Towards a Lean Assessment Model for Evaluating the Maturity Level of Business Intelligence and Analytics Initiatives in Higher Education

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1. Introduction

BI and analytics market is one of the fastest growing markets in the technology segment. Currently, it is ever more relevant to periodically assess the progress of Business Intelligence (BI) initiatives in terms of delivering the expected value to business users. Although Higher Education Institutions (HEI) are seldom directly business driven, such assessment is equally relevant. There is a growing global competition for both qualified students, and the best faculty that excel both in the teaching programs and research projects. In this setting, the alignment of information systems and the business needs is key to standing out from competing HEI. Business intelligence and analytics have been instrumental for many years in delivering this alignment. However, the development of such initiatives is seldom a straightforward path. Many initiatives stall or fail for a number of reasons. It is well acknowledged that organizations that successfully deploy BI systems follow an iterative path, starting with a basic usage of data and analytical tools, and progressing to a growing sophistication of their BI applications, until the BI data-driven culture becomes embedded in the organization's activities and decision making. The design of maturity models tries to map this progressive path, in which an organization starts with a basic or initial stage of maturity and progresses towards a more mature state. Maturity is therefore related to this notion of evolution or progression.

Maturity models (MM) play an important role by reducing the uncertainty of how BI managers perceive the maturity of the BI systems in their organizations. Some existing MM enable the possibility to benchmark the performance of one's BI systems against the average performance of other organizations in the same industry. Furthermore, a MM establishes an evolution path that, with a set of recommendations, helps organizations to know what to do next if they want to achieve a higher level of maturity.

Several BI maturity models have already been created. Many of them focus on a specific set of processes, such as project management or learning management, and often they are not directed toward any particular application or business domain. This approach allows the same maturity model to be used across many different industries. However, such approach tends to be complex, with large amount of assessment questions and a terminology set that is not particularly overlapping with the vocabulary and definitions in a particular domain. Past survey experience shows that such complexity and discrepancy resulted in difficulties in assessing correctly, either due to lack of understanding of key concepts or due to complications in locating the expert(s) who has the capabilities of in-depth understanding of many diverse questions (Cardoso et al. 2013). In addition, some of the unique or highly important information needs of HEI as a specific domain cannot be addressed in detail. Finally, the field of BI and Analytics (BI&A) is going through rapid changes, with a shift from heavy Data Warehouse focus to increasing emphasis on issues such as IoT and Natural Language Processing. Such changes are not sufficiently captured and reflected in many of the current BI MM.

In this paper, we will study the relevant BI MM in literature. Based on the literature study, we will develop a lean assessment model to be used by HEI in Europe to evaluate the maturity of their BI and analytics initiatives. This model could then be used to benchmark European universities in the context of future activities of the EUNIS BI Special Interest Group (SIG-BI).

2. Overview and analysis of existing BI&A maturity models

In the literature, we find many BI maturity models that have been used for several years, some of them for almost two decades. In this paper we will critically analyze the following MM:

- Data Warehousing stages of growth (Watson et al. 2001)
- Data Warehousing process maturity (Sen et al. 2006)
- Gartner's Business Intelligence and Performance Management Framework (Hostmann et al. 2006)
- HP Business Intelligence Maturity Model (HP 2007)
- Capability Maturity Model for Business Intelligence (Raber et al. 2012)
- TDWI Maturity Model (TDWI Research 2012)
- TDWI Analytics Maturity Model (Halper and Stodder 2014)
- TDWI Modern Data Warehousing Maturity Model (Halper 2018)
- Institutional Intelligence White Book Maturity Model (OCU 2013)

The above listed models can be applied to any industry, except the last one OCU, which has been developed specifically for the Higher Education sector. This model, which is a lean assessment with nine questions across nine dimensions, has been used by the HEDW (Higher Education Data Warehouse) community in the United States to benchmark the maturity of DW/BI systems. These models have been selected in accordance to the following criteria: credibility of the proponent and availability of documentation.

In this paper, we will analyze these models by comparing key properties of MM: dimensions, levels, principle of maturity (continuous or staged) and assessment type (qualitative or quantitative). The goal is to develop a lean assessment model to be used by HEI in Europe to evaluate the maturity of their BI and analytics initiatives. This model could then be used to benchmark European universities in the context of future activities of the EUNIS BI Special Interest Group (SIG-BI).

This exercise will also take into account the findings from an initial assessment of the maturity of BI initiatives in European HEI, developed in 2013 using an adaptation of the 2012 The Data Warehouse Institute (TDWI) BI maturity model (Cardoso et al. 2013). This model contains 40 questions across eight dimensions: Scope, Sponsorship, Funding, Value, Architecture, Data, Development, and Delivery. As common in a MM, the user adoption curve is divided into stages, in this case, five: nonexistent, preliminary, repeatable, managed, and optimized (see Figure 1).

In 2014, TDWI proposed a new MM for analytics, acknowledging the fact that many organizations had moved forward from traditional BI systems, and were now implementing advanced analytics projects and that self-service BI became accessible to many more users. Advanced analytics projects include for instance, text analytics, real-time analytics, and big data analytics to deal with machine data and the Internet of Things (IoT). More recently, in 2018, TDWI issued a new interactive benchmark assessment called the Modern DW Maturity Model (Halper 2018). This model uses 50 questions across five categories: Data Diversity, Infrastructure Agility, Analytics Support, Sharing and Collaboration, and Security and Governance.

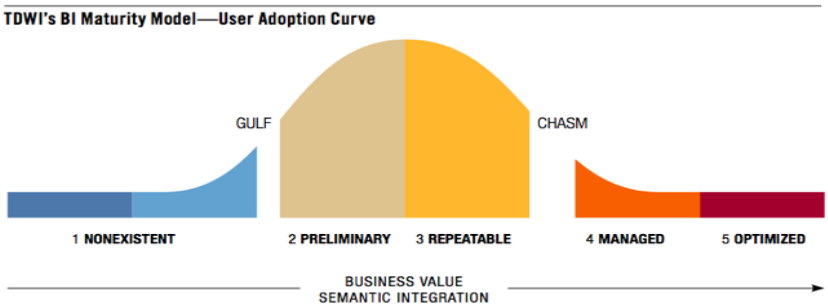

Figure 1: TDWI BI Maturity Model (TDWI Research 2012)

3. Summary

This paper aims to propose a lean and yet adequate maturity model that can be used by HEI to benchmark the maturity of their BI and analytics systems. Given the current volume and variety of data that is currently generated and available for analysis, HEI are also starting to move forward from the traditional DW/BI architectures. For instance, it is now possible to analyze how students are interacting and using the campus facilities and IT systems. Hence, a revised MM for BI and analytics needs to be developed. As a starting point we will use the TDWI models and adapt the questionnaire to the context of Higher Education, following a similar approach that has already been used in the 2013 EUNIS BI maturity survey.

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