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DEDUCING DEMANDS AT BUSINESS-INTELLIGENCE-SYSTEMS BEYOND UNBUNDLING WITHIN THE EUROPEAN ENERGY MARKETS

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Abstract

The paper presents a process model to deduce utility specific requirements within the utility industry beyond unbundling. It is based on a case study. Due to the market transition, Business Intelligence (BI) and its tasks of extracting, transforming, and analyzing data at different enterprise levels becomes relevant within this industry. Whereas utilities were formerly protected by regional monopolies, they had to change to competition nowadays. Therefore, getting information in the appropriate quality, at the right time, and in every situation is important for all management levels. According to empirical studies, the BI usage within the utility industry is low. The companies invested a lot of money into hard- and software, but had no time to fulfill business requirements. One reason is that priority tasks like unbundling had to be implemented first. Such projects were time consuming so that there were no resources left for additional vertical information flow oriented activities. Moreover, current BI implementation models do not consider utility specific requirements. Due to this reason, the contribution of this paper is to present a business flow orientated process model that deduces requirements by presenting the main business processes, data volume, and complexities on a department level, especially in context of the European unbundling directive.

Keywords: Business Intelligence, Utility Sector, Unbundling

1 INTRODUCTION

The liberalization of the energy market has dramatically changed the European power market since 1998. The former monopolistic market structure has been broken and abruptly substituted with competition (EU 2007, Steger et al. 2008, p. 20). Moreover, the liberalization induces that the management have to satisfy also investors' demands. Due to this reason, supporting the management with internal and external information is of increasing importance in context of planning, forecasting, and budgeting (Appelrath & Chamoni 2007, Horvath 2006). However, traditional planning and controlling tools are neither flexible nor structured enough to support the management with information and to bridge the gap between strategic and operative business processes (Kemper et al. 2006, Oehler 2006). Therefore, *Business Intelligence* tools (BI) are used in order to ensure fast, reliable, and integrated planning and controlling. According to Howard Dressner, BI includes all decision support information systems,[1] from collecting data to storing data and its presentation (Gartner 2008). Its core applications imply adequate tools and applications in order to improve both the decision making process and communication with the users. The goal of BI is to design and implement business applications, enabling qualitative and quantitative analyzes (Gluchowski & Dittmar 2008, pp. 89)[2]. Consequently, the contribution of BI is a flexible corporate management on all management levels. Furthermore, BI is an instrument for knowledge generation, knowledge distribution, and knowledge usage (Gluchowski & Dittmar 2008, pp. 319). However, introducing BI does not work automatically. Existing reference models for BI strategy and BI implementation, e.g. Steria Mummert (Czochter 2008) and BARC (BARC 2007) do not imply utility specific requirements. Instead, they present a multitude of criteria that are either too general or do not concern utility specific requirements. Due to this drawback it is the paper`s goal to present utility specific requirements as a basis for BI software evaluation and successful implementation. The selection and weighting of requirements serves as a guide for coming BI implementation within the utility sector.

The research objective is realized by a process model that is based on a case study with a German utility company. Additionally, the research objective is to deduce department- and business-oriented as well as unbundling-conform requirements in favor of an enterprise wide BI-system. The paper is structured as follows:

- The necessity of formulating utility specific demands is explained by describing the background of the European energy sector (section 2).
- IT strategy is explained, because the characteristics of the energy sector influence the requirements so that they are very specific and a *copy&paste* from other economic sectors is not adequate.
- The meaning of vertical information supply is described as well as its influence for BI in the energy sector (section 3).
- The reference framework is presented in order to substantiate the chosen research method.
- Chapter 4 deals with the explanation of the process model in order to deduce requirements. The contribution of this chapter is a business task oriented information flow from data sources to their destinations in utility companies. This is summarized in a data-flow oriented architecture (process-system-map). This enables us to determine so called gravity centers (defined by their amount of data and complexity of algorithms) to characterize the departments and to define a generalized strategy map which is done the first time within utility companies.
- Following, the BI requirements and their impact in respect of the utility industry are presented.
- Finally, the paper ends with the conclusion.

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[1] The term was mentioned by IBM in 1958, but refers to a more general sense (Luhn 1958).

[2] It is not the paper's goal to analyze the different BI definitions and describe the BI process. These definitions and explanations can be found in (Gluchowski & Dittmar 2008a; Watson & Wixom 2006; Kemper et al. 2006).

