

Business Intelligence Readiness Issues for Higher Learning Institution (IHL): Preliminary Study and Research Model

ABSTRACT

Introduction: Business Intelligence Systems (BIS) are the most potential application for many popular organizations in different industries such as telecommunication, healthcare, airline, transport, government and others [1], [2]. The implementation of Business Intelligence (BI) for Institutions of Higher Learning (IHL) still at the early stage for most of these organizations. Results from the previous studies found that more than half of the BI project fails to meet the objective even though a lot money are spent. Based on that problem, the readiness level of BI for IHL is important to identify in order to reduce the risk before the actual BI project is implemented. In this paper, rigorous literature review on the aspect success factors such as Critical Success Factors (CSFs), Readiness Factors (RFs), Success Factors (SFs), are discussed by different authors.

Aims: The aim of this study is to develop the Business Intelligent Readiness Model (BiRM) as a guild for IHL before implement the BI system.

Study design: For this study, semi-structured interview will be chosen as a method of collecting relevant qualitative data to explore and refine the model of BI readiness model for IHL in Malaysian. Here, the list of themes, issues to be addressed and questions to be asked were identified and pre-defined by the researcher. The use of semi-structured interviews ensured that information was captured from the respondent's perspectives rather than being imposed by the researcher.

Place and Duration of Study: The study will be conducted at Malaysia Institutions of Higher Learning (IHL). This study also expected to finish within 12 month months period.

Methodology: The study is proposed to be conducted through mix methodology comprising qualitative and quantitative methods, including interviews and observations with a range of stakeholders such as ministry officers, computer center managers, technician and the end users from difference IHL in Malaysia.

The results: The result of the data collection will be analyzed using the causal modeling approach of SEM SmartPLS for the validity and the relationship between construct. The expected finding from this research is the Business Intelligent Readiness Model (BiRM) as a guild for IHL before implement the BI system.

Keywords: Business Intelligence Readiness Model, Business Intelligence for Higher Learning, Readiness Factors

1. INTRODUCTION

Business Intelligence Systems (BIS) are the most potential application for many popular organizations in different industries such as telecommunication, healthcare, airline, transport, government and others [1], [2]. BIS trend, for many years has been rated as one of the highest priority information system (IS) applications among the top management of the companies [2] and [3]. On the other hand, the survey result from Gartner (2014), predicting that the Chief Information Officer (CIO) will consider BIS and analytics as a top priority and focus on multi departmental unit, including marketing, sales, supply chain management, manufacturing, engineering, risk management, finance and human resource continue until the year 2017. The expenses for BI deployment in most of the organization are very high. According to analysis release by Gartner firm, overall spending on application of BI market will increase from USD\$ 13.8 in 2013 to USD17.1 billion by 2016 [4].

Even though, the BIS is synonymous with the business organization, other organization such as institutions of higher learning (IHL) also need the business intelligence to manage their daily activities in administration, teaching and learning, research and publication, key performance index (KPI) and other area [5]. According to [6], business intelligence (BI) is a set of methodology and technology for gathering, storing, analyzing, and providing access to data to help users to make business decisions. Therefore, BI can generally be referred to as a process of turning data into information and then into knowledge that can be used for good decision making [7], [8] and [9]. BI has also been extended to support executives and senior line-of-business managers. The strategic BI is used to support long-term corporate goals and objectives, which usually drive the short-term initiatives by tactical BI applications. Common data operations behind these applications include aggregations, statistical analysis, multidimensional analysis, data mining and exploration [10]. The business purpose includes trend and pattern discovery, development of business and behavioral models and what-if analysis. While, operational BI is used to manage and optimize daily business operations and the concepts and techniques discussed for tactical and strategic BI apply equally to operational BI [11].

1.2 PROBLEM STATEMENT

BI implementation is a challenging and costly task because it involved multiple stages and various data from internal and external sources to provide the right information to the organization for organizational performance. Even though BI influence the performance of the organization, a review of the previous studies found that a significant number of companies often fail to utilize the benefit of this technology [12], [13]. Latest information from [14], conclude that 60% of a BI project failed due to "inadequate planning, poor project management and undelivered business requirement". Similar to that, the failure rate for BI and data warehouse project estimated between 50-80% [15]–[17]. The organization must understand the BI stages, multiple data sources and various needs of users to make BI success [18].

