The Implementation of Enterprise Business Intelligence: Case Study Approach

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Abstract

Recently, Business Intelligence (BI) play an essential role particular in business areas. BI is particular important for enterprises and it enables manager to view business performance in convenient way and hence improve decision making. Despite knowing how important of BI implementation, many organizations still struggle to achieve this especially in the construction company. This paper proposes an Enterprise Business Maturity Model (EBI2M) and evaluates in the three construction company in Malaysia. Preliminary result indicates that that all three companies do not achieve highest maturity of BI implementation. Therefore, an EBI2M is used to provide symmetric guidelines for these companies to improve the BI implementation in the future.

Keywords: Business Intelligence, maturity model.

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Introduction

BI applications have appeared the top spending priority for many Chief Information Officers (CIO) and it remain the most important technologies to be purchased for past five years(Gartner Research 2007; 2008; 2009). Although there has been a growing interest in BI area, success for implementing BI is still a questionable (Ang & Teo 2000; Lupu et.al (1997); Computerworld (2003)). Lupu et.al (1997) reported that about 60%-70% of business intelligence applications fail due to the technology, organizational, cultural and infrastructure issues. Furthermore, EMC Corporation argued that many BI initiatives have failed because tools weren't accessible through to end users and the result of not meeting the end users' need effectively. Computerworld (2003) stated that BI projects fail because of failure to recognize BI projects as cross organizational business initiatives, unengaged business sponsors, unavailable or unwilling business representatives, lack of skilled and available staff, no business analysis activities, no appreciation of the impact of dirty data on business profitability and no understanding of the necessity for and the use of meta-data. A maturity model is needed to provide systematic maturity guidelines and readiness assessment for such resourceful initiative. While there are many BI maturity models in the literature but most of them do not consider all factors affecting on BI. Some of BI maturity models focus on the technical aspect and some of the models focus on business point of view.

Therefore, this research seeks to bridge this missing gap between academia and industry, through a thorough formal study of the key dimensions and associated factors pertaining to Enterprise Business Intelligence (EBI). It aims to investigate the dimensions and associated factor for each maturity level. The remainder of this paper has been structured as follows. The next section discusses the components of Business Intelligence (BI), Capability Maturity Model (CMMI) as well as review of BI maturity models. The third section then outlines and discusses the

proposed EBIM model, then follows by empirical research.

Literature Review

There are many Business Intelligence maturity model developed by different authors such as Business intelligence Development Model (BIDM), TDWI's maturity model, Business Intelligence Maturity Hierarchy, Hewlett Package Business Intelligence Maturity Model, Gartner's Maturity Model, Business Information Maturity Model, AMR Research's Business Intelligence/ Performance Management Maturity Model, Infrastructure Optimization Maturity Model and Ladder of business intelligence (LOBI). This section reviewed several of business intelligence maturity models by different authors.

Table 1: Summary of Various BI Maturity Models

Maturity models	Description
TDWI's maturity model	• The maturity assessment tool is available in the web to evaluate BI's maturity level as well as documentation. • Concentrates on the technical viewpoints especially in data warehouse aspect. • Can be improved on business viewpoint especially from the cultural and organizational view.
Business Intelligence Maturity Hierarchy	• Applied the knowledge management field • Author constructed maturity levels from a technical point of view but can considered as incomplete. • The documentation of this model in the form of one paper and is not enough for maturity level assessment.
Hewlett Package Business Intelligence Maturity Model	• Depicts the maturity levels from business technical aspect. • This model is new and need to improve to add more technical aspects such as data-warehousing and analytical aspects.
Gartner's Maturity Model	• Uses to evaluate the business maturity levels and maturity of individual departments. • Provides more non technical view and concentrates on the business technical aspect. • Well documented and can search easily on the Web. • The assessment offers the series of questionnaire to form of spreadsheet.
Business Information Maturity Model	• Well documented with the series of questionnaire to assist the users to perform self evaluation. • However, criteria to evaluate the maturity level are not well defined.
AMR Research's Business Intelligence/ Performance	• Concentrates on the performance management and balanced scorecard rather than

Management Maturity Model	business intelligence. • Not well documented and criteria to evaluate the maturity level are not well defined. • No questionnaire to evaluate the maturity levels and is very hard to analysis the model
Infrastructure Optimization Maturity Model	• Focuses on the measurement of the efficiency of reporting, analysis and data-warehousing and is not complete in the business intelligence area • Discuss about the products and technologies rather than business point of view • Not well documented and criteria to evaluate the maturity level are not well defined.
Ladder of business intelligence (LOBI)	• Apply the knowledge management field • Author constructed maturity levels from a technical point of view but can considered as incomplete. • Not well documented and criteria to evaluate the maturity level are not well defined.
Business intelligence Development Model (BIDM)	• Not well documented and criteria to evaluate the maturity level are not well defined. • Concentrates on the technical aspects rather than business point of view

