An Agile Integrated Methodology for Strategic Business Intelligence (AimS-BI)

Completed Research

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Abstract

Business Intelligence (BI) has become a strategic initiative of many organizations and successful BI implementations have generated significant increases in revenue and cost savings, however, failure rates are also very high and some organizations are cautious to invest in BI initiatives. One of the reasons for this high failure rate is that traditional BI methods are not suited to all organizations; they are seen by some as being too rigid and resource intensive. Additionally, the focus is often on localized rather than enterprise-wide analytics.

This paper addresses these issues by proposing a BI methodology that integrates a number of existing techniques to support an agile, enterprise-wide perspective. This methodology provides a systematic and structured approach that is enterprise in reach yet agile in execution and generates a strategic BI Roadmap. It was evaluated using a case study and the agile and strategic focus was found to be extremely beneficial.

Keywords

Strategic Business Intelligence, Agility, BI Methodology, AimS-BI.

Introduction

Organizations that aspire to be Analytics Competitors (Davenport 2006) need to develop a data-driven decision making culture by developing an analytic orientation and Business Intelligence (BI) capabilities enterprise wide. Embracing the notion of “Data as an Asset” and the establishment of an explicit Data Governance mechanism has become a key success factor for deriving strategic value from Information Technology (Khatri et al. 2010). Within the strategy domain, BI is considered to be an enabler of organizational transformation that can be employed at the enterprise level to enable new business models and business strategies and fundamentally change the way a company competes in the marketplace (Cooper et al. 2000; Meredith et al. 2012; Sambamurthy et al. 2003; Watson 2009). Therefore, BI has become a strategic initiative and is now recognized by chief information officers and business leaders as instrumental in driving business effectiveness and innovation. This is reinforced by a growing body of research describing the strategic benefits of BI (Davenport 2006; Jourdan et al. 2008; Negash 2004; Trkman et al. 2010). However, there are also high failure rates where companies have spent more resources than their competitors on BI solutions and at the same time have seen their market share and customer base shrink (Jourdan et al. 2008).

Davenport (2006) describes Analytics Competitors as organizations that improve performance through the application of data analytics to their business processes. An important feature of these organizations is that they apply analytics in a structured way, as part of an organizational strategy, championed by top leadership and delivered through an integrated enterprise approach, to empower decision-makers at every level. A Gartner report emphasizes the need for structured frameworks that help business and IT
leaders architect a more complete plan for BI, analytics and performance management (PM) that will align people, processes and applications, and ultimately yield better returns (Hostmann et al. 2006). A key insight from this report is that each organization needs to derive the appropriate configuration (e.g. roadmap) based on its own strategic objectives and business circumstances.

Davenport and Harris (2007) describe many exemplars of organizations that, by employing an enterprise approach with strong senior management advocacy and leadership, make widespread use of Business Analytics and Data Assets to create significant value for the business. The authors suggest a path that organizations need to traverse to arrive at a state of being an Analytics Competitor in which the organization consistently realizes a stream of rich insights from BI that it is able to translate into actionable value. This path typically requires navigating through a critical stage (stage 2) in which functional analytics initiatives are used to build momentum and secure executive interest. The next stage, stage 3, requires an executive commitment and resource allocation to a strategic BI vision. While the functional analytical initiatives are supported by a number of existing process models; methodologies for moving from functional to enterprise wide BI are lacking, which prevent organizations from reaching stage 3.

There are a number of existing approaches to Enterprise level BI (Ariyachandra et al. 2010; Davenport et al. 2007; Inmon 2005; Jukic 2006; Kimball et al. 2011). However, these approaches are not agile and are often seen as being inflexible and rigid (Evelson 2014). This paper describes an Agile Integrated Methodology for Strategic Business Intelligence (AimS-BI), that addresses the need for implementing strategic yet agile BI in organisations, that was developed using design science (Hevner et al. 2004). It will enable organizations to derive appropriate configurations (i.e. roadmap) based on its own strategic objectives and business circumstances.

AimS-BI integrates a number of existing techniques, including information maturity assessment, multi-criteria decision-making, proof of concepts through prototyping, to support the agility and strategic perspective needed to achieve optimal business value from BI initiatives. The methodology is a multi-phase solution that helps the organisation understand not just what needs to be done but also when, how and why. Thus, it describes the activities, methods, tools and techniques that should be used throughout the process.

