The Business Value of Enterprise Data Models

Full paper

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Abstract

It is hard to underestimate the role of (big) data in modern society. An organization’s ability to handle its data management has become a competitive force in its own right. While the business value of Enterprise Architecture (EA) as a whole is widely recognized, little practical guidance can be found in literature on the business value of Enterprise Data Models (EDM) as part of EA. To bridge this gap, we propose a framework for evaluating the business benefits of EDM, based on a Grounded Delphi study we performed at a large multinational case organization in the oil & gas industry.

Introduction

At the turn of the decade, several scholars reported on the emergence of the ‘information mindset’; the trend towards organizations recognizing that data and information are vital assets, to be managed carefully. This concept was since added as the fifth competitive force in Porter’s framework (Kohli and Grover 2008), proving it’s impact in the competitive market. In the current day and age, an organization’s ability to capture, process, store and analyze vast quantities of data and to derive and implement sensible decisions from such data has become a boardroom concern. Companies, small and large alike, are pushing their ‘analytical skills’ to gain operational, tactical and/or strategic competitive advantages.

Whether or not to engage in this ‘information mindset’ is a decision every organization has to make. Similar to the advent of enterprise systems at the end of last century, a large investment in an analytics environment may not be the recipe for success for all companies. Enterprise Architecture (EA) as a field has evolved to manage the complexity of such enterprise systems and to facilitate discussions on the business value such systems deliver. Espinosa et al. (2011a) show the critical role coordination and governance play in a successful EA process. Similarly, one would expect that the Enterprise Data Model (EDM), as part of EA, would enable the assessment of the business value of the ‘information mindset’. However, despite the rising importance of data and the common interest in its valuation, we have found few studies addressing this, which leads us to ask the question: how can we value the business benefits of the Enterprise Data Model (EDM) as part of the overall Enterprise Architecture (EA)?

Due to the highly abstract character of EDM, there are difficulties aligning it with the business, yet business support is necessary to make it a success. We aim to bridge this gap by demonstrating the potential benefits of EDM and their categorization into a practical framework. Following a Grounded Theory approach, we have investigated this within a large multinational corporation in the oil & gas industry, trying to make the EDM concept less abstract.

In the next section, we define the key concepts EDM and Business Value. We then discuss the research set-up, followed by a presentation and discussion of the findings when confronting our initial theoretical model with the reality of the Case Organization. We conclude with recommendations on the next steps to be taken as well as a critical review of the limitations of our study.
The Business Value of Enterprise Data Models

Theory

Although we follow a Grounded Theory approach (see Research Design section), we consider it essential to first delineate two concepts central to our study: EDM and business benefits. First, we position the EDM in the context of enterprise systems architecture and data architecture. Next, we address the definition of business benefits and explore the possible categorization of these benefits.

Enterprise Data Models (EDM)

“The enterprise data model is the heart and soul of enterprise data architecture” (DAMA International 2010). Every system, tool, application or project uses data and has its data defined, either explicitly or implicitly. The growing complexity and volume of data necessitates the use of models that structure and summarize the data. Furthermore, the globalization and centralization of businesses requires integration amongst functions. This raises the necessity for dispersed and unaligned data models to be merged into one single data model (Fox and Gruninger 1998). As such, EDM can serve as the foundation which will “lead the consistency of data, more easily integrated systems, improved productivity in systems development and maintenance” (Goodhue et al. 1988, p. 379).

The goal of an EDM is to represent the data of the entire organization. It is part of the data architecture (Winter and Fischer 2007), which in turn is part of the EA. The Data Management Association (DAMA) defines data architecture as “an integrated set of specification artifacts used to define data requirements, guide integration and control of data assets, and align data investments with business strategy” (DAMA International 2010). It is the part of the EA that aligns the business requirements regarding data with the applications and technology which use it. For its actual components we follow DAMA and consider “areas, entities, attributes and the relationships between them” (DAMA International 2010).

The fact that the EDM is a part of the data architecture, which is in itself part of the EA, means that the EDM needs to be congruent with the underlying Enterprise Model. An Enterprise Model is “a computational representation of the structure, activities, processes, information, resources, people, behavior, goals, and constraints of a business, government, or other enterprise and can be both descriptive and definitional” (Fox and Gruninger 1998, p. 109). This definition stresses the representational character of the model and describes the enterprise, while in addition providing definitions and rules applying to the enterprise (Kim et al. 2007).

