Successful Business Intelligence System for SME: An Analytical Study in Malaysia

Umar Bin Qushe\textsuperscript{1}, Akram M. Zeki\textsuperscript{2}, Adamu Abubakar\textsuperscript{3}

Department of Information Systems, Kulliyyah of Information and Communication Technology, International Islamic University Malaysia.

Corresponding author: umar.overseas14@gmail.com\textsuperscript{1}, akramzeki@iium.edu.my\textsuperscript{2}, adamu@iium.edu.my\textsuperscript{3}

Abstract. While many larger organizations is adhering to a new level of competence by adoption of advanced Business Intelligence (BI) systems, in the same time there are other small-medium companies who are left behind in terms of updating them for better success in the industry. Thus the aim of the research is to identify Small and Medium Enterprise (SME) specific determinants for Business Intelligence efficiency which will lead those organizations a better understanding of development and testing of BI framework in the business world. In this study, it is therefore considered extensive literature reviews to measure the efficiently factors and proposed a holistic conceptual framework. In the same time, feedbacks of the Business Intelligent experts were taken into consideration to provide new insights for SME companies to ensure where to focus and which type of sector is crucial for an SME organization in order to be successful in parallel with Big organizations. Thus in this regard, Quantitative Survey research method is used and Statistical analysis were used for analyzing the data. The results revealed that SME Companies should focus on Environmental factor (EF) as it is the most identified factor lead BI efficiency in Business Organization.

1. Introduction

Today’s enterprises require to experience the challenge of responding to turbulent market change. They are require to meet the rising customer requirements and to provide the quality product within a short product lifecycle [1]. In recent years, market enthusiasm toward business intelligence (BI) is overwhelming [2, 3]. According to Gartner [3], BI spending rose 16 percent in 2012 to hit $12.9 billion. Meanwhile, a CIO survey of 251 IT leaders revealed that more than 56 percent of organizations are considering expanding their usage of BI [4]. However, the question is raised that big companies are going ahead while the Small-medium-company are left behind and they are incapable of keep pace with their big jaunt. This is the reality or fact that most of the companies knows the benefits of using BI technologies which are able to handle huge amount of unstructured data to develop, identify and innovate new strategic opportunities for business. To allow for the easy interpretation of these large volumes of data is the main goal of BI. Identification of the new opportunities and implementation of an effective and doable strategy based on data insights can provide competitive market advantage and long-term stability for businesses to flourish. Nevertheless, BI technologies deliver historical and predictive views of business operations. Frequently used functions of business intelligence technologies that include online analytical processing, data mining, reporting, analytics, process mining, business
performance management, complex event processing, text mining, benchmarking, prescriptive analytics, and predictive analytics.

There are lot of SME Technology based companies established in Malaysia which was investigated in [5]. However, implementing Business Intelligence (BI) system are very inadequate although a comprehensive and competent BI Strategy is crucial to succeed in Business. Lacking of business intelligence encounters nearly every processes of business growth. Avoiding Business Intelligence, any team of business organizations experience difficulties to sorting out through reports to locate the right data, weakening the decision-making process. There are few smart organizations institute a unified and effective system that can grow with the company instead of becoming obsolete in a couple of years. This kind of system pays dividends immediately payroll hours which are considered more efficient, forecasting is more accurate, and streamlined processes are more productive. Making smooth and coordinated operation of any organizations, Business Intelligence adoption is none but critical nowadays. As such, the use of BI is becoming more prevalent in organizations of different industries. Nevertheless, it has found out that some SMEs in Malaysia that invested in BI did not earn the promised benefits. There are still need for rigorous investigation and validation on BI readiness [6]. Therefore, it is dire need to assess the efficiency factor for implementing Business Intelligence. This study will focus on investigating what is the most crucial factor and the reason of using BI throughout the organization.