The following section describes the background to this work. The details of the development and evaluation of AimS-BI are then discussed and finally some concluding remarks are presented.

**Background**

Data driven decision making practitioners and researchers have recognized the value of adopting a systematic approach to BI. These models have collectively been termed Knowledge Discovery and Data Mining (KDDM) process models which are used to understand and apply the Knowledge Discovery process and to provide guidance in planning and carrying out data driven initiatives (Chapman et al. 2000; Kurgan et al. 2006; Mansingh et al. 2013; Sharma et al. 2012). However, these models support functional rather than enterprise wide analytics and do not consider the issue of resource constraints. To achieve enterprise wide success other important factors need to be considered, these include: the alignment of the initiatives with strategy, agility, resource constraints and the prioritization of a portfolio of possible BI initiatives. These are considered in AimS-BI.

In today’s business environment, agility it considered to be essential to innovation and competitive performance (Highsmith 2009; Sambamurthy et al. 2003). The literature identifies a number of characteristics that proposed agile methods/methodologies should exhibit, these include:

- User and executive support (Cockburn et al. 2001)
- Experienced Project Manager (Cockburn et al. 2001)
- Interaction and collaboration between stakeholders (Larson et al. 2016)
- User Centeredness (Highsmith 2009; Muntean et al. 2013)
- Exploring and prototyping (Highsmith 2009; Muntean et al. 2013)
• Incremental, iterative, user-centered, value delivery cycle-time in days/weeks (Muntean et al. 2013)
• Rapid access and integration of data from multiple heterogeneous sources to explore on-demand, and prototype various BI initiatives, to better control the scope, cost, and timeline of their implementation/evaluation (Muntean et al. 2013)

BI Agility is also enhanced by the increased proliferation of mature Open Source BI Platforms (Thomsen et al. 2009). Not only are these technologies more accessible to organisations with less resources, but they enhance deployment agility by reducing product acquisition lead-time and cost, increasing solution experimentation and pervasiveness, and ultimately accelerating time-to-value.

AimS-BI incorporates these characteristics of agility in a number of ways along the various steps of the methodology. One of the key aspects of the methodology is the inclusion of the key stakeholders from the very first phase. It is the employees of the organisation that are doing the Information Maturity Assessment, the results of which are integral to the development of the roadmap. They are also the ones that are developing and prioritizing the portfolio of PoCs. User centeredness has also been addressed through this engagement of the key stakeholders and decision makers throughout the methodology. The exploration and prototyping is an integral part of the proposed methodology through the development of the portfolio of initiatives as well as the PoCs. This is facilitated by the lower cost of exploration through the open source solutions. The availability of the stakeholders as the PoCs are developed is also an important part of the user centeredness. Additionally, the quick delivery time of the PoCs provides value to the users very early. The final phase of the methodology – the roadmap provides an entry point which lends itself to agile execution.

Many organisations do not realize the expected returns on their BI investments because they have some fundamental information maturity management challenges. Information Maturity (IM) models are used and adapted by organisations to assess their current state in terms of the maturity of their information management practices and to identify gaps in these areas (Becker et al. 2009; De Bruin et al. 2005; Mettler 2009). These IM models provide organizations with a formal means of identifying capability gaps in enterprise information management disciplines, critical for strategic Business Intelligence success. Information maturity assessment is a critical first step of AimS-BI.

Some critical BI success factors have been identified from case studies (e.g. Visa, Wal-Mart, First American Corporation, Capital One, Harrah’s, Continental Airlines, Blue Cross and Blue Shield North Carolina) (Anderson-Lehman et al. 2004; Cooper et al. 2000; Hannula et al. 2003; Loveman 2003; Watson et al. 2004) and other literature (Apte et al. 2002) these include: (i) The alignment of the data driven initiatives and strategic objectives; (ii) the need for high quality data; (iii) sensitizing staff to the importance of BI to get their buy-in; (iv) senior management buy-in; (v) a cultural change where decision making is based on data rather than intuition or gut-feeling; (vi) a need for a clear vision and roadmap; (vii) tools and training in BI (viii) effective data/BI governance (ix) a cross functional team that included both IS and business persons. Many of these factors support agility and have been integrated into AimS-BI.

