# Maturity Models for Business Intelligence: An Overview

**Rafi Ahmad Khan[1], Mansoor Farooq[2]**
[1] Department of management studies, University of Kashmir, Jammu & Kashmir, India.
[2] College of Engineering and Computing, American University of Bahrain, Bahrain.

**Abstract:** *Growing technological progressions have given rise to many issues concerning the contemporary decision making in business, which is a difficult phenomenon without understanding the intricacies of business intelligence. In today's world organizations require measurement of their business value and comparison with similar systems in other companies. Maturity models specify tiers of clarity, effectiveness, controllability, and assessment of the observed environment. This paper briefly describes the different maturity models that can be used for the maturity of Business Intelligence (BI) systems assessment.*

**Keywords:** *Business Intelligence (BI), Business Process Management, Capability Maturity* **Models** *(CMM).*

## I.INTRODUCTION

Over the past few years, the approach to business management has been repeatedly changing across the entire world. Whether the organization is small or big in size at every instant of time it needs to know the different aspects of its performance. Information needs to be captured from various diverse sources. Whenever there is growth in the organisation be it in the revenues, sales, production, investments the need for more factual, accurate and opportune information grows in strength with time. Organizations are experiencing enormous environmental changes characterized by diminishing organizational barriers and boundaries. As a result firms need proper decision support infrastructures in order to face these challenges. Companies have invested a lot of money into the renewal of business processes and the improvement of information systems for gaining competitive advantage over competitors or to reduce the costs. In order for the companies to exist not only the decisions need to be correct but also timely. One of the main areas for the past few years, where companies were investing a lot of money, was Business Intelligence (Economics, 2009). The influence of faster access to better and broader information on business decisions is difficult to be identified. Even more difficult is to assess and/or measure this influence on business results as a total. Maturity models can be used for this purpose.

Maturity models are considered useful instruments for IT managers as they help in evaluation of the present scenario of the organization and they aid in the designation of sensible improvement measures. In the last decade, more than a hundred maturity models have been developed to backup IT management. They aim at a broad range of dissimilar application areas, comprising holistic assessments of IT management as well as appraisals of specific subareas (e.g. Business Process Management, Business Intelligence). BI maturity models (MM) can help in assessing the overall performance of an organization and the decision making process also.

## II.BUSINESS INTELLIGENCE

Business Intelligence (BI) can be defined as getting the right information to the right people at the right time (David L. , 2010). The term Business Intelligence (BI) was initially employed in 1989 by Howard Dresner as a general term to refer to "concepts and methodologies for the enhancement of business decisions utilizing data and information from supporting systems" (Power, 2007).

Business intelligence was defined by David Losehin as the processes, technologies, and tools needed to turn data into information, information into knowledge, and knowledge into plans that drive profitable business applications (David L. , 2003). As such, business intelligence is a key discipline that needs to be adopted by healthcare organizations to transform the vast quantities of data contained in their transactional EHR systems into a format that enables improved strategic, tactical, and operational decision making (David L. , 2003). BI systems combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers (Negash, 2004).

## III. MATURITY MODELS

A maturity model can be described as a structured collection of elements that help in describing the characteristics of effective processes. A maturity model provides:
- A place to start.
- The advantage of a community's earlier experiences.
- A common language and a shared vision.

▪ A structure for prioritizing actions.
▪ A method to articulate what improvement signifies for your organization.

A maturity model serves as a standard for evaluating various organizations for comparative purposes. It outlines the maturity of the organization based on the project that the organization is engaged in.

Maturity models are often derived from the generally acknowledged and recognized Capability Maturity Model (CMM), which has been developed for the software development process based on the Maturity Thesis (Humphrey, 1989) by the Software Engineering Institute at Carnegie Mellon University in the USA (CMMI Product Team, 2010).

A maturity model can also be described as a mark of service that provides a model for understanding the maturity of an organisations business process. A maturity model is particularly applied when assessing the ability to execute data management strategies and the extent to which that organization may be exposed to risk from those strategies.

