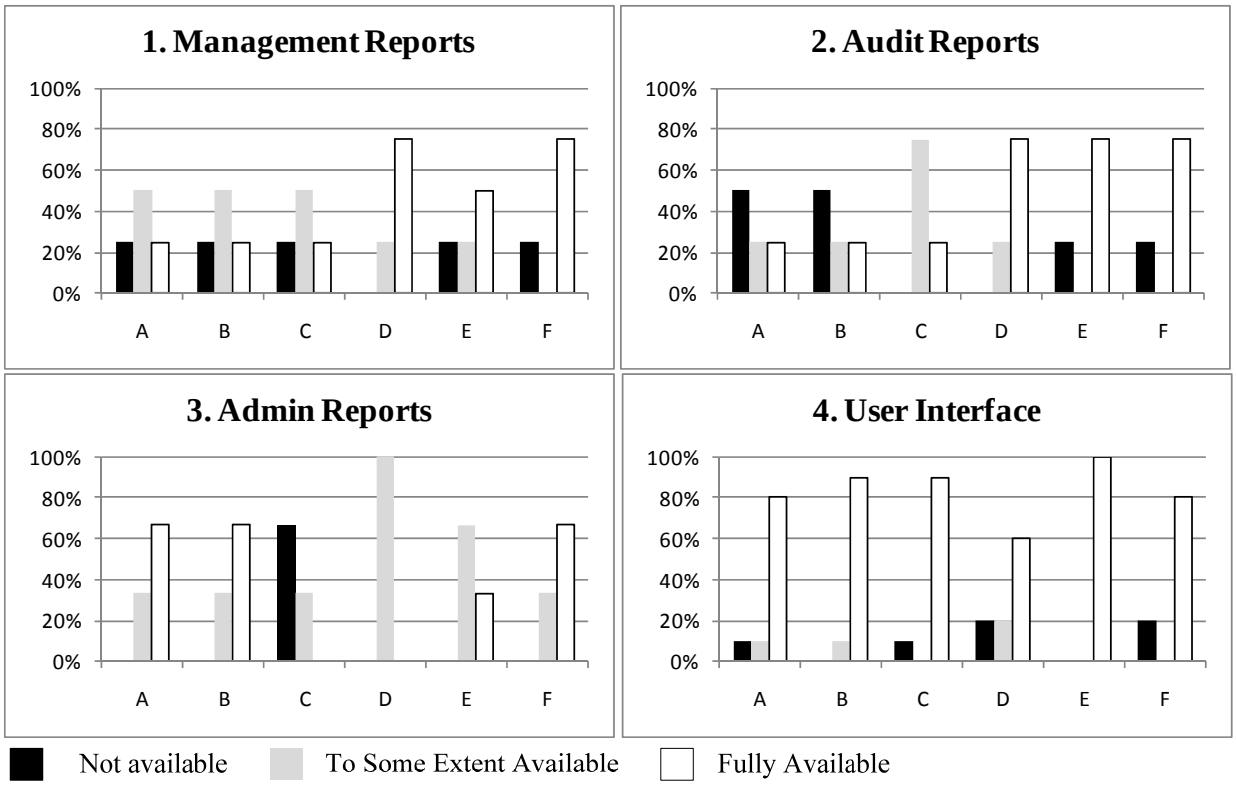

Fig. 2: Reports and Interaction Capabilities

5.2.1 Standard Process and Functions (B)

Concerning (5) *data collection*, basically all data entry options are available at each application or easily realizable. Slight differences exist concerning automatic data upload from transactional systems and offline data entry. In terms of (6) *data preparation*, no application provides sufficient predefined logic for data preparation, resulting in necessary enhancements by individual rules using rule building tool sets or manual programming using API (high assessments with “to some extent available”). Second, only three of six applications support IC reconciliation (B, E and F). Within those, however, only one application provides a sufficient functionality/process step for IC reconciliation (F). Therefore, five of six companies use individual software or additional software by the vendor or third parties (A to E). Regarding the core functionality of (7) *data consolidation*, the basic consolidation steps are contained in every application. However, the elimination of intra-company revenue and expenses,

the calculation of goodwill, and the calculation of hidden reserves are not satisfying in any application. Two applications are delivered with few predefined functions, but those could be obtained by buying "starter kits" from the vendor (C and D).