Table 1 above depicts summary of various business intelligence maturity models. As shown in the table 1, the majority of the models do not focus the business intelligence as entire which some of models focus on the technical aspect and some of the models focus on business point of view. For example, TDWI's model only concentrates on the data warehousing while Business Intelligence Maturity Hierarchy only concentrates on knowledge management. It is not complete to represent business intelligence. We know that business intelligence covers not only data warehousing, but also business performance, balanced scorecard, analytical components. In addition, the documentation of some maturity models above is not well defined and they do not provide any guidelines or questionnaire to evaluate maturity levels.

Proposed Framework

Based on the literature review above, the majority of the models do not focus the business intelligence as entire which some of models focus on the technical aspect and some of the models focus on business point of view. If the organizations want to know exact their business intelligence maturity levels as whole, they have to use multiple models and that it is time consuming. Hence, there is need to have integrated maturity model to combine existing different maturity model and questionnaires and evaluation criteria should be provided. In view of this, an Enterprise Business Intelligence Maturity Model (EBI2M) is proposed.

The proposed EBI2M consists of five levels namely; initial, managed, defined,

quantitatively managed and optimizing; all of which are adapted from CMMI maturity levels. There are thirteen key process areas, namely; change management, culture, strategic management, process, people, performance management, balanced scorecard, information quality, data warehousing, master data management, analytical, infrastructure and knowledge management.
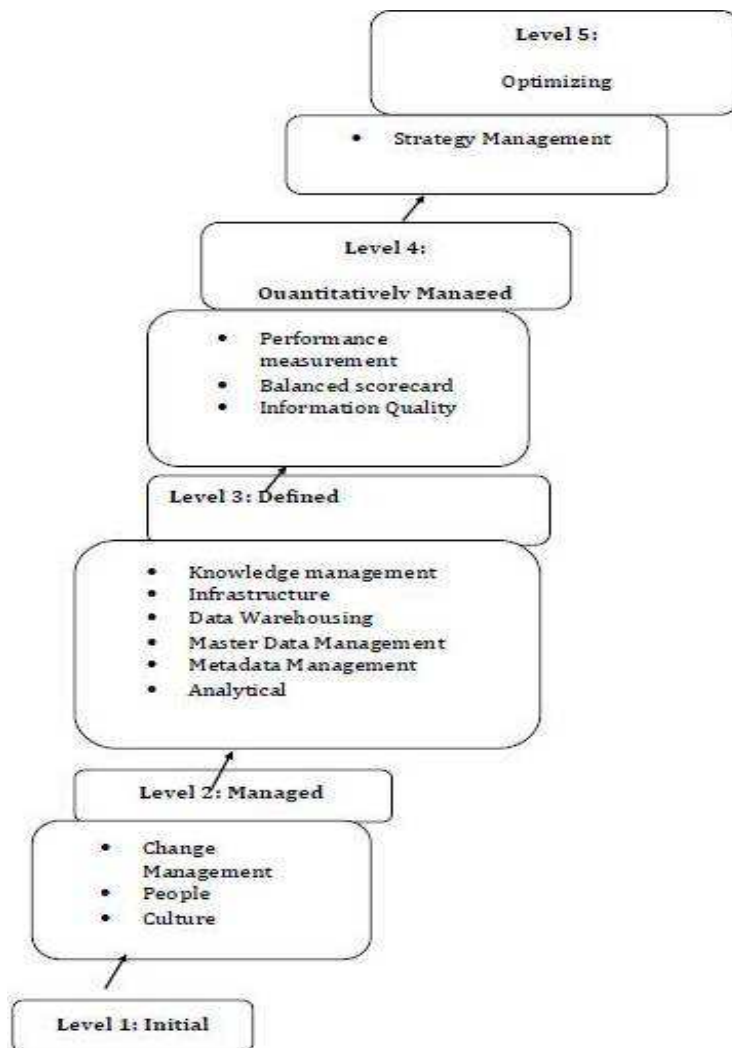
Figure 1: Preliminary Enterprise Business Intelligence Maturity Model (EBI2M)
Developed by Author

Methodology

The proposed Enterprise Business Intelligence Maturity model (EBI2M) was applied in the three construction companies in order to evaluate the maturity of BI implementation. This case study was prepared following a series of detailed interviews with staff, the collection of supporting documents and follow up interviews to clarify specific issues arising from the analysis of case study materials.

