



# A framework for developing a domain specific business intelligence maturity model: Application to healthcare



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## ABSTRACT

The implementation of electronic health records has resulted in a rapid accumulation of data. Healthcare organizations can use business intelligence (BI) technologies to leverage the data and improve operational and clinical efficiency. Approaches to understanding BI readiness are needed for organizations to develop an overall BI strategy. While there are a number of BI maturity models, they are often generic and do not meet the industry specific requirements. This research proposes a framework for developing a domain specific BI maturity model. The research further demonstrates the efficacy of the framework by applying it to the development of a BI maturity model in healthcare. The results indicate that the framework is able to address the needs of a domain specific BI maturity model, and guide the development of such model that proved acceptable to expert practitioners in the field.

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## 1. Introduction

A BI maturity model provides a systematic method for understanding existing BI maturity. It includes a review of important business and technical processes, taking into consideration the critical success factors for BI within an organization. A maturity model can be used as a readiness assessment tool for developing a BI strategy (Chuah & Wong, 2011).

Although 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, or 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, it is proposed that processes within a complex industry, such as healthcare, may not be addressed with the use of a general BI maturity model (Brooks, El-Gayar, & Sarnikar, 2013).

In this paper, we propose a framework for developing a domain specific BI maturity model. The research further demonstrates the efficacy of the framework by applying it to the development of a BI maturity model in healthcare. From a theoretical perspective, the research provides a methodological and systematic approach for assessing the need for a domain specific BI maturity model, and for developing such model, should a need exist. From a practical

perspective, the research can help practitioners to successfully deploy BI initiatives in their particular domain.

The remainder of the paper is organized as follows. The next section presents a brief background on BI and supporting maturity models with particular emphasis on the limitations of such models with respect to domain-specific needs in complex industries such as healthcare. Section 3 presents the proposed framework followed by the results of instantiating the framework in the healthcare industry in Section 4. Section 5 concludes the paper with a summary of the contributions, limitations, and suggestions for future research.

## 2. Background and related work

The term “business intelligence” has been around for about 50 years. Earlier definitions focused on the tools for data analysis (Anandarajan & Srinivasan, 2004). Over time, the definition for BI has broadened to include not only technology, but also organizational and business processes. This is important, because BI is not only about technology, but also about organizational decisions, analytics, information and knowledge management, decision flows and processes, and human interaction (Herschel, 2010). The primary objective of BI systems is to improve the timeliness and quality of input available for the decision making process. This implies that actionable information needs to be delivered at the right time in the right location and in the right form (Negash, 2004). For the purpose of this research, a broad definition describing business intelligence as a “broad category of technologies,

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applications, and processes for gathering, accessing, and analyzing data to help its users make better decisions” will be employed (Wixom & Watson, 2010).

In order to achieve success with BI strategy, it is important to understand how people think and work with one another. In the case of BI, performing a BI readiness assessment within an organization can be beneficial in understanding the culture and readiness level for BI technologies and strategies. A BI readiness assessment goes beyond a review of the technology infrastructure. It must also extend to an understanding of governance, policy, culture, and business processes. It is not uncommon for organizations to assume that all that is needed for a successful BI implementation is quick and accurate visually appealing reports. There are many other elements that must be taken into consideration in BI implementations, including business processes, organizational culture, people, resources, technology, and the organizational environment. These additional elements can actually make or break the BI implementation (McKinney, Hess, & Whitecar, 2012). One approach to assessing business intelligence readiness is through the use of a maturity model, and more specifically, a business intelligence maturity model. The characteristics of maturity models will be discussed in the next section.

### 2.1. Business intelligence maturity models (BIMMs)

The term “maturity” assumes a “state of being complete, perfect, or ready” (Simpson & Weiner, 1989). To reach a desired state of maturity, there needs to be an evolutionary path of transformation from an initial to a target stage of progression (Fraser, Moultrie, & Gregory, 2002). It should be noted that maturity levels are not a goal, but rather, a means to evaluate the adequacy of internal processes with respect to the objectives of the organization (Pederiva, 2003). Maturity models have a similar set of characteristics including the maturity concept, dimensions, levels, maturity principle, and assessment approach (Lahrman & Marx, 2010). Maturity concepts can be distinguished by people or workforce capabilities (Curtis, Hefley, & Miller, 2010), process maturity (Paulk, Curtis, Chrissis, & Weber, 1993), or technology maturity (Gericke, Rohner, & Winter, 2006). Dimensions are specific capability or process areas of the maturity situation that is being evaluated (deBruin, Freeze, Kaulkarni, & Rosemann, 2005). Each dimension is broken down into sub-processes including practices at each level of maturity (deBruin et al., 2005; Fraser et al., 2002).