2. Related Work
It is important to conduct an extensive literature review pertaining to the research area for establishing a better understanding and insight into the topics discussed. Reviewing the existing literature critically will provide a solid theoretical foundation to the selection of research methodology, as well as justification that the proposed research enlarges a new contribution to the body of knowledge [7]. Adoption of BI system from preliminary ideas include a progress decision-making procedures of top managers, supply chain managers, and customer relationship managers as well as to ease the company by sharing data insights. According to the requirements of the managers, the customization of the BI system is the most significant factor of successful adoption of BI. In addition, the importance of all system life cycle stages can be emphasized for the successful BI adoption in general. Business Intelligence (BI) is a Technology tool that allows its users to leverage the best utilize of their data. BI tools provide aggregation, analytics and reporting functions on the organizational data to summarize and to aggregate information. However, the absence of enablers might undermine the benefits. In this section, Heeks Design-Reality gap model [8] is considered as a lens to review the literature and determine obstacles for BI adoption in public sector organizations. There are various elements of BI adoption. These include; Technology, Information, Processes, Objectives, values, staffing, management, school and Other resources. Maturity towards implementation of Business Intelligence is prevalent before Identification of BI performance or determinant factor towards the organization. It is therefore needed that information maturity level of the organization has a strong effect on BI technology which needs to be considered prior embarking on BI initiatives [9]. The Information Evolution Model proposed by Davis, Miller, and Russel can be used to evaluate the information maturity of the organization in regard to process, infrastructure, culture and people [8].

According to Ventana Research’s benchmark report on a sample of 308 participants around the world (executives, management, and users across a range of roles and titles working in IT organizations), 85 percent responded that organizations are still at the lower levels of a maturity chart in their use of BI as a result of poor knowledge and usage of advanced BI capabilities [11]. There are many existing business intelligence model, noticeable mostly focuses on technical and process issues on Business. In fact, due to lack of focal point on other critical aspects likewise organization, many business organizations are not yet advanced stages of BI implementation that require to draw attention and improvement.

Literature related review on Critical Success Factor (CSF) for successful BI system is inadequate than other information System research [12]. However, there are already enormous studies took place on BI success factor [13]. In addition, earlier works disclosed the importance of various issues such as personal, technical, educational, and business [14]. Hence, some authors identify CSFs of BI in different
dimensions that include organization, environment, and project planning. In the perspective of the organizational dimension, top management support is considered as the most essential success factor [15, 14, 16]. In particular, Ang and Teo described that successful implementation completely lies on the strong, commitment, and persistent of top management [15]. The reason is that organization can surpass political resistance by the assistance of management support and encourage proactive presence throughout the organization [14]. Hwang, Ku, Yen and Cheng [16] further reassure that strong executive sponsorship is pivotal to demonstrate commitment to the BI project, and reinforce the vital linkage of a BI system to business strategy. In addition, on view of the project dimension, Herrmann [17] states that project planning and standardization of activities and documents are needed to reduce the difficulties in collaborating with other organizational units, as well as to minimize coordination and management costs. Apart from this, the project team needs to ensure that a more complete representation of the entire organization occurs within the data warehousing project [18], as the BI initiative always involves a variety of organizational stakeholders over a lengthy period. From the technological perspective, Knox [19] emphasizes that management must focus on building BI data environments based on a central data warehouse that allows direct writing of BI applications, constraining DataMart creation and introducing standards across data repositories.

3. Methodology

3.1 Conceptual Framework Design
The conceptual framework of this research is presented in Figure 1. In this research, 5 dependent variables and 1 independent variable took into consideration to depict the Business Intelligence Efficiency which are management factors, technology factors, organizational factors, environmental factors and facilitating condition factors.

Management Factors
Describing the management factors in this study considered management of the data in the organization. How valuable and important it is in having data are more consistent and more complete. It is important to know about data consistency which refers to that data values are the same for all instances of an application or for all multiple data sets. Data consistency is crucial to the functioning of programs, applications, systems and databases in the organizations. In addition, to meet requirements of current as well as future demand for information, data completeness is also essential. Data completeness ensures that the above criterion is established. Having complete data can give an accurate guidance of the business organization’s decision maker. Therefore, producing demographic by BI from data could give a better security of company’s data for its produced output and and worked to address the business problem and process which make the companies to reach on high level of better performance. None the less, management support and sponsorship with top management decision for BI implementation considered as precondition to BI efficiency [5].