Research Design

AimS-BI was developed using the Design Science research methodology (Gregor et al. 2013; Hevner et al. 2004) which provides a set of guidelines for the development and evaluation of ICT artifacts to address real-world problems. The artifact can be in the form of a construct, a model, a method, or an instantiation. In this study the target artifact is AimS-BI - An Agile Integrated Methodology for Strategic Business Intelligence. Design science research requires the rigorous evaluation of the artifact and this was done using the observational method of primary cases studies (Hevner et al. 2004) where the artifact is studied in depth in a business environment.

The scope of AimS-BI starts with an assessment of the organization’s information maturity in step 1 and progresses to the development of BI prototypes in step 4. This methodology bridges the gap between knowing and doing. The early stages emphasize “knowing” about the organization, identifying strategic priorities and discovering BI opportunities. The latter stages focus on the “doing” aspect of BI, including experimentation and demonstration of business value, and culminates with the strategic BI roadmap.
which provides the organisation with a pathway for strategic BI. Table 1 summarizes how the overall research process conforms to Design Science guidelines.

<table>
<thead>
<tr>
<th><strong>Guideline</strong></th>
<th><strong>Description</strong></th>
<th><strong>Relevant Project Activities</strong></th>
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<tbody>
<tr>
<td><strong>Guideline 1:</strong> Design as an Artifact</td>
<td>Design-science research must produce a viable artifact in the form of a construct, a model, a method or an instantiation.</td>
<td>There are two artifacts coming out of this research (i) The Agile Methodology discussed in detail throughout this paper (AimS-BI) and (ii) An adapted Information Maturity Assessment Model.</td>
</tr>
<tr>
<td><strong>Guideline 2:</strong> Problem Relevance</td>
<td>The objective of design science research is to develop technology-based solutions to important and relevant business problems.</td>
<td>This methodology addresses the organizational need for an increased strategic and agile focus for BI solutions.</td>
</tr>
<tr>
<td><strong>Guideline 3:</strong> Design Evaluation</td>
<td>The utility, quality and efficacy of a design artifact must be rigorously demonstrated via well executed evaluation methods.</td>
<td>AimS-BI is evaluated using the Observational Method of a Case Study (Hevner et al. 2004).</td>
</tr>
<tr>
<td><strong>Guideline 4:</strong> Research Contribution</td>
<td>Design science must provide clear and verifiable contributions in the areas of the design artifact, foundations, and/or methodologies.</td>
<td>This research extends the existing body of research as it relates to methodologies for strategic, agile BI.</td>
</tr>
<tr>
<td><strong>Guideline 5:</strong> Research Rigor</td>
<td>Design science research relies upon the application of rigorous methods in both the construction and evaluation of the artifact.</td>
<td>AimS-BI was developed through building on relevant research and by integrating a number of existing methods and techniques (see Table 2). The evaluation was done using the case study approach (Hevner et al. 2004).</td>
</tr>
<tr>
<td><strong>Guideline 6:</strong> Design as a Search Process</td>
<td>The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment</td>
<td>Several existing methods and techniques were explored, adapted/extended and most importantly integrated to develop a repeatable process methodology.</td>
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<tr>
<td><strong>Guideline 7:</strong> Communication of Research</td>
<td>Design Science research must be presented effectively both to the technology-oriented and management-oriented audiences.</td>
<td>The intention is that this methodology will be validated and extended by other researchers and applied in other domains by practitioners.</td>
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</table>

**Table 1 - Design Science Guidelines**

**Proposed Methodology – AimS-BI**

Existing tools and techniques were synthesized into a repeatable methodology referred to as an *Agile Methodology for Strategic Business Intelligence - AimS-BI*. AimS-BI has been designed to be *enterprise in scope yet agile in execution*. The agility is achieved through the user centeredness and interactivity that has been designed into the methodology as well as the PoC exploration and prototype development which provides a quick turnaround to demonstrate the strategic benefits of BI.

