Organising for Business Intelligence: A Framework for Aligning the Use and Development of Information

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Organising for Business Intelligence: 
A framework for aligning the use and development of information

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Abstract
Organisations invest in Business Intelligence systems to improve their performance, provide management information and support decision-making. In practice however, Business Intelligence can be ineffective. While Business Intelligence software enables company-wide reporting, problems are encountered in the fit between systems’ provision and changing requirements of a growing amount of users. To contribute to the solution of these problems, a framework is defined to align the use and development of information for Business Intelligence. This framework has been validated using four explorative case studies of larger organisations.

Keywords: Business Intelligence, Business Intelligence System, Organisation of Business Intelligence, Business Intelligence Process, Business Intelligence Governance.

1 Introduction
Business Intelligence (BI) systems are accounted for narrowing the so-called information gap. They have the potential to shorten the time to obtain relevant information and enable efficient utilisation (Den Hamer, 2005; Liautaud and Hammond, 2001). Even in times of recession, when IT investments are not popular, organisations have invested in BI systems (Negash and Gray, 2003). While BI system implementations are successful from a technological perspective, in practice problems occur when organisations are using BI systems (Den Hamer, 2005). Most significantly:
1. Organisations have uncovered an additional demand for information throughout the organisation;
2. New (type of) business users have new information needs
3. As the dynamic environment or the goals of the organisation change, the information needs of business users’ changes accordingly (Miller et al., 2006).

Even if the information provided initially meets the requirements, the information needs and BI activities are not regularly evaluated (Den Hamer, 2005). Organisations rarely have a cross-organisational information needs analysis process or resources dedicated to that process (Moss and Atre, 2003). The amount of BI business users has increased and is expected to grow further in the coming years (Hemingway et al., 2004; Imhof, 2005). So, the question seems not ‘whether’ to invest in BI, but ‘how’ to organise it structurally (Van Beek, 2004; Philips and Vriens, 1999).

In order to properly describe and improve the BI activities in organisations, we propose a framework supporting the organisation and management of BI. More specifically, we address the question how to organise BI in order to align the information provided with the dynamic information needs of business users. Although BI has been widely applied in practice, IS research in this field is limited, sparse and the topic seems to be flown under the radar of academics (Negash and Gray, 2003). According to Pirttimäki et al. (2006) there is currently a lack of research on BI and there are practically no empirical research papers at hand. Also Hamers (2003) concludes that although BI has widely gained attention by software vendors and consultancy firms, educational offerings and research are lagging behind. In other words, our research aims to contribute in a number of ways to understand BI, and in particular to help organisations to explain and solve problems in this field.

In this paper, we build upon the work of Gilad and Gilad (1985) and Philips and Vriens (1999), describing formal BI as the continuous activity of gathering, processing and analysing data - supported by a BI system. Conceptually, our research addresses formal BI including structured data sources (originating from e.g. Enterprise Resource Planning and Customer Relationship Management systems) with corresponding BI systems. Empirically, we studied four organisations with at least 500 employees that implemented a BI system. Our perspective of analysis is based on a framework that is developed to align the use and development of (BI) information. The outline of the paper is as follows. The next section provides an overview of BI theories taking a process-oriented perspective. Subsequently, we elaborate on how the framework was developed. The last two sections describe the approach used for validation, the results, and the conclusions.

2 Business Intelligence from a process perspective

From literature we distinguish four major BI process models. Below we summarise and compare them as a basis to develop an integrative framework for organising BI.

1. The model of Philips and Vriens (1999) is based on the intelligence cycles of Bernhardt (1994), Gilad and Gilad (1988), Herring (1992), and Kahaner (1997). They describe BI as the process of gathering and processing information for the strategy formation of organisations. To gather and process strategically relevant information, the authors identify four phases: aim, search, analyse and distribute.
2. The model of Dresner et al. (2002) consists of two distinct intersecting cycles, construct and consume. The model embraces concepts of iterative development methodologies and is based on best practices established by organisations that have successfully implemented BI. The construct cycle consists of five phases: definition, data identification and preparation, tools evaluation/selection, develop and implement and train, and discovery and exploration. The second cycle, the consume cycle consists of four phases: access and monitor and analyse facts, develop decision alternatives, share and collaborate, and effect changes.

3. Van Beek (2004) models BI as a recurring cycle of processes and identifies two BI cycles. The ‘big’ cycle consist of three generic processes (register, process and react), which characterise an organisation. From the ‘big’ BI cycle, the process is divided in a ‘small’ BI cycle, including three sub-processes (gather, analyse and distribute).