Technological Factors
Technological factor is indeed a ground breaking factor in extending business value and performance. There are many substances used to make it realistic, Business Intelligence is none but one of them. It is proven by the Porter and Miller [21] by their research framework which proposed to ground measures of IT use and IT performance impact [22]. Apart from this, Delusion of Innovation theory (DOI) used as fundamental innovation theory for many disciplines including communication, sociology, marketing, education [23, 24] as well as Technology that describes many innovation factors such as compatibility, trainability, complexity, observability and relative advantage which influence to determine acceptance or rejection of IT innovation such as Business Intelligence [20]. However, these are sourced factors that measures of Business intelligence efficiency in organizations. Boonsiritomachai, McGrath, & Burgess [25] found that other than those technological factors manager owner-manager innovativeness and owner-manager IT knowledge are also crucial to ensure Business Intelligence efficiency. Uçaktürk,
Uçaktürk, & Ya-vuz [26] highlights better scalability as technologic factor that using Business intelligence system organization can handle of lots of data in order to accommodate the company’s growth on efficiency level.

**Organizational Factors**
As earlier mentioned TOE framework [27], describes organization factor also one of the factor need to consider for Business Intelligence adoption in organizations. Besides. After reviewing papers collected for measuring business efficiency, it is found that organizations BI adoption can be affected by many factors. It is there-fore need to point out which factors are mostly responsible to determine Business Intelligence efficiency. Porter [21] proposed a framework called as Porter’s framework’ which can measure of IT use and IT performance impact [22]. Porter [21] in his framework introduced size and time can be a vital factor in Business Intelligence efficiency. This is because company size and time influence by each other and even could be mention as integral part. Another possible BIS adoption factor is absorptive capacity [28] In addition, vendor selection, better decision, management system and structures are also identified determinants for Business Intelligence efficiency which are suitable to place as organization factors.

**Environmental Factors**
The TOE framework [27] determines three context groups which are technological, organizational, and environmental. However, “The technological context refers to internal and external technologies applicable to the firm. Organizational context refers to several indexes regarding the origination, such as firm size and scope, centralization, formalization, and complexity of managerial structure and the quality of human resources. Environmental context refers to a firm's industry, competitors and government policy or intention” [29]. Competitors are also responsible to influence on Business efficiency by putting pressure on their counterpart business organizations to change its old environment to cope up with other business organizations [30]. In working organizations, supervisors and co-workers are prominent in identifying technology acceptance behavior [31] which supervises business efficiency level. Last but not least, continuous process improvement in organization is also significantly crucial factor for business to succeed.

**Facilitating Condition Factors**
Before knowing the Resource facilitating condition, it is important to know about facilitating condition which refers to an organizational and technical infrastructure to support the utilization of acquired systems in their contexts. However, according to Taylor and Todd [32], they separated facilitating condition into two types: Resource and Technology. Only Government support is not enough, organization must be facilitated by resources, business activity, business process monitoring, improved training, competitive intelligence, cost saving, as well as cooperation between different platforms. Other important types of determinants are related to the management of the company. Behavior of organization’s leaders towards change of organization is an individual characteristic which includes a part of DOI theory [20]. In other studies, same or closely related factors are also presented, like Ifinedo [33] where “management support” is referred as top management involvement with Information System implementation that influence acceptance of other organizational members. Decision-making in SMEs is considered a part of the top management roles. Therefore, similar factor can be expressed as “top management support” [34], which fall into a facilitating condition of this framework.
4. **Analysis and Presentation of Results**