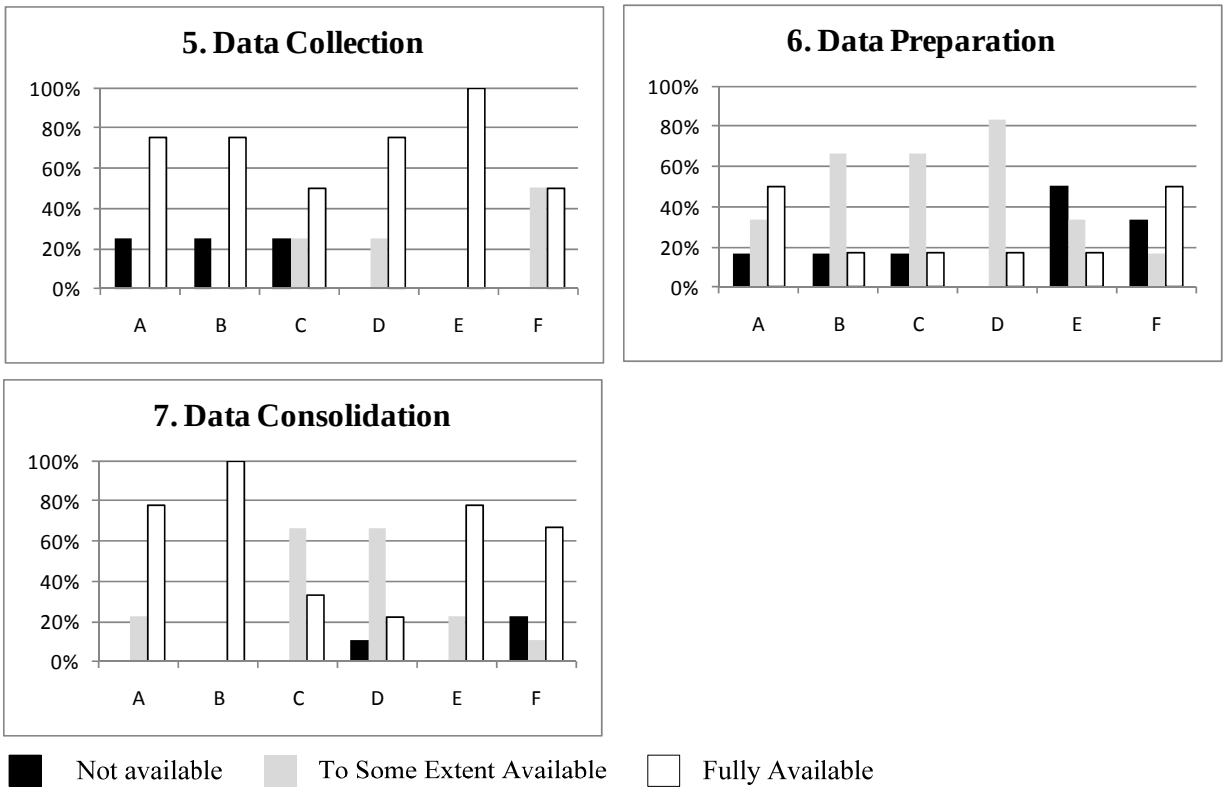

Fig. 3: Standard Process and Function Capabilities

5.2.2 Advanced Process and Functions (C)

Compared to the standard consolidation functions, only few (8) *special business cases* are directly supported with functionality. Individual rule building, programming or walkaround is necessary to realize such functionalities. The same is basically true for (9) *advanced consolidation.* Concerning *tax*, only two of six applications support the reclassification from trade to tax balance sheet (B and F). Deferred taxes are not supported either. Often, specialized applications from third parties are used. Regarding *multiple GAAPs*, all applications are prepared to handle them, e.g. by allowing multiple charts of accounts. However, except for one application (B), there is basically no predefined content or vendor support for additional accounting standards. In terms of *multiple scopes*, nearly all applications provide the possibility to handle them on different hierarchy levels but also for management purposes. The same is true for *event-driven consolidation runs:* Only one application is restricted to one set of consolidation logic (F). All other applications allow the definition of event-driven or simplified consolidation runs, e.g. for planning data or for fast closing, for

management consolidation etc. Concerning *matrix*, a distinction has to be made between real matrix capabilities and the capability of consolidation in multiple different hierarchies. A real matrix is able to reflect and reverse business relationships on all hierarchy levels. The input concerns entities with more than one parent, and the positions are allocated by using distribution keys or secondary transaction attributes. Consolidation steps are also processed on higher hierarchy levels. A consolidation based on multiple hierarchies needs data input for entities having one-to-one relationships with each hierarchy. Therefore, the granularity of basic entities is much higher. Consolidation steps are only taken in one hierarchy. Only one application is prepared for real matrix consolidation (B). Four of six applications support consolidation in multiple hierarchies (C to F). Only one application does not support multiple hierarchies (A). In terms of *special KPIs*, no application is delivered with additional KPIs like CF or EVA out of the box. In all applications, more complex computation could be realized within the application set or using the API.