One of the reasons for this problem is the readiness level of the BI implementation stage. Fail to understand the organization readiness level of BI will influence the wrong decision in implementing the BIS [19]. This scenario related to the organizational readiness toward Business Intelligence System (BIS). In summation, the readiness level is significant as an indicator before BI system is broken **because it reflects** the monetary value and company return of the investment (ROI). Organizational readiness for **BI is a prerequisite for** successful BI implementation. To date, No accurate scientific model or standard measurement can be used as a tool to evaluate the readiness of BIS implementation in the organization to date [20].

2. BACKGROUND OF THE STUDY

2.1 BUSINESS INTELLIGENCE

The term of business intelligent (BI) is first introduced by Howard Dresner in 1989. He was the analyst of the Gartner group, an information technology researcher firm that implemented BI in the ICT industry. He then first coined BI term in 1996 and introduced the term to describe a set of concepts and methods to improve business decision making, by extracting and analyzing data from database for strategy formulation. BI is the art of wading through tons of data overload, sieving through data and presenting information both internally as well as externally [21]. Internal information normally resides in the organizational databases while external information is from market intelligence on which management can act or build strategies. BI systems consist of a complete process of creating reports and analysis for decision making from start to end.

Generally BI application combines data gathering, data storage, and knowledge management tools to present complex internal and useful information for decision makers [22]. BI applications include the activities of *decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining*. BI has different definitions from different field of expertise and is viewable from several approaches [23]. Almost all definitions share the same focus, even though definitions have been defined from two broad perspectives of managerial and technical [24],[25]. The managerial approach sees BI as a process that gathers data from inside and outside of organizations and integrates them in order to generate information relevant to the decision-making process. Among the vendor/author that implemented the managerial approach as in [26]. While the technical approach presents BI as a set of tools that support the process. Among the vendor/author that implemented the technical approach as in [27], [21].

Business Intelligence (BI) software is designed to help people make more informed decisions by aggregating many different sources of data into a meaningful format. BI is already in use in many establishments today, by finance departments to examine financial performance, sales and marketing to identify customer trends, and operations to enhance the efficiency of supply chains. BI technologies provide historical, current, and predictive views of business operations [28]. The main target of business intelligence deployments is to support better business decision-making. Though the term business intelligence is sometimes a synonym for competitive intelligence (because they both support decision making), BI uses technology technologies gathers, analyses and disseminates information with a topical focus on company competitors.

2.2 BUSINESS INTELLIGENCE DEPLOYMENT

To date, BI system has been deployed in various types of organization, such government, private companies, manufacturing and other related organization. Prior to that, the first known BI application was the use of international BI for monitoring foreign currency instabilities way back in 1867 [29]. There are three deployment approaches of BI implementation in the organization that depend on the goal of usage and the required focus [30]; (1) managerial approach with focus on improving management decision making, (2) technical approach by focusing on tools supporting the management process, and (3) enabling approach by focusing on value-added capabilities in support of information. The result from 85 articles on BI shows that the majority of the organization implemented the BI managerial approach in their organization (50%), while technical approach and enabling approach are 29% and 21% respectively. Table 1, shows the definition of BI from three deployment approaches stated from multiple authors.

TABLE 1
Three approaches to the definition of BI
 (Source: Adapted from [31],[26])

Approach	Managerial/Process	Technological	Enabling Approach
<i>Definition</i>	How the data is collected from internal and external sources then analyst to generate useful information at the right time and place to the right person for decision making process.	How the tools and technologies is used that allow the recording, recovery, manipulation and analysis of information.	Describe BI as the emerging result/product of in-depth analysis of detailed business data as well as analysis practices using BI tools.
<i>Author</i>	[32][33][34]	[33][23][32]	[35][36][32]

2.3 BUSINESS INTELLIGENCE IN INSTITUTION OF HIGHER LEARNING (IHL)

Higher Learning Institutions (IHL) are the most important institution for producing the workforce in every country. Normally this institution is complicated and involved huge data sources across departmental boundaries toward achieving academic excellence [37]. In general, according to the Malaysian Ministry of Education (MOHE)¹, the main group of IHL involved five (5) business area; namely *i) Student Affairs ii) Academic Staff Affairs iii) Finance Affairs iv) Research and Development Affairs and v) Infrastructure Development Affairs*. Each of the business areas need to be integrate and had many application systems to support their daily task. The data from each application will produce useful information that can accessed by various group such as by the universities top management, faculty members, administrators, researchers and other relevant parties [38].

In general, the used of business intelligence in IHL involved talents, procedures, technologies, application and practices used to expedite internal and external information asset to facilitate the decision making process. The reason of BI is supporting the key performance index (KPI) of the universities. Data from different application such as student registration, course registration, research and publication, teaching and learning, financial system, examination results and others are extracted, transform and loading (ETL) before visualized using BI tools [39] and [40]. In Thailand, BI project is funded by Higher Education Commission (OHEC), Ministry of Education Thailand since year 2005 for developing the higher learning database that involved the total 147 Thailand's higher learning institutions [40].

