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# Does the Demographic Factor Impact Enterprise Business Intelligence Maturity Initiatives in Companies in Malaysia?

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## Abstract

This chapter proposes an Enterprise Business Intelligence Maturity Model that involves thirteen key process areas (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 chapter was to investigate impact on demographic factors such as age of BI initiative, organizational size, number of IT/BI employees, type of industry and revenue of the company towards the Enterprise Business Intelligence Initiative. A survey was conducted around 132 companies in this study. Results shows that age of BI initiatives, organizational size and number of IT/BI employees have relationship on BI maturity level while BI maturity level has strong relationship on the revenue of the company. Results above also show that the type of industry has no relationship on the BI maturity level.

**Keywords:** Business Intelligence, Maturity Model

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## 1. Introduction

Business Intelligence (BI) can be defined as any set of methodology or process or tools that transform raw data into useful information and provide decision support for managers [1]. BI

can be categorized as a black box, where a backup process takes place, such as where data are processed and translated into knowledge that can be used for decision making. BI can be formed from technological perspective, managerial perspective and product perspective. From the managerial perspective, BI can be named as a process, an emphasis on data collection and an analysis from their internal and external sources in order to produce applicable information [2, 3, 4, 5]. From a product perspective, Fernandes et.al [6] described BI as a result of a product for decision making and as a performance evaluation of business data and analysis products practice. From the technological perspective, BI can be labeled as BI systems and it can be considered as a tool to allow decision makers to discover information from the data source [7, 8, 9, 10].

BI consists of three core components: data warehouse, business analysis and business performance management. Data warehouse is one of important features of BI where data are extracted from the external sources such as transaction data, data from enterprise resource planning (ERP), and data source from supply chain management (SCM) and it is stored. In the business analysis component, data are taken from data warehouse where a data mining technique is applied to convert into useful knowledge. Lastly, the end user can view the business performance business performance management component.

BI is essential for the organizations in order to win the business's competitors. However, several of the organizations still find it hard to implement BI. Hwang [11] stated that one of the main reasons why BI failed is the lack of technical staff and the lack of budget. In fact, Pauli [12] pointed out that most BI projects failed because of the lack of technology and right tools. Besides that, change management and organization culture also important factors that determine the success of BI implementation [13, 14].

There are many studies [15, 16, 19] on the impact of demographic factors on business intelligence initiatives but these are only concentrated on three factors, such as types of industry, organizational size and age of BI initiates. For example, Eckerson [15] stated that the more years the company has implement BI, the higher the level of BI maturity. Rabel et.al [16] stated that the larger the organization, the more mature the BI implementation of the company. Williams and William [19] pointed out that BI adoption is beneficial to all type of industry. Studies that review other demographic factors (number of employees and revenue of the organization) that will affect the implementation of BI maturity are scarce. Thus, this chapter outlines the research question as follows:

RQ1: What is the relationship of the organization's demographic on business intelligence maturity in Malaysia?

This research question is composed of the following:

*RQ1.1: What is the relationship between the age of BI initiatives and BI maturity?*

*RQ1.2: What is the relationship between the organizational size and BI maturity?*

*RQ1.3: What is the relationship between the types of industry and BI maturity?*

*RQ1.4: What is the relationship between the numbers of IT/BI employees and BI maturity?*

*RQ1.5: What is the relationship between the revenue of the organization and BI maturity?*

## **2. Literature review and proposed framework**

In this section, the authors had reviewed several existing BI maturity models. These models include TDWI maturity model and Gartner's maturity model. The authors found that most BI maturity models do not cover BI as whole aspect. For example, Gartner's (2010) [23] maturity model proposed five maturity levels: unaware, tactical, focused, strategic, and pervasive but the model only concentrates on business standpoint and lack of technical standpoint. Furthermore, the criteria to rate the maturity levels are not well defined [24]. Eckerson [15] only concentrates on the technical point of view but lacks the technical point of view. Rajterič [24] recommended 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. Thus, an Enterprise Business Intelligence Maturity Model (EBIMM) is proposed and adopted from the theory of CMMI, which is integrated from technical perspectives and business perspectives.

The proposed Enterprise Business Intelligence Maturity Model (EBIMM) consists of five levels; Level 1-Initial level ; Level 2-the Managed level ; Level 3-the Defined level ; Level 4-the Quantitatively managed level and Level 5 – Optimizing level.

