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Business Intelligence Outsourcing - A Framework

Henning Baars
Universität Stuttgart, baars@wi.uni-stuttgart.de

T. Horakh
horakh@wi.uni-stuttgart.de

Hans-Georg Kemper
Universität Stuttgart, kemper@wi.uni-stuttgart.de

BUSINESS INTELLIGENCE OUTSOURCING A FRAMEWORK

Baars, Henning, Universität Stuttgart, Breitscheidstr. 2c, 70174 Stuttgart, baars@wi.uni-stuttgart.de

Horakh, Thomas Alexander, Universität Stuttgart, Breitscheidstr. 2c, 70174 Stuttgart, horakh@wi.uni-stuttgart.de

Kemper, Hans-Georg, Universität Stuttgart, Breitscheidstr. 2c, 70174 Stuttgart, kemper@wi.uni-stuttgart.de

Abstract

The purposeful application of selective outsourcing has become a core building block of IT Governance approaches. It seems compelling to apply outsourcing rationales for activities related to integrated management support infrastructures – Business Intelligence (BI) infrastructures –, which have grown in scale, scope and relevance in the recent years. Results from an exploratory study back this conclusion, but they also show that the related activities have to be handled with extraordinary care due to the vital importance of the affected data and the heterogeneity of the affected tasks. Based on these results a framework is derived that supports the identification and evaluation of BI outsourcing opportunities. Usage and benefits of the framework are demonstrated and discussed for five different scenarios.

Keywords: Business Intelligence, Outsourcing, IT Governance, Business Intelligence outsourcing Framework

1 RELEVANCE

This paper discusses outsourcing services in the management support realm – **Business Intelligence outsourcing**. The according subject is understood to be deeply embedded within the context of **IT Governance**, which has attracted increasing attention during the last couple of years (Brown and Grant 2005).

The term IT Governance is derived from Corporate Governance and focuses on the Information Technology (IT) of a company. It is defined to consist "… of the leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives." (IT Governance Institute 2003). IT Governance subsumes activities for implementing and pursuing of IT strategies, for the provision of organisational structures and control frameworks, for IT performance measurement, and for interlinking IT with business and external partners. To efficiently cope with the increasing relevance, scale, and complexity of contemporary IT infrastructures, it becomes imperative to pursue prudently tailored IT Governance approaches.

IT Governance naturally incorporates the crafting and implementation of sourcing policies, as most companies are nowadays dependent on external IT services to deal with the challenges of professionally meeting their ever increasing IT demands. The strategic goal of outsourcing related activities in IT Governance is "… to continually support and improve business effectiveness through the delivery of quality IS services aligned and responsive to business needs, while maximising the business return on investment in IS" (Office of Government Commerce 2004).

From this vantage point it seems logical to systematically evaluate the opportunities of outsourcing management support solutions, which have grown to costly integrated infrastructures of corporation-wide proportions. Such infrastructures are nowadays subsumed under the term "Business Intelligence". They can be used to support all business functions and processes and are build on intricate multilayer architectures with a multitude of distinct components (Moss and Atre 2003). Until now, though, relevant outsourcing options in the BI domain have not yet been adequately structured and charted. The goal of this contribution is to close this gap by the development of a framework for identifying and specifying BI outsourcing demands and offerings.

After a short discussion on the multi-facet nature of outsourcing and the peculiarities of Business Intelligence, results from a study on the demand for Business Intelligence outsourcing services are presented. The study motivates the delineation of a framework for Business Intelligence outsourcing, which allows for the identification and classification of different BI outsourcing service portfolios. Its application is demonstrated with the discussion of five exemplary scenarios. The paper concludes with an outlook on further research activities.

2 BI OUTSOURCING

Before further analyzing "Business Intelligence outsourcing" a clear-cut definition of what is to be meant by the term "outsourcing" is needed. Following a definition from Greaver outsourcing is here understood to be "… the act of transferring some of an organization's recurring internal activities and decision rights to outside providers, as set forth in a contract." (Greaver 1999). By highlighting the continuing nature of outsourcing and the long-term transfer of responsibilities this definition deliberately factors out both singular development projects and pure consultancy services.

Preferred fields for outsourcing in this sense can be found in the domains of industrial production and facility and property management. New management concepts like „Value Networks" (Weiner, Nohria, Hickman and Smith 1997) or „Electronics-Manufacturing Services" (Mucha 2005, Wolff 2006) that are aiming at reducing vertical integration and ensuring the efficiency of manufacturing, are also heavily outsourcing-driven.

