Organisational Dynamics and Ambiguity of Business Intelligence in Context of Enterprise Information Systems – a case study

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Abstract. Business Intelligence (BI) is playing a major role in most Enterprise Information Systems (EIS) architectures providing strategic and tactical management information on selected issues. BI is typically detached from mainstream transaction systems and provides a translated view of the business with high ranking executives as key audience. BI has as such a number of distinctive characteristics proposing that *management of BI* need more attention. This paper is based on an in-depth, longitudinal qualitative case study using an interpretivistic and sociologically inspired methodology. This study present findings within the relationship between technology and business in BI is particularly complex as operational issues are secondary to the desired systems outcome's character of a management construct. A management framework is proposed for BI related to its special characteristics involving enterprise communication between operational and tactical/strategic levels, inexact data, representation of historical consensus, and intrinsic translation between management culture and technology. BI should be viewed as integrated in and mutually interacting with corporate EIS. This paper contributes to a dualistic understanding of BI as both a technological and a social system. The originality of this paper is in its augmentation of IS management with a better comprehension of the BI aspect intended to contribute to a distinct management framework for BI.

Keywords: Enterprise Information Systems, Business Intelligence, Information Systems Architecture, Social Construct, Datawarehouse.

1 Introduction

Business Intelligence (BI) is the overall term for high-level reporting and analysis [1][2][3] in an Enterprise Information Systems (EIS) context [4]. BI emerged during the 1980ies [5] as a combined understanding of information system extracting and aggregating data from production systems and presenting this in an enriched form typically directed toward tactical and strategic management users[6]. BI is a critical

component in the overall EIS landscape of most large businesses [7] and worldwide BI software spending in 2011 were 12,2 billion USD [8].

BI is continuously evolving [9][10] with new features introduced such as fraud detection, advanced user front-ends, easier and faster data repositories, and master data management (MDM) system [11]. Dynamic business environments with mergers, divestures, and ongoing strategic business re-alignment [12] are putting strong demands on BI with redesign, timeliness of reporting, and operational changes [13]. BI is often the most important IS in strategic decision making [14][15][16][17]. With the linking of BI to top-level business management and the dynamics of both technology and application of technology [16], BI projects tend to be positioned in a techno-political cross-fire. This is an ideal situation for at least technology to gain attention, but also a risk in making up requirements more of perceived top-level management that a broader organizational usefulness.

In the following it is assumed that BI broadly represent an ongoing process for meeting ever-changing top-level management requirements – *dynamics* - with BI practitioners at risk for making large systems for ad hoc purposes, as the intended users only have lasting interest in few KPIs (Key Performance Indicators) and requested one-off analysis. The remainder of the organization might then be left with less useful BI systems. Subsequently it is claimed that BI systems represent a more ambiguous and socially determined set of translations and communications than a specific linear aggregation of the transactional base. BI has to deal with a co-existence of other reporting structures, e.g. accounting, operational reports from ERP systems, supplier's and customer's reporting. E.g. accounting is by law not allowed to transform data, but still tends to have important strategic validity. Tactical management, analytical specialists, and in some cases even of operational interest could generally be more in the focal point as key stakeholders of corporate BI. With BI clinging senior management as information receivers, it is interesting to study, how BI projects navigate within this organizational complexity.

IS and EIS research approaches emphasize the understanding of BI as a technology in an organization setting; in this paper it assumed the important differences exist between regular IS and BI. Subsequent the general claim is that these differences relate to issues like (1) lack of active transactions, (2) extraction (distancing, dis-location) and transformation of the original operational data, (3) the lack of interactive use case (CRUD absence), (4) the lack of business cases, and (5) the lack of integration in operational business processes and activities. BI is however integrated in EIS when it comes to infrastructure, operations management, MDM quality, [17][18][19] and probably most important: management attention.

Management of BI is a relatively overlooked discipline with either technology or strategic requirements dominating, and not more holistic considerations as generally associated with EIS and transactional oriented systems. The outcome of BI projects tends to be cost-driven compromises of business and technology.

