Assessing Organizations' Readiness toward Business Intelligence Systems: A Proposed Hypothesized Model

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Abstract— **Nowadays, the concept of Business Intelligence (BI) is being implemented within many organizations around the globe. Organizations invest billions of US dollars aiming to improve their timeliness and quality of the input to the decision process, where BI is the targeted keyword. However, organizations are often faced with many challenges in achieving the expected outcomes of BI systems within their firms. Here, one of the most cumbersome obstacles is the organizations' readiness toward BI systems. Therefore, it is highly justified to assess organization's readiness toward BI systems to avoid any loss and to enhance the overall revenue. This paper presents a brief history on BI systems and the challenges of their implementation within organizations. A review and analysis of models for assessing organizations' readiness toward BI systems is established to understand their weakness and strength points. Finally, this paper proposes a hypothesized framework for solving readiness assessment issues within organizations which will be evaluated in the coming studies.**

Keywords- business intelligence; business intelligence readiness; business intelligence success; hypothesized model; readiness factors; success factors.

I. INTRODUCTION

The growing demand for Business Intelligence (BI) applications ignites researchers to keep on investigating this field over and over again [1][2]. BI applications and systems have become almost inevitable in enormous fields including mobile phones [3][4]. The ability and flexibility of BI in terms of performance management, data mining, monitoring business activities and traditional decision support, planning and budgeting, and business reporting make it as an attractive investing system [1][5]. Nevertheless, the concept of BI is not totally understood by the related community. Thus, defining the concept of BI is an important matter. BI has been defined in many ways in the literature, some of which are irrelevant to this study; however, the most relevant one here is having the right access to the right data or information needed to make the right business decisions at the right time [7].

Historically, BI appeared as Management Information System (MIS) in the mid of 1960s. With the rapid development of computer technologies, Decision Support System (DSS) was appeared in 1970s [6]. The technology improvements and advancements kept improving to come up with executive information systems and Data Warehousing (DW) systems. However, the massive growing in the demand for a sophisticated DW system led the researchers to coin the term BI as a replacement [29]. Since then, BI systems are the predominant technology in use.

This paper is organized as follows: Section II discusses the literature review and the attempts made for assessing organizations' readiness toward BI systems. Section III presents the proposed hypothesized model and implementation methods. Finally, the concluded remarks and points are summarized in Section IV.

II. LITRATURE REVIEW

A. Organizations' Readiness towards BI Systems

BI is considered as a necessity for a lot of organizations. According to a survey done by Gartner Group in 2008, BI was considered as the top priority for CIOs [10]. In the same regard, the global spending on BI, analytics and performance management applications jumped 13.4 percent in 2010 to reach US$10.5 billion, according to figures released by analyst firm Gartner [11]. Having spent huge amounts on BI, a special care must be taken to ensure the Return of Investment (ROI) of BI systems. However, some studies show that the ROI of BI systems was questionable [12]. This is due to some challenges in the implementation of BI systems at organizations. The most cumbersome issue is organization readiness towards BI systems [9][13-15][19]. Therefore, the investigation of Readiness Factors (RFs) and Success Factors (SFs) which affect the performance of BI systems in real implementation is needed.

B. Attempts for Modeling the Assessment of BI Readiness

BI readiness can be defined as the degree to which a given company is prepared to make the changes that are necessary to capture the full business value of BI [12]. In this regard, to maintain a successful implementation of BI systems, two aspects have to be tackled, namely, the technical aspect and the business aspect. The technical aspect, delivering information to BI user community, has been investigated and well-understood, as it was the first to be considered. However, business aspect is relatively a new area of research [12][13][14]. The challenge here is

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how to drive BI systems to deliver a good quality business value to the user. In addition, it should develop business methods to ensure that BI investments payoffs [12]. In doing so, an assessment for organizations' readiness toward BI systems will have major contribution in reducing the high failure rate of BI project. Assessing organization's readiness toward BI systems is still a hot research area which needs to be reinvestigated [14][16][17]. The key-points which can be summarized from the previous studies are:

- discovering readiness factors and all related issues that may affect the successful implementation of BI system,
- developing questionnaires and surveys to examine the organizations' readiness based on discovered readiness factors,
- building-up models for assessing organizations' readiness toward BI systems.