Combining these various aspects we define an EDM as the computational representation of all enterprise data, its attributes and the definitions, and the relationships between the data objects.

Business Benefits

Much earlier research on the business benefits of IT focused on organizational performance (Bakos 1987; Brynjolfsson and Hitt 2000; Melville et al. 2004), taking a qualitative perspective on intangible business benefits. Over the years, this was enhanced to include tangible business benefits and the quantification of outputs measured in money, time or KPI improvements (Barua et al. 1995; Tallon et al. 2000). In contrast, the business benefits of EA have often been assumed but hardly investigated beyond qualitative assessments (Espinosa et al. 2011b). The enterprise-wide view brings complexity, entanglement and dependencies and complicates measuring of the effects (Porter 1990). Although some initiatives have been undertaken to assess the economic value of EA (Schekkerman 2009), the majority of studies use a qualitative approach for assessing the business benefits of EA. Brynjolfsson and Hitt (2000) suggested that the tangible benefits of IT are only half of the total benefits; they argued that the EA potentially comprises more of the complexity of the organization than the IT infrastructure itself. Therefore, an appropriate definition of the business benefits of EDM as part of the EA should encompass both aspects.

Melville et al. (2004, p. 287) define (IT) business benefits as “the organizational performance impacts of [IT] at both the intermediate process level and the organization-wide level and compromising both efficiency impacts and competitive impacts.” Cronk and Fitzgerald (1999) include the net effect and consider the “resource expenditure required” to achieve “sustainable value”. This is a key element for our study on EDM, given the fact that we want to support the a-priori assessment of the value of an EDM, making the business enablers “factors which could be clearly seen as [EDM] outcomes, and that in turn are known to have the potential to deliver organizational benefits” (Tamm et al. 2011, p. 144).
Combining these insights we define the business benefits of EDM as: the positive net results for the enterprise attributable to EDM, which can be both tangible and intangible, taking into account the time and resources needed to achieve these results.

**Research Design**

Our research questions are aimed at understanding what the business benefits of EDM are and how they can be categorized. In lieu of theory, the ‘what’ question would typically be addressed using a Grounded Theory approach (Corbin and Strauss 1990), whereas the categorization and frame working part of the question could be addressed using the Delphi Method (Okoli and Pawlowski 2004; Skulmoski et al. 2007). Methodological guidance on how to address both these aspects simultaneously can be found in Päivärinta et al. (2011), who coin the term “Grounded Delphi Method” for the combined application of these methods as well as Brady (2015), who discusses how to improve the use of Delphi for qualitative studies. In essence, it means that the first step of the traditional Delphi Method is enhanced using coding techniques described in Grounded Theory, delivering a more rigorous starting point for the expert sessions from the conventional Delphi Method aimed at verifying, ranking and categorizing the results.

We conducted our research in a single case organization instead of inviting experts from multiple organizations. While this approach risks negatively impacting the external validity of the findings, it does increase the internal validity of our findings. Furthermore, we believe that the transfer of these results to practical situations is facilitated by the fact that it is known upfront that these results were achieved in one particular setting and not presented as universally applicable insights. Companies applying our findings will know that they may have to make some adjustments for their own specific situation. However, we did select a case organization of sufficient size, scope and complexity to cover many different aspects of EDM.

The Case Organization is a large multinational company in the oil & gas industry. Its management was motivated to participate in this study because of the challenges they face in implementing EDM, even though the organization already has a mature EA in place. During this period, one of the authors was full-time on-site at the headquarters in the Netherlands. The data in this company is known to be costly, due to the content and volume (in the range of 10’s of Petabytes) and therefore data management is a complex task. The geographical spread within the Case Organization resulted in the practical challenge of organizing the interviews and expert sessions remotely. We used a group support system for the expert sessions to overcome this challenge. A group support system is “a collection of computer-based meeting tools specifically designed to improve creative problem solving by teams” (Briggs and de Vreede 1997, p. 107). In particular, they allow for parallel anonymous contributions (‘chat’ function), strengthen the structure of the session and automate the transcribing process (Nunamaker et al. 1996). Furthermore, modern group support systems allow these sessions to take place distributed across the globe and asynchronously, making them perfectly suitable to fulfill the requirements of the Delphi Method. The interviews and sessions were conducted from April - July 2014 and followed the steps proposed by Päivärinta et al. (2011): data collection, concept discovery, concept prioritization and theory development.