4. Den Hamer (2005) describes the BI as a cyclic, continuous process that consists of gathering data, analysing data and applying information. Data is gathered and transformed into information through analysing; subsequently information leads to action. The actions affect the organisation and influence the environment, leading to new data, which starts a new BI cycle.

Differences between the models typically occur in the number and structure of the cycles, the number of phases and the type of information gathered. The model of Dresner et al. (2002) provides a practical proof of concept as it is based on best practices, i.e. organisations who have successfully implemented BI. Moreover, the BI process consists of two cycles; one for the use of information and one for the development of information. Van Beek (2004), Den Hamer (2005), and Philips and Vriens (1999) do not directly describe these two cycles. However, taking a closer look at the phases of the other models this distinction can also be made. In the BI process of Den Hamer (2005) the phase ‘gather’ resembles the development of information and the phases, while ‘analyse’ and ‘apply’ can be considered as the use of information. Within the smaller BI cycle of Van Beek (2004), the phase ‘gather’ represents the development of information and the phase ‘analyse’ represent the use of information. In the BI process described by Philips and Vriens (1999), the phases ‘search’ (develop) and ‘analyse’ (use) represent the two sub cycles.

3 Towards a Business Intelligence Framework

An important shortcoming of the models described in the previous section is that the alignment or interaction between the two key BI process cycles – the use and development of information – is not described. In addition, most of the models do not take the organisational aspects into account as continuous process improvement elements. Therefore, we decided to develop a new framework for capturing BI in an integrative way. This framework is based on a combination of all the relevant BI processes and the Plan-Do-Check-Act (PDCA) cycle of Deming (1982).

One of the reasons for using the PDCA cycle is that it contains parts that should be included in every process (Nieuwenhuis, 2003); moreover, the philosophy of the PDCA cycle is to focus on satisfying the needs of customers (users) through continuously evaluating their requirements. The importance of continuously
determining the information needs and regularly evaluating them is also emphasised by Dresner et al. (2002) and Philips and Vriens (1999). The key BI process within our framework consists of two cycles: one for the use of information and one for the development of information. The use of information by business users, who are responsible for planning and adjusting processes, is described by the four phases of the Deming cycle: 1) Plan, 2) Do, 3) Check 4) Act. The addition to the PDCA cycle, the development of information, is described by two phases 5) Plan and 6) Do. See figure 1.

**Figure 1:** The BI process

In the Plan phase (1), the strategy of the organisation is translated into products/services and processes. This phase entails setting targets for the key performance indicators, constructing planning and allocating budgets. The planning is then delegated to lower levels of the organisation (Nieuwenhuis, 2003). In the Do phase (2), the employees of the organisation execute the processes as planned. The actual results are compared against the targets set in the Check phase (3). To check and monitor the performance, data has to be gathered from various sources, as well as reports have to be developed (Kok, 2005). The information can already be available, or is required in the Check phase (3). In the latter case, business users cannot assess the performance of processes and a demand for information is created.

We extend our framework by including two situations that – based on an analysis or deviations – require an intervention within the described cycle (cf. Kok, 2005). The first intervention is assumed at the Act phase (4), where the insights gained from the analysis in the Check phase (3) are used to formulate improvements, make adjustments and decisions to achieve the planned targets (Nieuwenhuis, 2003). The results from this fourth phase are then used for learning purposes and feedback to the planning process. The knowledge obtained and the experiences gained are taken into consideration, plans and targets are adjusted and a new cycle starts. If organisations in the Act phase (4) use the information to make decisions and adjustments, it is referred to as ‘closed loop’ (Den Hamer, 2005).

The second intervention concerns the case that insufficient information is available in the Check phase (3), the second cycle is executed. The first phase of
this cycle, the Plan (BI) phase (5), starts with gathering the information needs of business users, and determining, prioritising and planning of the actual development. In the Do phase (6) the reports are developed and the required architecture of the BI system is established. In order to improve the communication and coordination between the Business and IT, several activities are proposed to align the use and development of information.

The flow from the Check phase (3), to the Plan phase (5), Do phase (6) and back to the Check phase (3) of the BI process can be visualised and described as an integrative framework for BI. The demand for information of business users in the Check phase (3) is the trigger for the development of information. The framework is actually based on the premise of Choo (2002) who indicated that the entire information chain starts with identifying and determining the information needs and closes with the use of information. Figure 2 presents the flowchart as the visual expression of our new integrative BI framework. For further details and elaborations of the model elements we refer to www.cs.uu.nl/groups/OI/Bled/BI_framework_details.pdf.