Information Technology (IT) has ever since been a popular subject of outsourcing projects as well. Starting in the 1970s in form of "Data Processing Centers" which supported small and medium-sized enterprises with computing services, IT outsourcing has been applied to more and more tasks – culminating in "Total IT outsourcing" attempts in the 1990s (Lee, Huynh, Kwok and Pi 2003, Greaver

1999). Organizations tried to transfer nearly the complete IT expertise to outside vendors in order to focus on core competencies. In many cases such far-reaching approaches were unsuccessful (Lacity and Willcocks 2003; Lacity, Willcocks and Feeny 1996). One of the lessons learned from these days is that IT-outsourcing needs to be considered as a multilayered and complex phenomenon and that a selective approach is usually more reasonable (Greaver 1999). However this approach presupposes a core prerequisite: IT needs to be managed as a *portfolio* of activities and capabilities (Lacity and Willcocks 2003).

Prone to be outsourced are primarily activities which are highly-standardized and non-core, because such services can be easily defined, priced, and transferred without entailing high risks (Lacity and Willcocks 2003). Based on this rationale lines can be drawn between more commoditized infrastructural services and others that are rather oriented towards a "business process outsourcing". Based on these ideas Kern et al. derive a "stack" model for network based outsourcing services (Kern, Willcocks and Lacity 2002).

Of vital importance for the success of an outsourcing venture are moreover the choice of the service partner and the outsourcing arrangement, as well as the gap between the capabilities of inhouse IT and the vendor (see e.g. Kishore et al. 2003, DiRomualdo and Gurbaxani 1998). Obviously in the sector of Business Intelligence some companies seem to perceive such a gap (Philippi 2005). This supports the need for a closer examination of the challenges and opportunities of outsourcing Business Intelligence related services.

Originally coined by Gartner group as a collective term for data analysis tools (Anandarajan, Srinivasan and Anandarajan 2003), "Business Intelligence" is now commonly understood to encompass all components of an integrated management support infrastructure of an enterprise (Moss and Atre 2003). These components can be mapped in a three-layer architecture (Kemper and Baars 2006):

1. The **Data Layer** is responsible for storing structured and unstructured data for management support purposes. Regarding structured data the central component to accomplish this task in larger BI installations is the "Data Warehouse". According to Inmon (2005) a "Data Warehouse" is defined as a "subject-oriented, integrated, time-variant, and non volatile collection of data in support of management's decision-making process" (Inmon 2005). Many current realizations of Data Warehouses are based on so called Core Data Warehouses, which are dedicated components for the storage of all management support data. Core Data Warehouses are usually not used as a direct source for analysis systems, but rather distribute data to individual *Data Marts* that keep application specific data, i.e. data prepared for the support of a single business process or business function.
   More recently there has been a shift towards Data Warehouse infrastructures that also feed operational systems and thereby support real time data monitoring and analysis. In such an environment it might be of use to introduce an "Operational Data Store" (ODS) that keeps real time data on a transactional level for time critical tasks (Inmon 1999).
   To feed the before mentioned data storages "ETL tools" are needed to support the extraction and transformation with data from the source systems. The transformation encompasses filtering out syntactical and semantic errors, harmonizing data from different sources, aggregating data, and enriching it by calculating additional business metrics (Kemper 1999).
   A current trend is the systematic integration of unstructured data (esp. documents) in management support systems. For this purpose it is usually necessary to provide for Content and Document Management Systems for their storage and administration.
2. The **Logic Layer** provides functionality to analyze structured data or unstructured content and supports the distribution of relevant knowledge among different users. The most salient tools in BI environments are "reporting", "data mining", and "OLAP" tools (Moss and Atre 2003):
   Reporting tools present quantitative data in a report-oriented format that might include numbers, charts, or business graphics. OLAP stands for "Online Analytical Processing" and denotes a concept for interactive and multidimensional analysis of aggregated quantitative business facts (like budgeted costs, revenue, and profit). OLAP tools give the user flexibility regarding the choice of dimensions that describe the facts of interest (e.g. product, time, customer), the excerpt of facts to be looked at (e.g. March to December) and the level of detail (e.g. store, ZIP code,

county, nation, region) (Codd, Codd and Salley 1993). Data mining tools support the identification of hidden patterns in large volumes of structured data based on statistical methods like association analysis, classification, or clustering (Hand, Mannila and Smyth 2001).

3. The Access Layer allows the user to conveniently use all relevant functions of the Logic Layer in an integrated fashion – within the confines of defined user roles and user rights. Usually the Access Layer is realized with some sort of Portal software that also provides a harmonized Graphical User Interface.