AimS-BI provides this agility in a number of ways along the various phases of the methodology. One of the key aspects of the methodology is the user centeredness through the inclusion of the key stakeholders and decision makers from the very first phase and throughout. The users do the Information Maturity (IM) assessment and assist in developing and prioritizing the portfolio of PoCs. The exploration and prototyping is facilitated by the lower cost of exploration through the open source solutions. The
An Agile Methodology for Strategic BI

The availability of the stakeholders as the PoCs are developed is also an important part of the user centeredness. Additionally, the quick delivery time of the PoCs provides value to the users very early.

The final phase of the methodology – the roadmap which consists of a dynamic portfolio of initiatives provides an entry point which lends itself to agile execution.

The proposed methodology (Figure 1) consists of four steps which culminate in the generation of a comprehensive strategic BI roadmap. Each of the steps, their justification and how they overcome the shortfalls of the traditional approaches is described below.

![Figure 1 - AimS-BI](image)

**Step 1: Information Maturity Assessment**

While BI technologies and tools may be readily acquired, effective BI capabilities encompass data assets, technologies, processes and human expertise. Organizations seeking to deploy BI at the strategic level, need an effective means of assessing the current state and maturity of their enterprise information management practices and identifying critical gaps that could present barriers and inhibit the desired returns on, and success of BI investments. IM assessment models provide a formal means of identifying capability gaps in Enterprise Information Management disciplines, critical for strategic BI. Periodic assessments, conducted through self- or 3rd-party assessment and benchmarking, help to establish an informed basis for formulating effective IM development programs and tracking continuous improvement.

The participants are identified through consultation with the leader and/or champion of the project and the results are used to automatically generate a preliminary assessment report. The online assessment is performed in parallel with a number of semi-structured interview sessions and then a final IM assessment report is generated which is informed by the findings and insights from both sets of interactions.

The outputs of this step form an important part of the BI roadmap as they identify keys areas that the organisation should focus on improving. This IM assessment supports agility as it allows the institution to quickly determine the state of its information management capabilities as a precursor to formulating an enterprise-wide analytics strategy capable of supporting the desired transformation. The assessment is done by the stakeholders which again supports the user centeredness needed for agility.

**Step 2: BI Opportunity Discovery**

The aim of this stage is to identify the organization’s strategic BI opportunities which requires the extensive engagement of the stakeholders. These persons are identified through the champion of the project and should cover the full gamut of stakeholders, including business leaders, business analysts, and
An Agile Methodology for Strategic BI

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data analysts. Again, this early engagement of stakeholders and building of executive awareness provides agility in the methodology. The engagement is done using semi-structured interviews and the objectives are to: (i) gain a more thorough understanding of the organization’s business, (ii) assess current BI initiatives, (iii) identify any planned BI investments and (iv) discover BI opportunities.

This discovering of BI opportunities must be done within the context of the specific organisation. As such, the interviews are also used to assess the current situation of the organisation including identifying existing resources, understanding the organizational constraints and identifying business success criteria. In parallel an understanding of what other institutions, of a similar nature, have achieved through the adoption of BI initiatives is extremely important. This allows the organisation to be clear, not just about what they are thinking of investing in, but as importantly what other organisations, globally, have done.

These BI opportunities are then used to develop a portfolio of Proof of Concepts (PoC) initiatives.

**Step 3: BI Portfolio Evaluation**

This aim of this step is to develop and prioritize a portfolio of possible BI initiatives. Executives from various functional units will have their own preferences and there are a number of criteria to consider in this prioritization process, therefore, the process of selection and prioritization of the BI initiatives requires a subjective, multi-criteria decision making (MCDM) technique. Based on the needs the MCDM technique, Analytic Hierarchical Processing (AHP) (Saaty 1980), is used as it is specifically designed for subjective estimation.

It may be the case that some of the PoCs are mandatory, for example, some may be the foundational for others but all of the others will be included in the prioritization process. AHP (Saaty 1980), uses a hierarchical structure with a goal, which in this case is the prioritization of the PoCs in the portfolio. There is then a set of criteria that need to be considered and a set of alternatives. In this case the alternatives are the possible PoCs that have been identified and the criteria are the strategic initiatives of the organisation. The pairwise comparison of the alternatives in relation to each of the criteria is done by the stakeholders using a ranking guide.

