

International Conference on Accounting Studies (ICAS) 2015
17-20 August 2015, Johor Bahru, Johor, Malaysia

Are Malaysian companies ready for the big data economy? A business intelligence model approach

Wong Kee Luen*, Chuah Min Hooi, Ong Seng Fook

Universiti Tunku Abdul Rahman, Malaysia

Abstract

The next big phenomenon within the management accounting practices would be the big data economy. The phenomenon concerns the production of a large stream of data from diverse sources, analysing these big data so as to provide important insights for better decision making. This paper attempts to evaluate the readiness of Malaysian companies to take advantage of big data by using the Enterprise Business Intelligence Maturity Model (EBIMM) as the evaluation tool. Data were collected from 132 Malaysian large scale enterprises using the EBIMM questionnaire. The results indicated that Malaysian companies are relatively ready for the big data economy. Up to 82% of the organizations surveyed attained the Defined level of maturity and had a decent level of capabilities and competencies to capture the benefits of big data analytics. However, none of the organizations reached the Optimizing level indicating that more investments in technology, talents and culture are required to enable Malaysia to become the regional hub for big data analytics.

Keywords: Big data, maturity, readiness, decision making, performance

1. INTRODUCTION

Management accountants are on the look-out for the next big thing – the big data phenomenon. Big data, also known as the data economy is concerned with the production of a large and constant stream of data which is monitored and analysed by advanced technologies and techniques so as to provide new insights needed for better decision making and enhanced business performance (Accountants Today, Nov/Dec 2014).

Many companies have already make use of big data and advanced analytics to improve their business performance and achieve competitive advantage. For example, Boeing Commercial Aircraft Manufacturing is making use of big data to save fuel and flying time in order to make commercial flying more efficient and effective. The data can be obtained from satellites or from the sensors installed in the airplanes and remitted back to the ground control facilities for analysis to be conducted. In another example, Chartered Institute of Management Accountants (CIMA) and American Institute of Certified Public Accountants (AICPA) (2014) reported that the Intercontinental Hotel Group made use of internal and external data to improve customer service, predict guests' spending patterns, and identify market trends. Many companies leverage on data to improve operational efficiencies, create new innovative products, and make better strategic decisions and build new business models.

The global big data economy is forecasted to be US\$28.5 billion in 2014. In 2013, big data related revenue made up of 40% of the total IT market where hardware made up 38% and software 22% (Accountant Today,

*Corresponding author. Tel.: +605-468 8888
E-mail: wongkl@utar.edu.my

Nov/Dec 2014). Big data vendors provide professional services to help businesses to identify big data use, propose solutions to problems and improve business performance of companies. In Malaysia, the Ministry of Communications and Multimedia drives the National Big Data Initiative with the purpose of becoming the regional big data and analytics hub. It is expected to generate revenue of RM720 million by 2020. But according to IT market revenue firm IDC, Malaysia is still at the “ad-hoc” stage in terms of big data maturity. This is in line with the results of a survey of 2,000 financial professionals by CIMA, that 86% of business organizations are struggling to get valuable insights from the data they possess. This means that the big data economy remains a “blue ocean” market waiting to be tapped.

The main purpose of this study is to identify and examine the level of readiness and maturity Malaysian companies have achieved in terms of big data maturity. We are curious to find out how Malaysian companies are using their data and what steps they are taking to use their big data analytics efficiently and effectively. Therefore, our research questions are two folds:

- The big data maturity may be classified into three levels: operational, managerial, and strategic level. What level of maturity have Malaysian companies achieved?
- How are Malaysian companies using data available to them to improve their business performance?

2. LITERATURE REVIEW

As the big data phenomenon is a relatively new concept, there is relatively little literature related to the issue. The Chartered Institute of Management Accountants (CIMA), however, spearheads to examine the phenomenon by starting the Chartered Global Management Accountants (CGMA) Briefing on Big Data with the purpose of readying business for the big data revolution. They listed down the huge benefits business organizations can reap on successful implementation of big data analytics in their companies:

- Driver-based forecasting and performance management
- Customer segmentation to improve focus and increase revenue
- Improved process efficiency and product quality
- Tracking shipments, improving routes and supply chain management
- Understanding customers’ needs and identifying opportunities to innovate
- Improving promotional messages and channel effectiveness
- More effective employee recruitment and retention
- New business models
(CGMA, 2014)

In addition, CGMA (2014) pointed out the priority of business organizations is to data mine the readily available streams of data in their IT systems. The imminent weakness among the business organizations is the lack of skills and competencies to capture the promising opportunities and benefits of the big data phenomenon. Thus, there is a dire need for new competencies and talent development in the organizations.