The management of BI components and BI contents induces the need to document information about both technical configurations, e.g. regarding the connection to the source systems, and business related background, e.g. the semantics behind the data and the transformation steps (Vaduva and Vetterli 2001). This is done with metadata storages that can either come along with each individual component (decentralized metadata repositories) or be realized in a centralized fashion (central and federal metadata repositories).

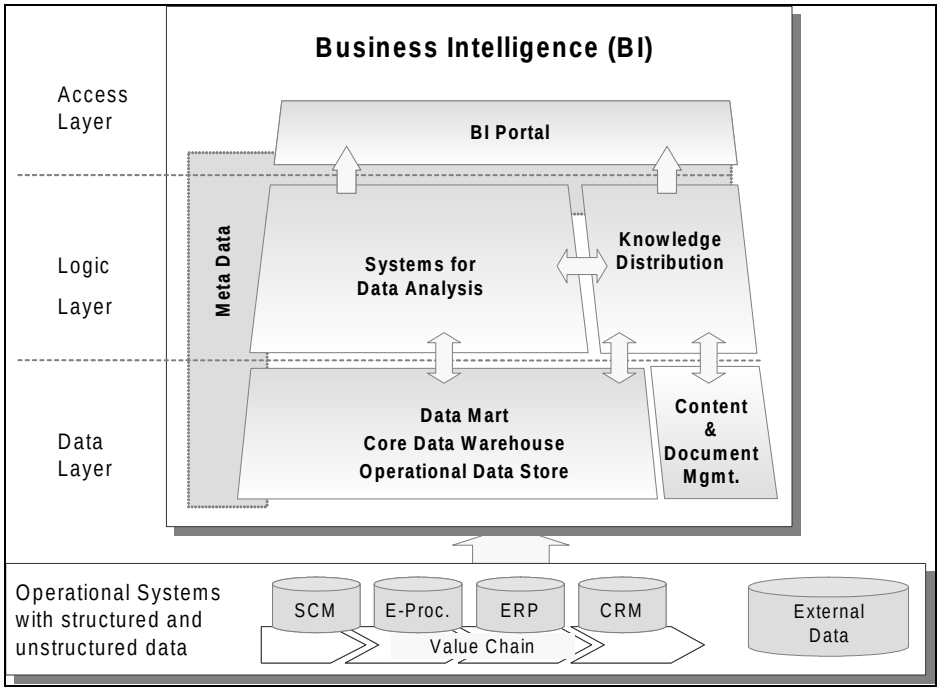

Figure 1 Conceptual three-layer BI architecture (Kemper and Baars 2006)

Current developments are aiming towards corporation-wide infrastructures that enable coherent business performance management and therefore span all business functions and support strategic, tactical, and operational managers alike (Kimball and Ross 2002; Eckerson 2006; Kohavi, Rothleder and Simoudis 2002). Respective BI architectures are interconnected to heterogonous source systems (Kimball and Ross 2002), are supposed to handle extraordinary high volumes of data (Wiel 2005), and need to suffice challenging requirements regarding data integration and harmonization (English 1999). These trends seem to corroborate the need for external suppliers with dedicated know how.

In spite of this, management support is by its nature a core task of an enterprise and the processed data is often of strategic importance. This is why BI outsourcing could be associated with severe risks and be therefore rejected right-away by potential customers. Before further analyzing the possibilities of BI outsourcing it is therefore necessary to get an impression of the acceptance towards such an approach and to get first qualitative insights into how it could be designed to meet possible acceptance barriers.

3 RESULTS OF A SURVEY ON BI OUTSOURCING

As a first step towards the exploration of the yet unstructured field of "BI outsourcing" a Europe-wide web based survey was conducted among BI practitioners. The design of the study was aiming at *hypothesis generation* rather than hypothesis testing. Based on an interpretive approach (Dibbern,

Goles, Hirschheim and Jayatilaka 2004) the study was intended to glean a deeper insight into the perception of BI outsourcing on the users' side and to substantiate the relevant factors of a framework for BI outsourcing services. To gather meaningful results the chosen target group was defined to consist of companies which have already become familiar with BI. The survey was carried out between autumn 2005 and spring 2006. Companies were invited by e-mail or by a hyperlink, which was placed on a website focused on BI topics.

The survey was based on three major pillars: It gathered data on **customer related factors,** which reflected the current BI solutions and their perceived weaknesses, **offering related factors,** that captured expectations of the customers regarding the range of services and their minimum quality, and **vendor related factors** that addressed requirements that a possible BI outsourcing provider needs to meet.