2 RESEARCH BACKGROUND

This section explains the transformation of the European energy market. It illustrates the necessity of BI within the utility sector. Moreover, the problem of formulating utility specific BI requirements is described.

2.1 The European Energy Market Transition

The majority of the European utility industry is still structured by monopolies and oligopolies (Storr 2007). In Germany and France for example, the five largest utility companies hold 95 percent of the high voltage grid and generate more than 80 percent of the total power generation (NA 2004, EDF 2007). The monopolistic structure is based on a vertical integration of the utility companies from power generation, transmission and distribution (T&D), and retail services. Nevertheless, the monopolistic structure has some advantages. Firstly, building up a second grid is expensive and wasteful, because the T&D system is a natural monopoly. Therefore, it is easy for utility companies to reach economies of scale by increasing their capacity at a progress rate to gain decreasing average cost. Secondly, a vertical integration leads to economies of scope. Because of extensive investment cost, monopolies can realize synergies by coordinating and concentrating both investment and operations (Hung-po et al. 2005). But this aspect contrasts the goal of the *European Union* (EU) which is characterized by economic integration in order to eliminate the economic frontiers between two or more countries (Pelkmans 2001, pp. 2). In context of the European energy sector, the EU has started a single market for electricity and gas (EU 2003) by opening the market for competition and incrementing transparency and data protection. While the progress may differ within the EU countries, the one thing they all have in common is the unbundling of the utility companies' business activities and the highly volatile trading of commodities such as fossil fuels, electricity and even water (Felden 2002). Unbundling means that the main operation, T&D and retail in vertical integrated companies are separated from each other to enable third parties a non-discriminating access to the market. According to the directive, the member states have to implement regulatory authorities that secure competition, free market access and fair compensation fee for the unbundled grid (the grid still remains as a regulated monopoly). Moreover, the directive is distinguished into legal, operational, accounting and informational unbundling. Legal unbundling deals with the company legal entity of the *Distribution Service Operator* (DSO). Accounting unbundling separates the T&D from an accounting perspective, so that the market prices for electricity can be identified independently from T&D costs. Organizational unbundling ensures that the T&D unit operates independently from the utility company. Finally, the informational unbundling deals with the confidential treatment of sensitive and business oriented information. In summary, unbundling shall create equal market conditions for all grid users (EU 2003).

2.2 Problem Formulation

Integrated utilities are confronted with increasing competition whereby they had to implement the unbundling regulations first, before other demands could be fulfilled. Such an implementation leads to efforts caused by a large number of national legislations[3] based on the EU directive (Nick 2006)[4]. Additionally, utility companies are faced with increasing market stress of competition, especially in the power generation and DSO units (Steger 2008). Hence, decision makers have a need to get the right information in context of energy trading and incentive based regulation (Nick 2007).

3 The German legislations are concerning grid access (both natural gas and electricity), incentive based regulation, and grid remuneration e.g. EnWG, StromNZV, StromGVV, StromNEV, GasNEV, GasGVV, EEG, Anreizregulierung.

[4] E.g.: Business processes have to be checked to unbundling guidelines. Moreover, utilities are forced to prepare an unbundling report yearly.

Furthermore, the management is obligated to its investors. Both reporting oriented needs are usually not formulated, yet.

But whereas the power generation is capital-intensive, budgets are getting tighter. In this context, controlling tools like planning, forecasting and budgeting are of major importance (Horvart 2006). Surprisingly, especially these tasks are often done manually within the utility sector. It is quite evident that the considerations about unbundling determine both the business oriented horizontal and also the vertical information flow. An information flow can be described as a path from a supplier to an end user or customer independently from their locations (Felden 2008). Management decisions are based on information that is gained from the vertical information flow. With regard to unbundling and particularly competition, BI offers opportunities in order to fulfill information requirements and to handle the increasing data volume in utility companies. Empirical studies show also that the technical premises for a BI system are already established in utility companies. But BI maturity studies explain an initial status of BI usage. It is limited to distinctive departments, ad-hoc reporting is not established, and reports are created manually and redundantly (Chamoni & Gluchowski 2004). Moreover, the business requirements remain unclear, so that the actual system's usage is low (Czotscher 2008). This defines the need for BI within the utility sector. Due to this, we set up a case study to be able to identify BI-oriented requirements of the utility sector so that a functional BI implementation is easier to handle.