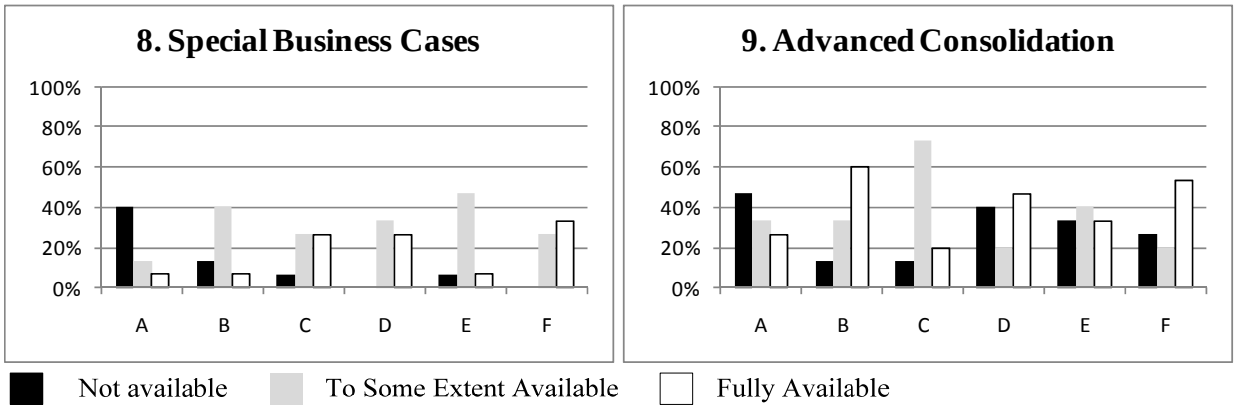

Fig. 4: Advanced Process and Function Capabilities

5.2.3 Governance (D)

Regarding (10) *master data management*, nearly all applications have full capabilities of it. Some restrictions exist concerning graphical hierarchical management, which is only supported by two of six applications (B and C). In terms of (11) *transactional data preparation*, nearly all capabilities are either available or easily realizable. An important difference between applications consists within the (12) *functional and system management*: All applications provide the possibility to enhance the functionality of the applications, but with different degrees of complexity. Two applications use an API-supporting manual programming (A and B). The programming language is complex, so it has to be done by IT staff, not by accountants. On the other end of the spectrum, two applications provide a graphically supported rule editor for the building of functionality, which is easy to use for accountants (C and

D). The other applications are stuck in the middle, as they use their own declaration language (E and F). Authorization, on the other hand, is well supported, which allows defining different roles and accesses. Regarding (13) *process management*, there is a mixed result. Two applications are based on a well-defined reference process but are very inflexible at the same time (A and B). The process cannot be modified without manual programming. Three applications are based on a very basic consolidation process (D, E, and F). One application is equipped with a very flexible workflow engine (D). Only one application does not contain a reference process (C). Concerning (14) *report management*, only one application has a satisfying report management tool set (D). All other applications only provide basic and inflexible functions.