According to the logfile, 332 companies participated in the survey and 136 companies answered all questions. The sectors represented by the participants are depicted in Table 1.

Sector	**N**	**Approx. %**
Banking and Insurance Industry	43	32
Services, Consulting	29	21
Telecommunication, IT	11	8
Automobile, Aircraft Industry, Plant Construction, Metal Working	9	7
Energy Supply, Water Distribution	5	4
None or Other sectors	39	29
Total	136	100

Table 1 Sectors of the participating companies

Among those two thirds stated that BI is considered an essential component of their company's strategy. Interestingly this did obviously not deter the participants from at least taking BI outsourcing into account: Only a third expected fundamental obstacles. Most of the companies saw definite benefits of outsourcing arrangements and named concrete BI tasks that could be transferred to an outside vendor.

The study also identified a possible driver for BI outsourcing: The self-implemented and self-operated BI systems are for the most part regarded to be only "fair" or "satisfactory" by a large portion of the participants. Areas particularity characterized by shortcomings seem to be the data delivery from operational systems, support provided by the tool vendors, and the integration of the BI systems in existing IT infrastructures (cf. Figure 2).

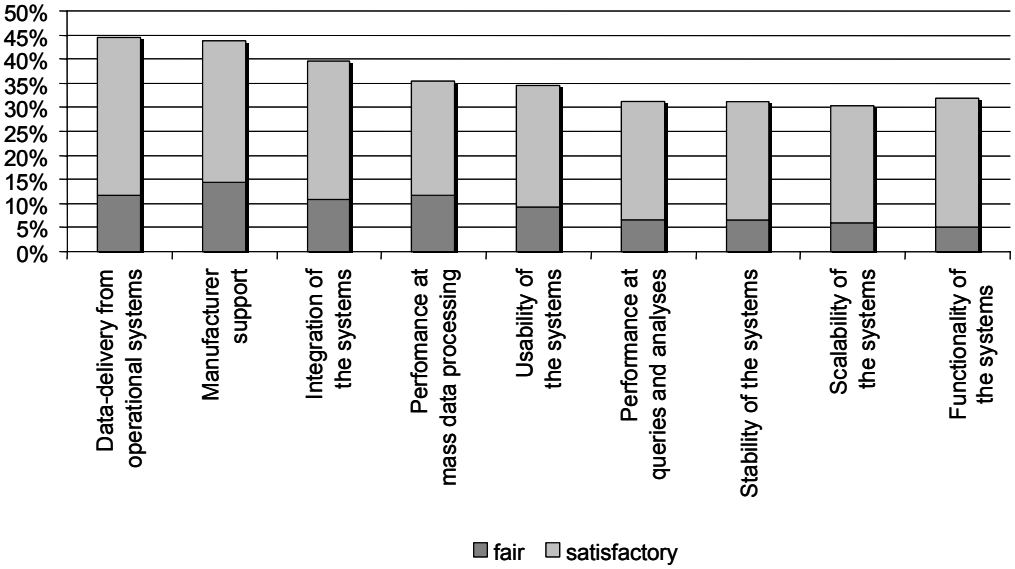

Figure 2 Perception of the quality of the employed BI solutions at the participating companies (N = 119)

A closer look reveals though, that the general acceptance of BI outsourcing arrangements can by no means be interpreted as a demand for a "total BI outsourcing": **Not a single participant claimed all BI tasks to be suitable for outsourcing**. As Figure 3 illustrates, the most requested services are first of all of infrastructural nature, like operating and maintaining technical infrastructure or maintaining software applications. **More than 60% of the participants stated that these tasks might be completely or at least predominantly handed over to an external vendor**.