3 IT IMPACT

The unbundling directive determines the IT-architecture of utility companies. Securing non discriminating access to the market and information preservation of sensitive and confidential data are the core messages of informational unbundling (§10, 3 EnWG[5]). In context of a horizontal information supply, business processes and its information are faced with unbundling, although they were fully integrated before[6] (Abel 2005). Unbundling determines data that can be of technical, economical, or legal nature. From a technical point of view, especially ERP and metering systems are focused with unbundling. On the one hand, it is necessary to adapt the interfaces of formally integrated systems in order to comply with unbundling directives. On the other hand, the user authorization concept has to be mentioned. In this context, the *Need to Know* policy plays an important role. *Need to Know* means those users are allowed to see just the information concerning their business needs (Hartmann & Bitz 2008). This principle enables the opportunity that every DSO customer is able to access its user data that are recorded within the DSO (Nick 2007). National authorities advise the separation between data sources that are used from DSO, retailer, and a generation unit. Moreover, unbundling requires a detailed documentation of data and folder structure (§10 EnWG).

The consequences of unbundling are that the IT architecture and strategy determine the horizontal information flow. Due to the increasing competition, the management is more interested in appropriate and aggregated information at the right time in order to take decisions comprehensively (Oehler 2006). So, the unbundling within the horizontal information flow influences heavily the vertical, BI-oriented information flow. Thus, it is necessary to consider unbundling directives to identify and analyze critical business processes. The identification implicates the effect that utility companies have to think about their business processes by identifying the process operations, the responsible person, the trigger, the interfaces, and the expenses (Nick2007). The contribution of BI is the integration of measured processes performance data from operational systems like an Energy Data Management system (EDM). Consequently, unbundling and the requirement to identify business processes is a device to accelerate the implementation of internal cost allocation. In this context, BI contributes to the strengthening of competitiveness while supplying the information demand. But the collected data

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[5] EnWG is the abbreviation for Energiewirtschaftsgesetz.

[6] E.g.: change of supplier, metering services, changing master data, business data query, and grid-use-billing.

at the different company levels have to comply with the defined unbundling requirements. These requirements are relevant in context of integrated planning and decision support systems. Also specifically, such requirements are not valid for other industries.

4 PROCESS MODEL FOR BI ARCHITECTURE

This section presents the research framework to explain the chosen research method. After the explanation, a process model is described in order to deduce specific requirements.

4.1 Research Framework

We are using a case study as an empirical method, in order to describe the construction of a process model for a BI-strategy to be able to deduce utility specific requirements. Yin has described the case study as an empirical inquiry, "…that investigates a contemporary phenomenon within its real-life context …" (Yin 2003). We have chosen this method, because the direct involvement into business processes was very important to us. Speaking face to face with department managers and system users in order to understand their issues and identify requirements of BI systems in the energy sector is important, because current studies (Czotscher 2008, BARC 2007) ignore usage characteristics and specific requirements. Furthermore, companies are confronted with numerous surveys so that it is disputable, if they participate with the necessary engagement, if another anonymous one is approaching (Pendse 2007).

4.2 Process Model for a BI Architecture

The current procedure is based on the project model of VDI directive 2221 (VDI 1993). This approach is appropriate, because other process models are too specific in context of a service design (e.g. Scheuing & Johnson 1989, Shostack & Kingman-Brundage 1991), are focused on software development (e.g. Royce 1970, Boehm 1988, BMI 2006), or ignore utility sector specific requirements in context of a BI implementation (Totok 2006, Knoell et al. 2006). Due to the reason that the VDI directive gives advice on an aggregated level, we are able to adapt its general rules in favor of the study. The study uses the first four steps of the VDI approach, because the focus is not the development of new software but the construction of a process model for BI architecture. These steps are:

- Defining the problem;
- Identifying the functions and structures of the determined departments;
- Searching for solution principles and its structures;
- Classifying modules;