CGMA (2014) presented the big data competencies model. The required competencies range from technical ability to business acumen and span from performance management to conformance to data management standards (see Figure 1). Based on the model, business organizations required the following abilities and competencies:

- Data analytics – advanced level of analytical skills for data mining, deriving algorithms, and predictive analytics
- Data management – businesses need to ensure that their IT systems ensure data integrity, that data are captured correctly and relevantly, that data stored are accessible for consistent use.
- Data culture – the culture that decisions are made objectively and based on analysis of available data and evidence.
- Value creation – the ability to translate analytical insights into commercial insights, and business acumen to identify opportunities.

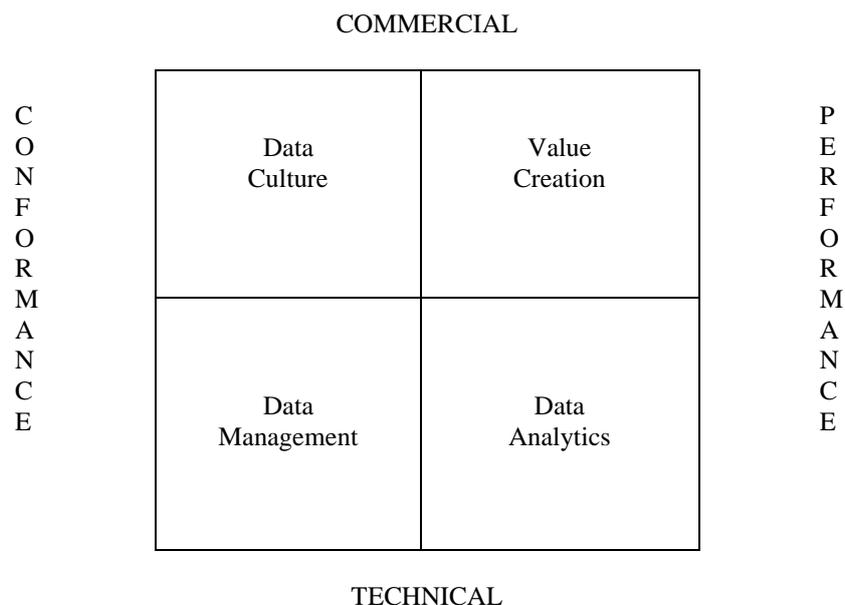


Figure 1. The range of big data competencies
(Adapted from CGMA, 2014)

McKinsey (2014) argues that the non-readiness of business organizations for the big data economy is largely due to a significant shortage of talents skilled in advanced analytics. Another factor they pointed out is the shortage of managers with the skills to understand and make decisions objectively based on data analytics (McKinsey, 2014). Benefits from big data analytics are based on the principles of management accounting: providing information for better decision making to improve efficiency and effectiveness of businesses (Drury, 2012). Notwithstanding the huge benefits that can be derived from data analytics, and from the Malaysian perspective, the pertinent question is: Are Malaysian companies ready to capture the benefits offered by this big data analytics? We therefore need to source for a valid tool and a reliable technique to measure and determine to what extent Malaysian companies are ready for the big data economy.

In the field of information systems (IS), data analytics is generally referred to as business intelligence. Business intelligence (BI) can be defined as a process, focusing on data collection and analysis from both internal and external sources of business organizations in order to generate relevant information for making better decisions (Fisher, et al., 2014; Knabke & Olbrich, 2013; Turban, 2011). BI systems, then is considered as a tool that enables decision makers to find or get information from the data source (Damjanovic & Behrendt, 2014; Yoon et al., 2014; Mathrani & Mathrani, 2013; Han & Farn, 2013). Many authors in the field of IS make use of maturity model to benchmark and assess the competence of an organization to implement business intelligence system successfully (Harpham, 2006; Paulk, et al., 2006; Rajeric, 2010).

Gartner's (2010) maturity model can be used to rate business maturity levels and the maturity of respective departments. He proposed five maturity levels: unaware, tactical, focused, strategic, and pervasive. However, the criteria to rate the maturity levels are not well defined (Rajteric, 2010). We examined a number of maturity models including TDWI's maturity model (2004), Hewlett Packard's business intelligence maturity model (2009), Business information maturity model, 2007, AMR Research's business intelligence/performance management maturity model (2006), Business intelligence development model (2010). We found that the maturity models were not well defined and they do not offer any instructions or questionnaire to evaluate maturity levels. We follow Rajteric's (2010) recommendation that there is a need to integrate the existing different maturity models with appropriate design questionnaire and evaluative criteria in order to evaluate the maturity level of the business organizations.