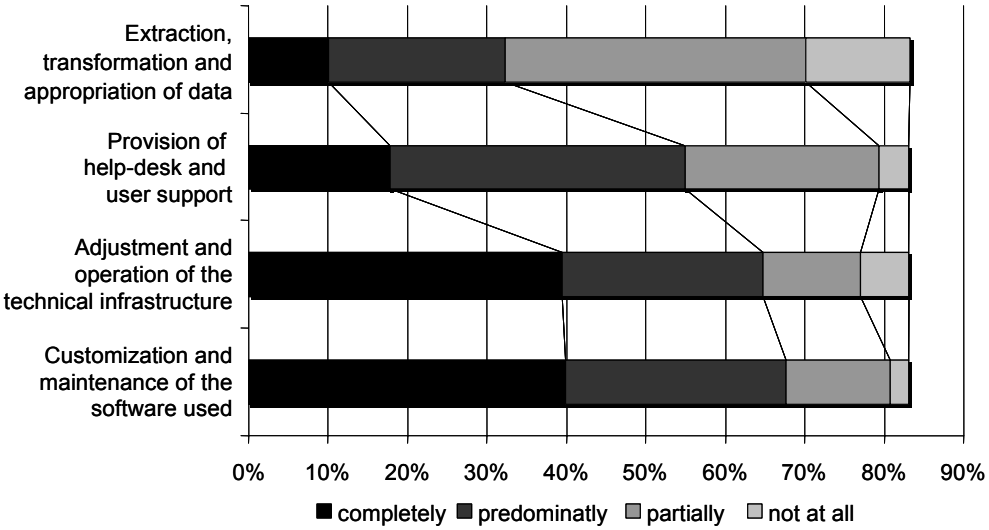

Figure 3 Suitability of certain infrastructural BI tasks for BI outsourcing (N = 213)

In case of actually preparing and conducting BI analyses the numbers are far less clear. According to the participants the execution and distribution of standard reports and the preparation of multidimensional data cubes for OLAP reports bear the greatest potential for BI outsourcing (cf. Figure 4).

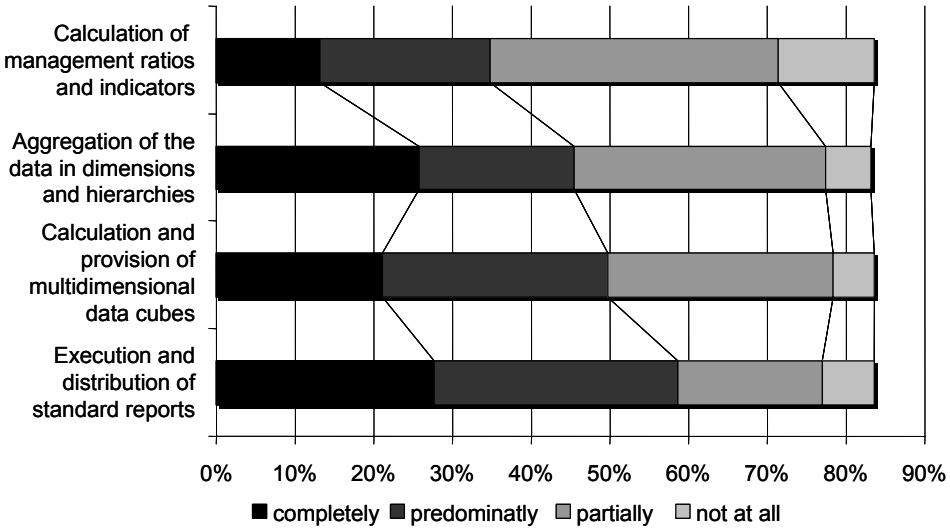

Figure 4 Suitability of analysis related BI tasks for BI outsourcing (N = 213)

The study indicates that ETL related tasks are least suitable for outsourcing. More than half of the participants consider these to be only partially or not at all outsourceable. Apparently there is a widespread scepticism, whether an external vendor can efficiently build up knowledge required for integrating a company's individual IT systems landscape or specific operational data and semantics. This goes in line with another result of the study: The most severe problems regarding a BI outsourcing arrangement are expected in the fields of **data quality and data security of business-critical data**. Of the surveyed participants 80% stated data quality to be an important or a very important issue in this context.