In the first phase, the problem definition is done by interviewing managers of the strategic management and the IT department. Furthermore, the projects goal and budget are defined. In the second phase, the status quo is established via an expert survey in different departments. Its goal is to describe an actual handling of information and the department functions. The survey concentrates on controlling, IT-services, investment, customer service, DSO- and sales department managers. BI is relevant for these departments, because controlling needs standardized reporting tools whereas the other departments use complex analyzes in order to plan investments, understand customers' requirements, and to forecast grid capacity and grid costs. The results of this phase are use cases for the business processes. In the third phase, all use cases are consolidated to a process-system-map

(PSM)[7] that describes the main business processes within the departments. After that, a consolidated PSM of the utility company and the DSO is built. Its goal is to illustrate the main company processes by showing which business process runs, which data sources are used as input, and which data are produced as output. At the end of this phase, each department and the whole company are skipped into a maturity model. This model is based on the *Mummert BI Maturity Model* [biMM] (Mummert 2004). This model is chosen, because of its empirical evidence, especially in Germany (Chamoni & Gluchowski 2004). The model's intention is to clarify the interrelation between maturity and return on investment. On the first stage, a company does not have any integrated databases. Therefore, it focuses on data integration. Within the second stage a company has reached a first level of standardization by implementing a BI tool for reporting. At the third stage, a company involves a data warehouse [DWH]. In addition, extensively BI functions are provided, e.g. OLAP. At the next stage, companies have the opportunity to use data mining algorithms in order to discover implicitly information in databases. Finally, companies which are placed on the highest maturity stage are able to use data mining results directly to improve their processes. The fourth phase uses the results from the previous phases. Its goal is to deduce department specific requirements. At first, *BI gravity centers* are built. The centers are symbolized as bubbles, whereas each bubble represents a department. The bubble's surface area describes the number of users and its locality symbolizes the grade of complexity and data volume. The surface shows which department has a critical status in context of information supply. Additionally, it is a basis for the BI architecture. It combines the different management levels with functional requirements. The resulting three components (PSM, maturity model, and gravity centers) engage all dimensions that cover specific requirements. These requirements are consolidated in a BI architecture that consists of different dimensions. Finally, specific requirements are deduced from the set of results. The requirements are weighted in consideration of comprehensibility and clarity. Additionally, they constitute the present situation.

It is evident that the current procedure of deducing requirements reflects a process view that describes a strategic development process. A BI strategy is necessary in order to describe how to deal with information (Totok 2006). It defines the information supply and its meaning for the company (Horvard 2008). A utility company should implement a BI strategy that is congruent with its company strategy. The BI strategy defines functional and technical requirements by implementing a BI architecture (Totok 2006). Whereas a BI architecture describes the information supply, a process model based BI roadmap constitutes a schedule in order to realize the architecture. Such a road map is the result of this case study and it supports in different phases how to reach the architecture.

5 RESULTS

This section presents the PSM, because it describes the survey results in the second phase. Additionally, gravity centers are explained. Its function is to present the impact of BI in the different utility applications. Finally, the requirements are mentioned and the evaluation method is illustrated.

5.1 Process-System-Map, Gravity Centres and BI Maturity

The process-system-map presents the results of the expert survey within the department managers. As already mentioned, two PSM are created in respect of unbundling: one for the utility company and one for the DSO. The map itself is built upon a two dimensional one. The first dimension deals with the business processes that are faced with BI within the utility. The PSM clarifies the data flow from incoming data, data transformation and outgoing data for each BI relevant business process in the utility industry. Due to this reason, relations between business processes become obvious. On the basis

[7] The name process-system-map belongs to the presentation of main activities of each department, although business processes run across several departments.

of the risk assessment processes the PSM and its meaning for deducing BI requirements is explained. Furthermore, it identifies the status quo and is the basis for BI maturity classifications and the definition of gravity centers.