**Data Collection**

To prepare for the interviews, desk research was executed exploring the existing reports on EDM and EA in the Case Organization. The goal of this desk research was to get a complete understanding of the concept in the context of the Case Organization. The desk research produced background material and did not serve as a primary source of data. The first interviews were held via conference calls with middle to senior level managers from the Case Organization, all with experience or expertise on EDM. Subsequent interviewees were found using the snowball technique to reduce selection bias (Coleman 1958). The amount of interviews was initially not set. However, after around 25 interviews the responses became repetitive: no new insights were retrieved and the same names for additional interviewees came up. We did not let the literature influence the questioning during the interviews and adapted the unstructured method as prescribed by Grounded Theory. The interview notes were verified by the interviewees, which resulted in an unstructured list of identified business benefits from EDM.
**Concept Discovery**

Subsequently, the unstructured interview findings were labeled and categorized in similar units to check for collectively exhaustive and mutually exclusive benefits and preventing overlaps (Tamm et al. 2011). Corbin and Strauss (2015) refer to this stage as *open coding*. The labels were transferred into a coding scheme using first, second and third order concepts (Hsieh and Shannon 2005). Axial coding explored the relationships between categories and classified the subcategories (Juliet and Corbin 2015). In our literature review, we found the framework presented by Shang and Seddon (2002) to be a good mix of the various categorization dimensions. They use a functional distinction between *IT*, *operational* and *managerial* benefits and add the categories *organizational* and *strategic* benefits. This matches the requirement in the EA/EDM domain to have a more business-driven methodology (Wan et al. 2013). The categorization that resulted from the coding of the interviews was confronted with their model and matched their categorization of the business benefits of enterprise systems. The categories were adopted from their framework, while the sub-categories were aligned with the coded interview findings.

Two expert sessions, consisting of two rounds each using a group support system (Meetingsphere™, with audio via Microsoft LiveMeeting™), were organized to maximize participation of the experts. One session aimed at data experts and the other one at business managers. The sessions were not anonymous, as this did not fit the Case Organization’s internal procedures. During the first round, the framework constructed from the interviews and literature was validated by means of a discussion. The business benefits from the framework were clarified when necessary, deleted when redundant, added when missing or put in a different category when the expert session decided to do so. When an expert suggested a benefit was missing, it was added only after approval of the other experts. Benefits were deleted when the experts commonly agreed that the benefit was irrelevant (after explicit agreement on the proposed deletion from the originator of the benefit) or when other benefits had a similar meaning. This validation method ensured the collectively exhaustive and mutually exclusive character of the business benefits. All modifications have been documented to offer maximum process transparency (Brady 2015).

**Concept Prioritization**

During the second round of the expert sessions, the benefits of the framework were ranked based on their overall impact on the business. Ranking is commonly used in the Delphi Method and in this case provided an understanding of the relative importance of the benefits (Päivärinta et al. 2011). The measurement used was a 5-point Likert scale. A calculation of the average score of each benefit across all participants served as the basis for the overall ranking, with equal ranks assigned to equal scores.

**Theory Development**

The resulting set of 35 business benefits have been assigned to the categories identified in the Concept Discovery stage and are listed following their order of ranking (Table 2). In addition, we have asked the participants to apply the model on a best practice case of EDM they knew from own experience. Although this is technically not a joint expert session to discuss the outcome, we felt that the richness of the feedback would be improved by having experts applying the results in a practical setting. This resulted in the development of 9 mini-cases, which not only confirmed the practical applicability of our framework, but also provided valuable (confidential) insights for the Case Organization. Finally, the framework and illustrative mini-cases were validated at a senior management meeting.