Figure 2: The integrative BI framework for aligning the use and development of information for a BI system
4 Data Collection and Empirical Validation

To validate the created framework, four case studies were conducted using the approach of Soy (1997). The selection criteria used to select the four companies were company size (≥500 employees to ensure a useful context for BI), whether a BI system was implemented, and the type of enterprise (i.e. ERP) system. The case studies were performed using semi-structured interviews, containing open and closed questions. In each case study, the framework was presented and discussed with several respondents.

The interviews particularly focused on exploring the type of BI organisation and the type of cost allocation for BI activities within the four organisations. To do so, a classification of three BI organisation types was pre-defined:

- In the case of a centralised BI organisation, both the BI front-end and the BI back-end are located centrally. The BI front-end determines information needs, developing reports and conducting analysis. The BI back-end loads data into the data warehouse (the so-called Extraction, Transformation and Loading ETL process) and the architecture of the BI system. The BI organisation is responsible for planning and executing all the BI activities within the entire organisation (Philips and Vriens, 1999). On a corporate level there is a central BI staff function.

- In case of a decentralised BI organisation, departments organise their own BI activities and are responsible for their entire BI initiatives (Philips and Vriens, 1999). Combinations of a centralised and decentralised BI organisation are possible (Philips and Vriens, 1999).

- In the case of a federal BI organisation, on corporate level there is BI staff located centrally and there are people who perform a BI role located within different functional departments. With a federal BI organisation, the BI back-end is mostly located centrally, within the IT department and the BI front end is located within one or more functional departments (Van Beek, 2004, Imhoff, 2005).

Regarding cost allocation, we used the work of Dresner et al. (2002), and Miller et al. (2006) in pre-defining three methods of BI cost allocation:

- In the case of overhead cost allocation, there is a BI sponsor and all the costs are treated as overhead costs.

- When an internal billing system is in place, business users are charged per activity, project, change or ad hoc analysis.

- In the case of a subscription based billing system, the profile of the users (for instance heavy against light users) determines the allocation of costs. After upfront paying a fee, business users receive certain privileges and reports.

It should be noted that Miller et al. (2006) and Dresner et al. (2002) argue that most organisations treat the costs of BI as overhead.

The respondents for each case study were selected based on their function and position in the organisation. We succeeded to select respondents that perform different roles as defined within the BI framework. In general, our research method seemed well suited to capture the knowledge of practitioners and to test our propositions and framework theories (Benbasat et al., 1987). In fact, it
appeared to be a useful methodology for a holistic, in-depth investigation (Feagin et al., 1991).

In succeeding sub-sections, each case is described. First, we shortly introduce the organisation. Then we describe the results and differences found in applying the developed BI framework.

4.1 HEMA
HEMA is an international retail organisation with stores that offer the same standard assortment of products under their own brand. The organisation also has a distribution centre, pastry shops, an online shop and a photo printing service. HEMA is part of the retail group Maxeda and for two years now the organisation has been using SAP BW as BI system. The case validation included one participant: the SAP BW team leader. In the HEMA case, the BI back-end is located centrally within the IT department and the BI front-ends are located within the different functional departments.

All the steps of the framework are performed in a similar order at the HEMA. The organisation distinguishes between a Request For Change (RFC) and a project. However, the benefits are not formulated in measurable quantities. The managers of the functional departments determine the priority of the RFC’s and projects which are combined into one priority list. The Maxeda IT service provider (ITS), responsible for the architecture of the data warehouse, takes the developed products into support. ITS also determines the impact, if for a RFC or project the architecture of the data warehouse needs to be changed. Small differences were found in the BI roles assigned. The distinction between the different roles is less explicit; different roles are combined and executed by one employee. For instance, there is no separate BI architect: a BI developer or BI analyst/designer executes this role. In cases of conflicts, the BI program manager, makes the final prioritisation and implementation decision. The HEMA has a federal BI organisation and uses two methods of BI cost allocation: overhead and an internal billing system.

4.2 Corus IJmuiden
The Corus group is an international organisation providing steel and aluminium products/services. The Dutch Business Unit, Corus IJmuiden manufactures hot rolled, cold rolled and metallic-coated steels for a broad range of markets e.g. automotive, construction and consumer appliances. For three years the organisation has been using SAP BW as BI system. The case validation included one participant: the SAP Competency Centre manager. The BI organisation is located centrally within the IT department.