- First, the report recipients are identified. By identifying the recipients it becomes obvious which report aggregation level is necessary. This conclusion is important to deduce requirements in context of report presentation and drill down functions. Furthermore, requirements of report distribution can be deduced.
- Second, the incoming data objectives are examined. The examination provides information about requirements of data sources. The risk assessment department has both technical and functional data sources that have to be integrated. Therefore, the BI system has to integrate local sources, need interfaces to the geographical information system (GIS) and utility specific systems.
- Third, the outgoing data object is explained by describing its report presentation and distribution format. Hence, graphical functions for presentation are enumerated as requirements. Moreover, architectural artifacts, like client platform, supported browsers and clients, play an important role in distributing reports.
- Fourth, the PSM describes the data requirements. The description distinguishes between structured and unstructured data in general. The risk assessment department enumerates financial data, geographical data and maps. Financial and geographical key figures and their meaning are mapped. This mapping facilitates the allocation of revenues to distribution stations and net customers, as well as analyzing the state of distinctive assets. Therefore, a BI system must consider techniques like data plausibility check, simulation methods to forecast revenues, and also report features like quick views and calculation within a report. Moreover, working with customer data requires a sensitive handling.
- Fifth, the PSM lists these systems supporting the business processes. In case of risk assessment, SAP BW, SAP R3, GIS and MS-Office applications are needed. Therefore, a BI system should processes relational and multidimensional data sources. Furthermore, it needs certified interfaces to SAP BW and GIS. Especially the GIS and SAP IS-U interface is an industry specific BI-requirement.
- Six, the purpose of the business process is described to improve the functional understanding.

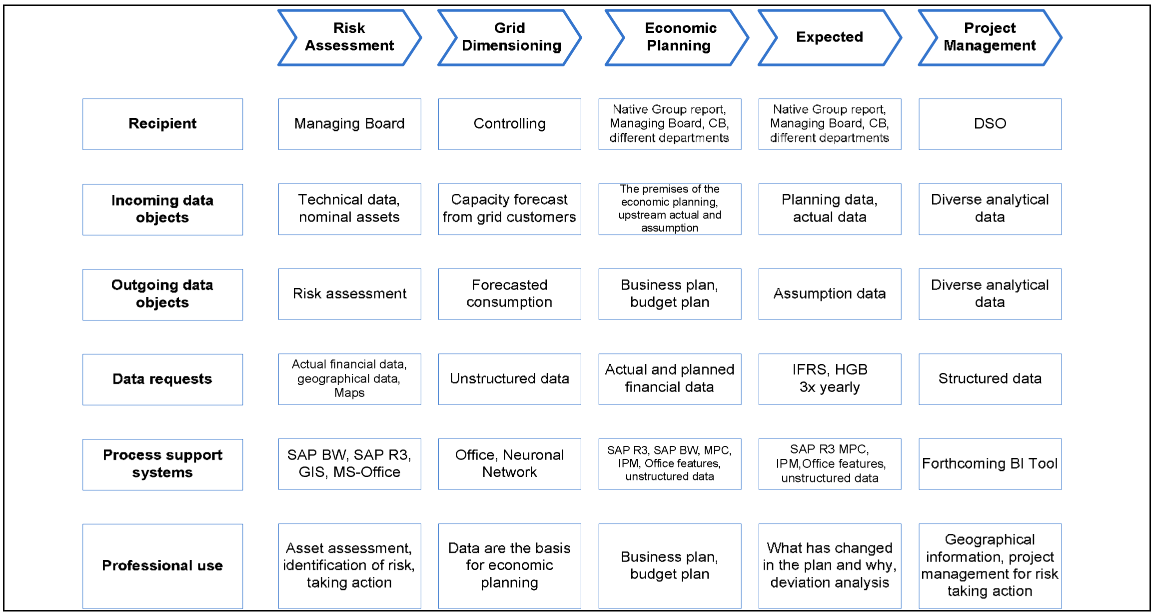

Figure 1: Process-System-Map of the DSO

Considering the PSM, the meaning of the controlling department in context of planning, forecasting, and budgeting within the utility sector is important. It has the function to consolidate reports from utility and unbundled sales and the DSO division. Moreover, it has to distinguish between financial and action planning.[8] In context of financial planning, the generation of planned and actual data is a core application of BI. Additionally, analytical processes, like *knowledge discovery in databases* (KDD), forecasting and operation research methods become more important. Thereby, it has to be distinguished between DSO and Sales. A DSO customer refers to competitors of the utility company, whereas the utility customer is defined as an end consumer. Methods like data mining afford a better customer relation management (CRM) by analyzing customer behavior in order to plan and optimize marketing activities and improve customer service programs. Furthermore, incentive based regulation becomes interesting for DSO. This leads to the need of analytical tools that enable excellent grid capacity, power consumption and peak load forecast.

The PSM emphasizes the information flow within a business process. It describes the data transformation by explaining incoming data objects, their transformation, and the outgoing data to supply information requirements. Furthermore, the presentation is the basis for the further examination of necessary interfaces, especially if data are transformed manually. So, unbundling-sensitive data are identified.