BI projects and governance thus tend to overlook the broader organizational context in which to obtain usefulness and business value [20] in favour of perceived or short-term management objectives. This leads to the following research question for the subsequent study: Can a broader organizational contextualization of BI in direction of corporate tactical and operational levels, better provide value especially by considering the intrinsic properties of BI of ambiguity, translation and

communication? Besides this question this paper is to serve as a substantiated position paper employing an extensive literature review and in in-depth case study.

2 Theoretical considerations

BI is a regularly found component in most EIS landscapes. BI's prime role is to provide information for strategic and tactical (human) decision making. Management Information Systems (MIS) [21] are here seen separately from BI as MIS relates to execution and control in an integrated operational context whereas BI relates trailing-edge reporting. In IS and EIS literature, BI is rarely seen distinctively, however O'Brien & Marakas [4] suggest BI as positioned exclusively in the two upper layers of the corporate organizational and information hierarchy and suggest BI as the overarching notion for a set of technologies comprising among others Management Information Systems (MIS), Decision Support Systems (DSS), Data Mining and Online Analytical Processing (OLAP). Clark et al. [16] suggest a super-class of management support systems (MSS) whereof DSS, executive information systems (EIS), knowledge management systems (KMS) [21], and business intelligence (BI) are a part. However, BI is in the following understood as the portfolio of systems extracting, aggregating and presenting data from any operational system of the enterprise. The theoretical considerations below go to the technology of BI and the organisational issues of BI.

2.1 The technology of BI

Data completeness and consistency is a major topic across information sources and silos, [22] suggest implementing a cross-cutting Enterprise Information management framework o.a. including meta-data and MDM consideration across silos.

Characteristically BI works on data extracted from the general transaction systems of the corporate IS landscape. The Extract, Transform and Load (ETL) system [23] [7] ensure relevance, consistency, integrity and purpose of the BI-data; but the ETL process do at the same time change data, leaves out data decided not to be included, and adapt to scope of further utilization of data. Classic compromises exist with e.g. currency values, week/month comparisons, stable/new business, re-grouping of items, unclear stock ownership, linking of data and business processes.

On user front-ends, data accessibility and presentation, Lee and Noah [25] suggest embedding BI into general information portal of the enterprise.

BI is occasionally suggested as a technological solution to overcoming reporting of internal IS / IT processes [26], also 'BI on BI' is discussed by Lin et al. [27] in making of analytic network process (ANP) based assessment model to assess the effectiveness of BI systems.

Information management is dealing with collecting, understanding, filtering, transforming and conveying data from sources to BI repositories [28][29][22]. Data sources might not only be company-internal, but also external data sources of business partners and 3rd party information providers can play an important role [30].

BI is typically context dependent in the sense that it must give meaning to the design and purpose [31] of the specific business and business unit, e.g. sales, purchase, B2B, B2C. BI might also reflect other specialized demands and requirements, e.g. BI in support of business processes [32].

Ramakrishnan et al. [33] emphasize data collection strategies in datawarehouse construction highlighting insight, consistency and organizational transformation as main purposes of BI. Data collection is viewed either to be problem driven or comprehensive; consistency is linking to institutional isomorphism. This also support the idea of BI as preservant of the organization.

2.2 Organisational issues of BI

There is a broad understanding that BI is about complex technology in an organisational and business environment [4][14][15]. There seem to be less understanding on the drivers, motivators and impact of BI. Elbashir et al. [34] present a host of BI-induced successes in enterprises but also make reservations on validity of BI-success measurement. Learning is the key organisational issue in [13]. Viaene et al. [35] exemplifies BI for organisational transformation at operational level in police work. Finnie and Barker [36] propose a framework for developing supply chain organisations using real time BI. IBM [37] propose a framework inspired by Gartner looking at People, Processes and Applications&Tools; it is also suggested to give equal considerations to these three areas.

The literature on regular BI implementation is relatively rich [38][39][40] however several of these tend to draw a straight line from BI project governance to usefulness and BI as competitive factor [41]. BI is different between enterprises, high initial costs are widely recognized [13][42], and special low cost measures are suggested for SME [40][43]. As whole, BI for SME is drawing attention of its own [44].

Alter's work system method (WSM) [45] relates to general IS understanding using a assessment frame of simplicity, clarity, scope, systematic power, explanatory power, validity, reliability, and fruitfulness. It is expected that general IS research methodology can contribute both in capturing the identical features of BI and IS and the differences.