## IV. BUSINESS INTELLIGENCE MATURITY MODELS

With the majority of companies placing BI at the forefront of their priorities, and with the increasing expenses and bewilderment surrounding the demonstration of BI's value and justification of its costs, it is reasonable to attempt to grasp the progression of BI adoption and maturity within organizations. Understanding what can be achieved with BI along with recognizing the challenges and risks enables organizations to devise their BI strategy and execution.

There are several perspectives and available literature regarding the lifecycle of BI implementation and maturity within organizations, outlining the models. Most of these are proprietary models offered by consultancies, which are mainly based on a technical perspective or apply the knowledge management function to BI. There are multiple models available in the public domain such as:

1. The TDWI BI Maturity Model.
2. Hewlett Package Business Intelligence Maturity Model.
3. The Business Information Maturity Model.

**The TDWI BI Maturity Model:**

This model was developed by Wayne Eckerson in 2004 and it comprises of six stages. It is founded on the premise that the implementation of business intelligence within organizations generally evolves from a low-value cost centre operation to a high-value strategic tool to offer competitive advantages to the organization (Eckerson, 2009).

**Stage 1- Prenatal:** This is the most costly stage it lasts as long as the Data ware house is created. An organization usually relies on the manual means applied in an adhoc manner. The organizations have management reporting systems that are used to generate static reports and then distribute these reports among the employees. The organization depends solely on operational reports for information. Nevertheless, it is crucial to recognize that operational reports are rigid and unchanging.

**Stage 2- Infant:** Due to the inflexibility of the operational reports certain users themselves try to create the reports by whatever tools are available be it spread sheet or a desktop database. The users collect, clean and transform the data so that it can be used by individuals or groups. The end result of all these processes is called the spreadmart. Eckerson defines Spreadmarts as spreadsheets or desktop databases which are used as a replacement for regional data warehouses. Each of them holds a particular collection of data, metrics, and rules with little to no correlation among them, operational reports, or analytical systems (Eckerson, Gauge Your Data Warehouse Maturity, 2004). Fragmented data sources are creating contradictory perspectives on business information. They hinder the efficient decision-making process backed by strategic objectives and obstruct a clear and consistent view of all events within the organization.

A 'Gulf' exists between the infant stage and the child stage. The Gulf encompasses challenges and obstacles that hinder a company from transitioning from the Infant to the Child level, even after developing the first data warehouse, which is typically an indicator of progress towards a higher maturity level. The Gulf is not so vast or deep that organizations cannot navigate it and advance from the Infant to the Child stage, yet it poses significant threats. A mix of inadequate planning, data quality problems, cultural resistance, and the proliferation of spreadmarts prevents the organization from achieving a smooth transition (Arch, 2007).

**Stage 3- Child:** It is the stage characterised by growth and learning the organization expands the technology which it has recently adopted. This represents the initial evolution into an analytical system where OLAP and ad-hoc reports utilize data marts. During this phase, business intelligence users are accompanied by knowledge workers. Companies buy their reporting tools which are used to drill the data by knowledge workers. It helps in analysing the past data and predicting the future trends.

**Stage 4- Teenager:** BI management is overseen by a group of individuals from various departments under the direction of the BI program manager. Software solutions for BI are created based on a unified data model utilizing a shared platform. The organization acknowledges the importance of merging regional data warehouses into a centralized data warehouse.
A 'Chasm' exists between the Teenager Stage and the Adult Stage.

Chasm encompasses the challenges and barriers that hinder a company from progressing from the Teenager level to the Adult level. To address this hurdle, an Enterprise Data Warehouse is typically established. The initiative usually originates from management. The objective is to consolidate independent regional data warehouses to provide a more uniform perspective on distributed business information and reports concerning all facets of the organization. Successfully navigating the chasm

necessitates significant global transformations, such as enterprise-wide adoption or restructuring of solutions.