The pairwise comparison combines the criteria importance with the alternative preference measure to derive a numerical priority for each solution alternative (Saaty 1980). This priority is used to identify those PoCs that will provide the greatest impact in terms of achieving the strategic objectives and thus should be where the limited resources should be focused. This approach checks the rankings consistency in the pairwise comparison to ensure that the comparison is being done in a consistent manner. From this the output will be the portfolio of PoCs with a numerical priority for each.

The inclusion of the stakeholders in the prioritization process as well as the alignment of each initiative with a strategic objective supports the agility of the proposed methodology.

**Step 4: Proof of Concept Prototypes**

The top PoCs that can be implemented with the available resources are selected from the portfolio. The ability to rapidly mobilize analytics PoC initiatives and evaluate Data Quality issues requires a flexible platform for connecting to heterogeneous, non-conventional internal and external sources of data to experiment, prototype, evaluate the various analytics initiatives and better control the scope, cost, and timeline of their implementation/evaluation. The emerging discipline(s) of “Data Virtualization” (Van der Lans 2012) and “Data as a Service” (Demirkan et al. 2013) present alternative approaches to the traditional ETL/Data Warehousing applications for Data Integration and provides a range of functions and Data Delivery Services, to enable Agile BI. There are a number of Open Source solutions for these services which should be considered.

The data needed for each PoC is extracted from the sources and transformed into a format that is required for the appropriate BI technique. Open source solutions are also available for both the extraction and transformation process (e.g. Talend (http://www.talend.com/)) as well as for the analytics (e.g. Rapid Miner (https://rapidminer.com/)). The development of the PoCs allow the executive team to have a better understanding of the value of strategic BI and can help in early identification of problems that may have to be addressed before investing significant resources in a full blown BI strategy. They give the
organisation a good sense of how much time and resources will have to be invested in order to get the data to a form that is suited for the analytics required.

The use of open-source data integration software to support the PoCs provides a level of deployment agility and experimentation that yields significant reductions in lead-time, cost, and time-to-value. Additionally, given that the PoCs are deployed using iterative, prototyping techniques that allow for active user engagement and experimentation, all of which contribute to agility.

**Strategic Business Intelligence Roadmap**

All the previous steps of the methodology provide important input into the final output – the BI roadmap. The emphasis throughout the process is on aligning the initiatives with the organizational strategy. Both the maturity assessment and the PoCs form a key component of the BI roadmap as both identify some key areas on which the organisation needs to focus and develop capabilities if it is to maximize the benefits of its investment in BI. The roadmap will provide a plan for ensuring that the information management policies and critical success factors will be in place to support the implementation of these initiatives. The nature of the methodology incorporates strategic alignment, reinforced through executive awareness and engagement, all key notions of agility.

In developing the steps of AimS-BI a number of existing techniques identified in the literature were integrated to ensure rigour in the development of the methodology. The identification of the appropriate techniques and the synthesis and integration of these existing techniques into a holistic methodology is an important contribution of this research. These existing techniques, the steps of AimS-BI they were used and some key outputs they generated for each step are summarized in Table 2.

<table>
<thead>
<tr>
<th>#</th>
<th>Step of Aims-BI</th>
<th>Existing Techniques Used</th>
<th>Key Outputs / Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information Maturity Assessment</td>
<td>Survey design &amp; administration; Capability assessment</td>
<td>IM Assessment Report; Information maturity Capability baseline; Gap Analysis</td>
</tr>
<tr>
<td>2</td>
<td>BI Opportunity Discovery</td>
<td>Semi-structured interviews (Hoffman et al. 1995); Case study analysis</td>
<td>Business understanding, strategic priorities; Discovery of BI opportunities; Portfolio of Proof-of-Concept initiatives (PoCs)</td>
</tr>
<tr>
<td>3</td>
<td>BI Portfolio Evaluation</td>
<td>Stakeholder engagement / priority assessment; PoC value assessment/strategic alignment; Multi-Criteria Decision Making (MCDM) Analysis (Melon et al. 2008; Saaty 1980)</td>
<td>Select priority PoC Initiatives; Key Executive / Participant awareness &amp; engagement</td>
</tr>
<tr>
<td>4</td>
<td>Proof of Concept Prototypes</td>
<td>Technology deployment; Agile software prototype development; Knowledge Discovery/Data Mining (KDDM); Data profiling/quality assessment</td>
<td>Data integration/Data as a Service technology; PoC Analytics Prototypes; Systematic Process for Data Quality Management/Metrics</td>
</tr>
<tr>
<td>5</td>
<td>Strategic BI Roadmap</td>
<td>BI portfolio planning &amp; strategic alignment</td>
<td>Strategic BI Roadmap</td>
</tr>
</tbody>
</table>