The management orientation of BI is in risk of overlooking the importance of other factors, and misinterpret BI as a "universal truth" instead of a best-possible translation of measurable factors from the business operations. Senior level management only managing from BI is rarely seen and management processes normally also include substantial qualitative reasoning.

BI is expected to move from a strategic, de-coupled perspective into more operational usefulness requiring faster conveying of data from operational platforms to reporting platforms [46][43][36][47]. Operational systems based on BI feedback has drawn research interest of its own [14][35].

Fernandes [48] propose to see BI using an Enterprise Architecture lens projected into a so-called Entrepeneurial Information Architectue comprising mission, prospects and business success factors, thereby calling for a more holistic understanding.

Clark et al. [16] highlight the gap between technologies available in the marketplace and organisational capability to acquire and leverage this technology as a

construct of *technology gap*. BI failures are thus tied to organizational issues such as (lack of) organizational readiness [49], inappropriately managing the technology or use of an inappropriate technology.

2.3 Theoretical frame of research

Key theoretical issues of BI in the subsequent analysis are centred on ambiguity, translation and communication to understand management challenges of projects and systems. Ambiguity relates to the filtered and aggregated character of data extracted from the original operational context. Translation relates to adaption of original operational data into staging of data for the use in various front-end systems. Communication relates to data in form of analytical systems and reports directed towards corporate management with the management's requirements for insight, oversight, abstraction and distance from operational contexts.

3 Method

This study is qualitative, cross-disciplinary and inspired by interpretivism [50][51]. Critical is the positioning of BI within an IS research methodology [52]. The basic platform of BI is viewed as both a technological system and a social system. Information conveyed by the IS platform includes disciplines such as sales, customer relationship management, branding and an array of socio-technical issues which each has research traditions of its own [53]. This relates to Taylor [54] identifying IS research as issues of balancing focus and diversity by applying a polycentric view.

This paper stretch from business strategy into IS strategy [55]. A critical issue within BI is that various receivers relate to different foci: all challenging a clear cut methodological stance. Bryant [55] states that communication is always prevalent in IS research and that communication convey social constructs, i.e. aiming at maintaining the view on the techno-social construct around BI; the context of the system, more than the system itself, is critical Avgerou [56]. Smithson & Hirscheim [57] have in their contribution(s) underlined IS as a research discipline of comprehension through evaluation of technological and business factors.

Baskerville & Myers [58] have described the "danger" of IS research working in waves of fashion with rising and declining interest for certain topics. In this study we "suffer" from the majority of BI contributions are technological and BI in a social context is more an empirical notion than a scientific construct. We therefore join Baskerville & Myers by conducting this study in close collaboration with IS practitioners and as Benbasat & Zmud [59], we emphasize relevance in practice. The idea of engaged scholarship from Van de Ven [61] and Mathiassen & Nielsen [60] focuses the research agenda on finding reason and provide practitioners, as well as research communities, with insight from the matured use of BI. The IS method and its cross-disciplinary nature include elements of technology and business research [52].

4 Case

The following case is a study of Company B's BI systems with a starting point in 1997 and a preliminary end-point somewhere in 2012. Company B is a privately owned Northern European fashion company selling clothes out of around 2500 concept stores and 8.000 independent stores.

4.1 15 years of BI in Company B

In 1997 Company B was in an early but rapid growth phase. With just over 100 stores, there was no clear information exchange strategy between the central office and the stores. The company had initiated collaboration with several vendors of Point-of-Sale (POS) systems and central office systems, but all of the projects were terminated prematurely. Finally NCR took up the challenge and succeeded in supplying a POS, a simplistic data exchange based of copying of flat files, and a central datawarehouse based on Teradata's server and analytical front-end products. The Teradata system remained until around 2004 were Company B raised increased criticism of issues of infrastructural management. It was decided to switch the full retail platform to Microsofts portfolio of servers and POS-systems. During 2005 dataload from the simplistic file share was established loading data in Microsoft SQL Server using SQL Server Integration Services (SSIS). A front-end was established using SQL Server Reporting Services (SSRS) with Targit®. The POS conversion to Microsoft suffered from lack of cost-efficiency and were winded down during 2007. Teradata and SSRS/Targit remained concurrently for some years until a sufficient amount of features had been ported away from Teradata.