All the steps of the framework are performed at Corus IJmuiden, however, slightly different. The activities are performed per functional area, e.g. Human Resources and Finance. On the Business side, one Functional Owner (FO) is assigned the ownership of one functional area. In the IT organisation, one application manager (AM) is assigned ownership of one functional area of the BI system. Corus IJmuiden distinguishes between a RFC and project. There are two priority lists, one with the information needs per functional area and one with the
RFC’s and projects. The FO, the BI budget holder, justifies the information need and discusses the RFC’s or projects in a Change Advisory Board (CAB). The CAB determines the priority of the RFC’s and projects and allocates the resources. Differences were found in the assigned BI roles. These differences are either naming conventions or inherent to the concept of a role: people can perform different roles at different times. For instance, the application manager performs and combines the roles of the BI analyst/designer and BI developer. Corus IJmuiden has a central BI organisation and uses two methods of BI cost allocation: an internal billing system and a subscription-based system. The RFC’s and projects for the BI system and operational systems are not considered differently and discussed within one CAB.

4.3 Legal, Tax & Regulatory Europe division of Wolters Kluwer
Wolters Kluwer is a multinational publisher and information services organisation. The division Legal Tax & Regulatory Europe (LTRE) provides content, software and services to customers in tax, law, and finance. The organisation has been using SAP BW for one year. The case validation included one participant of the organisation: a BI architect. LTRE has a federal BI organisation: BI architects are located centrally, BI analyst/designers and BI business process owners (BPO) are located in each county. External organisations perform BI support, hosting and implementation.

All the activities of the framework are performed, however, in some cases with small differences. Business users contact the BI BPO of their country. An external organisation determines the required time and costs, to develop, test, document and implement. LTRE distinguishes between a Request For Change (RFC) and a project. The benefits are not formulated in quantifiable measures. The justified RFC’s and projects, are prioritised by a Change Advisory Board (CAB). Differences were found in the assigned BI roles. The BI architect determines the impact of the information needs. The priority of the justified RFC’s and projects is determined by the CAB. The BI BPO combines and performs the role of business analyst and BI analyst/designer. LTRE has a federal BI organisation and uses two BI cost allocation methods: overhead and an internal billing system. The CAB also discusses the RFC’s and projects for both the BI system and the operational systems.

4.4 Sanoma Publishers
Sanoma Publishers is a subsidiary of the international media group Sanoma WSOY. The organisation is a dominant player in the Dutch magazine market with a market share of 50%, 2.6 million active subscribers and 75 consumer magazines. The organisation has been using SAP BW for 5 years and SAS for 3 years. The case validation included four participants: the BI program manager, a BI coordinator, a functional BI consultant and a marketing manager. The framework was validated for both BI systems. The BI back-end is located centrally within the IT department and the BI front-ends are located within the different functional departments.

The activities are performed in an identical order for the SAP and SAS BI system. However, some activities are performed less explicitly. The requirements are not
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always formulated in a functional and technical design, and the benefits are not expressed in measurable quantities. Sanoma Publishers distinguishes between a Request for Change (RFC) and a project for both BI systems. However, the justification and prioritisation of the RFC and Projects is handled differently. The BI program manager and IT manager justify and prioritise the RFC’s. Managers of the functional departments determine if projects for the SAP BI system are justified. The IT manager and the BI program manager determine the priority of the BI projects for the SAP BI system. For the SAS BI system a Change Advisory Board (CAB) justifies the RFC and projects. All the RFC’s and projects are combined into one priority list, coordinated by the BI program manager. The department BI Projects & Support implements and supports the developed products.

The BI roles for the SAP BI system matched, however, small differences were found for the SAS BI system. For instance, the BI program manager determines the impact and costs. With four respondents with different perspectives, position and location the framework was validated for both BI systems. Sanoma Publishers has a federal BI organisation and uses three BI costs allocation methods: RFC’s are treated as overhead, BI projects are allocated using an internal billing system, and for the SAP BW system costs are also allocated through a subscription based billing system. Furthermore, the marketing manager valued the practical applicability of the framework and the BI program manager recommended one CAB for both BI systems.

5 Results from Case Study Comparison

We start our case study comparison with the notion that it is based on four large organisations with different types of business, markets, products and services. The organisations also differed in size, both in revenues generated (€542 million - €3.4 billion) as the number of people employed (1,150 – 10,000). BI systems were in use from one to five years.