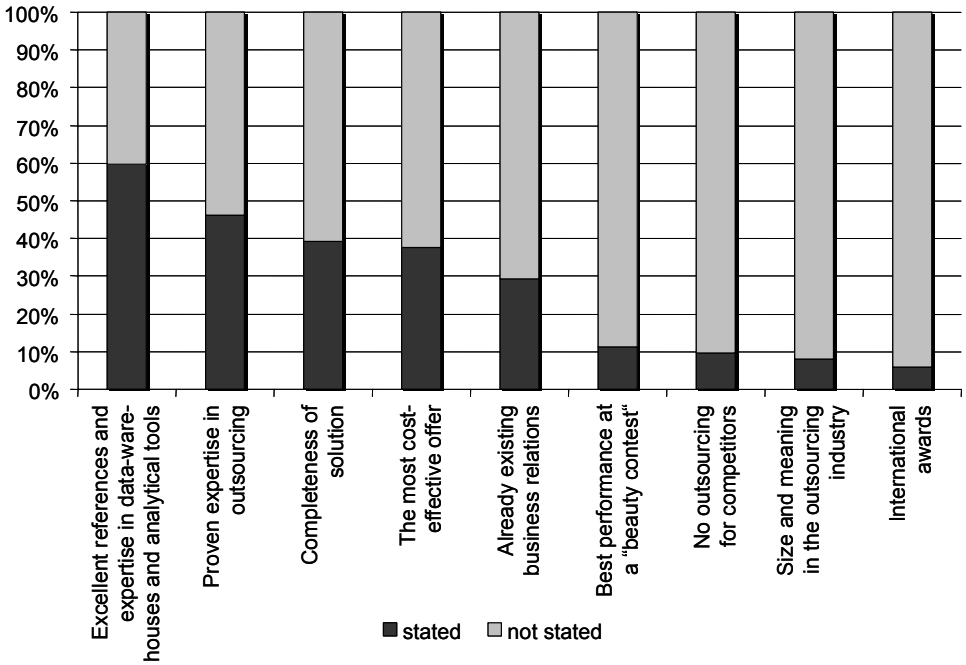

Figure 5 Important criteria for the selection of an outsourcing provider (N = 188)

The vendor related results of the study impose several requirements on the vendor (cf. Figure 5): Almost 60% of the respondents named excellent references, roughly 50% stated proven expertise in outsourcing, and close to 40% mentioned the completeness of the provided solution as the most important criteria for selecting a certain vendor – these criteria turned out to be even more important than the reason "price", which usually holds a more prominent position in IT outsourcing decisions.

4 A FRAMEWORK FOR BUSINESS INTELLIGENCE OUTSOURCING

The grave anxieties of the surveyed companies regarding data quality and data security as well as the high degree of scepticism towards a transfer of crucial BI tasks like ETL to a service provider clearly indicate that a full scale Business Intelligence outsourcing would most likely meet only limited acceptance. However the results also portray a widespread **openness towards handing out several BI specific subtasks**, like infrastructure operations or report generation. To actually be able to conduct such a "selective BI outsourcing" one needs to **unbundle the intricate and interwoven structures of contemporary BI solutions** first and slice them into well defined services that can be seamlessly taken over by third parties: Possible BI offerings need to be mapped according to a systematically derived framework. The one proposed in this paper is depicted in Figure 6:

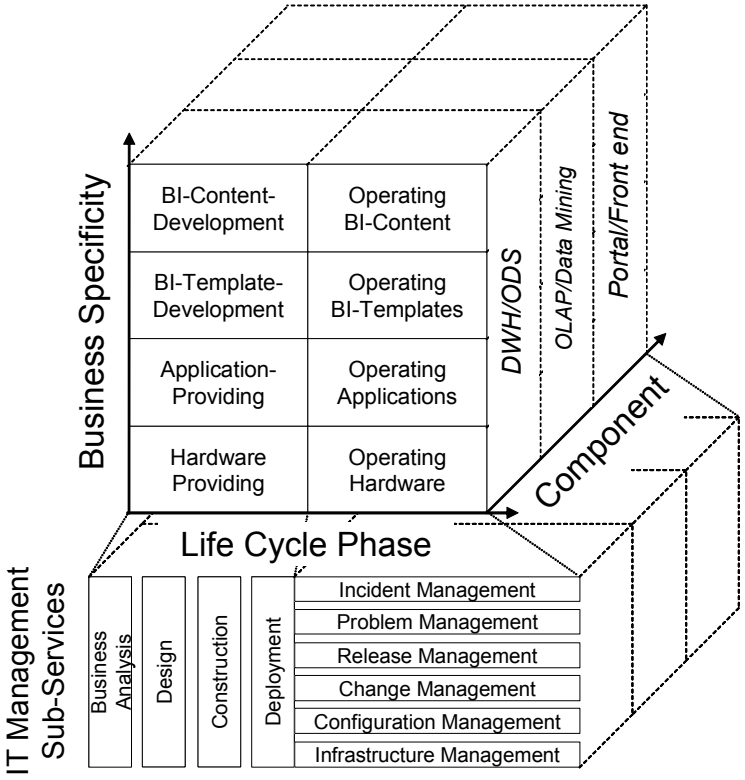

Figure 6 Framework for BI outsourcing services

A core expectation of the users in the study is that a potential outsourcer has excellent know how in running and developing BI *application systems*. It is therefore a natural starting point to use different types of application systems for a decomposition of BI services: Services can directly address defined subsystems like the Core Data Warehouse, a Data Mining Tool, an OLAP application etc. For the generation of a taxonomy that further specifies this "**component dimension**", established BI frameworks may be utilized, e.g. the one presented in section 2. The relevance of this dimension stems from the self-contained nature of most of those components, the different specializations necessary to run und maintain them, their distinct user groups, and the different requirements regarding hard- and software.