Early 2006, after less than a year of operation, there came increased criticism of the SSRS. A newly established business development function suggested a redesign based on a different technology. Mid-2006 they made a Request for Information (RFI) and invited vendors to present their suggestions for solution; invited vendors were Oracle/Discoverer, Oracle/SiebelAnalytics, Oracle/Hyperion, Business Objects, SAS. Business Objects were chosen together with a large Indian consultant company ("Ivor") for implementation. Soon after, Business Objects was acquired by SAP. Under project management by the business development team, Ivor continued to fail deadlines for acceptance of the delivery. Ivor suggested issues within Company B to be determining, and reduced the project team mostly to provide support. Problems were mostly centered around getting the same figures out of the Targit system as the Business Object system even if dataload and masterdata were left unchanged from the SSIS system. Users remained with Targit. Late 2010 a new Business Objects team ("TLA") was brought in and Ivor was dismissed; meanwhile the technology was rebranded to SAP Business Warehouse (BW). The TLA team came out of SAP BI experience. The project was restarted together with a general strategic realignment towards general use of solutions from SAP. The TLA team defined an acceptable subset of masterdata to be supported. Furthermore are team defined a minimum subset of reports to be offered to users even though the users still had Teradata's richness of functionality in mind. The SAP BW project was relatively quickly completed, but

most retail operations groups stopped to use the system and relied afterwards on local, manually updated Excel reporting.

4.2 Critical issues of learning

In several of the critical phases over the years the process has been far more technology-centred than centred on business requirements. The later projects have had difficulties in remaking well-accepted reports and functionalities of the first system. Given the organisations distributed character with more than 2000 data collection points (shops), a certain degree of 'contamination' of data will happen, this is removed in the ETL processes, but happen to change data too far away from the transactional basis and therefore nurturing organizational scepticism. Up until 2003 there was one POS system with one software version. After this the number of different POS has now grown to around 8 distinctive systems/versions. Each system has slight differences that add up in the ETL process.

Ambiguity of data has been prevalent during the projects from 2003 – 2011. Ambiguity resulted in consultants repeatedly failed to validate new reports against older reports and led to scepticism. Ambiguity could e.g. be "a troubled store got a marketing support payment made as a credit note against an invoice making the value of goods a large negative number", "ongoing change of product categories made certain categories incomparable", "damaged price tags in stores were replaced with stores own tags and prices unrelated to master data".

The direct system management responsibility was shifting around over the years between teams with very distinctive focus and little attention to cross-organisational issues. When the systems were more stable, operations and infrastructure teams were in charge with little business insight. When changes were to happen, the business development team took charge with little technology insight. Collaboration and distinction of responsibilities largely failed. External consultants were often in critical positions as manpower, change agents or technologists. The external consultants were often stuck between the organisation's lack of clarity of roles: to rely on business developers as technology resources or vice versa to rely on operations associates when asking business questions. The consultants were actively used in blame games and continuously being sacked and re-hired.

BI is by the business organization regarded as an independent reporting regime. Beside this the most operational parts of the organization also has organizational units for supply chain management and financial reporting. Both of these units has during the most of the period relied on parallel reporting systems, typically transactions (sales orders, purchase orders, etc.), invoices and bookkeeping. This has created a referential situation continuously challenging the BI systems and offering the organization a personalized and agreed reporting scheme. The different organizational units have obviously personalized each in its direction making these local reporting systems incomparable. The centralized, generally accepted BI has during the years been a shared vision.

5 Discussion

BI projects and systems are no more complex than other IS and EIS, but also no less prone to failure. BI has the thankless role on putting together data from potentially massive numbers of operational databases, and displaying this in a useful and meaningful way. It is here claimed that BI systems must be viewed differently than general transactional EIS to ensure project and system success. The differences are bound to

- the absence of operational criticality and integration,
- the transformed and henceforth ambiguous character of data – with the risk of losing business transparency, and
- the strategic (mis-) interpretation where BI is communication-wise directed towards the corporate top-level, but has more clear usefulness in tactical, analytical and operational areas

Particularly the strategic direction leads to several deeper issues on the managements need for "ad hoc, unscheduled, summarized, infrequent, forward looking, external, wide scope" information [4], which is difficult to obtain in any IS. This need is prioritised and interpreted above the lower part of the organisations much more mundane information requirements. Much is this can be condensed into that alignment of BI with business [35][33][40][46] is more difficult than general IS and EIS because of the missing rooting of BI in operational practice and subsequently the definition of the BI outcome as a social construct rather than a business or technology construct.