Nonetheless, the validation of previous research findings yet to be proven. Thus, the consideration of all above key points is critical in describing the proposed scheme.

The investigation of readiness factors goes back in time for about a decade or so. One of the first ideas in this field was coined in [15], where the authors described their vision in transforming some strategic lessons for managers who use technology to improve organizational performance. They also raised interesting questions about the means by which information technology can be used to gain competitive advantages. They proposed a DW called VISION that stored information about client behaviors, client buying preferences, and client value positions. They linked the information from VISION to other information collected from First American Corporation to improve the competitive stance. They came out to a conclusion that deploying information technology tools, e.g. DW systems will aspire to a radical change at the organization.

As suggested in [15] B. Wixon and H. Watson carried on the research by proposing a cross sectional survey investigation for developing a model of DW success. They assumed in their study that there was a little empirical research about the implementation of the DW projects. They collected their data from managers and data suppliers from 111 organizations by mail questionnaire mainly on implementation factors and success of the DW. The model in their study is divided to three stages, namely, implementation factors, implementation success, and system success [16].

This study came out with the identification of a significant relationship between system quality and data quality factors and perceived net benefits. Thus, contributing to the way in which implementation SFs can be grouped together into organizational, project, and technical to more clearly communicate with kinds of effects implementation factors may have. In addition, they suggested that most of the traditional factors such as management support and resources affect the success of DW and provide further evidence for common success implementation factor. However, they declared that their models cannot be used to investigate DW without some modifications.

As a consequence of previous attempts in modeling SFs, M. Hwang proposed a framework for analyzing SFs of the implementation of the DW [14]. In his study, the utility of the framework was illustrated by classifying SFs discussed in eight academic journal articles. The framework in this study identified several research opportunities that may benefit the practice and research of DW. Although, the study offered a valuable comparison and assessment for the SFs but the study lacks of a validation model for extensive study of further SFs. As a final recommendation, the researcher highlighted that all these factors shouldn't be treated equally. In other words, the value of each one should have different weight, as they impact differently on the success of DW implementation.

Up to this point, most researchers focused on DW other than BI. One of the earliest researches which connect BI systems with design and implementation strategies was presented in [18]. This research described the life cycle comprising various phases of a BI system. It also discussed the issues of implementation of BI in organizations based on a case study. Although, the study is considered as a pioneer in the field and has rich information about readiness factors but it doesn't offer a real solution or model for BI assessment.

A new theme was proposed in addressing Critical Success Factors (CSFs) for DW was presented in [19], where a survey was conducted to gain insight into DW success issues based on DW professionals' answers. This study assumed that there were three interrelated questions link success factors and DW success which are:

- What constitutes to DW success?
- What factors contribute to DW success?
- Which factors are related to which success measures?

Based on these questions, the researchers developed their methodology which listed eight DW success measures, namely, ease of use, speedy information retrieval, more information , better quality information, improved productivity, better decisions, improved business process , and increased competitive positions. In addition to that, basing on 11 success factors, found in the literature, the study proposed that the success factors are related to four feasibility tests of information systems development projects, listed in table 1. It is interested to mention that, they used an indicator about how important each success factor is. This will later on determine which factors will be addressed the most. Moreover, for the success measures and success factors, the researchers used 1-to-5 scale as a response to the questionnaire. Following the same scenario, the authors expanded their study to gain a better understanding of DW implementation success factors in [21] where they conducted a study on CSFs for DW implementation using survey method to collect the data on 11 implementation factors perceived by DW

professionals. The data was analyzed for identifying the best subset of variables using common criteria available in popular statistical packages such as Minitab. These criteria include R^2, C_p, the total squared error and S, and the average prediction mean square error. Upon the analysis, the authors could affirm results in table 1 and contribute to the understanding of factors that impact DW success. However, the study was based on a survey of respondents of DW professionals; which means their perception on the success of the delivered system is probably not without bias. Thus, further research should include the views of the end users of DWs. Also, is interesting to mention that the relationships between success factors should be investigated and validated in order to have an extensive view on the overall behavior.