In this research, descriptive statistics were used to find out the participating organizations’ demographic data and to provide an initial insight to BI efficiency factors of Malaysian organizations as well as foreign companies which will be a predictive insight for the new SME companies [35]. From the targeted two hundred questionnaires sent to the BI companies, 55 forms were returned of which 55 were deemed useful and complete. For this project, the results of the descriptive and frequency analyses are shown in Tables 1-4.

| Table 1. Profiles of the Respondents |
|--------------------------------------|
| Category | Frequency | Percentage |
| MF | 40 | 72.70 |
| TF | 22 | 40.00 |
| OF | 23 | 41.82 |
| EF | 15 | 27.30 |
| FCF | 43 | 78.20 |

Table 1 is accumulated the information of respondents Gender, Age, Category, Position, and task in the organization. According to the table, for the Gender, Male participation accounted for the highest frequency at 40 over N=55 which is considerably 72.70%. In addition, for the Age, group of 35-44 considered for the highest frequency rate at 22 out of N=55 that is 40% of the age groups, followed by
organization where IT Application type is identified as prominent with frequency rate of 23 (41.82% in total). Moreover, Sub ordinates in the position category took highest point of percentage at 27.30% with 15 responses. Lastly, for the Task section, 43 experts mentioned use of BI tool ‘occasionally’ in their business function which comprises 78.20% of total population and it is clearly shown, this is also the highest level of frequency recorded compared to other category.

| Factors | Agreement Responses | Disagreement Responses |
|---------|---------------------|------------------------|
| MF      | 65.5                | 43.6                   |
| TF      | 56.4                | 16.3                   |
| OF      | 58.2                | 9.1                    |
| EF      | 58.1                | 18.2                   |
| FCF     | 58.2                | 18.2                   |

On the Table 2, Management factor is identified the highest percentage of 65.5 that respondents are agreed upon and expressed mostly positive for the statement number 10 “Company used Business Intelligence is fully addressable and capable of Identifying Business problem and process (MF10)”. In addition, Management Factor (MF) is also recognized highest disagreement for the statement “Incomplete non-critical data may not matter to the business (MF5)” and total 43.6% are disagreed for Data incompleteness as matter of problem which is basically shown that both cases Management Factors mostly influence for determining Business Intelligence Efficiency either positively as well as negatively.

| Factors | Agreement Responses | Disagreement Responses |
|---------|---------------------|------------------------|
| MF      | 16.3                | 3.6                    |
| TF      | 31.0                | 5.4                    |
| OF      | 41.8                | 1.8                    |
| EF      | 16.4                | 1.8                    |
| FCF     | 23.6                | 1.8                    |

On this Table 3, Management factor is seen the lowest percentage of 16.3 that respondents are agreed upon and expressed mostly negatively for the statement no 3 “Data consistency have a negative impact on the effective use of data in organizations (MF3)”’. In addition, respondents are lowly disagreed consequently for the statement no 8 from Organizational Factor (OF) and statement no 2 from Environmental Factor which are “Management provided IT Training and education to the employers” and “Individual differences determined progressive outcome of company”. Lastly, both factors are least disagreed for total of 1.8% in mentioning training are not provided and difference are not good for the company. Thus, it is observed from this table that Management factor have slightly lower influence on BI system efficiency and higher influence on Organization Factor (OF) as well as Environmental Factor (EF).
Lastly, the Table 4. shows that statistics for 50 statements from each factor by 10 on measuring efficiency factors, although, it is a summary of those statements providing mean and standard deviation. Having 5 factors with a sample N=55, mean and standard deviation defers from each other. In this final point of analysis, the mean for MF is 4.70, followed by TF (4.81), OF (5.01), EF (4.67), and FCF (4.71). In contrast, Standard Deviation reported consequently MF (1.81), TF (2.02), OF (1.91), EF (1.99), and FCF (1.99). On this table, Standard Deviation are quietly close to the Mean and Environmental Factor is nearest where the mean value is 4.67 and standard deviation is 1.99. According to The relationship between Factors mean and standard deviation are MF 2.88, TF 2.79, OF- 3.90, EF 2.68 and lastly FCF- 2.72. Therefore, this assures respondents have decided Environmental factor (EF) would make a difference for BI efficiency in Business Organization, followed by Facilitating Condition Factor (FCF).

