

The Impact of Capability Level on Maturity of Business Intelligence Initiatives

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Abstract

This paper proposes Enterprise Business Intelligence Maturity Model that involves thirteen capacity factors, which are (Strategic Management, Performance Measurement, Balanced Scorecard, Information Quality, Data Warehouse, Master Data Management, Metadata Management, Analytical, Infrastructure, Knowledge Management, People, Organization Culture and Change Management). This key objective of this paper is to investigate how does the capability level impact on the maturity on Enterprise Business Intelligence (EBI) initiatives. Results indicates that all thirteen the capability factors are (Strategic Management, Performance Measurement, Balanced Scorecard, Information Quality, Data Warehouse, Master Data Management, Metadata Management, Analytical, Infrastructure, Knowledge Management, People, Organization Culture and Change Management) have strong significant effect on BI maturity level.

Keywords: Business Intelligence, Maturity Model

1. Introduction

Business Intelligence (BI) can be defined as “black box”, where data is process and transform into useful knowledge that can be delivered for decision making. In order to win among competitors, BI technology is needed to implement in the organizations. Numerous of organizations still struggle to implement BI even though know BI is important.

Hwang (2009) [1] pointed out the factor barriers to BI were insufficient staff, insufficient budget and lack of skilled staff and recommended the organizations to invest sufficient resources including human capital for BI projects. Pauli (2009) [2] argued that most the BI projects failed because lack of technology and right tools. BI project failures can be contribution due to ineffective of change management [3]. In fact, Gartner research (2009) [4] reported that 70%-80% organizations suffer failure on BI implementing due to organization culture. Computerworld (2003) [5] 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 metadata.

Therefore, Business Intelligence Maturity Model is essential to present pace by pace guidelines to help the companies to implement BI.

This paper tries to answer the research question and hypothesis as below:

RQ1: How does the capability level impact on the maturity on EBI initiatives?

H1: Strategic Management capability level does demonstrate significant effect on the maturity level

H2: Performance Measurement capability level does demonstrate significant effect on the maturity level

H3: Balanced Scorecard capability level does demonstrate significant effect on the maturity level

H4: Information Quality capability level does demonstrate significant effect on the maturity level

H5: Data Warehouse capability level does demonstrate significant effect on the maturity level

H6: Master Data Management capability level does demonstrate significant effect on the maturity level

H7: Metadata Management capability level does demonstrate significant effect on the maturity level

H8: Analytical capability level does demonstrate significant effect on the maturity level

H9: Infrastructure capability level does demonstrate significant effect on the maturity level

H10: Knowledge Management capability level does demonstrate significant effect on the maturity level

H11: People capability level does demonstrate significant effect on the maturity level

H12: Organization Culture capability level does demonstrate significant effect on the maturity level

H13: Change Management capability level does demonstrate significant effect on the maturity level

2. Literature Review

Table 1 indicates comparison between numerous business intelligence maturity models. As depicted in the table 1, the majority of the models do not focus the business intelligence as whole which some of maturity models emphasis on the technical aspect and some of the maturity models emphasis on business point of view. For example, TDWI's model [6] only concentrates on the data warehousing while Business Intelligence Maturity Hierarchy [7] only concentrates on knowledge management. It is not complete to represent business intelligence. Business intelligence is umbrella term and it 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.

Table 1 : Comparison between various BI maturity models
 Source : [6], [7], [8], [9]

Maturity Model	Author	Aspect cover	Level	Criteria	Questionnaire
TDWI's maturity model	Eckerson from TDWI	Focus on technical aspect, data warehouse	Six stages namely Non-excitant, Preliminary, Repeatable, Managed and Optimizing	Well defined	Online
Business Intelligence Maturity Hierarchy	Roger Deng	Knowledge management	Consists of four levels: data, information, knowledge and wisdom	Not well defined	Offline
Hewlett Packard Business Intelligence Maturity Model	Hewlett Packard	Focus on business aspect	Consists of three dimensions namely business enablement, information technology, and strategy and program management	Well defined	Online
Gartner's Maturity Model	Gartner	Focus on business aspect	Five maturity levels: unaware, tactical, focused, strategic and pervasive.	Not well defined	Online
Business Information Maturity Model	William and William	Focus on business aspect	Concentrates of three success factors namely alignment and governance, leverage and delivery	Not well defined	Online

3. Proposed Framework

Based on the literature review above, the common of the BI maturity models do not emphasis the business intelligence as entire. Some of BI maturity models emphasis on the technical perspective and some of the BI maturity models emphasis on business perspective. 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 various 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.