As reviewed above, up to this point, not much of a research had been accomplished in addressing the factors that play critical roles in the implementation of an information system as well as BI systems. That what led W. Yeoh, A. Koronios, and J. Gao to propose an imperative approach for validating and addressing CSFs [20]. This approach was proposed to enable BI stakeholders to focus on the key issues that lead to successful BI systems' implementations. In their method, the authors utilized the Delphi method to conduct two rounds of surveys with 10 BI system experts of engineering asset management organizations domain. Upon the first round of the survey, the authors could elicit many factors, however, 10 of them received a panel consensus of more than 70% were reported in their study. The 10 crucial CFSs are summarized in Fig 1.

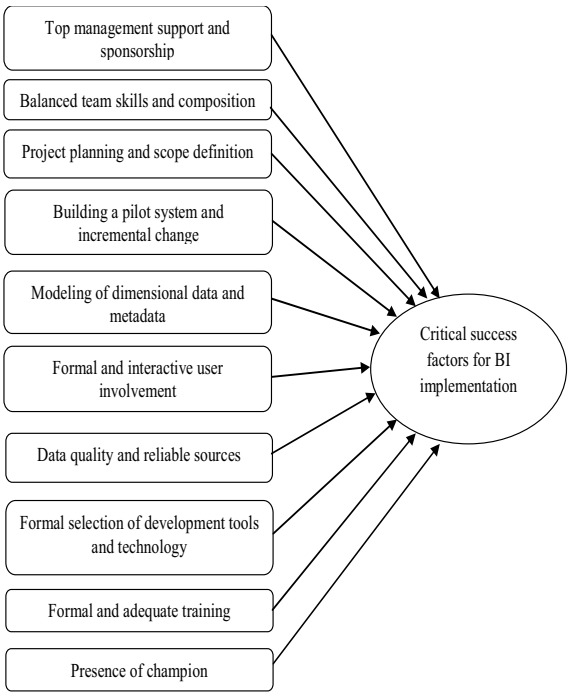

Figure 1. CSFs for the implementation of BI systems [20].

TABLE I. SUCCESS FACTORS FOR DW [19]

Feasibility Test of IS Development Project	Success Factors
Operational	Clearly defined business needs/benefits
	Top management support
	User involvement participation
Technical	Source-data quality
	Proper development technology
	Adequate IS staff and consultants
	Project management (team work)
Schedule	Practical implementation schedule
	Proper planning/scoping of project
Economic	Adequate funding
	Measurable business benefits

W. Yeoh, A. Koronios, and J. Gao presented another attempt of developing a critical success factor frame work for implementing BI systems based on a Delphi study in engineering asset management organizations [22][23]. The authors in this research used the results of three rounds Delphi study with 15 BI systems experts in the domain of engineering assist management. They provided in their study a CSFs framework consist of seven dimension and 22 factors crucial for successful BI system implementation. The proposed critical dimensions are management commitment and championship, user oriented change management, business vision, project planning, team skills and composition, data and infrastructure related dimensions. It was revealed by their study a new trend towards multidimensional challenges in implementing BI systems. Interestingly, it was found that non-technical dimensions were perceived to be more important than the technological ones because the BI team considered then outside their direct control. Also, it was indicated that the 22 CSFs exist in the above mentioned seven major dimensions.

The maturity of the outcomes from the reviewed attempts has led Arnott to utilize the identified CSFs set to analyze the failure of a corporate DW/BI project and the subsequent of a smaller functional BI system [24]. The new in this study is the CSF analysis approach which was done within the project's organizational context and in terms of the dynamics of CSF over the life of the project. The study used detailed case description made the organizational context clear. In addition, the data analysis was divided into three natural eras, the dynamic of the CSFs were also uncovered. The study contributed in more comprehensive understanding of the CSFs and their effect on the overall BI system performance. Dividing the case into three eras provided stronger evidence for the robustness of CSFs set than one round case study. The first limitation of this study is data collections and analysis reliability which could be improved by using a case protocol based on the theoretical background of the project. Secondly, there is a problem concerning

constructing the validity which could be minimized by multiple data sources, having participant validate transcripts , and through clarifying phone calls and email to participant. In addition to that, a single case study is not adequate in generalizing the results to other engagements. This could be overcome by using more one stage of study or extending the study to more than one project.