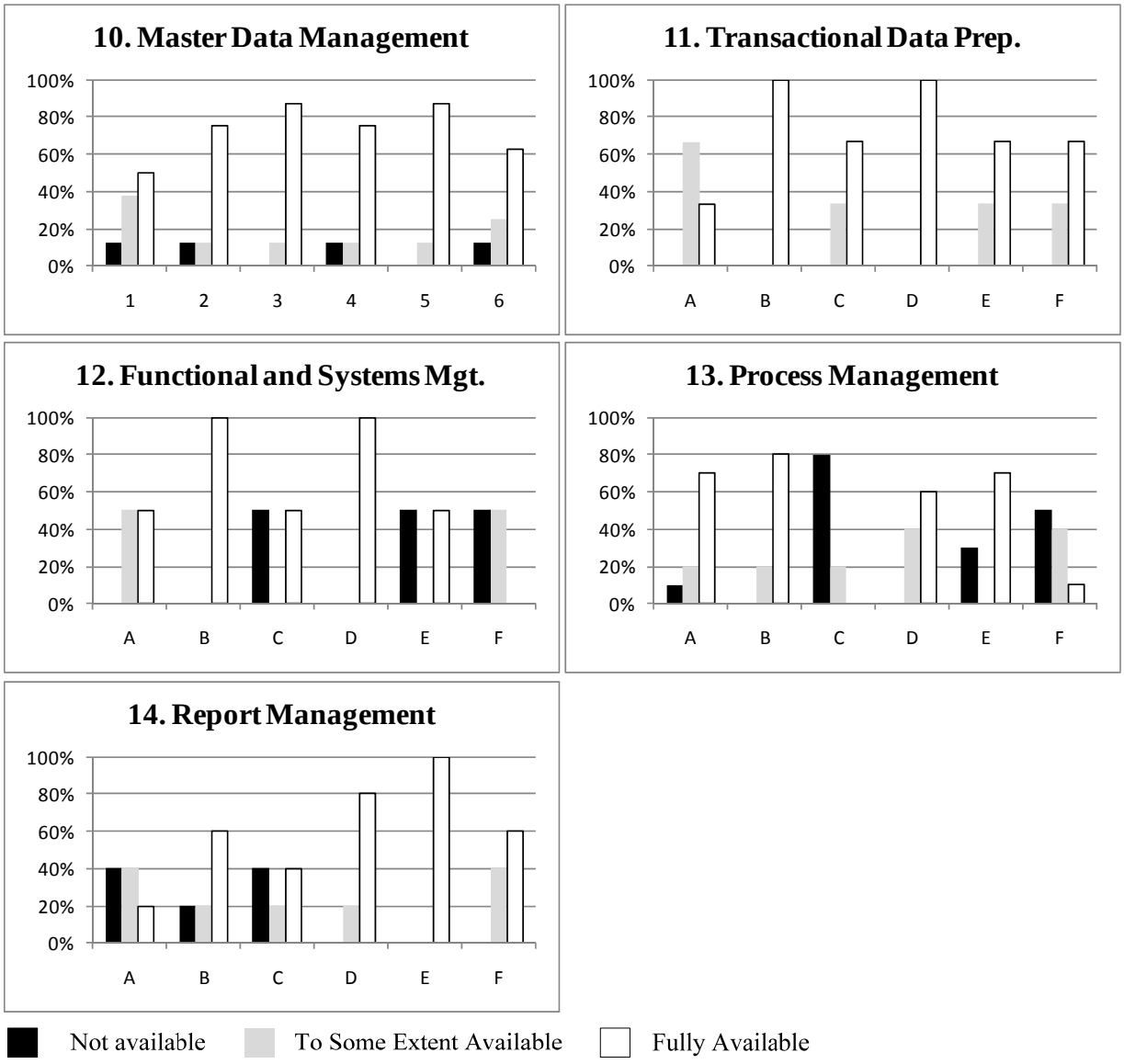

Fig. 5: Governance Capabilities

5.2.4 Data Model (E)

The data model is essential for consolidation applications, as functionalities such as matrix consolidations and simulations are directly dependent on it. In terms of (15) *data model*, all applications are based on generic concepts consisting of entities and parents, accounts and data categories. Basically all data options of creating, updating, and deleting are possible. The support of "slowly changing dimension" or temporal master data is more differentiating. Discrete temporal data is supported by four applications (A, B, E, and F). Proper temporal data, using time stamps, is only provided by three applications (B, E and F). In all cases, this is often restricted to organizational data and not provided for accounts, restricting the possibilities for restructuring, simulations, and restatements. There is only one valid chart of account for each version. No application supports (16) *meta data*. Concerning (17) *quantitative data*, there is a mixed picture. Two solutions (A and B) only offer basic support. The other four applications provide a sufficient support for notes, comments, and data attachments.