Whereas the PSM describes the data centric view on business processes to understand the operational workflows and to deduce requirements for a BI system, it does not give information about the contribution of BI within the processes directly. Due to this reason, gravity centers are built to describe both the complexity of BI requirements and the data volume for each business process. A maturity classification also clarifies the contribution of BI within an utility company.

Besides the complexity of requirements, the data volume is very extensively, too. On the one hand, the sales department deals with a big set of data; on the other hand, the DSO is confronted with capacity data, geographical data, and legal data for the regulatory authorities. Whereas in the three mentioned departments both requirements and data volume are high, the controlling department concentrates on reporting. Therefore, it is not focused on analytical methods (in the meaning of using complex algorithms), but on reporting consolidation.

The maturity classification bases on the process-system-map. In context of the case study, the utility company is placed on the second level because it focuses on reporting. But in regards to the intensifying competition, analytical methods are of increasing importance. Therefore, it is the goal to reach the fifth level in the intermediate term (Chamoni & Gluchowski 2004). Furthermore, our classification is supported by current maturity classifications of BI within the utility sector, because it shows comparable results.

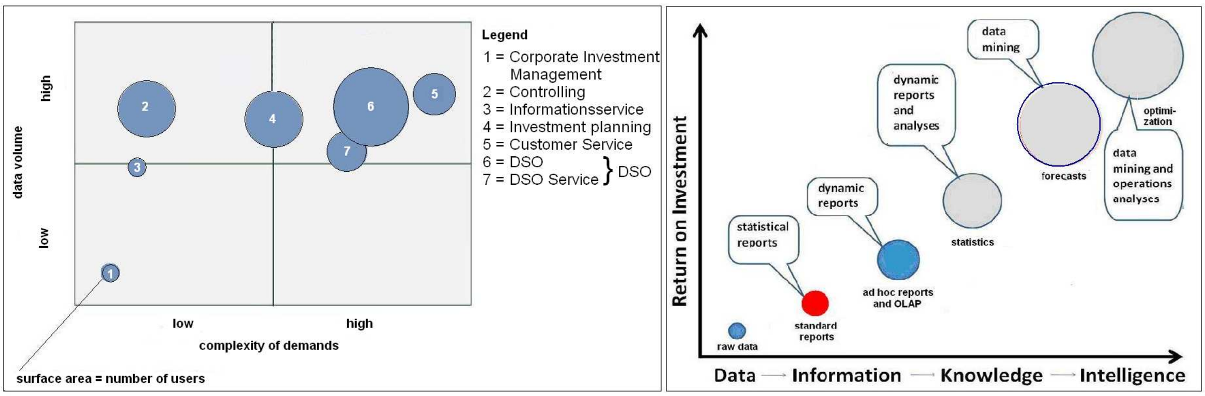

Figure 2: Gravity Centers and biMM

[8] E.g. grid capacity planning and investment-planning.

5.2 Deducing Requirements

Formulating requirements is essentially in order to establish a BI architecture. Besides, copying requirements from recent studies like BARC (BARC 2007) and TEC (TEC 2008) offer a multitude of BI criteria. Many of them are not relevant for an adoption within the utility industry. It is evident that a list of requirements does not match with industry specific requirements. The PSM and the gravity centers are the basis for deducing requirements. By giving information about the business workflow, their functional complexity, the data volume, and the requirements ensure an appropriate contribution of BI to support business processes.

Nevertheless, not every requirement has the same significance. Hence, they are ranked on a scale from 1 to 10; a scale of 1 means that the requirement is relevant for a BI implementation, but it is not as important as other requirements. A scale of 10 reveals that the requirement is very important. The scaled requirements are the result of a second survey with the department managers after presenting the deduced requirements. The following Figure 3 and Figure 4 present in different radar charts the significance of each deduced requirement. The ranking is basis for a comparison of BI software and help evaluating an appropriate BI software for the utility sector.[9]

The following section presents the deduced requirements which are separated in four parts. The first part deals with general requirements like user support within the implementation and usage, vendor size, administration, and reference customers. Usually, big BI vendors are synonymous with good performance, but small vendors normally show greater engagement (BARC 2007). Moreover, the price is an important criterion, whereas it is separated into implementation cost, cost of development, training cost, and maintenance cost.