At this moment, the number of researchers doing the BI research in IHL still not satisfied. Most of them concentrating on the business or commercial organization. BI normally used to support the decision making process in business, by converting the data to the knowledge. However [5] prove that BI can also be used to support tutors in teaching environments. In fact, **most of the university are continuously collecting** and storing high quality database through teacher preparation, student engagement, research and publication, key performance index (KPI) and other activities [41]. Similar to this, [42] suggested BI can be used in multiple group of application such as, 1) Classes preparation, 2) Teaching material, 3) Student evaluation, 4) Research activities, 5) Publication and 6) School requirement and other activities.

¹ Workshop on Data Collection System for IHL-MOHE, 13-14 December 2006, Awana Hotel Langkawi, Malaysia.

3. READINESS AND SUCCESS FACTORS OF BI IN IHL

3.1 THEORETICAL FRAMEWORK

Most of the IHL are allocated with a very tight of budget to operate the university. So that before BI system is developed the BI readiness evaluation is one of the important steps to organize. The literature from scholar stated that half of the BI projects has failed to success even though a billion of dollars are spent. The main reason for the failure because many or the organization are not ready with BI System [20],[43],[22]. Fail to know the organization readiness level of BI will influence wrong decision in implementing the BIS [44]. So that, organizational readiness for BIS is prerequisite for successful of BI implementation.

In another expression, organization readiness for BI and BI system success has a positive relationship [44] and [45]. Referring to IHL, the readiness level is importance as an indicator before BI system is develop because this reflect the cost and return of investment (ROI). To date, in the literature, there is no accurate scientific model or standard measurement can be used as a tool to measure the readiness of BIS implementation in the organization. Developing a research model for assessing the IHL readiness is not an easy task. The clue from most of the researches was based on the term of success as mentioned in the following Table 2.

The success factor from different authors can be used as a guide to develop the framework of readiness BIS for the IHL. As, for example, a model developed by [20] shows the possible readiness factors in one conceptualized model, as can be seen in Fig. 1. This model was developed based on dimension categorization focusing on readiness factors (RF) and success factors (SFs).

TABLE 2
SUCCESSION FACTORS TERM FROM DIFFERENT AUTHORS

Success Factors Term	Authors
Critical Success Factors (CSFs)	[46], [47], [19], [13], [48], [49], [50]
Key Success Factors (KSFs)	[46]
Implementation Success Factors ISFs)	[51]
Success Factors (SFs)	[52], [53]
Implementation Factors (IFs)	[34], [54]
Readiness Factors (RFs)	[55] , [56],[57], [58]

3.2 BI READINESS ASSESSMENTS

BI Readiness assessments can be investigated prior to a BI implementation. This process, includes investigations into certain organizational data, process and technical level characteristics to establish readiness [44]. The BI readiness assessment can be consider as a series of steps to analyze several importance keys across an organization and evaluate how ready they are to begin short term tactical deployment of BI solutions and long term practices [43]. A few scholar such as [19], [48], [56] categorized the BI readiness into technical aspect and non-technical aspect. Technical aspect, such as hardware, middleware and database management system (DBMSs) while non-technical aspect involved management issues such as standards, meta-data, business rules, key performance index (ROI) and policies as shown in figure 1[33].