Table 2: Case Study's Participate

Company	Industry	Positions of Interviewers	Size of employees	Years of experiences in BI
A	**Construction and property**	**Executive vice president (strategic planning)**	**1000 to 5000**	**5-6 years**
B	Construction and property	CIO and MIS mangers	1000 to 5000	1-2 years
C	Construction and property, Healthcare, education	CIO and IT mangers	Above 10,000	1-2 years

Results and Discussions

The respondents were instructed to rate their companies' capabilities of BI implementation from level 0-5.

Below are the results of three companies' capabilities of BI implementation on thirteen dimensions.

Data Warehouse Perspective

Table 3: Data Warehouse Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Data Warehouse	ETL	• Ability to read directly from your data source	3	1	3
		• Automating capturing and delivery of metadata	1	0	3
		• An easy to use interface for the developer and the functional	3	1	3
	Data Mart	• No redundancy of data mart	4	0	3

Table 3 depicts the capabilities levels among three companies in data warehouse perspective. As shown in table 3, Company B has lowest capacities in term of ETL and data marts. This is might be due to lack of top management support and lack of experience among IT developers in the company B.

Master Data Management (MDM) Perspective

Table 4: Master Data Management (MDM) Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Master Data Management (MDM)	Data Integration and Synchronization	• Combining data residing in different sources and providing users with a unified view of these data	2	1	3
		• Establishing consistency among data from a source to a target data storage and vice versa and the continuous harmonization of the data over time	2	2	3
		• Ensuring multiple versions of a data are synchronized	2	2	3
	Data Profiling	• Ability to find out whether existing data can easily be used for other purposes	2	2	3
		• The ability to search the data by tagging it with keywords, descriptions, or assigning it to a category	3	0	3
	Data Migration	• Ability of data on the old system is mapped to the new system	2	3	3
		• Ability of data move from disk files from one folder (or computer) to another	2	3	3
	Data Consolidation Segmentation	• Ability to collect master data from several systems at a central location and groups of individuals that are similar in specific ways relevant into several categories such as age	3	1	3

Table 4 depicts the capabilities levels among three companies in master data management perspective. The overall score for company A, B and C is 3.13, 1.67 and 3 respectively. Company B is lowest capacities among company A and B.

Metadata Management Perspective

Table 5: Metadata Management Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
3Metadata M3anagement	Business Metadata	• Ability to define business rule for manipulating, transforming, calculating and summarizing	2	1	3
	Technical Metadata	• Ability to provide information regarding configuration, tools and programs	2	1	3
	Operational Metadata	• Ability to provide information regarding change and update activity, archiving, backup and usage statistics	2	1	3

Table 5 depicts the capabilities levels among three companies in metadata management perspective. The overall score for company A, B and C is 2,1 and 3 respectively. Company B is lowest capacities among company A and B.

Knowledge Management Perspective

Table 6: Knowledge Management Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Knowledge management	Knowledge creation	• Knowledge can be created through the way of people's doing things or developing something	2	1	3
	Knowledge Capturing	• New knowledge should identified and represented in a convenient way	2	2	3
	Knowledge Refining	• Knowledge must be put in context so that it is actionable.	2	2	3
	Knowledge Storing	• Knowledge must stored in a knowledge repository to let organization access it	2	0	3

Table 6 depicts the capabilities levels among three companies in knowledge management perspective. The overall score for company A, B and C is 2, 1.25 and 3 respectively. Company B is lowest capacities among company A and B in knowledge management perspective.

Infrastructure Perspective

Table 7: Infrastructure Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Infrastructure	Networking	• Centralized and enterprise levels	3	3	3

Table 7 depicts the capabilities levels among three companies in infrastructure perspective. Company A, B and C has achieved capacities of score of 3.

Analytical Perspective

Table 8: Analytical Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Analytical	OLAP	• Ability to support Ad hoc reporting (development of new reports	3	1	1
		• Ability to support historical comparisons/trending	3	1	3
		• Ability to perform drill down back to the source Data Base tables	2	1	2
		• Ability to do ad hoc complex calculations (@ report level and cube level)	3	0	3

Table 8 depicts the capabilities levels among three companies in analytical perspective. The overall score for company A, B and C is 2.75, 0.75 and 2.25 respectively. Company B is lowest capacities among company A and B in analytical perspective.

Performance Measurement Perspective

Table 9: Performance Measurement Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Performance measurement	Scope of Measurement	• Financial and non-financial indicators are measured on a regular basis.	3	3	5
	Data collection	• Collection of financial and non financial performance data is fully automated.	3	1	3
	Storage of data	• Performance data is stored in an integrated IT system.	3	0	3
	Communication of performance results	• Financial and non-financial performance results are	2	0	4
	Use of the measurement	• Quantitative goals for the measurement processes are set.	2	1	5

Table 9 depicts the capabilities levels among three companies in performance measurement perspective. The overall score for company A, B and C is 2.6, 1 and 4 respectively. Company B is lowest capacities among company A and B in performance measurement perspective.