BI needs to deal with complex requirements in presenting the actual state of the enterprise with filtered and aggregated data. Nowhere else in the enterprise would it be acceptable to communicate with a reduced set of data. The definition of the acceptable would in any enterprise be rooted in management directives, quasi-consensus among the involved, and the technological potentials or limitations. As mentioned before, BI lack some characteristics of IS, but inexact data and *definition by culture* could be added. The risk is that BI defining a perceived version of the corporate truth as technology idealize top management wants it, and thereby risk misleading critical enterprise insight.

Case learning: BI needs a balanced and dualistic approach to technology and business; several of the incidents in the case failed due to unbalance. The ambidextrous character of IS [20] and IS organisations seem important particularly stretching both beyond the narrow technologist and analyst view provided in the case: Analysts must be able to get insight and represent even highly simplistic and low-skilled on-the-floor business processes, e.g. purchasing and sales assistants work processes. Likewise must technologists not only address infrastructure and narrow information flow, but also be able to take broader view into the fuller EIS landscape potentially including external business partners and dis-joint IS platform.

The case study methodology is here giving a possibility of moving very close to a single case. The case has a longitudinal perspective were repeated patterns are found; this perspective is furthermore interesting in the found growth scenario were the lack of well-functioning BI didn't stop growth and also reflected strategic managements use of a multitude of sources in decision making. The case provided a critical view on BI. The case obviously also needs a critical distance on organisational and

management immaturity, projects being pushed despite lack of readiness, and absence of a capable internal project organisation on both business and technology side.

A management of BI framework should be building upon a *dualistic business – technology management thinking* and obviously moving forward to more complex multi-process and multi-stage approach as suggested in [37]. *Time* must be a part of the framework as technology and business are expected to follow some roadmaps that must be included in planning to maintain relevance. *Alignment* with business strategy but also operational practice seems critical. This is furthermore leading to suggestions of organisational and technological *embeddedness* where BI must be able to provide an account of data, data flow, data remediation, and rooting in business processes and use cases. Readiness and maturity are by some authors suggested but could probably also depend business and technology.

Summary: Management of BI must aim at avoiding 'islanding' of BI and seek to make BI data more reflecting on the business foundations of the enterprise, and along with this create an environment for less strategy and more tactics and operations of corporate BI.

6 Conclusions

The arm's length between production systems and BI can be beneficial in having more refined, cleansed, consistent data for strategic business control and decision making. This establishes an information repository of general corporate benefit particularly if it is incorporated into EIS environment with a broad operational orientation.

Suggestions for further research include a more holistic understanding of success criteria of BI where technology, business characteristics, and BI process assessment is taking part. Also the suggested management framework of dualistic thinking, time, alignment and embeddedness would be interesting to research further. As the case describes, even failed BI projects can have secondary effects of significant business value. So future research is in the line of finding the more determining factors in creating BI success or turning little used BI systems into assets of the general EIS.

The general rhetoric in BI satisfying the very need of the senior management seem disputable in the light of (1) BI is intentional translations done before senior management get insight, (2) BI do probably have its core users among tactical management and analysts, (3) BI is by many authors expected to move closer to operational requirements and need adaptions to this, (4) BI is one besides more quantitative reporting systems that together with qualitative reporting strongly compete on senior management's attention.

In terms of IS research a more inclusive view on BI would strengthen the holistic understanding of EIS and could support BI with better organisational support, relevance and value-orientation.

From the discussions in this study it seem questionable that BI can succeed in its predominant strategic role, much more important is it to conclude BI as a tactically oriented information system with strong operational potentials – in line with [34]. A

more distinctive approach to BI within the EIS frame as suggested in this paper could help both BI research and BI systems and projects in succeeding.

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