Table 1 summarizes the four different stages of our research.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Data Experts</th>
<th>Business Managers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Collection</td>
<td>15</td>
<td>11</td>
<td>Desk Research &amp; Interviews</td>
</tr>
<tr>
<td>Concept Discovery</td>
<td>11</td>
<td>16</td>
<td>Group Support Sessions, Round 1</td>
</tr>
<tr>
<td>Concept Prioritization</td>
<td>11</td>
<td>16</td>
<td>Group Support Sessions, Round 2</td>
</tr>
<tr>
<td>Theory Development</td>
<td>9</td>
<td>23</td>
<td>Development of 9 mini-cases</td>
</tr>
</tbody>
</table>

**Table 1: Research Stages and Involvement of Experts in Case Organization**
Results

In each of the following paragraphs we discuss one of the five dimensions of our framework (operational, managerial, strategic, organizational and IT infrastructure). The complete set of benefits is found in Table 2, including some key quotes from the interviewed experts.

Operational

“Operational activities process day-to-day activities that transform data input or resources into services, goods or results” (Shang and Seddon 2002). The business benefits in this category are characterized as being easily quantifiable, since they are very close to the process and existing measures. “Operations value is rather obvious: rework, time is money, avoidable costs are all quantifiable benefits”, as stated by an EA lead. We identified productivity improvement, quality improvement and cycle time reduction as the key operational benefits.

Managerial

The managerial category directly reflects all activities that ensure operations run effectively and smoothly. This managerial layer is quite extensive in most large companies and consists of a diversity of activities and benefits. “Important management activities are the allocation and controlling of resources, the monitoring of operations and also the support and input for strategic decisions” (Shang and Seddon 2002). Data management improvement, improved decision making and planning, performance improvements and resource management improvement are the key areas where EDM is expected to yield managerial benefits.

Strategic

The strategic dimension focuses on the continuous improvements of the organization, the bigger picture and future goals. “Strategic activities involve long-range planning regarding high-level decisions, such as business merging and acquisition, marketing competition, product planning, customer retention and capital sourcing” (Shang and Seddon 2002). Strategic benefits are often intangible, since they are characterized by a predictive element, such as a strategy or vision. Interestingly, the category of strategic business benefits is the first in which the enterprise benefits become visible. Both for operational and managerial practices the business benefits can also be addressed with (multiple) regular data models. Focusing on the strategy from an enterprise-wide view allows for revealing the actual benefits of aligned data across the enterprise. We identified support for business alliances, enabling sustainable competitive advantage and enabling global expansion as benefits of EDM for corporate strategy.

Organizational

Organizational benefits can be expected when the use of an EDM “benefits an organization in terms of focus, cohesion, learning and execution of its chosen strategies” (Shang and Seddon 2002). This category therefore, mainly focuses on the employees and how they and their work would benefit from EDM and, conversely, how their actions benefit the EDM. We identified empowerment, support for building a common vision and improved employee satisfaction as the main - typically intangible - benefits.

IT Infrastructure

The benefits to IT infrastructure refer to the data in the context of IT. The operational aspects of data management are also covered in this category, since data and IT are always related to each other. Since IT infrastructure benefits often have an operational core, they are easily quantifiable. The benefits of EDM for IT infrastructure have been identified as reduced complexity of the IT landscape, enabling the identification and removal of redundancy and the reusability of the data model. Although these elements are interdependent, with some of the benefits also in the operational and managerial domain, they have specific impact on the IT infrastructure and are therefore highlighted here.
### Table 2: Framework for the Business Value of EDM and Illustrative Quotes from Experts

<table>
<thead>
<tr>
<th>Operational</th>
<th>Managerial</th>
<th>Strategic</th>
<th>Organizational</th>
<th>IT infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity improvement</td>
<td>Data management improvement</td>
<td>Support for business alliances</td>
<td>Empowerment</td>
<td>Reduced complexity of the IT landscape</td>
</tr>
<tr>
<td>- Less rework (First time right) (3.8 #7)</td>
<td>- Consistency in definitions and data structure (4.1 #2)</td>
<td>- Quicker deployment of solutions (Time) (3.6 #16)</td>
<td>- Clear ownership data roles (4.1 #2)</td>
<td>- Ability to standardize (3.9 #4)</td>
</tr>
<tr>
<td>- Less time to search for data (3.4 #24)</td>
<td>- Strategic segmentation of data management activities (3.2 #31)</td>
<td>- Off the shelf solutions (Content) (3.4 #22)</td>
<td>- Transparent accountability (3.9 #4)</td>
<td>- Less updating data/systems (3.3 #28)</td>
</tr>
<tr>
<td>- Less time to create reports (3.3 #28)</td>
<td></td>
<td></td>
<td></td>
<td>- Reduced time onboarding / training IT staff (3.1 #33)</td>
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</table>