While this research has ended up with insightful analysis and findings. However, it was a real challenge getting the data and doing the analysis for accomplishment of the project. Many companies rejected to participate in the project because of their restriction and violation of company’s rules and regulations. However, above all of the constraints, the research was carried out with proper time management and with dedication to create a new value for the SME companies to ease them for future Technology adoption like as Business Intelligence (BI), a advanced technology for data analysis, in order to achieve its business goal and create more value to the industry with proper use of technology and operations. Besides, analysis of demographic factors could lead to improve further understanding of BI in varying contexts, and thus contributing to more effective BI investments.

5. Conclusion
It is believed that this research project will lead a comprehensive understanding of identification of factors for SME companies right after company’s readiness as well as BI maturity on adopting a dynamic Information System. This analytical study could assist existed organizations to focus their BI improvement as efforts on the critical factors to advance overall BI infrastructure and activities. As like few other country, Malaysia’s tremendous participations in SMEs sector is also outnumbered which played a vital role for the economic development in last few decades. However, adoption on BI Technology are still yet to emerge in order to survive with other Big industries for better understanding of customers as well as accelerating the business process in Malaysia.

6. Acknowledgement
This research is supported by International Islamic University Malaysia research grant.

References
[1] Lee, C. K., Lau, H. C., Ho, G. T., & Ho, W. (2009). Design and development of agent-based procurement system to enhance business intelligence. Expert Systems with Applications, 36(1), 877-884.
[2] Evelson, B., 2012, *Top 10 BI predictions for 2013 and beyond* [Online]. Available at: http://blogs.forrester.com/boris_evelson/12-12-12-top_10_bipredictions_for_2013_and_beyond [Accessed: 11 January 2013].

[3] Gartner, 2013, *Gartner says worldwide business intelligence software revenue to grow 7 percent in 2013* [Online]. Available at: http://www.gartner.com/newsroom/id/2340216 [Accessed: 13 March 2013].

[4] IDG Enterprise, 2013, *CIO magazine tech poll/tech priorities survey* [Online]. Available at: http://www.cio.com/documents/pdfs/CIOTechPrioritiesFeb2013.pdf [Accessed: 11 August 2013].

[5] Anjariny, A. H., & Zeki, A. M. (2014, December). Management dimension for assessing organizations' readiness toward business intelligence systems. In Advanced Computer Science Applications and Technologies (ACSAT), 2014 3rd International Conference on (pp. 21-25). IEEE.

[6] Anjariny, A. H., & Zeki, A. M. (2013, December). The important dimensions for assessing organizations' readiness toward business intelligence systems from the perspective of malaysian organization. In Advanced Computer Science Applications and Technologies, 2013 International Conference on (pp. 544-548). IEEE.

[7] Ellis, T. J. (2006). The Literature Review: The Foundation for Research.

[8] Heeks, R. (2002). Failure, success and improvisation of information systems projects in developing countries.

[9] Crossland, M (2010). How Business Intelligence is Adding Business Value. University of Cape Town. Retrieved from https://books.google.com.my/books?id=ot-LXwAACAAJ on 19 April, 2016.

[10] Davis, J., Miller, G. J., & Russell, A. (2006). Information revolution: using the information evolution model to grow your business (Vol. 4). John Wiley & Sons.

[11] Ventana Research. (2010). “Business intelligence and performance management for the 21st century,” Pleasanton, CA, Apr. 2010.

[12] Yeoh, W., Koronios, A., & Gao, J. (2006). Critical Success Factors for the Implementation of Business Intelligence System in Engineering Asset Management Organisations. In Engineering Asset Management (pp. 344-351). Springer London.