A relatively new theme was adopted in [13] to study CSFs for BI systems. The study followed two-stage qualitative approach where the authors utilized a previous three rounds Delphi method study to develop a CSFs framework crucial for BI systems implementation [22][23]. Next to that, the framework and associated CSFs were verified through five case studies of large and complex organizations. In the five case studies, the authors addressed CSFs from both business and technological prospective, and they came out with a result that non-technical factors, including organizational and process related factors, are more influential and important than technological and data related factors. They also highlighted that CSFs should not be applied to BI systems without giving careful consideration to the relevant contextual issues.

It was shown that the technical, business, and managerial issues related to CSFs for BI implementation were extensively reviewed and widely addressed by a number of studies [9][16-19]. It is logical to raise the question are the CSFs discovered so far the solely role makers in successful implementation of BI? An attempt to answer this question was reformed in [2], where the authors adopted a research in documenting BI specific CSFs that industry partners, vendors or systems users have identified in their presentations at conferences, educational forms or formal user group meetings. The research analyzed the applicability of existing CSFs associated with the implementation of BI systems as an extension of an Enterprise Resource Planning (ERP). The aim was focused on determining how relevant these factors to each other and whether there are new success factors not previously documented by academic literature. A total of 9868 presentations were used as a source in this study. They mainly were located online or retrieved from conferences CDs. One of the important outcomes of this was identifying two CSFs were not previously reported, namely, training and changing management.

Although a number of researches have addressed CSFs for implementing BI, but the lack of an extensive and universal model is still questionable. Therefore, studying weaknesses of previous studies is obviously the gate for any new reseach. It can be summarized from previous attempts the following weaknesses were noticed:

- Addressing of an extensive and universal model to cope with all CSFs needs and considerations yet to be evaluated.
- The CSFs which have been uncovered and addressed are not the only factors that may affect the success of BI implementation. In other words, the consideration of CSFs may fall in some issues related to bias in the judgment, lack of experience, business trends,and cultural effects.
- Qualitative – quantitative survey models yet to be validated based on variety of organizations to prove or disprove the applicability of such models.

III. PROPOSED HYPOTHESIZED MODEL

In this section, the paper highlights the proposed attempt scheme to overcome the cumbersome issues discussed above by creating a hypothesized model based on selected and justified SFs, then the model will be used to these validated RFs based on survey results.

A. Theoritical Framework

Generating a model for assessing organizations' readiness towards BI systems is not an easy task. As we have seen above, many researchers attempted to develop models for such purpose. The common point of those researches was based on what is called CSFs [13][14] [19] [2][22][23], Key Success Factors (KSFs) [26], Implementation Success Factors (ISFs) [30], SFs [24] [33] or Implementation Factors (IFs)[16] [21], while others preferred to call it Readiness Factors (RFs) [12] [28] [31] [33]. Generally, these names (CSF, KSFs, ISFs, SFs, IFs or RFs) refer to the factors that lead to successful implementation of BI systems and this is the aim of this study. These terms differ from success measurements of BI system performance, which will be beyond the scope of this study. As SFs play a critical role in forming any model aimed to assess the readiness of BI systems, it is then logical to address SFs and their related issues. In this regard, some of the researchers preferred to consider CSFs in their framework as dimensions of multiple factors [22][23], while others preferred to use the categorization of SFs to main and sub-factors [2] [16] [19]. In this study, we prefer to use the dimensions to encapsulate all related SFs under one dimension to facilitate reforming the theoretical framework.

After considering previous studies, weakness points, users' and vendors' demands, technology scope, and etc., this paper takes into consideration all SFs and RFs dimensions listed in Table 2. Encapsulating all these dimensions in one framework reforms the proposed hypothesized framework of this paper. This framework is presented in Fig. 2.