<table>
<thead>
<tr>
<th>Quality improvement</th>
<th>Improved decision making and planning</th>
<th>Enabling sustainable competitive advantage</th>
<th>Support for building common vision</th>
<th>Enabling identification and removal of redundancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Accurate data (Right content data) (3.8 #7)</td>
<td>- Enabling data driven decision support (3.9 #4)</td>
<td>- Quick decision making (3.8 #12)</td>
<td>- Common language (4.2 #1)</td>
<td>- Redundancy of systems / interfaces / hosting (3.8 #7)</td>
</tr>
<tr>
<td>- Traceable data (Data lineage) (3.3 #26)</td>
<td>- Broadening availability of high quality data (3.8 #7)</td>
<td>- Business agility (3.4 #22)</td>
<td>- Improved communication (3.8 #7)</td>
<td>- Data redundancy (3.8 #12)</td>
</tr>
<tr>
<td></td>
<td>- Better insights in expenditures (3.4 #24)</td>
<td>- Getting right product, at the right time at the right costs in the right place (3.1 #33)</td>
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<tr>
<th>Cycle time reduction</th>
<th>Performance improvements</th>
<th>Enabling global expansion</th>
<th>Improved employee satisfaction</th>
<th>Reusability of the data model</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Reduced cycle time of projects (3.3 #27)</td>
<td>- Ability to execute business analytics (3.5 #19)</td>
<td>- Cost-effective worldwide solution deployment (3.8 #12)</td>
<td>- No unnecessary redo of work (3.5 #19)</td>
<td>- Reduced time spent on designing data models (3.6 #16)</td>
</tr>
<tr>
<td></td>
<td>- Monitoring and combining processes on local and global level (3.2 #32)</td>
<td>- Industry alignment (3.6 #16)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Economies of scale (3.5 #19)</td>
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<table>
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<tr>
<th>Resource management improvement</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>- Better inventory mgmt (3.3 #28)</td>
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</table>

(x #y): x = the average score in the ranking of the business benefits on the impact on the business; scoring was based on a 1-5 scale, 1 low – 5 high. y = the overall ranking of the specific benefit compared to all other identified benefits.

**Quotes from Interviewed Experts**

- **“Initially engineers are spending more than half of their time searching for the right data or checking the rightness of the data, [this time is not spent on their engineering work].”**
- **“The thousands of consultants who are necessary for collecting the data and reporting on it.”**
- **“It costs 10 times more when the data are entered into the system incorrectly.”**
- **“One common reporting structure and operational results greatly facilitate the consistency of reporting.”**
- **“The EDM value in finance is that it answers the question how the costs are spent.”**
- **“The wells were all made out of similar equipment and installed at the same time, but with different yields. HR and maintenance data showed a training issue with the mechanic doing the maintenance.”**
- **“We do not have to reinvent the wheel every time.”**
- **“Business agility gives us the ability to make large portfolio changes - buy, sell assets or business, or the ability to rapidly change capabilities in an existing business.”**
- **“Allow faster adoption of industry and regulatory standards.”**
- **“If vocabulary is not aligned between stakeholders, you cannot work together.”**
- **“Changing the hearts and minds is the greatest benefit to adoption of any standard, the new way becomes doing business as usual in an excellent manner.”**
- **“Definitions, attributes and domain lists must be used consistently across the business, otherwise there is no benefit to the business. This requires a give/take from all users.”**
- **“When the EDM is more mature, it will be used as a reference point for all data in the enterprise.”**
- **“Thousands of employee accounts that were not used, were identified, blocked and deleted.”**
Discussion

Analyzing the benefits of EDM collected in this study results in some key insights. First, the majority of benefits enabled by EDM are also known as EA benefits (Bernard 2012; Niemi 2006; Porter 1990; Tamm et al. 2011; Wan et al. 2013). This confirms the theoretical relevance of EDM as part of EA, but more interestingly, it suggests that some classical EA benefits are in fact EDM benefits that the overarching EA inherits. To demonstrate this finding, our study suggests that two benefits typically assigned to EA (Niemi 2006), increased standardization and improved decision making, are in fact enabled by EDM. Accountability and ownership are closely related to the employee attributes and therefore these benefits play a vital role in pursuing a data driven culture. Their ranking demonstrates that EDM is an impactful enabler of these benefits and hence an essential element in becoming a data-driven organization.