**Stage 5- Adult:** The Adult stage occurs when BI teams cross the Chasm and deliver a strategic, enterprise resource that enables organizations to achieve its key objectives. (Eckerson, 2009)

In this stage the BI finally crosses the tactical stage and reaches the strategic stage. Key performance indicators and business performance serve to contrast the current condition with the strategic objectives of the organization. The primary features of the Adult level include: centralized oversight of BI data sources, uniform structure of the data warehouse, completely populated with data, adaptable and tiered, timely delivery, forecasting analysis, performance oversight, and centralized administration. The company starts using a more accurate and more complex prediction and modelling tools.

**Stage 6- Sage:** Companies at this level are turning BI system capabilities into technical and business services and are moving development back to basic organizational units through Centres of Excellence (COE). The principal features of this level include: distributed development, data services, and an extended enterprise. The most common application of the BI system is the generation of user-specific reports, KPIs, and various information services. The Sage stage completes the cycle by converting core BI capabilities into services and distributing development back out to the business units via centres of excellence (Arch, 2007).

**Hewlett Package Business Intelligence Maturity Model**

The model is grounded in HP's interactions with clients across various industries. This model consists of three capabilities: business enablement, information management, and strategy and program management. The business enablement aspect illustrates the evolving nature of the business needs and problems addressed by BI solutions. The information management aspect depicts the evolving nature of the information solutions that a company implements to meet diverse business needs. The strategy and program management aspect highlights the evolving nature of management expertise as a critical facilitator and driver of BI success.

**This model encompasses 5 stages:**
**Stage 1 – Operation (Running the business):** It entails ad-hoc solutions focused solely on project activities.
**Stage 2 – Improvement (Measuring and monitoring the business):** Consists of localized solutions with a focus on project management.
**Stage 3 – Alignment:** Encompasses shared resources through program management and governance that integrates performance management with BI programs.
**Stage 4 – Empowerment:** Involves enterprise operationalization through portfolio management emphasizing organizational innovation and productivity of people via knowledge management.
**Stage 5 – Transformation (Change the business):** Consists of enterprise services monitored by service management, fostering strategic agility and differentiation.

**The Business Information Maturity Model**

The Business Information Maturity Model emphasizes the growing significance of BI. It identifies three essential success factors for Business Intelligence: alignment and governance, leverage, and delivery. These factors encompass seven crucial areas that are assessed in Business Intelligence: the strategic position of BI, collaboration between business units and IT, management of the BI portfolio, the culture of information and analysis usage, the process of enhancing business culture, the approach to establishing a decision culture, and the technical readiness for BI (William, April 2009). The primary features of the Business Information Maturity Model are:

**1st level:** The routine use of information is still performed in the same unstructured manner as prior to the introduction of the Data Warehouse. The advantages of the Data Warehouse manifest through swifter and timely access to information. Requests for information focus on the question of "what" business users desire to access, typically presented as data elements that are relayed from end users to the IT department.

**2nd level:** The organization starts to understand that it is essential to define the role of information for business to maximize the investment. End users have shifted from being solely focused on "what" they need to seek the rationale behind "why" the information is necessary. In addition, they begin to consider their information needs in the context of "who," "when," and "where" this information integrates into the business processes that support organizational objectives.

**3rd level:** In the final phase of Business Intelligence maturity, all segments of the organization are engaged where information is utilized. The organization now seeks to determine "how" existing processes can be enhanced if the information is accessible and "how" business processes can utilize the information effectively. The emphasis transitions to the management of business processes and the implementation of organizational changes. The organization acknowledges that decision-making processes prior to the availability of timely information were not optimal, and it endeavours to replace them with new decision-making processes that optimize information utilization throughout the organization.

If an organization aims to harness the complete potential of Business Intelligence, then the operational methods must be transformed. Required changes involve redefining the roles of information within the organization, altering the definition of

information requests, and modifying the manner in which information is utilized (William, April 2009).

**Business Intelligence Maturity Hierarchy**

The Business Intelligence Maturity Hierarchy consists of four stages, developed in knowledge management. These are: data, information, knowledge and wisdom. The main characteristics of the hierarchical maturity model for BI are (Deng, 2007)

**Stage 1- Data Level:** This is the first stage and in this stage the organization is busy in collecting the raw data, cleansing it, standardizing it and then finally storing it in a searchable format. This is the starting point of the DW and BI.