The second dimension to structure BI services can be derived from the uneasiness to hand out tasks that are affecting business semantics. The study results indicate that tasks like the calculation of business indicators or the extraction and transformation of source data meet far less acceptance than transferring the responsibility for hard- and software infrastructures. This calls for a rationale that distinguishes between services that are more infrastructure-related, like hardware provision or BI tool hosting, and others which are more directly dealing with contents, e.g. data harmonization or the development of individual data mining solutions. The core criterion for differentiating along this dimension is the allocation of responsibility between the vendor and the customer of BI outsourcing services. The more responsibility for the content is shifted to the vendor the more the outsourcer needs to comprehend industry and business semantics and anticipate users' implicit needs. This is in line with the results from the literature review on general IT outsourcing presented in section 2.

At a first glance this "**business specificity dimension**" might seem to be entangled with the above discussed component dimension: Services closer to the end-user might be expected to carry more semantics than those hosted at the "back-end" like the Data Warehouse. However a closer look reveals the orthogonal positioning of these two dimensions. Indeed both content and infrastructure related tasks can be identified for *all* components: For example on the infrastructure side of a Data Warehouse data base software needs to be installed, operated, and maintained, the data base needs to be backuped and archived, etc. On the content side data models are designed, optimized, consolidated, harmonized, and enriched with respect to the business semantics of the source data and the analytical needs of the end-users.

The "business specificity" dimension is not to be understood as a discrete bipolar scale but rather as a continuum of varying degrees (even a "straightforward" hardware hosting needs some tuning based on content driven criteria like the volume and the structure of stored data). Building up on the concept of the "service stack" from (Kern, Willcocks and Lacity 2002) we propose to subdivide the continuum into four distinct layers to reach a clear-cut taxonomy:

- **Hardware** – provision and running of the relevant computing, storage, and telecommunications equipment necessary to operate one or more BI components.
- **Tools** – this relates to the BI software applications, from ETL tools and Data Warehouse software to dedicated solutions for reporting or data visualization.
- **Templates** – understood as preconfigured applications that can be adapted to individual needs. A template might provide functioning data structures, system connectors, interface designs, business logic etc. To be of any use a template must incorporate business function and / or sector specific knowledge. It therefore already embeds content which can be viewed as "raw material" that usually requires some honing to fully meet the actual requirements of a user. The provider of such templates does not have to take the responsibility for the actual content handled with the template but rather provides the means to facilitate application design.
- **Content –** this pertains to the actual business semantics. A provider that operates on this layer takes over responsibilities pertaining to the definition, gathering, structuring, transformation, and/or presentation of data. It needs to be emphasized that content related services can be confined a very narrow subtasks, e.g. the cleaning of address data, aggregating and feeding in external market data, or performing a statistically complex clustering job.
  Case studies suggest that obtaining content related BI services from an external provider is considered an acceptable option especially when the vendor provides data or knowledge that is otherwise unavailable to the customer (Heins, 2006; Leon, 2003).

The third dimension that needs to be addressed is the focused phase in the application life cycle: It can be differentiated whether a service is devoted to the development of components (or parts of them) or on their operation. Although one might define an even finer granularity on this scale, differing "development" and "operation" is the most prominent and significant one, because these two phases call for utterly different tools, skills, and management practices. As the study results show both are relevant for BI outsourcing, as there are tasks from both phases that are considered to be suitable to outsourcing. The "**life-cycle dimension**" is relevant for all components and for all discussed layers of the business specificity dimension.

It needs to be acknowledged that development services in the Business Intelligence realm often take the form of a continuous task and therefore comply with the above outsourcing definition: As management support solutions need constant change and redesign there have to be defined responsibilities for specifying, realizing, and implementing them which transcend singular projects.

Although the above dimensions span the core services needed for implementing and running BI infrastructures they are not yet fully sufficient: To professionally build and run the solutions a further structure needs to be imposed upon the framework derived so far – the definition of **IT management sub-services**!

The relevance for those sub-services can be seen in the vendor related requirements which show high demand for professionally structured and seamlessly interconnected services including on-site user support. Furthermore both relevance and a possible classification of these dimensions can be drawn from generic IT service management concepts like ITIL or CoBIT.

It needs to be acknowledged, though, that the division of subtasks will be naturally different for the phases of development and operation. Among others subtasks in the operation phase might encompass Service Desk, Incident & Problem Management, Change & Release Management, and SLA management. The development can e.g. be broken down in tasks for Analysis, Design, Construction, and Deployment. Besides this the sub-services are in varying degrees needed for all components and layers.