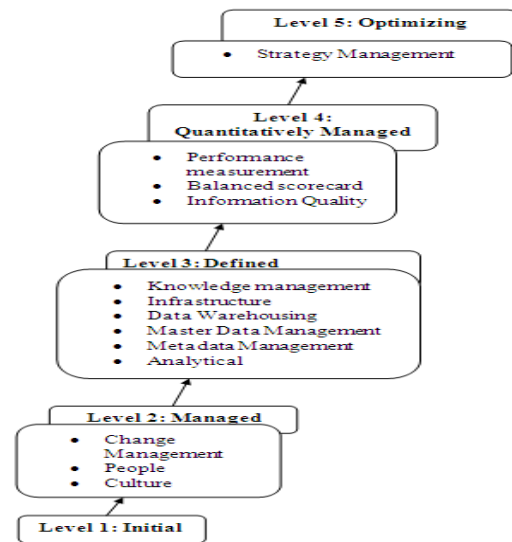


Fig. 1 Proposed staged representation of Enterprise Business Intelligence Maturity model (EBI2M)
 Developed by author

4. Methodology

The EBI2M assessment questionnaire is distributed to selected Malaysian companies that implement BI. The questionnaires were distributed through email, online or hand delivered to the head of IT or senior manager or BI experts that responsibility in the selected organizations across a wide range of organization size. A total of 132 companies were participating in the empirical study.

5. Results and Discussions

5.1 Testing Hypothesis 1

H1 : Strategic Management capability level does demonstrate significant effect on the maturity level

This hypothesis is aimed to investigate whether strategic management capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r= 0.902$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where strategic management capability level does demonstrate significant effect on the maturity level.

Table 2: Pearson correlation results for impact on strategic management capability level on maturity level

		strategic_mgmt	Maturity level
strategic_mgmt	Pearson Correlation	1.000	.902**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.902**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.2 Testing Hypothesis 2

H2 : Performance Measurement capability level does demonstrate significant effect on the maturity level

This hypothesis is aimed to investigate whether performance measurement capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r= 0.775$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where performance measurement capability level does demonstrate significant effect on the maturity level.

Table 3: Pearson correlation results for impact on performance measurement capability level on maturity level

		per_measureme nt	Maturity level
per_measurement	Pearson Correlation	1.000	.775**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.775**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.3 Testing Hypothesis 3

H3: Balanced Scorecard capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether Balanced Scorecard (BSC) capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r= 0.862$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where Balanced Scorecard (BSC) capability level does demonstrate significant effect on the maturity level.

Table 4: Pearson correlation results for impact on Balanced Scorecard (BSC) capability level on maturity level

		bsc	Maturity level
bsc	Pearson Correlation	1.000	.862**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.862**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.4 Testing Hypothesis 4

H4: Information Quality capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether Information Quality (IQ) capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r= 0.965$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where Information Quality (IQ) capability level does demonstrate significant effect on the maturity level.

Table 5: Pearson correlation results for impact on Information Quality (IQ) capability level on maturity level

		IQ	Maturity level
IQ	Pearson Correlation	1.000	.965**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.965**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

5.5 Testing Hypothesis 5

H5: Data Warehouse capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether Data Warehouse (DW) capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r = 0.814$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where Data Warehouse (DW) capability level does demonstrate significant effect on the maturity level.