## **3. Methodology**

The EBI2M assessment questionnaire is distributed to selected Malaysian companies that implement BI. The questionnaires were distributed through various Big Data Conferences, CIO forums and emails, online or hand delivered to the head of IT or senior manager or BI experts responsible in the selected organizations across a wide range of organization size. A total of 132 companies were participating in the empirical study.

The respondents were instructed to rate organizations' BI implementation based on thirteen factors, namely change management, culture, strategic management, people, performance management, balanced scorecard, information quality, data warehousing, master data management, metadata management, analytical, infrastructure and knowledge management. The rating for each appraisal criterion is based on the CMMI capability rating as 0 (process that is not performed and completely dissatisfied), 1 (process is performed but mostly dissatisfied), 2 (process is performed but slightly dissatisfied), 3 (process is performed and slightly satisfied), 4 (process is performed and mostly satisfied) and 5 (process is performed and completely satisfied).

Level 1 – Initial: 0 items

Level 2 – Managed: 10 items

Level 3 – Defined: 24 items

Level 4 – Quantitatively managed: 14 items

Level 5 – Optimizing: 6 items

The items at the respective levels were grouped together and the average scores for the levels were calculated based on procedures that proposed by Baskarada [25]. The estimated readiness ratings of the organizations were derived by adding 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 to give an estimate rating of the level of readiness for capability level. For example, given that Level 1 = 100%, Level 2 = 78.4%, Level 3 = 51%, Level 4 = 48.2%, and Level 5 = 66.7%, then:

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

## 4. Results and analysis

This section elaborates on the analysis of an organization's demographic data such as age of BI initiatives, organizational size, types of industry, number of IT/BI employees and the revenue of an organization on EBI maturity.

### RQ1.1: What is the relationship between the age of BI initiatives and BI maturity?

| age              | Mean   | N   | Std. Deviation |
|------------------|--------|-----|----------------|
| 1-2 years        | 2.0000 | 12  | 0.00000        |
| 10 years above   | 4.0000 | 4   | 0.00000        |
| 3-4 year         | 3.0000 | 32  | 0.00000        |
| 5- 6 Years       | 3.2500 | 48  | 0.43759        |
| 7-8 years        | 4.0000 | 12  | 0.00000        |
| 9-10 years       | 4.0000 | 12  | 0.00000        |
| less than 1 year | 2.0000 | 12  | 0.00000        |
| Total            | 3.1212 | 132 | 0.68829        |

**Table 1.** Description statistic for age of BI initiatives

From the table 2, it is found that Spearman Correlation,  $\rho=0.873$ , which is larger than 0.7, indicates that there is strong relationship between the age of BI initiatives and the BI maturity.

**Conclusion: There is strong relationship between the age of BI initiatives and BI maturity**

### RQ1.2: What is the relationship between the organizational size and BI maturity?

|                |                |                         | age_no | maturity_level |
|----------------|----------------|-------------------------|--------|----------------|
| Spearman's rho | age_no         | Correlation Coefficient | 1.000  | .873**         |
|                |                | Significance (2-tailed) | .      | .000           |
|                |                | N                       | 132    | 132            |
|                | maturity_level | Correlation Coefficient | .873** | 1.000          |
|                |                | Significance (2-tailed) | .000   | .              |
|                |                | N                       | 132    | 132            |

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

**Table 2.** Spearmen correlation between age of BI initiative and BI maturity level

|                |                 |                         | company_size_n<br>o | maturity_level |
|----------------|-----------------|-------------------------|---------------------|----------------|
| Spearman's rho | company_size_no | Correlation Coefficient | 1.000               | .608**         |
|                |                 | Sig. (2-tailed)         | .                   | .000           |
|                |                 | N                       | 132                 | 132            |
|                | maturity_level  | Correlation Coefficient | .608**              | 1.000          |
|                |                 | Sig. (2-tailed)         | .000                | .              |
|                |                 | N                       | 132                 | 132            |

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

**Table 3.** Spearmen correlation between company size and BI maturity level

From the table 3, it is found that Spearman Correlation, rho=0.608,, indicates that there is moderate relationship between the company's size and the BI maturity.

**Conclusion: There is moderate relationship between the company's size and BI maturity**

**RQ1.3: What is the relationship between the types of industry and BI maturity?**

Type of industry can be categoried as service and non service. Service industries focus on improving products and services for their customers (example : financial, healthcare, education, telecommunication) while non service focus on improving processes for the production and distrbution of the products and services (retail, logistic, manufacturing and construction).