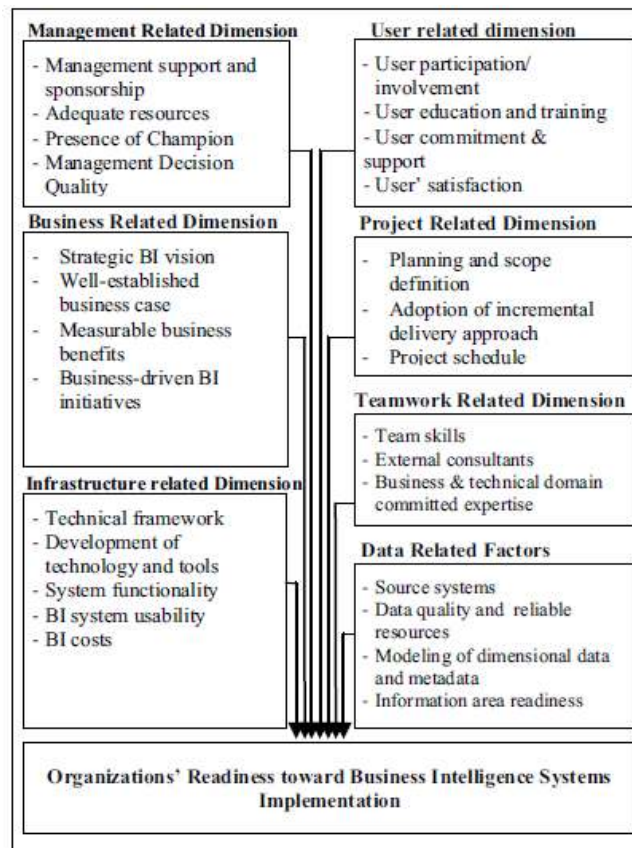


Fig. 1. Organizational BI Readiness BIS Framework [59]

The reason of readiness assessment, of course, to minimize the risk before the real BI system takes place. Once such example in the IHL, the student academic data record in need to analyze the academic performance for the universities. The deficiency of data and incomplete structure will increase the risk of project failure. In this case, evaluation of BI readiness will fulfill two important goals. First, it reflects the gap area where the IHL is not ready to proceed with BI and identified the area that need to improve without wasting time and resources. Secondly, the evaluation will guide the universities on what they need to do before implement BI at higher success level [43].

4. RESEARCH PROCESS AND PLANNING

The aim of this work is to investigate the readiness of business intelligence system in the institution of higher scholarship in Malaysia and develop the possible readiness model that can be used as guide before the carrying out of the BI system. The research attempts to explore how the readiness business intelligence are comply at the higher learning institution using a mixed method approach consists of qualitative and quantitative as establish by [60]. The main objectives of this research is to construct the "Business Intelligence Readiness Model for Institution of Higher Learning (IHL)" while the sub objective are as follows; 1.To determine the requirement for BI readiness model for IHL, 2.To construct the BI readiness model for IHL and; 3.To validate the BI readiness model at IHL level. The combination of qualitative and quantitative research process will be conducted in two sequential phases that involved eleven (11) steps as shown in figure 2.

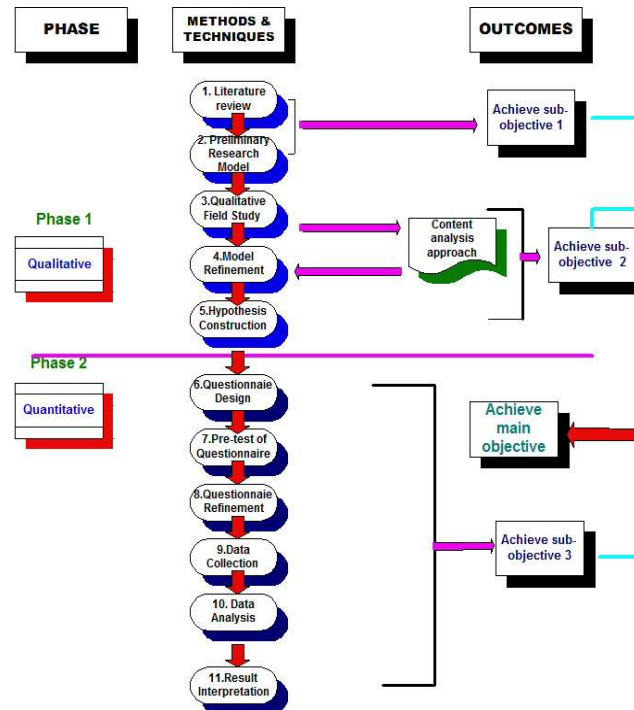


Fig. 2. Research Phases and Outcomes

4.1 QUALITATIVE AND QUANTITATIVE FIELD STUDY METHOD

This study endeavored to explore the phenomenon of the readiness factor of business intelligence at IHL in Malaysia, to validate and enhance the factors and variables identified as part of comprehensive literature review. Since this phase was concerned with understanding BIS readiness at IHL, the qualitative method is considered the most appropriate. As such, a field study approach [61] and [62] has been adopted as the research method for the qualitative phase. Qualitative methods permit the evaluator to study selected issues in depth and detail. The field study acquires the researcher to be involved in investigating the factors influencing readiness of BIS by interviewing the business intelligence expert in the organization. The inquiry process is sub-split into 5 sequential steps at the first phase and 6 until 11 for the second phase of the research process using quantitative methods as indicated in Fig. 2

The second phase of the research aims at finding the important factors and variables affecting the readiness of BIS of the IHL, which was reflected in the BI readiness model developed prior to this phase. A number of hypotheses were derived from the model, which were subjected to an empirical testing that focused on verifying or falsifying these hypotheses [63]. Since the methods employed in this phase were designed to be detached and independent of the specific situation under study, a quantitative method is considered more appropriate. Thus, the survey method was thought most appropriate for this study and a questionnaire-based survey was appropriate.