B. Methodolgy

- Population and samples

The sampling method used in this study is probabilistic and randomization. The respondents of this study will be business and IT managers from organizations in Malaysia. 40 participants or more will be targeted for the first round

survey, while for the second round survey 200 or more participants will be targeted.

- Research instruments

A questionnaire consisting of items that measure organization's readiness toward BI systems will be developed to suit this particular study. A seven-point Likert scale questions asking the respondents for their indication of the degree of importance for the readiness factors/success factors constituting the constructs in the questionnaire will be used.

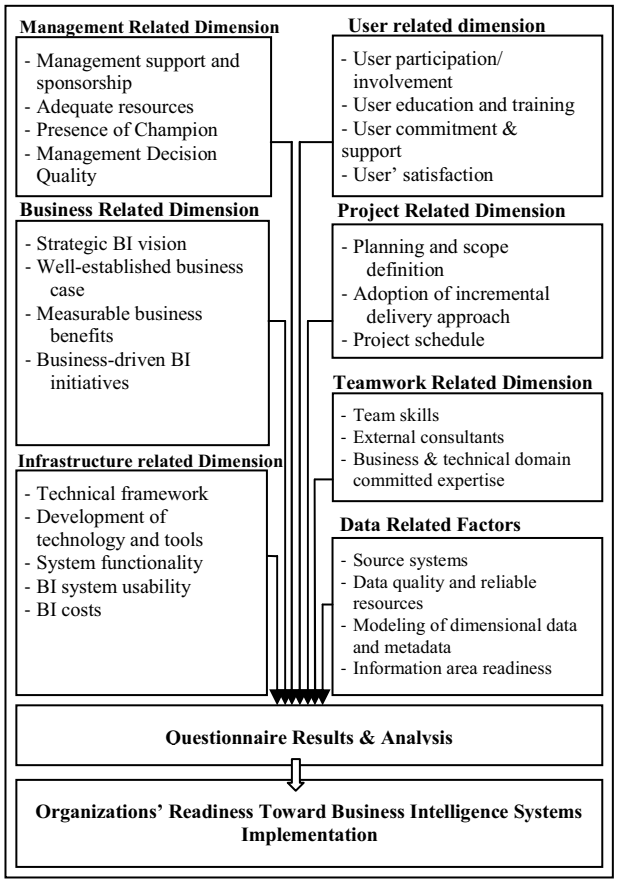

Figure 2. The proposed hypothesized framework.

- Data Collection

Two rounds survey based on Malaysian Organizations Context (MOC) will be conducted in which a pilot study will be the first, and the second round will be partially based on the responses to the pilot study. Therefore, in this section, pilot study elements will be presented and the discussion of the second round will be delayed after conducting the pilot study. The surveys will be conducted through both an online based survey and hand collected surveys.

- Data Analysis

The results from the pilot study will be presented in a response to a seven point likert scale. These results will be fed as inputs to SPSS 16.0 and AMOS 16.0 software. The outputs will be represented in validating the importance of each factor as percentage of weight. Based on the validated weights, the next round survey will be re-designed and conducted to ensure the accuracy of the model.

TABLE II. RFS AND CSFS (DIMENSIONS) AND THEIR SFS

Dimension	Readiness Factors (RFs) and Success Factors (SFs)
Management	Management support and sponsorship [16] [20][29]
	Adequate resources [16]
	Presence of champion [31]
	Management decision quality [24][26]
User	User participation/involvement [16][23]
	User education and training
	User comitment [27]
	User satisfaction [32]
	User support [28][30]
Business	Strategic BI vision [9][23]
	Well-established business case [23]
	Clearly defined business need [31]
	Measurable business benefits [17][25]
	Business-driven BI initiatives [23]
Project	Planning and scope definition [23]
	Adoptiong of incremental delivery approch [23]
	Building a pilot system [31]
	Project schedule [25]
Teamwork	Team skills [31]
	External consultants
	Business domain committed experise [9]
Infrastructure	Source systems [16] [23]
	Technical framework [23]
	Development of technology and tools [16]
	System functionality [27]
	BI tools [29]
	BI cost [27][25]
	BI system usability [27]
	Problem space match [28]
Data	Data quality and reliable resources [16][20]
	Modeling of dimensional data and meta-data
	Information area readiness [9]