From the table 4, it is found that Spearman Correlation, rho=0.087,, indicates that there is no relationship between the type of service and the BI maturity.

**Conclusion: There is no relationship between the type of service and BI maturity**

|                |                |                         | type_no | maturity_level |
|----------------|----------------|-------------------------|---------|----------------|
| Spearman's rho | type_no        | Correlation Coefficient | 1.000   | .087           |
|                |                | Sig. (2-tailed)         | .       | .319           |
|                |                | N                       | 132     | 132            |
|                | maturity_level | Correlation Coefficient | .087    | 1.000          |
|                |                | Sig. (2-tailed)         | .319    | .              |
|                |                | N                       | 132     | 132            |

Table 4. Spearman correlation between type of service and BI maturity level

**RQ1.4: What is the relationship between the numbers of IT/BI employees and BI maturity?**

Number of IT/BI employees can be categorized as low (1-5 persons) and medium (6-10 persons).

| no_of_employee | Mean   | N   | Std. Deviation |
|----------------|--------|-----|----------------|
| Low            | 3.0000 | 112 | 0.65760        |
| Medium         | 3.8000 | 20  | 0.41039        |
| Total          | 3.1212 | 132 | 0.68829        |

Table 5. Description statistic for number of IT/BI employees maturity level

|                |                |                         | no_of_staff | maturity_level |
|----------------|----------------|-------------------------|-------------|----------------|
| Spearman's rho | no_of_staff    | Correlation Coefficient | 1.000       | .429**         |
|                |                | Sig. (2-tailed)         | .           | .000           |
|                |                | N                       | 132         | 132            |
|                | maturity_level | Correlation Coefficient | .429**      | 1.000          |
|                |                | Sig. (2-tailed)         | .000        | .              |
|                |                | N                       | 132         | 132            |

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

Table 6. Spearman correlation between number of IT/BI employees and BI maturity level

From the table 6, it is found that Spearman Correlation,  $\rho=0.429$ , indicates that there is weak relationship between the number of staffs and the BI maturity.

**Conclusion: There is weak relationship between the number of staffs and BI maturity**

**RQ1.5: What is the relationship between the revenue of the organization and BI maturity?**

With respect to the revenue of an organization, it was classified into small (Less than RM 20 million), medium (RM 20 million to RM200 million), and large (more than RM200 million) enterprises.

|                |                |                         | revenue_no | maturity_level |
|----------------|----------------|-------------------------|------------|----------------|
| Spearman's rho | revenue_no     | Correlation Coefficient | 1.000      | .608**         |
|                |                | Sig. (2-tailed)         | .          | .000           |
|                |                | N                       | 132        | 132            |
|                | maturity_level | Correlation Coefficient | .608**     | 1.000          |
|                |                | Sig. (2-tailed)         | .000       | .              |
|                |                | N                       | 132        | 132            |

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

**Table 7.** Spearman correlation between the revenue of the organization and BI maturity level

From the table 7, it is found that Spearman Correlation,  $\rho=0.608$ , indicates that there is moderate relationship between the revenue of an organization and the BI maturity.

**Conclusion: There is moderate relationship between the revenue of an organization and BI maturity**

**5. Conclusion**

This chapter has condensed the findings of the analysis based on survey data collected from 132 participating companies in Malaysia. Results shows that age of BI initiatives, organizational size, number of IT/BI employees and the revenue of an organization have relationship on BI maturity level. Results above also show that the type of industry has no relationship on the BI maturity level. The result above also tally with Eckerson’s study [20], which stated that in the phenomenon of increasing the age of BI initiatives, the mean of BI maturity will increase. The recent survey conducted by Rabel et.al [16] also indicated that BI maturity and the number of year conducting are related to each other. Han et.al [10] pointed out that BI maturity rating



undertaken in different organization and BI maturity is increase with the longer the company implement BI. Elbashir et.al [17] proved that there is a positive relationship between the organization size and the BI maturity mean while Sen et.al [18] argued that for organization size is one of the success factors in order for data warehouse or BI technology.

This research project may be used as a framework to lead any future research towards advancing the theory of Enterprise Business Intelligence Maturity. In the future, large samples size could be used to strengthen the generalizability of the proposed framework. Moreover, this research could intend to explore more maturity indicators that contribute to the EBI maturity model. This is because technology and business environment is always keeping changing and there are more maturity indicators that could emerge in the future.

## Author details

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