**Stage 2- Information Level:** An organization at this stage starts to use integrated and high quality data by assigning a meaning to them. The organization uses the data to create reports; it slices the data to show the various different views of data. As the organizations reach higher levels of this stage, they start identifying key success factors and key performance indicators (KPIs) and then use them to produce dashboards on the web so that information on business performance and activities are clearly defined and easy to read and understand.

**Stage 3- Knowledge Level:** BI at this stage is concerned with identifying the patterns and to perform the what-if analysis, which in turn helps the organization in identifying root data for individual trends so that this knowledge can then be used in various business processes. At a later stage an expert system is build, which combines discrete samples to produce a new knowledge based on past experience.

**Stage 4- Wisdom Level:** This is the last stage. Decisions that are made should be sound, timely and effective to maximise competitive advantages over their competitors regarding time to deliver, meeting product targets and services quality. Business productivity ought to be significantly greater than it was previously (Deng, 2007).

## V.CONCLUSION

The various tools and systems that assume a primary role in the strategic planning process of the organization are encapsulated by Business Intelligence (BI). It aids the organization in gathering, storing, accessing, and analysing corporate data to facilitate decision-making. Business intelligence systems amalgamate operational and historical data by employing various analytical tools to furnish valuable and competitive information to business planners and decision-makers. The continually increasing number of maturity models signifies a certain degree of randomness concerning their development processes. When an organization seeks to achieve a more precise outcome regarding its maturity level, it should utilize multiple maturity models but one must bear in mind that results from disparate models are not directly comparable. This is due to the fact that metrics, areas, levels, and criteria are not standardized.

The maturity model proves advantageous in assessing the business intelligence maturity of the organization, as it can be utilized to identify which areas necessitate particular focus. The model reveals areas that would otherwise be readily overlooked. Organizations that seek to obtain a swift and preliminary assessment of business intelligence maturity or wish to compare their maturity with that of other companies should employ one of the established models that provide evaluation and/or comparison.

## References

1. *Arch, T. (2007). TDWI Research: TDWI Benchmark Guide Interpreting Benchmark Scores Using TDWI'S Maturity Model.*
2. *CMMI Product Team, T. (2010). CMMI for Development, Version 1.3. (Technical Report CMU/SEI-2010-TR-033). doi:https://doi.org/10.1184/R1/6572342.v1*
3. *David, L. (2003). Business Intelligence:The Savvy Managers Guide. Addison Wesley.*
4. *David, L. (2010). The Benefits Of Embedding High Value Business Intelligence. http://events.businessobjects.com/ forms/Q309/oemctr/ebook/downloads/embedding_high_value_bi.pdf.*
5. *Deng, R. (2007, March 5). Business Intelligence Maturity Hierarchy. Retrieved from http://www.information-management.com/infodirect/20070323/1079089-1.html*
6. *Eckerson, W. (2004, April 29). Gauge Your Data Warehouse Maturity. DM Review, 14(11).*
7. *Eckerson, W. (2009). TDWI'S Business Intelligence Maturity Model. Chatsworth: The Data Warehousing Institute.*
8. *Economics, C. (2009, February 19). Business Intelligence: Bright spot in IT Investment. Computer Economics Inc. Retrieved January 19, 2011, from http://www.computereconomics.com/article.cfm?id=1406*
9. *Humphrey, W. S. (1989). Managing The Software Process. Pittsburgh: Addison-Wesley.*
10. *Negash, S. (2004). Business Intelligence. Communications of the Association For Information Systems, 13, 177-195. doi:https://doi.org/10.17705/1CAIS.01315*
11. *Power, D. J. (2007). A Brief History of Decision Support System. DSSResources.COM, Version 4.0. Retrieved from http://dssresources.com/history/dsshistory.html,March 10*
12. *William, N. (April 2009). The Profit Impact Of Business Intelligence. San Francisco: Morgan Kaufmann.*