Sanoma Publishers and Corus IJmuiden that have been using the BI system for the longest period allocate the costs using a subscription-based billing system. On the other hand, Wolters Kluwer and HEMA, that have been using the BI system for respectively one and two years, allocate the BI costs as overhead and through an internal billing system. It seems plausible that organisations that have been using a BI system for a longer period are more mature with respect to their BI activities. Knowledge and experience were gained and the organisation has started to professionalise and (structurally) organise their BI activities. Initially, the costs of BI are treated as overhead, while in later BI maturity stages an internal billing system and subscription-based billing is used. In three cases, a formal steering committee (Change Advisory Board) is appointed to discuss and coordinate the RFC’s and projects. Furthermore, in two cases the RFC’s and projects for the BI system are treated as with operational systems and were discussed within the same CAB.

In all four case studies, the BI back-end is located centrally. Advantages inherent to a federal and centralised BI organisation are that it is easier to develop and use, and that standards and best practices can be shared. The decentralised BI
organisation - in which each department organises their own BI initiatives - was not applied in any of the cases.

Furthermore, from the interviews it can be concluded that all the elements of our BI framework were recognized and executed in practice. However, some BI activities were performed less explicitly within the organizations. In particular, differences between our framework and practice were found in the BI roles assigned:

- Business users contact a business analyst or a BI analyst / designer. These roles act as an interceptor between the Business and IT/BI organisation.
- Requirements are formulated however less explicitly; it not always delivers a functional and technical design.
- Every organisation distinguishes between an RFC and project to determine the impact for the BI system. However the sizes of the categories varies significantly.
- Benefits are not expressed in measurable quantities.
- A CAB with a BI program manager prioritise and justify the RFC’s and projects.
- In two organisation the implementation and support is performed by an external organisation.

Obviously, these differences can be subsequently used to improve our BI framework and increase its fit with BI processes in practice. Most likely, we consider adapting the framework by adding the CAB as a formal steering committee for BI program management and for steps 5 and 6 of the framework. In addition, the case study results suggest not to involve Business Users in the second step during which the requirements are formulated. Further considerations and recommendations are presented in the next concluding section.

6 Conclusions, discussion and recommendations

In this paper we developed an integrative framework to model the key activities, processes and roles with regard to BI. The main target of the framework is to improve the alignment between the use and development of information in BI systems. More specifically, the framework support three major goals:

1. It provides insight in the activities, roles and decision points for satisfying information needs;
2. It is a method to assess and monitor all key BI activities by determining the degree to which BI related information gathering and processing activities are present in an organisation;
3. It provides an approach to further improve and professionalise BI in an organisation, by making BI activities, processes and roles (more) explicit.

Case studies at four large organizations resulted into a successful validation of the integrative BI framework. It was found that in general the key BI roles, process and activities defined within the framework were indeed relevant and performed in practice. The framework can be further improved however, as the four case studies also demonstrated quite specific results.
One such result from the case studies regards the BI roles. The first notion was that the task descriptions from the framework do match the practical situation within the case study organizations. In a second instance however, interesting differences between the cases were found. Depending on the size and complexity of the BI deployment, it appeared that in some cases multiple BI roles can be combined and executed by one person only. Alternatively, in some cases multiple persons jointly executed one BI role. The case studies also demonstrated that there are differences in BI organisation and cost allocation methods. The most experienced organisations appear to use more mature cost allocation methods.

These observations drive new directions for further research. One of the remaining questions is directed towards the (internal and external) conditions that determine when a specific BI approach might be preferred or might be more successful. As is commonly argued in IS/IT, the alignment or success of enterprise systems is relative and/or situational (cf. Ward and Peppard, 2002). Hence, the next version of the BI framework is aimed to be extended, taking into account *situationality*. Related to this is the influence of a specific BI technology used. The case study organisations included two types of BI systems. Software characteristics like ease of use, functionality and complexity may have consequences. These type of characteristics may well impact the division of activities performed by BI roles and the amount of training and support required.

Finally, we can derive some practical recommendations from the application of our BI framework onto the case study organisations. First, we recommend that organisations should focus on improving requirements engineering. We believe that explicitly constructing functional and technical designs help organisations to e.g. scope and structure the development work; functionality and information needs are thought through earlier and business users are involved more actively. Another recommendation for improvement is making benefits of projects and RFC’s more tangible and measurable.

**References**