Table 2 - The Research Activities
Evaluating AimS-BI

The methodology was evaluated using a case study of a financial organisation. In design science research case studies require the application and evaluation of the artifact in a real world context (Hevner et al. 2004; Peffers et al. 2012). The organisation, up until this point, had instances of functional BI but senior management had recognized the importance of moving to an enterprise wide perspective. After applying all the steps of AimS-BI in this organizational setting the key stakeholders were interviewed to ascertain their perceived value of the methodology. Some of the findings included:

1. The IM assessment was found to be extremely useful in identifying the state of readiness of the organisation for strategic BI. It helped it to identify a number of areas that needed to be addressed in order to maximize the benefits of the BI investment. Further, the findings from the PoC prototypes further supported what was found from the maturity assessment. For example, the assessment identified issues with data quality and in developing the PoCs specific issues were identified (e.g. the inconsistency of data values across tables). The interviewees felt the IM assessment is an extremely valuable first step and including the stakeholders in the assessment gives them the validation that what they thought to be the case is actually so. They were also of the view that doing the assessment in the partnered approach which was proposed (i.e. organisation and researchers) was the best approach as they felt that if it were done using a purely internal approach the results could be perceived as biased.

2. The inclusion of the key stakeholders and decision makers in the development and evaluation of the BI portfolio was valuable as it was felt that this allowed the stakeholders to come to a common understanding of what should be prioritized and why. It was the view that they may have felt left out if they were not a part of the process and so this was important to get the buy-in from these persons.

3. The PoCs and, more specifically, the development of the prototypes demonstrated to the executive management team and all the key stakeholders the business value of advanced analytics, systematic approaches to better data quality management, the importance of data governance and agility of data as a service (DaaS). This secured/reinforced executive commitment to the process.

The findings from the research also support the literature in terms of some of the critical success factors, these included:

1. The need for a champion within the organisation. The organization’s project manager turned out to be this champion and the success of the study can be attributed, in large part, to this person as she ensured that the sponsors and executive team were available to meet with the researchers in a timely manner.

2. Data quality is critical to BI success. Data quality received a low score from the IM assessment and the development of a formal data quality process was included as an early, mandatory initiative in the roadmap.

Conclusion

Although there are existing methods/techniques that have been used for some of the activities identified in this research, a main contribution of this research is the synthesis and integration of these existing techniques into a holistic methodology. The final output of this methodology, the strategic BI roadmap, provides a visible program of implementation, and positions the organization to secure executive commitment and resources required to put the organization on the path to becoming a serious “Analytics Competitor”. AimS-BI prevents an organization from wasting resources in BI investments before they are ready for them or before they understand where the value can be realized.

The agile principles rooted in this methodology proved to be critical for strategic BI success. An important output of step four are the working prototypes that are at an advanced stage of development and will not require a great deal more effort for full deployment. Developing the PoC in close collaboration with the stakeholders enabled knowledge transfer and allowed the researchers to explore the possibilities for the data. This supports the notion of agility as the focus is on delivering comprehensive BI artifacts rather than extensive documentation. All the steps of AimS-BI encourage interaction with the stakeholders, this agile principal proved to be a critical success factor.
This research makes a valuable contribution to practice in the form of the AimS-BI methodology, which can be applied by organizations interested in building strategic business intelligence capabilities. This methodology also makes a valuable contribution to theory by helping to address the need for having more agile methods for enterprise level BI and provides a systematic methodology for organizations to become “analytics competitor”. Other researchers can adapt this methodology to advance the research in the strategic, agile BI field of study.

REFERENCES