The observation that EDM functions as a common language between business and IT and as such creates value is an important finding of this case study. This demands further understanding of the existing, yet under-exposed communication issues. Our study at the EDM level confirms the findings of Espinosa et al. (2011a), who have shown the critical role of “cognitive coordination and common ground” in the EA process, particularly in the context of aligning business and IT.

Remarkably, the arguably most practical benefit of EDM - a reduction in the time spent on designing data models - reached a modest 16th position in the ranking. This could be due to the fact that this activity usually takes place inside the IT architecture department with limited direct involvement of the business in the design of the data model. As a result, problems arising in the process are not visible to the business either, making their proper valuation more difficult. We hope this study can contribute to changing this.

The relatively low scores of strategic and managerial benefits are also noteworthy. We see two possible reasons for the lack of managerial/strategic business benefits in the top of the ranking. Firstly, these benefits are simply unknown in this developing stage of EDM, which is where the Case Organization is currently at. Secondly, these benefits may not be attributable to EDM and consequently EDM does not have an impact on these business benefits.

Finally, in the current world where data driven management is a topic receiving wide attention, one might expect a higher ranking for EDM’s role in the ability to execute business analytics and the related data driven decision support quicker decision making. The reason for this outcome could be the still nascent data driven culture at the Case Organization. It is not amongst the priorities of business managers and the data experts are not as involved in the business side. This might also be the reason for low scores on other IT cost reduction benefits.

Scientific Contribution

While EDM was previously known as a rather abstract part of EA, our study clearly shows the relevance of having an EDM. This study provides a definition of EDM, defines its relation to EA and in particular focuses on the business benefits EDM enables, including a categorization thereof. We have provided empirically validated business benefits, explained by illustrative quotes from business experts, which we believe increase the conceptual knowledge of EDM and its benefits. As such, this study complements earlier research by Espinosa et al. (2011b), who identified data management benefits as one of three technical benefit categories in evaluating the organizational impact of EA.

We applied a framework originating from IS benefits research (Shang and Seddon 2002), due to the lack of categorizations that cover the wide range of benefits across multiple and diverse organizational levels. This functional categorization fitted seamlessly with the benefits that were empirically identified for EDM. The use of this framework could be extended to EA, where optimization of the existing EA benefits model was requested (Tamm et al. 2011). The functional classification used will classify the benefits closer to the business and thus stress the enterprise-wide influence of EA. Furthermore, this study adds to the emerging field of information/data valuation. EDM, being the foundation of all enterprise data, is a valid starting point for exploring the value of data and our work lays a foundation for this.

Finally, from a methodological point of view, this study is another example of how Grounded Theory and Delphi Method can be successfully combined to improve the trustworthiness of the result while keeping the execution of the research practical and manageable. In particular the use of the group support system
for the Delphi stage of the research serves as an example for other studies, where it is cumbersome to organize face-to-face synchronous and anonymous expert settings.

**Practical Contribution**

Our framework enables companies to define the components of their business case for having an EDM. It facilitates the group cognition across functional disciplines and helps business and IT to understand each other better (Espinosa et al. 2011a). This can be further enhanced by explaining the benefits using quantifying examples (DeLone and McLean 2003; Nah et al. 2001), which was part of the research, but not presented here due to space limitations. Our framework can serve as a good foundation and starting point for assessing the organization-specific benefits in other organizations. Additionally, it could serve as a checklist (Shang and Seddon 2002) to evaluate the business benefits after implementation.

For the Case Organization there were some positive effects of this study as well. Due to the abstract character of EDM, the fact that it is in its developing/early implementation stage and its distance from the daily business, it was previously difficult to obtain engagement with and support for EDM. As a result of this study, the business case for EDM can be developed, by showing explicit benefits, explained and validated in a framework. Additionally, this study provided some best practice case examples to senior management in which the business benefits of EDM have been quantified, increasing their engagement.