4.2 DATA COLLECTION AND ANALYSIS

The study will implement expert review or Delphi technique with a few reputable people in this area. The result from this method is the BI readiness model that need to be tested. Next, the questionnaire will be design and the data will be collected base on the variable from the BI readiness model. Stakeholders

from different university agencies, including computer center managers, technician and end users in Malaysia who were willing to participate were selected. The main selection criterion was that the selected participants have to be directly involved in Information Technology application (ICT). The participants will be contacted personally via email and face to face interview on voluntarily basis. Data collection and analysis method in qualitative studies are different from quantitative techniques [64].

For this study, semi-structured interview will be chosen as a method of collecting relevant qualitative data to explore and refine the model of BI readiness model for IHL in Malaysian. Here, the list of themes, issues to be addressed and questions to be asked were identified and pre-defined by the researcher. The use of semi-structured interviews ensured that information was captured from the respondent's perspectives rather than being imposed by the researcher [65].

The final output from this phase was a comprehensive BI model based on interview scripts from the qualitative survey. The combined model was used as a basis for the construction of hypotheses. The information is gathered from extensive literature reviews, plus findings from interviews made up the hypotheses. The refined BI model and hypotheses definitions were used in the next phase of the main quantitative research. Finally the model will be tested in the next phase of the study using quantitative analysis method. A causal modeling approach of (SEM) using SmartPLS will be undertaken to validate the final BI readiness model for Malaysian IHL [66]. This part of the research will use a quantitative approach, which will test a number of hypotheses and the model itself.

5. CONCLUSION

In this paper, a brief concept and background of BI system, including deployment from various industries focusing on IHL was discussed. The paper also, investigated the technical and non-technical of readiness theory and assessment of BI from different authors. From the literature, success factors from seventeen (17) difference authors with difference term such as CSF, KSF, ISF, SF, IF and RF are identified as a main references to get the readiness variable for the rest of this research. Next, the paper also explains the brief concept of the research step to undertake using both qualitative and quantitative techniques to model the BI readiness model for IHL in Malaysia. This research contributes to both theory and practice with a series of data collection will give the idea to construct the comprehensive BI model for the next phases. Finally, the data analysis will test using the SEM SmartPLS method.

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REFERENCES

- [1] N. Azizah, A., & Shiratuddin, "Business Intelligence for Sustainable Competitive Advantage: Field Study of Telecommunications Industry," *Bus. Intell. Data Warehous. (BIDW 2013)*, 2010.
- [2] H. J. Watson, B. H. Wixom, J. A. Hoffer, R. Anderson-Lehman, and A. M. Reynolds, "Real-Time Business Intelligence: Best Practices at Continental Airlines," *Inf. Syst. Manag.*, vol. 23, no. 1, pp. 7–18, Dec. 2006.
- [3] V. Farrokhi and L. Pokorádi, "The necessities for building a model to evaluate Business Intelligence projects- Literature Review," *Int. J. Comput. Sci. Eng. Surv.*, vol. 3, no. 2, pp. 1–10,

297 2012.

298 [4] C. Kanaracus, "Gartner: BI software spending to hit \$17.1 billion by 2016, but pace of growth
299 slowing from, [http://www.infoworld.com/d/business-intelligence/gartner-bi-software-spending-](http://www.infoworld.com/d/business-intelligence/gartner-bi-software-spending-hit-171-billion-2016-pace-of-growth-slowing-213093)
300 [hit-171-billion-2016-pace-of-growth-slowing-213093](http://www.infoworld.com/d/business-intelligence/gartner-bi-software-spending-hit-171-billion-2016-pace-of-growth-slowing-213093)," 2013.

301 [5] Popescu, M. C, U. A, and I. L, "Resource Management – A Key Point for Success Project,"
302 *WASEAS Trans. Bus. Econ.*, vol. 7, no. 2, 2010.

303 [6] J. Keyes, "Knowledge Management, Business Intelligence, and Content Management: the IT
304 Practitioners' Guide," *Auerbach Publications: Boca Raton, USA*, 2006.