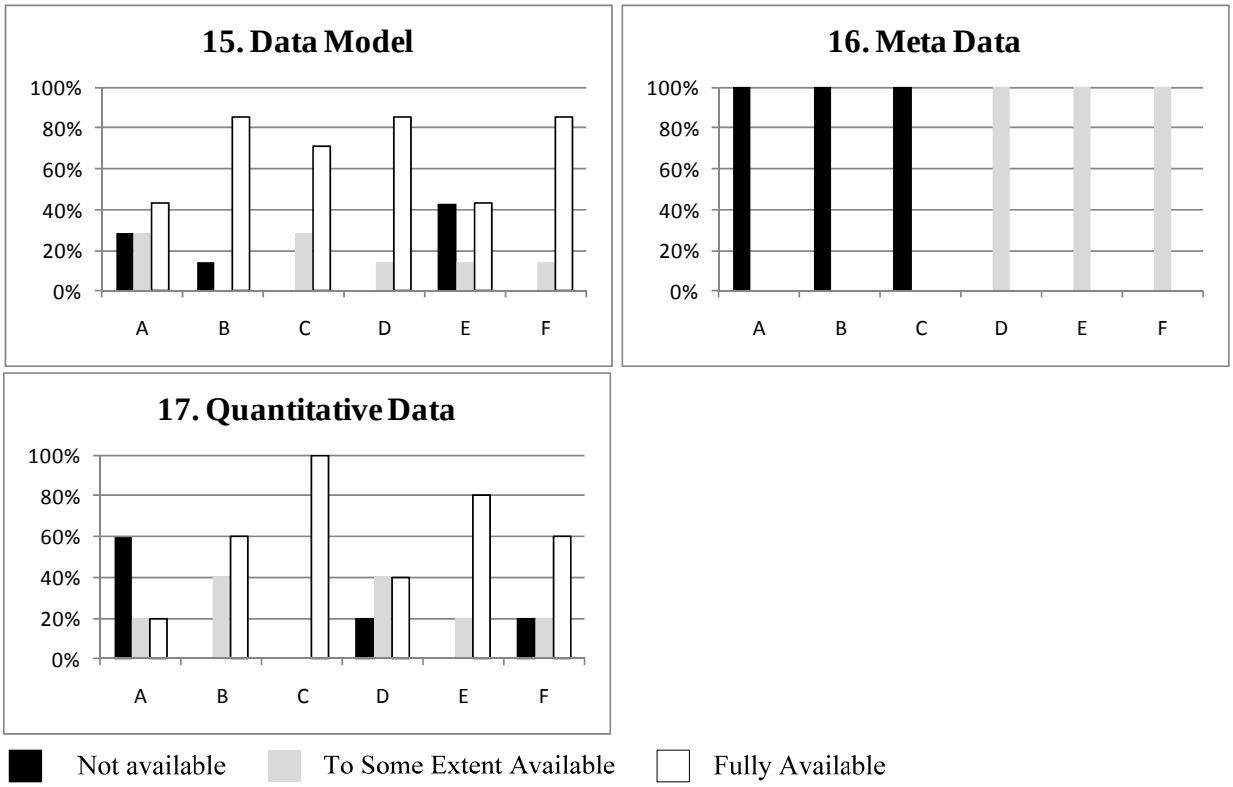

Fig. 6: Data Model Capabilities

5.2.5 Non-functional Requirements (F)

Non-functional aspects concern the points of performance, ease of use, and vendor support. (18) *Performance* has been a problem for consolidation applications for a

long time, as consolidation runs take a couple of hours. Today, the performance has greatly improved. On average, a single run is done in less than 30 min by all the selected applications, depending on the underlying hardware allowing fast closing. Thus, the number of units to be consolidated has been between 60 and 2600. The stability of each application has been rated well. Only two of six applications mentioned stability issues (D and E). However, a first analysis has neither shown if it is a hard- or software issue in both cases. All applications are scalable, as there are no restrictions in the number of consolidation units or users. As for (19) *ease of use*, the question has been raised if the applications are developed and maintained on the accounting side rather than on the side of the IT department. In each company, the share of the accounting department has been between 80% and 100%, in both phases of development and maintenance. However, each accounting department has its own IT-specialized employees. On average, the introduction of a consolidation application has taken about 1.5 years at all six companies. Within this time, the accounting employees have been working on the ongoing financial reporting as well. Regarding maintenance, the usage of tool boxes is indeed favored, as changes could be done flexibly. Concerning (20) *vendor support*, all but one of the applications are part of the vendor strategy and branded as part of an actual BI suite. Right now, however, the integration is rather a marketing issue. The integration into enterprise-wide master data, meta data, workflow, reporting tools, and unified GUIs has not been realized yet. For all applications, trainings are available, either by the vendor or third parties.

5.3 Further Analysis, Summary & Major Gaps

All in all, detailed analysis shows a heterogeneous state of the art. Nearly every solution offers a mature but not a complete set of capabilities. Each application has its individual strengths and weaknesses, which is grounded in the development history and philosophy behind the applications. Often, advanced and even some basic consolidation features are not directly supported, e.g. strong workflow functionalities and good support of quantitative data. Especially the latest requirements are purely supported, leading to a multitude of manual adjustments either by individual programming (see “to some extent available” in Fig. 7) or the usage of additional applications from the vendor itself or third parties, e.g. tax tools, IC reconciliation tools, reporting and XBRL/publishing tools. Sorting the capabilities (whole analysis units and selected single requirements (not numbered)) into three categories, according to the number of applications supporting them, leads to an interesting additional analysis (see Fig. 8)