Table 6 : Pearson correlation result for Data Warehouse (DW) capability level on maturity level

		DW	Maturity level
DW	Pearson Correlation	1.000	.814**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.814**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.6 Testing Hypothesis 6

H6: Master Data Management capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether Master Data Management (MDM) capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r = 0.898$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where Master Data Management (MDM) capability level does demonstrate significant effect on the maturity level.

Table 7: Pearson correlation results for impact on Master Data Management (MDM) capability level on maturity level

		MDM	Maturity level
MDM	Pearson Correlation	1.000	.898**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.898**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.7 Testing Hypothesis 7

H7: Metadata Management capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether metadata management capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r = 0.884$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where metadata management capability level does demonstrate significant effect on the maturity level.

Table 8: Pearson correlation results for impact on metadata management capability level on maturity level

		Meta_mgmt	Maturity level
Meta_mgmt	Pearson Correlation	1.000	.884**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.884**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

5.8 Testing Hypothesis 8

H8: Analytical capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether analytical capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r = 0.874$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where analytical capability level does demonstrate significant effect on the maturity level.

Table 9: Pearson correlation results for impact on analytical capability level on maturity level

		Analytical	Maturity level
Analytical	Pearson Correlation	1.000	.874**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.874**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.9 Testing Hypothesis 9

H9: Infrastructure capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether infrastructure capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r=0.950$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where infrastructure capability level does demonstrate significant effect on the maturity level.

Table 10: Pearson correlation results for impact on infrastructure capability level on maturity level

		infrastructure	Maturity_level
infrastructure	Pearson Correlation	1.000	.950**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.950**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.10 Testing Hypothesis 10

H10: Knowledge Management capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether Knowledge Management capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r=0.683$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where knowledge management capability level does demonstrate significant effect on the maturity level.

Table 11: Pearson correlation results for impact on knowledge management capability level on maturity level

		KM	Maturity_level
KM	Pearson Correlation	1.000	.683**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.683**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.11 Testing Hypothesis 11

H11: People capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether people capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r=0.729$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where people capability level does demonstrate significant effect on the maturity level.

Table 12: Pearson correlation results for impact on people capability level on maturity level

		People	Maturity_level
People	Pearson Correlation	1.000	.729**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.729**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.12 Testing Hypothesis 12

H12: Organization Culture capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether organization culture capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r=0.601$, significant $=0.000 < 0.01$, and hence conclude that hypothesis is accepted, where organization culture capability level does demonstrate significant effect on the maturity level.

Table 13: Pearson correlation results for impact on organization culture capability level on maturity level

		Org_culture	Maturity_level
Org_culture	Pearson Correlation	1.000	.601**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.601**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

5.13 Testing Hypothesis 13

H13: Change Management capability level does demonstrate significant effect on the maturity level

This hypothesis is to investigate whether change management capability level does demonstrate significant effect on the maturity level. It is found that Pearson correlation, $r = 0.807$, significant $= 0.000 < 0.01$, and hence conclude that hypothesis is accepted, where change management capability level does demonstrate significant effect on the maturity level.

Table 14: Pearson correlation results for impact on change management capability level on maturity level

		Change_Mgmt	Maturity_level
Change_Mgmt	Pearson Correlation	1.000	.807**
	Sig. (2-tailed)		.000
	N	33.000	33
Maturity_level	Pearson Correlation	.807**	1.000
	Sig. (2-tailed)	.000	
	N	33	33.000

** . Correlation is significant at the 0.01 level (2-tailed).

6. Conclusions

This paper discusses the result of the analysis based on survey data collected from 132 participating companies in Malaysia. There were 18 hypothesis identified for this study. Hypothesis 1 to hypothesis 13 was analysed using Pearson correlation, which indicated all capability level (Strategic Management, Performance Measurement, Balanced Scorecard, Information Quality, Data Warehouse, Master Data Management, Metadata Management, Analytical, Infrastructure, Knowledge Management, People, Organization Culture and Change Management) have strong significant effect on BI maturity level.

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