305 [7] R. Rahmat, A. Ahmad, R. Razak, R. Din, and A. Abas, "Sustainability Model for Rural Telecenter
306 Using Business Intelligence Technique," *Int. J. Soc. Hum. Sci. Eng. World Acad. Sci. Technol.*,
307 vol. 7, no. 12, pp. 1356–1361, 2013.

308 [8] J. Liebowitz, "Business Intelligence Cannot Exist Without Knowledge Management,"
309 <http://www.businessintelligence.com>, 2005. .

310 [9] I. Golfarelli, M., Rizzi, S., & Cella, "Beyond data warehousing: What's next in business
311 intelligence?," in *Proceedings of 7th International Workshop on Data Warehousing and OLAP*
312 *(DOLAP 2004)*, Washington DC, 2004.

313 [10] L. Loftis, "What's in the Name? Strategic, Tactical and Operational BI," *DM Rev.*, vol. 17, no. 9,
314 p. 32, 2007.

315 [11] C. White, "A Process-Centric Approach to Business Intelligence," *DM Rev.*, vol. 16, no. 12, pp.
316 14–18, 2006.

317 [12] T. Chenoweth, K. Corral, and H. Demirkan, "Seven key interventions for data warehouse
318 success," *Commun. ACM*, vol. 49, no. 1, pp. 114–119, 2006.

319 [13] M. Hwang and X. Hongjiang, "A Survey of Data Warehousing Success Issues," *J. Bus. Intell.*, vol.
320 10, pp. 7–13, 2005.

321 [14] L. T.Moss, *Extreme Scoping, An Agile Approach to Enterprise Data Warehousing and Business*
322 *Intelligence*. 2013.

323 [15] B. Beal, "Report: Half of data warehouse projects to fail from Search CRM:
324 <http://searchcrm.techtarget.com/news/1066086/>," 2005.

325 [16] P. Meehan, "Patrick Meehan speech during Gartner Business Intelligence Summit 2011. London,
326 UK. Retrieved from
327 <http://link.brightcove.com/services/player/bcpid1156010110?bctid=741282639001>," 2011.

328 [17] I. Legodi and M. Barry, "The current challenges and status of risk management in enterprise data
329 warehouse projects in South Africa. PICMET 2010 Technology Management for Global
330 Economic Growth.," 2010.

331 [18] J. Kimball, R., & Caserta, "The Data Warehouse ETL Toolkit. Practical Technique for Extracting,
332 Cleaning, Conforming and Delivering Data," in *Wiley Publishing, Inc., Indianapolis*, 2004.

333 [19] W. Yeoh and A. Koronios, "Critical success factors for business intelligence systems," *J. Comput.*
334 *Inf. Syst.*, vol. 50, no. 3, pp. 23–32, 2010.

335 [20] A. H. Anjariny and A. M. Zeki, "Development of Model for Assessing Organizations ' Readiness
336 Toward Successful Business Intelligence Systems," in *Research and Innovation in Information*
337 *Systems (ICRIIS), 2011 International Conference, IEEE*, 2011, pp. 1–6.

338 [21] V. King, W. R., & Sethi, "Development of Measures to Access the Extent to Which an
339 Information Technology Application Provides Competitive Advantage.," *Manag. Sci. J.*, vol.
340 40(12), pp. 1601–1627, 1994.