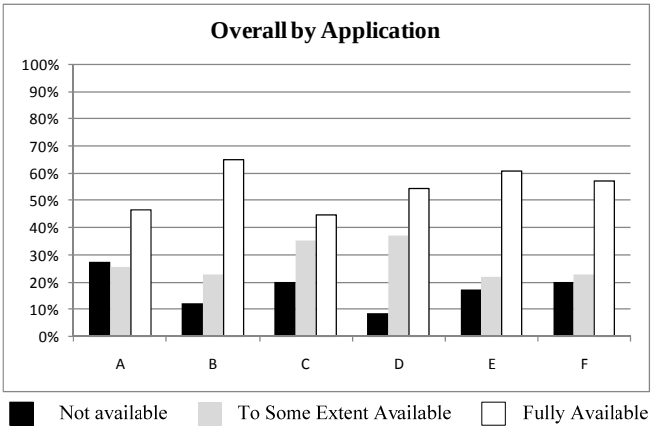

Fig. 7: Overall Capabilities

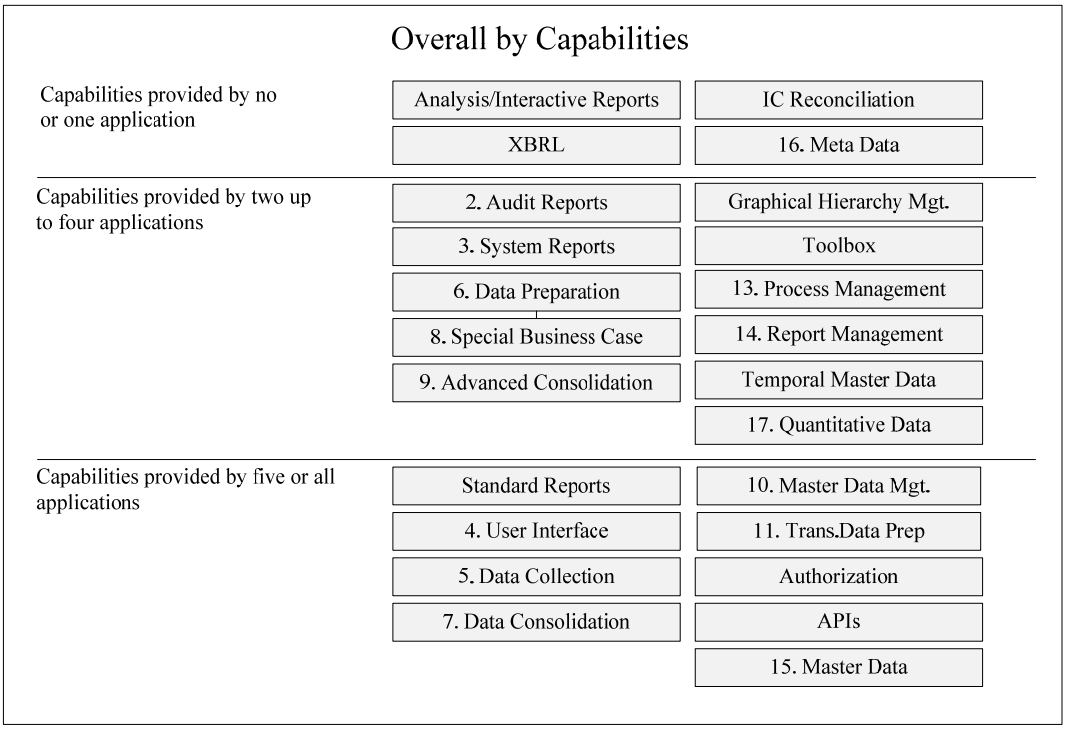

Fig. 8: Analysis of Overall Capabilities

This and the previous analysis point to two gaps: A first gap could be named "*incompleteness*". As best-of-breed or single isolated system, gap one remains a challenging task, as weaknesses have to be addressed by each application available. Regarding the fact that every application is now branded as part of a larger BI suite, a second gap could be named "*no clear profile*". It must be questioned if the applications should address all requirements or if it should be reduced to core consolidation functionality (especially cluster B and C). BI suites normally provide dedicated applications for report management, process management, authorization management etc., which could be used for consolidation purposes. Therefore, it

becomes necessary to develop a clear profile of consolidation applications, e.g. single isolated solution vs. focused consolidation service.

The most differentiating fact is the concept-oriented and generic system philosophy of the applications. The two applications with the most predefined consolidation functions, processes, and data models are much more complicated to change, as they are only changeable using APIs (A and B). The two applications based on more easier-to-use tool boxes are delivered with less predefined functions, processes and reports at the same time, therefore increasing assessment with "to some extent available" (C and D). The other two applications are stuck in the middle, using their own declaration language (F and E). Therefore, a third gap could be defined as a *"spread between predefined content and flexibility"*. Gap 3 is shown schematically in the following Fig. 9. The vendors of tool box-based applications are already reacting, providing so-called starter kits, meaning predefined functions (e.g. IFRS rules) aiming at closing parts of the content gap.