On further literature search, we noted that level of readiness of business organizations for data analytics could be related to the level of maturity of business intelligence in business companies. As the maturity levels of IT in companies can be rated by business intelligence maturity models, the level of readiness mentioned earlier can be measured by an appropriate business intelligence maturity model. Chuah (2014) attempted to construct a maturity model for this purpose using the Delphi study. She called the model – Enterprise Business Intelligence Maturity Model (EBIMM). The maturity model has five levels: Level 1- Initial; Level 2 - Managed; Level 3- Defined; Level 4 – Quantitatively managed; Level 5 – Optimizing, and thirteen competency areas such as

change management, culture, strategic management, people, performance management, etc. These competencies can be classified into the five levels:

- Level 1 – Initial
- Level 2 – Managed
Change management, people, culture
- Level 3 – Defined
Knowledge management, infrastructure, data warehousing, master data management, metadata management, analytics
- Level 4 – Quantitatively managed
Performance management, balanced scorecard, information quality
- Level 5 – Optimizing
Strategic management

We are of the opinion that the EBIMM model can be used as a tool to benchmark and rate the maturity level of business intelligence. As the maturity levels of business intelligence is considered to be related to the level of readiness for data analytics, the EBIMM should also work as a technique to measure the level of readiness of the business organizations for the big data analytics economy.

3. RESEARCH METHODOLOGY

This study is exploratory in nature. The research design consisted of three stages:

- Stage 1 Delphi study with fifteen business intelligence experts
The Delphi study went for three rounds requesting the experts to map the key thirteen competency areas to the related level of the maturity model.
- Stage 2 Case Study with nine companies
Stage 2 attempted to apply the maturity model constructed in Stage 1 to nine companies with substantive experience in business intelligence implementation. The EBIMM model constructed was found to be valid and reliable for rating the levels of maturity of the nine companies.
- Stage 3 A questionnaire survey
The survey managed to collect 132 responses. The respondents were requested to complete the EBIMM questionnaire. The questionnaire captured data on the demographical information as well as on fifty-four (54) items based on 5-point Likert scale that were classified into five levels of readiness:

Level 1 – Initial:	Zero item
Level 2 – Managed:	10 items
Level 3 – Defined:	24 items
Level 4 – Quantitatively managed:	14 items
Level 5 – Optimizing:	6 items

The readiness ratings of the business organizations were calculated by adopting the procedures of Baskarada, et al. (2006). The items at the respective levels were grouped together and the average scores for the levels were calculated. Approximate readiness ratings of the organizations were derived by adding up the average capability ratings at each level. For instance, if the average score at Level 2 was 3.92, then the rating was 3.92 divided by 5 giving a rating of 78.4%. These ratings for Level 1 to Level 5 were added up together to give an estimate rating of the level of readiness for data analytics capability. For example, given that Level 1 = 100%, Level 2 = 78.4%, Level 3 = 51%, Level 4 = 48.2%, and Level 5 = 66.7%, then:

$$\begin{aligned} \text{Level of Readiness} &= 1 + 0.784 + 0.51 + 0.482 + 0.667 \\ &= 3.442, \text{ which approximate at Level 3} \end{aligned}$$

In another example, if Level 1 = 100%, Level 2 = 85%, Level 3 = 84.8%, Level 4 = 65.4%, and Level 5 = 66.7%, then: Level of Readiness = 1 + 0.85 + 0.848 + 0.654 + 0.667 = 4.02, which approximate at Level 4

4. DATA ANALYSIS

Table 1 shows the demographical information of the respondent organizations.

Table 1. Demographical information of the respondent organizations

Type of industry	Percentage (%)	Frequency
Construction	9	12
Financial/Banking	12	16
Service/Consultant	18	24
Manufacturing	33	44
Healthcare	6	8
Telecommunication	6	8
Logistics	6	8
Retail	6	8
Education	3	4
Total	100.0	132
Number of years of experience in BI		
4 – 5 years	55	73
6 – 7 years	23	30
8 – 9 years	17	22
10 years and above	5	7
Total	100	132
Company annual revenue		
Less than RM20m	21.2	28
RM20m to RM200m	48.5	64
More than RM200m	30.3	40
Total	100.0	132
Type of Vendor used for BI		
IBM Cognos	15.2	20
Microsoft Server 2008	30.3	40
SAS	9.1	12
SAP	36.4	48
Oracle	9.1	12
Total	100.0	132

The data collected by the EBIMM questionnaire were checked and entered into SPSS version 16. The means of each process area were calculated. They were then added up and averaged according to the respective levels. Thus, each level had its average scores. The approximate level of readiness was derived by adding up the average scores for the five levels (Baskarada, et al., 2006). The results were presented in Table 2:

Table 2. The Readiness Levels of Business Organizations

Level of Readiness	Percentage (%)	Frequency
Level 1 – Initial	0	0
Level 2 – Managed	18	24
Level 3 – Defined	52	68
Level 4 – Quantitatively Managed	30	40
Level 5 – Optimizing	0	0

Table 2 shows the readiness level of business organizations for big data analytics usage. Up to 52% (68) of the companies surveyed were at the Defined level of readiness for big data analytics usage. About 30% (40) of the companies were at Level 4, the Quantitatively Managed level. Approximately 18% (24) were at Level 2, the Managed level. There was no company at Level 1, the Initial level as well as at Level 5, the Optimizing level.

5. DISCUSSIONS

The main purpose of this study is to evaluate the level of readiness of Malaysian companies for big data analytics. CIMA (2015) commented that based on a survey of over 2,000 financial professionals, 86% of organizations are having difficulties getting valuable insights from accessible data. McKinsey (2014) noted that one of the factors contributing to this inability and un-readiness is the shortage of advanced analytics talent and skilful managers.

Based on our data analysis, we found that Malaysian companies were at various levels of readiness for big data analytics. The majority of the companies surveyed were at the Defined level (Level 3) of readiness. In fact, 52% (68 out of 132) of the companies were found to be at Level 3 readiness. This means that most Malaysian companies passed Level 2 where they are ready for change management and adaptability related to big data analytics. They also have leadership and people-related capabilities to handle big data, coupled with the culture to make decision based on insights generated by data analytics. As they were at Level 3, they had six

competency areas ready for the big data phenomenon. The six capabilities were analytical, metadata management, master data management, data warehousing, and knowledge management.

By being analytical, the companies had the ability to support reporting, the ability to support historical comparisons/trending, the ability to perform drill down to the source database, and the ability to do complex calculations. By having metadata management, the companies had the ability to manipulate, transform, calculate, and summarize data, the ability to provide information regarding configuration, tools and programs, and the ability to provide information regarding change and update activity. By having master data management, it means that the companies had data integration and synchronization, data profiling, data migration, and data consolidation and segmentation. By having data warehousing, the companies had the ability to read directly from data sources, the ability to automatically capture and deliver metadata. By knowledge management, the companies were capable of knowledge creation, knowledge capturing, knowledge refining, and knowledge storing.

Only 30% (40) of the companies reached Level 4, the Quantitatively Managed Level. Companies at Level 4 have the competencies in three competency areas: performance measurement, balanced scorecard, and information quality. By performance management, the companies had performance indicators measured on a regular basis, the collection of performance data is fully automated and are stored in an integrated IT system. By balanced scorecard, the companies have both financial and non-financial indicators to benchmark performance. By information quality, it means that the data the companies have are accurate, complete, consistent, and timely.

Only 18% (24) of the companies is at Level 2, the Managed level. As discussed previously, these companies have change management and leadership, people-related and culture-related qualities to manage the big data phenomenon.

The Malaysian companies are yet to reach Level 5, the optimizing level of readiness or maturity. This means that Malaysian companies are yet to make use of data analytics strategically. The CIMA model of data competencies refers this level as value creation. At this level, analytical insights are translated into commercial insights, and business acumen is required to identify business opportunities for creating value. New strategic insights are turned into opportunities to generate extra revenue, cost leadership derived from data analytics is used to drive innovation and continuous improvement in the efficiency of business processes.

From the results of the survey, much needs to be done to bring Malaysia from the “ad-hoc” stage of maturity to the leadership stage of maturity in big data analytics. Suggestions by the Malaysian Institute of Accountants (MIA) are relevant, that is, to achieve leadership in the big data economy, there have to be huge investments in technology, talents, and culture (Accountant Today, Nov/Dec 2014). Investments in technologies will enable the abilities “to ingest, analyse, and act on streaming data from all manner of sources in real time” (*ibid*, 2014, p. 16). Investments in talent refer to time and resources in hiring and developing knowledge workers so that they have the skills to extract insights and value from big data. Investments in creating organizational culture require top management commitment, resources and time to transform their companies into analytics based organizations (*ibid*, 2014).

6. CONCLUSION

Based on our findings, 82% (52% + 30%) of the Malaysian companies surveyed achieved at least the Defined level (Level 3) of readiness or maturity in their capabilities and competencies. In other words, Malaysian companies are quite ready to take advantage and capture the huge benefits of big data analytics. However, no Malaysian company was found to be at Level 5, the optimizing level. This means that there is still a huge gap for improvement so that businesses can capture the maximum benefits from the big data economy.