The second part contains requirements concerning the administration. These criteria determine a BI architecture and its implications to performance, especially load sharing, authorization scheme, and metadata administration. In context of performance optimization, the server architecture is decisive, because load advantages can depend on partitioned servers. Furthermore, administration with its authorization scheme is very important, because of unbundling requirements. The more flexible the user authorization is, the higher is the transparency. The reason is that authorization can be constricted at the lowest level. Moreover, they treat with system stability which is a very important demand, especially in context of energy trading and net metering.

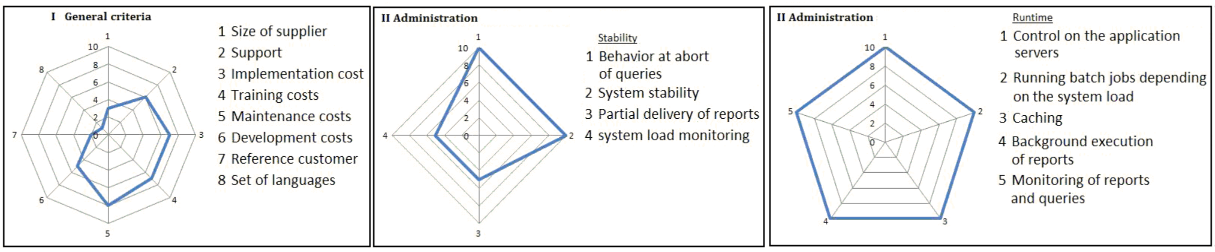

Figure 3: Requirements at BI in context of general and administration criteria

The third part examines the platform, software interfaces, operating system integration, and the kind of data sources. The platform determines the load performance and user scalability. Additionally, the supported programming languages, supplied programming tools and interfaces have an impact to data integration. It is important that data integration is easy and powerful in order to adapt numerous data sources, i.e. relational or multidimensional databases. Within the utility industry, interfaces to common systems like SAP IS-U or GIS are necessary.

[9] A software evaluation is not the paper's object.

The final part determines the application functions that are discriminated between graphical representation, report distribution, and the usage of technical methods. It is of major importance for users, to control the layout in order to satisfy their own information need appropriately. Therefore, potential users take emphasizes on aggregation of different data sources, zero row and zero column elimination. Because utility companies have to send several reports to national authorities (like federal net agency), it is important to describe report artifacts with annotations (comments about the measures). Moreover, users prefer to have graphical visualizations to understand complex interrelations. Due to this reason, dashboards or cockpit functions are significant BI applications. In regards of cockpit functions, the ability of navigation within diagrams is mentioned. With regards to a report distribution, BI systems should have extensively printing functionality. Finally, the technical methods are essential for the report quality. As shown in the gravity centers, the sales and the DSO department deal with large data sets. Thus, users take emphasis on data plausibility verification. The following Figure 4 presents the results.