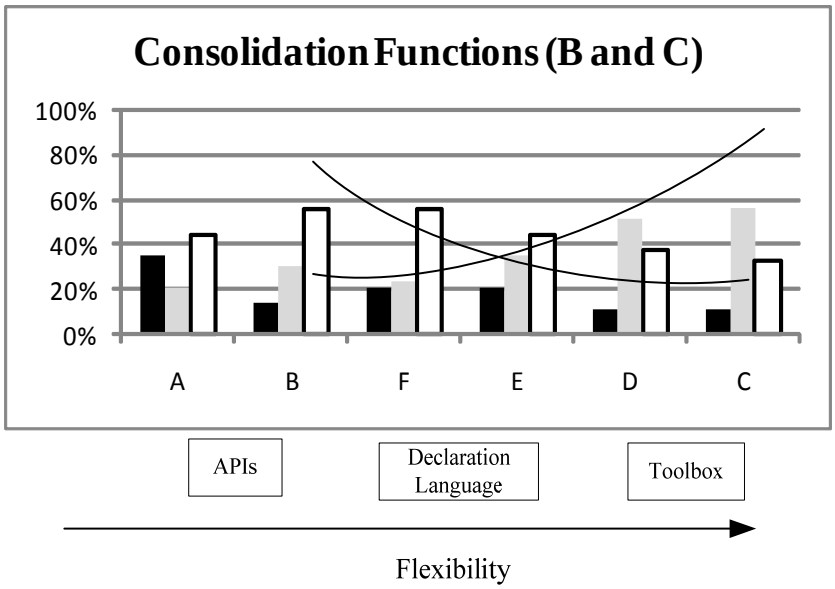

Fig. 9: Spread between Content and Flexibility

6 Development Directions

With regard to the requirements and the existing capabilities, the outlined gaps basically direct the development of consolidation applications.

Starting with gap 1 and gap 2, there is a need to overcome content incompleteness. This is especially true for the tool box-based solutions. However, there is an additional need to focus the development according to situational needs and not to demand complete capabilities for each company. The tailoring of consolidation applications according to situational needs should be done with respect to two dimensions: On the one hand, it has become obvious that consolidation applications have to be distinguished according to the question if they are single isolated solutions or part of a broader BI suite. Potentially shared functionality must not be part of a consolidation application, but could be reused by other BI applications. On the other hand and already indicated in the functional section in the requirements map (see Fig. 1), the analysis has shown that there should be a distinction between core functionality and more advanced/special business case functionality. This is also supported by the qualitative remarks of the two smaller companies out of the sample. They mentioned that advanced/special business case functionality is not necessary, as restructuring and other special cases occur only seldom. Using the requirements map and the analysis in Fig. 8 as a starting point, four profiles of consolidation applications could be drawn by sorting the requirements into three clusters of core consolidation functionality, advanced consolidation functionality, and potentially shared functionality (see Fig. 10). Sorting the requirements into these three clusters, it becomes obvious that the cluster of core consolidation is much larger than the basic capabilities which are provided by all applications (see Fig. 7). Furthermore, the cluster of advanced functionality is much more distinct than the cluster of capabilities supported by two up to four applications (see Fig. 8). Therefore, a reshaping of the capabilities of each application becomes necessary. In general, the following hypotheses could be drawn:

Guideline 1: The capabilities of financial consolidation applications need to be reflected against the background of and, accordingly, adjusted to the companies' needs and the existing BI environment. Functionality should be divided into consolidation functionality and potentially shared functionality.

Guideline 2: Within consolidation functionality, financial consolidation applications should provide a set of core and advanced capabilities. The latter are only necessary at very large companies.