- Structural Equation Modeling (SEM)

Structure Equation Modeling (SEM) is a family of statistical models that seek to explain the relationships among multiple variables which will be used in this study. Two-step structural equation modeling approaches will be applied to analyze the data such as Confirmatory Factor Analysis (CFA) to validate the measurement models and full-fledged structural model to estimate the casual relationships among the constructs.

IV. CONCLUSION

In this paper, a brief review and discussion of BI system was conducted. An insight of business and technical issues related to BI was described and highlighted. The paper furthered the investigation into the obstacles and challenges faced by organizations in implementing BI systems. Throughout this paper, it was shown that there are some factors deteriorate BI system performance and lead to a huge loss in the invested money. These factors, techno-business, are mostly based on the lack of

organizations' readiness toward BI systems. Thus, the paper reviewed and investigated some possible scenarios that may affect the readiness for BI systems. Further, upon the investigation, it was shown that there is a need for an extensive model, which addresses all readiness factors to evaluate the level of readiness and awareness of organizations willing to implement BI systems. Therefore, a framework for a model assessing organizations' readiness toward BI systems was proposed. The paper also discussed the methodology which will be conducted to test the proposed framework based on a survey within the context of Malaysian organizations. The result of the first round will be used to further the exploration for accomplishing the complete comprehensive model.

REFERENCES

[1] S. Negash, and P. Gray, "Business Intelligence," Ninth Americas Conference on Information Systems, 2003, pp. 3190-3199.

[2] P. Hawking, C. and Sellitto, "Business Intelligence (BI) Critical Success Factors," Proc. Australian Conference on Information Systems (ACIS), Dec. 2010.

[3] A. Stipic, T. Bronzin, "Mobile BI: the Past, the Present and the Future," Proc. IEEE MIPRO, May 2011, pp. 1560-1564.

[4] B. Sajjad, A. Mir, A. Khawar, F. Bashir, and A. Tariq, "An Open Source Service Oriented Mobile Business Intelligence Tool (MBIT)," Proc. IEEE International Conference on Digital Object Identifier, 2009, pp. 235-240.

[5] S. Williams, and N. Wailliams, "The Profit Impact of Business Intelligence," Moragan Kaufmann Publisher, Elsevier imprint, 2007.

[6] http://www.dssresources.com/history/dsshistory.html, Last access was on 16/3/2012 at 12:10 PM.

[7] R. Stackowiak, J. Rayman, and R. Greenwald, "Oracle Data Warehousing and Business Intelligence Solutions," Wiley Publishing, 2007.

[8] J. Gantz, H. Morris, D. Vesset, and A. Manfrediz, "Taming Information Chaos," IDC White Paper, Nov. 2007.

[9] C. Howson, (2008). "Successful Business Intelligence: Secrets to Making BI a Killer App," McGraw-Hill, New York, NY, 2008.

[10] http://www.dashboardinsight.com/news/news-articles/gartner-says-worldwide-business- intelligence-spending-to-grow-11-percent-in-2008.aspx, Lastly access was on 27 August 2012, at 12:52 AM.

[11] http://www.cio.com/article/680034/Gartner_BI_Analytics_Software_Spending_Jumps_13.4_, Last access was on 27 August 2012, at 12:53 AM.

[12] S. Williams, and N. Williams, "The Profit Impact of Business Intelligence," Morgan Kaufmann Publishers, San Francisco, CA, 2007.

[13] W. Yeoh, and A. Koronios, "Critical Success Factors for Business Intelligence Systems", J. Computer Information Systems, Spring 2010, pp 23-32.

[14] M. Hwang, "Critical Success Factors for Data Warehouse Implementation: A Framework for Analysis and Research", Idea Group Publishing, USA, pp 195-196.