Balanced Scorecard Perspective

Table 10: Balanced Scorecard Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Balanced Scorecard	Financial	• Ability to answer to the question "How do we look to shareholders?"	1	3	5
	Customer	• Ability to answer the question "How do customers see us?"	1	3	5
	Internal Business Processes	• Ability to answer the question "What must we excel at?"	3	3	5
	Learning and Growth	• Ability to answer questions "Can we continue to improve and create value?	2	3	5

Table 10 depicts the capabilities levels among three companies in balanced scorecard perspective. The overall score for company A, B and C is 1.75, 3 and 5 respectively. Company A is lowest capacities among company B and C in balanced scorecard perspective.

Information Quality (IQ) Perspective

Table 11: Information Quality Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Information Quality	Accuracy	• The degree to which data value agree with an identified source of correct information	3	2	3
	Completeness	• The expectation that data instances contain all the information they are supposed to.	3	1	3
	Consistency	• The degree to which information is in the same format	3	2	3
	Timeliness	• The degree to which information is current with the world that it models	2	3	3
		• How up to date is the data	3	2	3

Table 11 depicts the capabilities levels among three companies in information quality perspective. The overall score for company A, B and C is 2.88, 1.88 and 3 respectively. Company B is lowest capacities among company A and C in information quality perspective.

People Perspective

Table 12: People Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
People	Leadership	• Pro-active in preparing the organization for the future	4	3	4
		• Visible and engaged to ensure that staff understand the common vision and can translate it into terms relevant to their roles	4	2	4
	Skills	• Seeks to recruit people with good information skills and the workforce contains a high percentage of knowledge workers	4	2	5
	Training	• Comprehensive training plan program are scheduled and organized.	4	2	5
	Dynamic	• Multidisciplinary team / cross functional peers group come together to solve corporate issues.	4	3	4

Table 12 depicts the capabilities levels among three companies in people perspective. The overall score for company A, B and C is 4, 4.38 and 4.5 respectively. Company A is lowest capacities among company B and C in people perspective.

Organization Culture Perspective

Table 13: Organization Culture Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Organization Culture	Reward	• The compensation structure rewards knowledge workers with high analytical skills and collaborative ability.	4	3	4
	Attitude	• The environment of companies is not competitive.	3	3	4
		• People are starting to think strategically and a lot of ideas are being generated	4	3	4

Table 13 depicts the capabilities levels among three companies in organization culture perspective. The overall score for company A, B and C is 3.75, 3 and 4 respectively. Company B is lowest capacities among company A and C in organization culture perspective.

Strategic Management Perspective

Table 14: Company A's Strategic Management Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Strategic management	Strategic thinking and planning	• Ability to use consistent definitions of planning terms and to understand their distinctions	3	3	4
		• Awareness of the distinctions between project planning and strategic planning	4	3	4
		• Ability to discuss and describe items in plans at the appropriate "strategic altitude"	4	3	4
		• Awareness of the dynamic system effects in organizations, such as delays and feedback	4	3	4
	Visions	• People at all levels are motivated by a common vision and strategy	4	3	4
	Goals	• Organization defined global BI goals which are providing self-optimizing capabilities to end users, and move towards service orientation to maximize business growth.	3	2	1

Table 14 depicts the capabilities levels among three companies in organization culture perspective. The overall score for company A, B and C is 3.58, 2.67 and 3 respectively. Company B is lowest capacities among company A and C in organization culture perspective.

Change Management Perspective

Table 15: Company A's Change Management Perspective

Key process area	Criteria	Appraisal Measures	Company A	Company B	Company C
Change Management	Adaptability	• Employees across the enterprise understand change management, why it is important to project success and how they play a role in making change successful.	4	1	4
		• Employees can adapt to the change	4	2	3

Table 15 depicts the capabilities levels among three companies in change management culture perspective. The overall score for company A, B and C is 4, 1.5 and 3.5 respectively. Company B is lowest capacities among company A and C in change management perspective.

Conclusions

This paper proposes an EBI maturity model (EBI2M) to help the firms to identify the existing problems of BI implementation and plan a systematic path to evolve to higher levels of maturity. An EBI2M is evaluated through three companies in construction area. The result indicates that all three companies do not achieve highest maturity of BI implementation. Therefore, an EBI2M is used to provide symmetric guidelines for these companies to improve the BI implementation in the future.

Acknowledgment

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