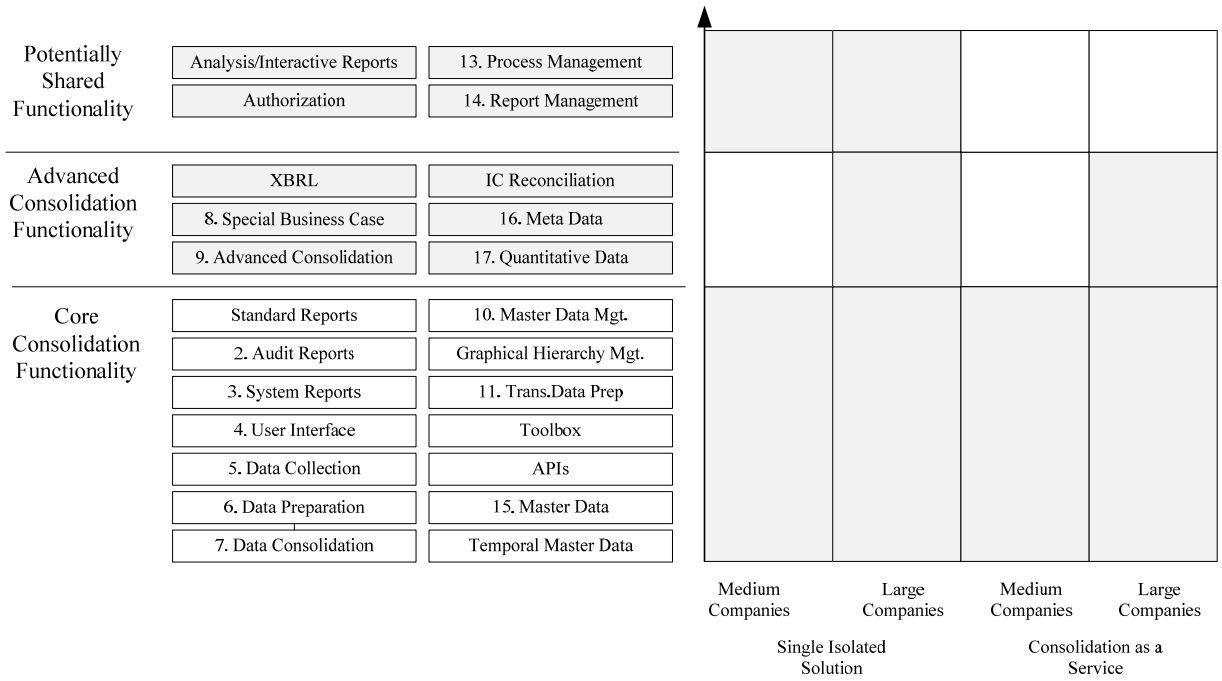

Fig. 10: Needed Profiles of Consolidation Applications

Addressing gap 3, it becomes obvious that only flexible and graphically supported tool boxes are an adequate means supporting financial and management accountants in coping with the increasing dynamics of financial consolidation. Therefore, it seems necessary for two of four applications to refine the basic architecture of the application and develop a flexible tool box. In general, the following hypothesis could be formulated:

Guideline 3: Modern financial consolidation applications should be based on flexible tool boxes rather than only providing applications programming interfaces.

7 Conclusion and Outlook

Grounded first and foremost in legal requirements, information system (IS)-based financial consolidation has developed into a central component of financial reporting and decision making for large international enterprises. Increasing internal requirements, but also high changing rates of accounting standards, are confronting financial consolidation applications with new requirements. In addition, CFOs are concerned to develop parts of financial and management accounting into efficient shared service centers/reporting factories, also making new demands on a central consolidation application. Despite its importance and challenging new requirements, financial consolidation is highly underrepresented in accounting information systems (AIS) research. This paper aimed at shedding light on this situation.

Based on a literature research, first requirements have been explored from an external and internal consumer perspective as well as from a supplier perspective. In a second step, those requirements have been consolidated in one central requirements map, which has been iterated and validated using an expert workshop of group financial and management accountants. Based on three layers and 20 clusters, this paper has identified over 70 requirements: On the presentation layer, there is one cluster - reports and interaction -, which consists of the analysis units of management reports, audit reports, admin reports, and the user interface. On the functional layer, the first central structuring element cluster is the consolidation process, which demands functional capabilities in the phases of data loading, data preparation, and data consolidation. It is accompanied by the cluster of advanced process und functions consisting of special business cases and advanced consolidation functionality, which are all not needed regularly but once in a while. The next important cluster concerns the supplier and governance perspective. It consists of the management of master data, transactional data, functions and systems, process, and reporting. Finally, the data layer differentiates between master data features, meta data, and quantitative information.

A subsequent analysis of six leading consolidation applications has shown a high level of compliance with the outlined requirements. However, all applications provide a basic but not a complete set of capabilities. This resulted in three specific gaps regarding functional incompleteness, an unclear profile of applications concerning stand-alone solutions or integrated modules of a BI suite, and missing flexibility. In order to overcome these gaps, this article recommends the following: first, a development of a financial applications distinction between core, advanced, and shared

capabilities; second, a situational design of those capabilities regarding existing BI capabilities and organizational demand; and third, a flexible architecture concept.

Limitations in terms of scientific rigor are given by the sample size of experts reflecting the requirements map and by the small number of analyzed applications. Concerning large enterprises, however, this paper has analyzed the market-dominating application. Therefore, the application selection should be acceptable.

The results – requirements map, gaps, and guidelines – provide an exhaustive overview of the state of the art of financial consolidation applications. For practitioners, the requirements map supports software selection, the gaps show potential threads, and the development directions are a foundation for the discussion with software vendors. For behavior-oriented AIS researchers, the article supports a better understanding of the actual AIS landscape, which is often reduced to some abstract variables like ERP, BI or analytical applications. The detailed view provides a better understanding of detailed capabilities of financial consolidation applications as an enabler or as an obstacle for fast decision making (e.g. simulation capabilities), change projects (e.g. fast reflection of restructured organization within IT), and reporting quality (e.g. validation capabilities). For design-oriented AIS researchers, the paper is a starting point for a further investigation of situational BI design from the accounting perspective, but also for a focus on design solutions which effectively and efficiently support new organizational forms of financial and management accounting. It especially points to the need to support accountants with flexible and highly customizable IS solutions.

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