There are more than 100 maturity models that have been published within the information systems field (Becker, Knackstedt, & Pöppelbuß, 2009). However, maturity models by themselves typically do not address organizational maturity with respect to how data is managed (Fisher, 2005). Business intelligence maturity models have been created to take into consideration the technology and data needs of an organization to make solid business decisions. In addition to technology, organizational processes and people skills are also very important concepts that need to be included in a comprehensive BI strategy. In addition to reviewing existing BI maturity models, publications evaluating critical success factors for BI can provide additional comprehensive insight into important business processes. Table 1 illustrates some of the most commonly listed critical success factors for BI implementations or portions of products or processes that are used for BI implementations.

It can be noted from Table 1 that there are common themes in critical success factors and strategies for BI success. This is especially true with strategic alignment and vision, management sponsorship and support, organizational culture/change management, people skills, resources, technology, and data quality.

Various BI maturity models were considered for analysis. The existing literature in BI has focused primarily on retail, manufacturing, finance, and government entities (Inmon, 2007; Mettler &

**Table 1**  
Critical success factors for BI implementations.

Critical success factors	Authors
BI governance	(Watson & Wixom, 2007)
BI portfolio management	(Williams, 2004)
Business champion	(Ariyachandra & Frolick, 2008; deHenry, 2007; Wixom & Watson, 2001; Yeoh, Koronios, & Gao, 2008)
Communication about the data and initiatives	(deHenry, 2007)
IT/business partnership	(deHenry, 2007; Eckerson, 2005; Williams, 2004)
Knowledge management	(Ocker & Mudambi, 2003)
Management sponsorship and support	(Ariyachandra & Frolick, 2008; deHenry, 2007; Eckerson, 2005; Ocker & Mudambi, 2003; Watson & Wixom, 2007; Wixom & Watson, 2001; Yeoh & Koronios, 2009; Yeoh & Koronios, 2010; Yeoh et al., 2008)
Organizational culture/change management	(Ariyachandra & Frolick, 2008; Eckerson, 2005; Geiger, 2009; Ocker & Mudambi, 2003; Watson, 2008; Watson & Wixom, 2007; Williams, 2004; Yeoh & Koronios, 2009; Yeoh et al., 2008)
People skills (analytic, business, and IT)	(Ariyachandra & Frolick, 2008; deHenry, 2007; Eckerson, 2005; Geiger, 2009; Ocker & Mudambi, 2003; Watson & Wixom, 2007; Wixom & Watson, 2001; Yeoh & Koronios, 2009; Yeoh et al., 2008)
Project management	(Ocker & Mudambi, 2003; Yeoh et al., 2008)
Data quality	(deHenry, 2007; Eckerson, 2005; Geiger, 2009; Yeoh & Koronios, 2009; Yeoh et al., 2008)
Resources	(Ariyachandra & Frolick, 2008; Eckerson, 2005; Watson & Wixom, 2007; Wixom & Watson, 2001)
Strategic alignment and vision	(Eckerson, 2005; Ocker & Mudambi, 2003; Watson, 2008; Watson & Wixom, 2007; Williams, 2004; Yeoh & Koronios, 2009; Yeoh et al., 2008)
Technology and data sources	(Eckerson, 2005; Geiger, 2009; Ocker & Mudambi, 2003; Watson, 2008; Watson & Wixom, 2007; Wixom & Watson, 2001; Yeoh & Koronios, 2009; Yeoh & Koronios, 2010; Yeoh et al., 2008)

Vimarlund, 2009). Generally, the models are not directed toward any particular domain. An advantage of a generic BI maturity model is that it can be used for any domain. A disadvantage is that unique or highly important information needs of a specific domain, such as healthcare, may not be addressed in detail.

### 2.2. Research gap

Despite the number of BI maturity models, these models are often generic and do not meet the industry specific requirements. For example, in complex domains such as healthcare, there is no evidence that can be found in the literature for the creation or consistent usage of a BI maturity model that is specifically tailored for the domain (Foshay & Kuziemy, 2014). When evaluating BI in the context of a particular domain, it is important to understand the complexities of domain and how BI needs and maturity may be impacted (Gastaldi, Pietrosi, & Corso, 2014). Evaluating existing BI maturity models relative to the complexities in a domain will help determine if an existing model can be used to adequately evaluate BI maturity within the domain and develop appropriate maturity models that are particularly suited to meet the needs of the domain. Just like the concept of mid-range theories, domain-specific maturity models can serve as a conceptual intermediary between higher level abstractions of domain-independent maturity models and actual application in an industry-specific BI context.

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