- 341 [22] S. Nagesh, "Business Intelligent.," *Commun. Assoc. Inf. Syst. J.*, vol. 13, no. 1, pp. p177–195,
342 2004.
- 343 [23] L. Adelman, S., Moss, L., & Barbusinski, "I found several definitions of BI," *DM Rev. Online*,
344 vol. August 200, 2002.
- 345 [24] E. Casado, "Expanding business intelligence power with systems dynamics. In Business
346 Intelligence in the Digital Economy: Opportunities, Limitations and Risks," in *Raisinghani, M.*
347 *(Ed.), Idea Group Publishing, Hershey., 2004.*
- 348 [25] M. Petrini and M. Pozzebon, "Managing sustainability with the support of business intelligence:
349 Integrating socio-environmental indicators and organizational context," *J. Strateg. Inf. Syst.*, vol.
350 18(2009), pp. 178–191, 2009.
- 351 [26] F. K. Chang, E., Dillon, T. S., & Hussain, "Trust reputation for service-oriented environments," in
352 *New York: John Wiley and Sons., 2006.*
- 353 [27] K. M. Tyson, K. M., & Swanson, "Global Business Intelligence Processes: Executive Information
354 Systems Approaches for Simple or Complex Organizations," *Prescott, J. E. Gibbons, P. T. (ed).*,
355 no. Alexandria, VA., pp. 367–375, 1990.
- 356 [28] A. Azizah and N. Siratuddin, "Business Intelligence for Sustainable Competitive Advantage :
357 Field Study of Telecommunications Industry," in *Annual International Academic Conference on*
358 *Business Intelligence and Data Warehousing (BIDW 2010)*, 2010, pp. 97–102.
- 359 [29] D. P. Hilty, "International Business Intelligence for Monitoring Foreign Currency Instabilities.
360 PhD Thesis, California State University, USA.," 1967.
- 361 [30] S. Rouhani, S. Asgari, and S. Mirhosseini, "Review Study: Business Intelligence Concepts and
362 Approaches," *Am. J. Sci. Res.*, vol. 50, no. 50, pp. 62–75, 2012.
- 363 [31] M. Petrini, M & Pozzebon, "What Role Is 'Business Intelligence' Playing in Developing
364 Countries? A Picture of Brazilian Companies," *Cah. du GReSI*, vol. 4, p. 16, 2004.
- 365 [32] C. Carlsson and E. Turban, "DSS: directions for the next decade," *Decis. Support Syst. J.*, vol. 33,
366 no. 2, pp. 105–110, 2002.
- 367 [33] S. Moss, L.T & Atre, *Business Intelligence Roadmap: The Complete Lifecycle for Decision-*
368 *Support Applications. Addison-Wesley Professional. 2003.*
- 369 [34] B. H. Wixom and H. J. Watson, "An Empirical Investigation of the Factors Affecting Data
370 Warehousing Success," *J. Management Inf. Syst. Q.*, vol. 25, pp. 17–41, 2001.
- 371 [35] G. R. Gangadharan and S. N. Swami, "Business intelligence systems: design and implementation
372 strategies," *26th Int. Conf. Inf. Technol. Interfaces 2004*, pp. 139–144, 2004.
- 373 [36] C. Shi and D. Zhang, "Web Service-Based Business Intelligence System Research and
374 Implementation," in *The 3rd International Conference on Innovative Computing Information and*
375 *Control (ICICIC'08)*, 2008, pp. 204–204.
- 376 [37] A. Ta'a, M. S. Abu Bakar, and A. R. Saleh, "Academic business intelligence system development
377 using SAS® tools," in *In Workshop on Data Collection System for PHLI-MOH*, 2006, pp. 1–14.
- 378 [38] J. Rome, "Development of Data Warehouse," 2007.
- 379 [39] M. Horninger, T. Blum, K. . Kelley, M. Shepherd, K. Fowler, and R. Gabriel, "Reporting Services,
380 Analysis Services, and Integration Services. How to Cheat at Securing SQL Server 2005," 2007.
- 381 [40] S. Kleesuan, S. Mitatha, P. P. Yupapin, and B. Piyatamrong, "Business Intelligence in
382 Thailand's Higher Educational Resources Management," *Procedia - Soc. Behav. Sci.*, vol. 2, no. 1,
383 pp. 84–87, Jan. 2010.