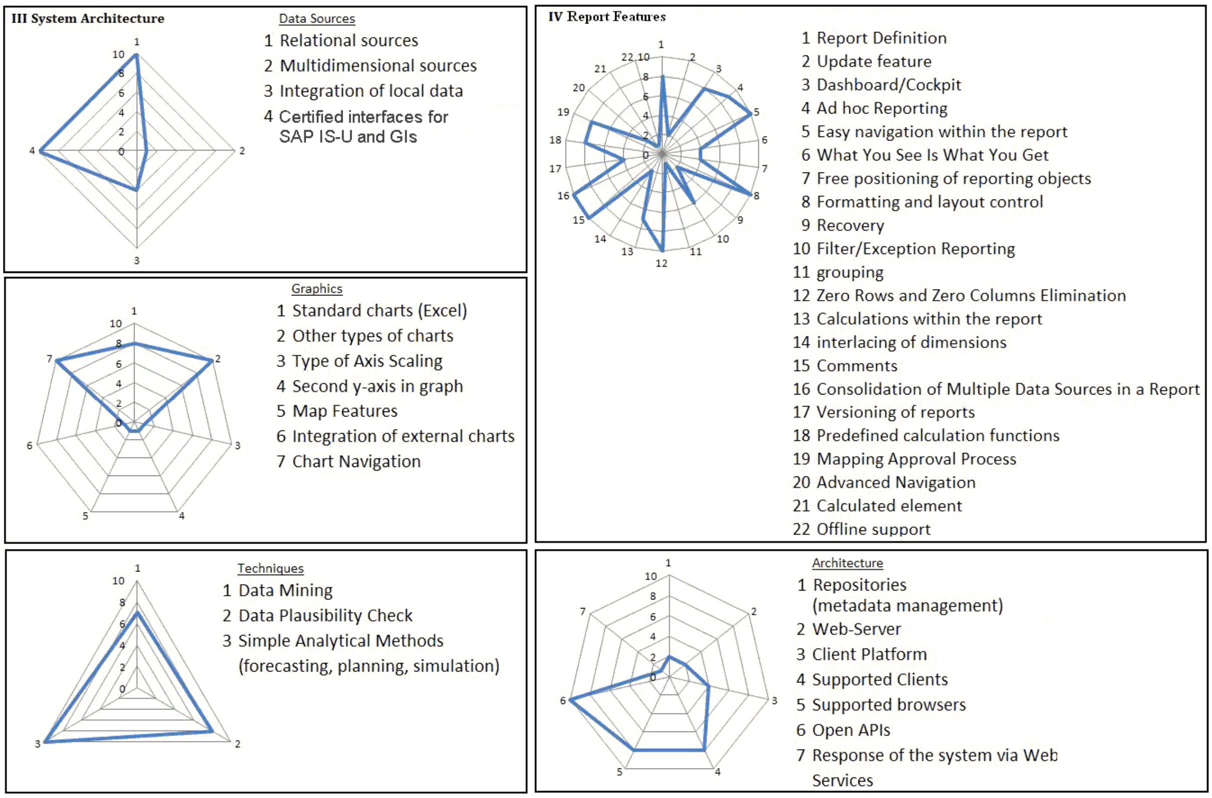

Figure 4: Requirements at BI in context of System Architecture and Report Features

6 CONCLUSION

The contribution of this paper is the deduction of requirements for a BI system in an unbundled utility company. Existing BI studies contain a multitude of criteria, but they do not consider industry specific requirements. It was not published which BI requirements are important and which applications are needed. Due to this reason, a process model based on a case study is presented. It takes emphasizes on process orientation by clarifying the data flow, specifying the input data, data transformation and output data. The process model is structured as follows. Firstly, the necessity of BI within the industry was explained. Since formerly vertical integrated utility companies have to unbundle their DSO to ensure open access to the grid, they are confronted with competition. Due to this reason, the information demand of the management increases to support the decision making process. Moreover, the management starts to think about their business processes, so BI can be an enabler for harmonizing, collecting, and analyzing data. By implementing a BI system, the IT strategy is affected, because data have to be structured in an unbundling conformable manner. In fact, current studies offer a wide variety of requirements. But not every requirement is relevant for the adoption of BI in the utility industry and the significance of BI requirements is different. In order to deduce utility specific requirements and to scale its impact for a successful adoption, a process model was presented. The main processes are consolidated in a PSM for both utility and DSO based on a case study. In the following step, gravity centers were developed to show the impact in context of data volume and data complexity for each department. Moreover, the utility company was classified by using a maturity model. The goal of these artifacts is to show the meaning of BI on an aggregated level for each department, especially retail and DSO. In the following phase, specific requirements were deduced and weighted in respect to their meaning within the utility sector. Thereby, requirements are divided into four parts: general, administration, architecture, and application functions. According to the utility industry, system stability in context of net metering and energy trading is very important. In context of these two processes, data mining methods become more important. Furthermore, administration tasks play an important role, because of unbundling requirements. A BI system has to supply interfaces to common utility specific systems like SAP IS-U. Especially the DSO integrates a multitude of different data sources that contain both technical and financial data. These data have to be integrated in a single report. Finally, users demand a high layout control, easy navigation, and annotation function.

The presented enumeration of requirements constitutes a guide to a function oriented BI implementation and evaluation of BI software within the utility industry beyond unbundling. Concerning both deducing and weighting requirements, an evaluation of the results is necessary. Although, the developed process model and the deduced requirements are the outcome of an case study, current results cannot be presented. Even if the results of a BI implementation are deliverable, a verification of the artifacts has to be arranged. Such verifications can base upon models that compare the actual and the specified state and formulate the degree of compliance.

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