To conclude, we like to take the cue from McKinsey (2014), in that what is lacking in the big data economy is not only the shortage of talents for advanced analytics such as IT professionals and data scientists but also the shortage of skilful managers who have the abilities to translate analytical insights extracted from big data analytics to commercial insights that can be implemented. Indeed, the big data economy is a blue ocean market and will remain so for many years to come.

REFERENCES

- Accountants Today, Nov/Dec 2014. *Will the Chief Analytical Officer please stand up?*
- Baskarada, S, Koronios, A & Gao, J. (2006). *IQM-CMM: A Framework for Assessing Organisational Information Quality Management Capability Maturity*”, Proceedings of MIT International Conference on Information Quality, Boston.
- CGMA Report, (2014). *CGMA briefing - Big data: Readyng business for the big data revolution*.
- Chuah, M. H and Wong, K. L. (2012). A framework for accessing an Enterprise Business Intelligence Maturity Model: Delphi study Approach, *African Journal of Business Management*, Vol.6 (23), pp 6880-6889.
- Damjanovic, V. & Behrendt, W. (2014). 'UNDERSTANDER: Business Intelligence Seeker – User Agent', *37th Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, pp. 1491 – 1496.
- Drury, C. (2012). *Management and Cost Accounting*, 8th Edition. Hampshire: Cengage Learning.
- Eckerson, W. (2004). Gauge Your Data Warehouse Maturity, *Information management*, Available from : <<http://www.information-management.com/issues/20041101/1012391-1.html>>. [Retrieved: 29 April 2009]
- Fisher, D., Drucker, S & Czerwinski, M. (2004). Business Intelligence Analytics, *Microsoft Research*, pp.22-24.
- Gartner Research, (2010). *IT Score Overview for Business Intelligence and Performance Management*, Available from: < http://www.gartner.com/resources/205000/205072/itscore_overview_for_busines_205072.pdf >. [Retrieved: 11 November 2010].
- Han, Y.M and Farn, C.K. (2013). 'A Study on the Effects of Empowerment and Habit on Continuance Usage of Pervasive Business Intelligence Systems', *System Sciences (HICSS). 46th Hawaii International Conference on System Sciences 2013*, pp.3768 – 3777.
- Hagerty, J (2006). *AMR Research's Business Intelligence/ Performance Management Maturity Model, Version 2*, Available from: <http://www.cognos.com/pdfs/analystreports/ar_amr_researchs_bi_perf.pdf >. [Retrieved: 21 April 2009].
- Harpham, A. (2006). *The APM Group's assessment model for portfolio, program and project management, its PRINCE2 maturity model and their benefits to organizations*, Available from : <<http://www.apmgroup.co.uk/nmsruntime/saveasdialog.asp?IID=576&SID=102>>. [Retrieved: 27 December 2009].
- Hewlett-Packard (2007). *The HP Business Intelligence Maturity Model*, Available from: <<http://h71028.www7.hp.com/ERC/downloads/4AA1-5467ENW.pdf> >. [Retrieved: 21 April 2009].
- Knabke, T. & Olbrich, S. (2013). Understanding Information System Agility -- The Example of Business Intelligence, *46th Hawaii International Conference on System Sciences (HICSS) 2013*, pp. 3817 – 3826.
- Mathrani, S. & Mathrani, A. (2013). Leveraging Business Intelligence to Build Meta-knowledge, *46th Hawaii International Conference on System Sciences 2013 (HICSS)*, pp. 3787 – 3796.
- McKinsey, (2014). *Views from the front lines of the data-analytics revolution*.
- Paulk, M. C., Curtis, B., Chrissis, M. B. & Weber, C. (2006). *Capability Maturity Model for Software, Version 1.2*, Software Engineering Institute/Carnegie Mellon University.
- Rajterič, I. H. (2010). Overview of Business Intelligence Maturity Models, *International Journal of Human Science*, Vol. 15, No. 1, pp 47-67.
- Sacu, C. & Spruit, M. (2010). BIDM: The Business Intelligence Development Model, *Proceedings of the 12th International Conference on Enterprise Information Systems*, Funchal, Madeira-Portugal.
- Turban, E., Sharda, R., Aronson, J. E., & King, D. (2011). *Business Intelligence: A Managerial Approach*, Prentice Hall.
- Yoon, T. S., Ghosh, B. & Jeong, B. K. (2014). User Acceptance of Business Intelligence (BI) Application: Technology, Individual Difference, Social Influence, and Situational Constraints, *47th Hawaii International Conference on System Sciences (HICSS)*, pp. 3758 – 3766.