[13] Scholz, P., Schieder, C., Kurze, C., Gluchowski, P., & Boehringer, M. (2010). Benefits and challenges of business intelligence adoption in small and medium-sized enterprises. In A. Trish, M. Turpin, & J. P. van Deventer (Eds.), *Proceedings of 18th European Conference on Information Systems, ECIS2010*.

[14] Wixom, B. H., & Watson, H. J. (2001). An empirical investigation of the factors affecting data warehousing success. *MIS Quarterly*, 25(1), 17-41.

[15] Ang J & Teo. (2000) Management issues in data warehousing: insights from the Housing and Development Board. Decision Support System, 29(1).

[16] Hwang, H. G., Ku, C. Y., Yen, D. V., & Cheng, C. C. (2004). Critical factors influencing the adoption of data warehouse technology: A study of the banking industry in Taiwan. *Decision Support Systems*, 37(1), 1-21.

[17] Herrmann C. (2004). Exploring the Structural Dimension of Data Warehouse Organizations: Results of a Survey and Implications. Proceedings of The IFIP TC8/WG8.3 International Conference, Tuscany.

[18] Little R & Gibson M. (2003) Perceived influences on implementing data warehousing. IEEE Transactions on Software Engineering, 29(4), 290-296.

[19] Knox, M (2004) Asset Managers are Building Their BI Environments, Gartner Research, April.

[20] Rogers, E. M. (1995). Diffusion of Innovations The Free Press. New York.

[21] Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage.
[22] Zhu, K., Kraemer, K. L., & Dedrick, J. (2004). Information technology payoff in e-business environments: An international perspective on value creation of e-business in the financial services industry. Journal of Management Information Systems, 21(1), 17-54.

[23] Gopalakrishnan, S., & Damanpour, F. (1994). Patterns of generation and adoption of innovation in organizations: Contingency models of innovation attributes. Journal of Engineering and Technology Management, 11(2), 95-116.

[24] Premkumar, G., & Ramamurthy, K. (1995). The Role of Interorganizational and Organizational Factors on the Decision Mode for Adoption of Interorganizational Systems*. Decision sciences, 26(3), 303-336.

[25] Boonsiritomachai, W., McGrath, M., & Burgess, S. (2014). A research framework for the adoption of Business Intelligence by Small and Medium-sized enterprises. In Small Enterprise Association of Australia and New Zealand 27th Annual Aeaanz Conference.

[26] Uçaktürk, A., Uçaktürk, T., & Yavuz, H. (2015). Possibilities of Usage of Strategic Business Intelligence Systems Based on Databases in Agile Manufacturing. Procedia-Social and Behavioral Sciences, 207, 234-241.

[27] Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). Processes of technological innovation. Lexington Books.

[28] Venkatesh, V., & Bala, H. (2012). Adoption and Impacts of Interorganizational Business Process Standards: Role of Partnering Synergy. Information Systems Research, 23 (4), 1131-1157. doi: 10.1287/isre.1110.0404.

[29] Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. Industrial management & data systems, 111(7), 1006-1023.

[30] Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. MIS quarterly, 31 (1), 59-87. doi: 10.2307/25148781.

[31] Schmitz, J., & Fulk, J. (1991). Organizational colleagues, media richness, and electronic mail a test of the social influence model of technology use. Communication research, 18(4), 487-523.

[32] Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. Information systems research, 6(2), 144-176.

[33] Ifinedo, P. (2011). An empirical analysis of factors influencing internet/e-business technologies adoption by SMEs in Canada. International Journal of Information Technology & Decision Making, 10 (4), 731-766. doi: 10.1142/s0219622011004543.

[34] Premkumar, G., & Roberts, M. (1999). Adoption of new information technologies in rural small businesses. Omega-International Journal of Management Science, 27 (4), 467-484. doi: 10.1016/s0305-0483(98)00071-1.

[35] Ong, I. L. (2014). An empirical study on business intelligence adoption and maturity in Malaysian organizations (Doctoral dissertation, UTAR).