- 384 [41] S. Hubalovsky, "The System Approach to Teaching of Algorithm Development," in
385 *WSEAS/IASME Applied computing conference 2010 (ACC'10)*, Timisoara, WSEAS Press, 2010,
386 pp. 22–27.
- 387 [42] J. Chromy, D. Dvorak, and J. Sedvy, "Business intelligence approach as communication tool of
388 tutors and teachers in technical education," *WSEAS Adv. Data Networks, Commun. Comput.*
389 *Mater. Journal*, vol. 1, no. 11, pp. 183–187, 2012.
- 390 [43] V. Farrokhi and L. Pokorádi, "The necessities for building a model to evaluate Business
391 Intelligence projects- Literature Review," *Int. J. Comput. Sci. Eng. Surv.*, vol. 3, no. 2, pp. 1–10,
392 2012.
- 393 [44] N. Williams, S. Williams, and S. Planning, "The Profit Impact of Business Intelligence Leading
394 and Managing a BI-Driven Profit Improvement," *Publ. by Elsevier, Inc*, pp. 1–5, 2007.
- 395 [45] A. M. Z. Ahmed H. Anjariny and H. Hussin., "Assessing Organization Readiness toward Business
396 Intelligence Systems: A Proposed Hypothesized Model," in *Int. Conf. Adv. Comput. Sci. Appl.*
397 *Technol.*, 2012, pp. 213–218.
- 398 [46] S. Adamala and L. Cindrin, "Key Success Factors in Business Intelligence," *J. Intell. Stud. Bus.*,
399 vol. 1, pp. 107–127, 2011.
- 400 [47] C. and S. P. Hawking, "Business Intelligence (BI) Critical Success Factors," in *Proc. Australian*
401 *Conference on Information Systems (ACIS)*, 2010.
- 402 [48] M. Hwang, *Critical Success Factors for Data Warehouse Implementation: A Framework for*
403 *Analysis and Research*, Idea Group Publishing, USA. 2010.
- 404 [49] and A. K. W. Yeoh, J. Gao, "Towards a Critical Success Factor Framework for Implementing
405 Business Intelligence Systems: A Delphi Study in Engineering Asset Management
406 Organizations.," in *Engineering Asset Management*, Springer USA, vol. 2, 2007, pp. 1353–1367.
- 407 [50] J. G. W. Yeoh, A. Koronios, "Managing the Implementation of Business Intelligence Systems: A
408 Critical Success Factors Framework," *J. Enterp. Inf. Syst.*, vol. 4, pp. 19–94, 2008.
- 409 [51] I. Candal-Vicente, "Factors That Affect the Successful Implementation of a Data Warehouse," in
410 *2009 Fourth International Multi-Conference on Computing in the Global Information Technology*,
411 2009, pp. 1–6.
- 412 [52] D. Arnott, "Success Factors for Data Warehouse and Business Intelligence Systems," in *19th*
413 *Australasian Conference on Information Systems*, 2008, pp. 55–65.
- 414 [53] A. H. Anjariny, M. Zeki, "Development of Model for Assessing Organizations' Readiness Toward
415 Successful Business Intelligence system.pdf," in *Res. Innov. Inf. Syst. (ICRIIS)*, 2011 *Int. Conf.*,
416 2011, pp. 1–6.
- 417 [54] M. Hwang and X. Hongjiang, "The Effect of Implementation Factors on Data Warehousing
418 Success: An Exploratory Study," *J. Information, Inf. Technol. Organ.*, vol. 2, pp. 1–14, 2007.
- 419 [55] S. Williams and N. Williams, "Assessing BI Readiness : The Key to BI ROI," *Bus. Intell. J.*, vol.
420 9, no. 3, pp. 15–23, 2004.
- 421 [56] N. Williams and S. Williams, "The Profit Impact of Business Intelligence," in *Morgan Kaufmann*
422 *Publisher, San Francisco, CA*, 2007, pp. 1–5.
- 423 [57] W. Eckerson, "Performance Dashboards, Measuring, Monitoring, and Managing Your Business,"
424 in *John Wiley & Sons, Inc., New Jersey*, 2006.
- 425 [58] K. Ralph, R. Margy, W. Thornthwaite, J. Mundy, and B. Beeker, *The Data Warehouse Lifecycle*
426 *Toolkit, 2nd Edition: Practical Techniques for Building Data Warehouse and Business*
427 *Intelligence Systems*, John Wiley & Sons. 2008.

- [59] A. M. Anjariny, Ahmed H.; Zeki, "The Important Dimensions for Assessing Organizations' Readiness toward Business Intelligence Systems from the Perspective of Malaysian Organization," in *Advanced Computer Science Applications and Technologies (ACSAT), 2013 International Conference*, 2013, pp. 544–548.
- [60] R. K. Yin, "Mixed methods research: Are the methods genuinely integrated or merely parallel.," *Res. Sch.*, vol. 13(1), pp. 41–47, 2006.
- [61] M. J. Patton, "Qualitative Evaluation and Research Methods, 2nd Edition Title," in *Newsbury Park, California: SAGE Publications.*, 1990.
- [62] W. G. Zikmund, "Business Research Methods 6th ed," in *Fort Worth, Orlando, Florida, USA: the Dryden Press.*, 2000.
- [63] J. A. Kaplan, S., & Maxwell, "Qualitative Research Methods for Evaluating Computer Information Systems. In Evaluating Health Care Information Systems: Methods and Applications," in *Anderson J. G., Aydin C. E. & Jay S. J., Thousand Oaks, CA: SAGE*, 1994, pp. 45–68.
- [64] Y. S. Guba, E. G., & Lincoln, "Competing Paradigm in Qualitative Research," in *In Handbook of Qualitative Research, (eds). Thousand Oaks, CA: Sage Publication Inc*, 1994, pp. 105–117.
- [65] M. Burns, "Business intelligence survey," *CA Mag.*, vol. 135(5), p. 18, 2005.
- [66] R. Barclay, D., Higgins, C., & Thompson, *The Partial Least Squares (PLS) approach to causal modeling: Personal computer adoption and the use an illustration, Technology Studies*. 1995.