These four dimensions span a fine grid that maps services of BI outsourcing. Although not all value-combinations of the dimensions are equally relevant, neither one of them is unimaginable. The grid allows for structuring possible service offerings and provides a common ground for their discussion. The services can also be packed into tightly integrated service bundles that span several layers, life cycle phases, and components, and include a set of different IT management subtasks.

The above discussion leads to the framework depicted in Figure 6 with each sub-cube representing a possible service. The usage and benefits of this framework will be demonstrated by the discussion of five BI outsourcing scenarios, which are derived from real outsourcing arrangements.

- **Scenario 1 - Application Service Providing for a Reporting software:** A company is hosting a Reporting software (including a report designer) for multiple clients that can be accessed via web. The software brings along extensive tailoring functionality and defined interfaces to upload data. The Application Service Provider ensures a stable service and provides a Help Desk for questions regarding the usage of the software (not for the represented data, though). In the framework the hardware- and the application side of the operation phase are covered for a reporting software and an adjacent local data storage. To ensure a smooth operation all IT service management sub tasks need to be defined prudently based on clear Service Level Agreements. A customer could benefit from such an outsourcing arrangement because of higher degrees of scalability, performance, and vendor support. Special attention needs to be given to the transmission and storage of data as this is a core requirement according to the study discussed above.
- **Scenario 2 - Provision of OLAP cubes with external market data:** A service provider who has access to a vast body of market data is responsible for the development of OLAP cubes for market analysis. In cooperation with the client relevant market data is selected and – if requested – integrated with customer data from the outsourcing customer. After realization the cube is transferred to the client's systems where it can be utilized for in-depth analysis. In this scenario BI content is developed for OLAP components. The advantage of this arrangement lies in the access to the service provider's additional content and the simplified development of meaningful OLAP content. The amount of critical data to be transferred can be limited and tightly governed based on rigid contracts.
- **Scenario 3 - Conducting data mining analysis and visualization:** A data mining specialist regularly analyses the vast customer's support data base for hidden patterns and uses state-of-the-art techniques for results visualization. The vendor thereby takes over services for providing data mining components up to the content layer. As the service is transparent from a client's perspective this includes both the development and the operation of an effective solution. While contracting one needs to be aware of the necessity of sub-services for this arrangement as well, as there needs to be some kind of service desk to handle questions regarding the derivation of the results or for the reaction to possible errors.
- **Scenario 4 - Hardware hosting for a large Data Warehouse:** A hosting provider offers database hardware that can handle Data Warehouse environments up to a size of several hundred terabyte. The vendor guarantees fast accessibility, high scalability, and extraordinary levels of security and service reliability. The service offering is indifferent regarding the hosted Data Warehouse software and thereby focuses on the hardware layer only. The main motive of choosing such a service provider is to overcome shortcomings of the own data center – especially in real-time Data Warehouse environments with particularly high data volumes.
- **Scenario 5 - Service Desk for ETL and Data Warehousing software:** A service provider offers Call Center and Help Desk services for a specific range of products of a certain vendor that encompass ETL and Data Warehousing. The service provider therefore works in close coordination with a second service provider who installs and runs the Data Warehouse environments for several customers. In this case only a defined sub service is subject to outsourcing – with enhanced possibilities for specialization. This example also shows the possibilities for multi-vendor outsourcing in a BI environment.

5 CONCLUSION AND OUTLOOK

The derived framework is a first milestone in the evaluation and implementation of BI outsourcing opportunities – both from the perspective of BI outsourcing customers and BI outsourcing vendors. It is currently applied by a major service provider in the finance industry who is in the process of implementing measures to become a BI outsourcing provider. The provider uses the framework for a description and differentiation of offered BI services and for the optimization of its services portfolio. The concept will furthermore be the bases for the elicitation of customers requirements and for the assessment of the customers' existing BI services landscapes.

During the course of this project it has become evident that there is a necessary to adopt the framework to the respective application environment regarding terminology, component selection, and granularity of service descriptions. So far experiences suggest, that such adoptions can be carried out without impeding the overall goal of providing a generically applicable framework.

Ongoing research addresses the definition of complex solutions comprised of several services and issues of services' interplay. Besides that, concepts for the specification of roles, activities, and quality measures are developed and combined with information on process cost and effectiveness. These activities aim at a calculation schema for BI outsourcing business cases. They are designed to be in step with the development of general BI service models and aligned with larger IT Governance concepts.

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