**Limitations**

This study was limited to a single multinational case company and used a small sample of participants, making it difficult to generalize the results and guarantee external validity. As there is no one-size-fits-all EA framework (Porter 1990), the business benefits will also differ for each organization, making it fundamentally questionable whether a general outcome would be feasible in other research set-ups. We did not address the question whether having a proprietary EDM or adopting an industry standard is more beneficial, nor have we looked at the consequences of the specific form of the EDM on benefits/issues.

Adopting the business benefit framework by Shang & Seddon (2002) does provide some external validity for this study. Their framework was based on interviews held by 34 organizations that implemented enterprise systems. Since their framework was based on inputs from many organizations, using this framework in our study provides indications that it can be suitable for assessing the enterprise business benefits in other organizations and industries. The internal validity of this study is high however, since the findings were validated by experts, the business benefits are all explained by quotes of the experts and, although the fieldwork was performed by one researcher, findings were always discussed and validated with managers from the Case Organization.

The removal of the anonymity of the participants may have introduced some bias in the ranking towards preferences of participants with high authority within the organization. Furthermore, the distribution between data and business experts may have caused a bias towards the strategic and managerial categories. We do believe that the result is nevertheless worthwhile reporting, given the fact that prioritization of business benefits is likely to be a fairly idiosyncratic exercise within each organization.

The time horizon of this study was cross-sectional, which is too short for assessing the complete spectrum of benefits enabled by EDM. Especially for quantifying business benefits, in-depth case studies and time-consuming projects are necessary for measuring. At the time of this research, EDM was not yet mature in the organization and actual benefits were predicted and quantifications estimated. Shang and Seddon (2002) conducted their study on business benefits of enterprise systems four years after implementation. By this time the benefits are visible, interpretable and quantifiable in some cases. However, waiting until the implementation had been completed would have resulted in a chicken and egg scenario. The implementation of EA will not be successful without business buy-in (Ross et al. 2006), however the business will not support the EA benefits without knowing ‘what is in it for them’. The same holds for the EDM as part of the EA. Consequently, it is necessary to attempt to define explicit business benefits before implementation.
Future Research

Future research should provide better understanding about the attributability of the benefits of EDM. Niemi (2006) focused on quantifiable vs. non-quantifiable benefits and strongly vs. weakly attributable benefits, which could be a basis to further improve our EDM categorization. An a-posteriori revisit of this case could further validate our findings and increase the understanding of the role of EDM and the most essential business benefits it creates. Our framework could thus also be tested as a method for assessing the success of a completed EDM implementation, assessing the business benefits after implementation.

Given the limited external validity, more studies should address whether the same benefits are valid for other organizations, e.g. with a different structure, industry, geographical characteristics, size, culture etc. This will make the benefits framework richer and more useful for other organizations. Also, this knowledge will allow investigating differences in competitive advantage as a result of EDM. Does EDM of competitive companies enable different benefits and how are they exploited? Can data really make the difference and how does data result in dollars? We discussed that some of the areas in our framework are difficult to quantify, yet most companies only accept quantifiable effects in their business cases.

As proposed in this study, many benefits of EA are also attributable to EDM. Future research should point out whether these benefits are attributable to EA, moderated by EDM, or whether there is a mediating relationship between them.

Conclusion

The aim of this study was to identify the business benefits of Enterprise Data Models (EDM) and to categorize these business benefits. The research was conducted with experts of a large multinational company in the oil & gas industry following the Grounded Delphi Method (Päiväranta et al. 2011), supported by a group support system. The resulting framework answers the question of why an EDM can be beneficial to an organization by identifying the most relevant business benefits. All too often business users find it hard to understand the benefits of an EDM, leading to a lack of commitment (Ross et al. 2006). The theoretical contribution of this study lies in the as yet underdeveloped understanding of EDM and its benefits as the foundation of successful data management. Our study also suggests that some benefits currently identified as Enterprise Architecture (EA) benefits, are in fact benefits enabled by EDM. It confirms earlier work at the EA level, in particular the importance of finding common ground in the architecting process (Espinosa et al. 2011a).

In conclusion, we hope our framework proves to be useful for other organizations as well, although they might have different priorities and some additional benefits not identified by the experts in our Case Organization. However, we believe the example we have provided through this study will serve as guidance in the process of assessing the business value of building or maintaining an EDM and help reduce the distance between business and IT when doing so.

REFERENCES