[15] B. Cooper, H. Watson, B. Wixom, and D. Goodhue, "Data Warehousing Supports Corporate Strategy at First American Corporation", J. Mangement Information Systems (MIS) Quarterly, vol. 24, Dec. 2000, pp. 547-567.

[16] B. Wixom, and H. Watson, "An EmpiricaLInvestigation of the Factors Affecting Data Warehousing Success," J. Mangement Information Systems (MIS) Quarterly, vol. 25, March 2001, pp. 17-41.

[17] M. Hwang, and X. Hongjiang, "The Effect of Implementation Factors on Data Warehousing Success An Exploratory Study," J. Information, Information Technology, and Organizations, 2007, pp. 1-14.

[18] G. Gangadharan, and S. Swami, "Business Intelligence Systems: Design and Implementation Strategies," Proc. Information Technology Interfaces, Jun. 2004, pp. 139-144.

[19] M. Hwang, and X. Hongjiang, "A Survey of Data Warehousing Success Issues," J. Business Intelligence, Vol. 10, Fall 2005, pp. 7-13.

[20] W. Yeoh, A. Koronios, and J. Gao, "Critical Success Factors For The Implementation of Business Intelligence System in Engineering Asset Management Organisations," Engineering Asset Management, Springer, 2006, pp.344-351 , DOI: 10.1007/978-1-84628-814-2_38.

[21] M. Hwang, and X. Hongjiang, "The Effect of Implementation Factors on Data Warehousing Success An Exploratory Study," J. Information, Information Technology, and Organizations, vol. 2, 2007, pp. 1 -14.

[22] W. Yeoh, J. Gao, and A. Koronios, "Towards a Critical Success Factor Framework for Implementing Business Intelligence Systems: A Delphi Study in Engineering Asset Management Organizations" Engineering Asset Management, Springer, vol 2, 2007, pp. 1353-1367.

[23] W. Yeoh, A. Koronios, J. Gao, "Managing the Implementation of Business Intelligence Systems: A Critical Success Factors Framework", J. Enterprise Information Systems, vol 4, 2008, pp. 79 -94.

[24] D. Arnott, "Success Factors for Data Warehouse and Business Intelligence Systems," 19th Australasian Conference on Information Systems, Dec 2008, pp. 55- 65.

[25] K. Torella, "Business Intelligence Project Management and Planning Right People, Right Plan," White Paper, Techdecisions for Insurance, Sept. 2010, pp. 1-11. Availble online at: (http://www.millbrookinc.com/Millbrook_TechDecisions_091010.pdf).

[26] S. Adamala, and L. Cindrin, "Key Success Factors in Business Intelligence," J. Intelligence Studies in Business, vol. 1, 2011, pp. 107-127.

[27] T. Clark, M. Jones, and C. Armstorng, "The Dynamic Structure of Management Support Systems Theory Development, Research Focus, and Direction," J. Mangement Information Systems (MIS) Quarterly, vol. 31, Sept. 2007, pp. 576-615.

[28] W. Eckerson, "Performance Dashboards, Measuring, Monitoring, and Managing Your Business," John Wiley & Sons, Inc., New Jersey, 2006.

[29] C. Olszak, and E. Ziemba, "Approach to Building and Implementing Business Intelligence Systems," J. Information, Knowledge, and Management, vol. 2, 2007, pp. 135-148.

[30] I. Candal-Vicente, "Factors That Affect The Successful Implementation of Data Warehouse," Fourth International Multi-Conference on Computing in the Global Information Technology, IEEE, 2009, pp. 1-6.

[31] S. Williams, N. Williams, "Assessing BI Readiness: The Key to BI ROI," J. Business Intelligence, vol. 9, Summer 2004 , pp 1-11.

[32] L. Chen, K. Soliman, E. Mao, and M. Frolick, "Measuring User Satisfaction with Data Warehouse: an Exploratory Study," J. Information & Management, vol. 37, 2000, pp. 103-110.

[33] A. Anjariny, and A. Zeki, "Development of Model for Assessing Organizations' Readiness toward Successful Business Intelligence Systems," Research and Innovation in Information Systems (ICRIIS), 2011, pp. 1-6.