

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

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Authors' contributions

This work was carried out in collaboration between all authors. Author ARR designed the study, research workflow, and wrote the first draft of the manuscript and managed literature searches. Authors AA and AT managed the analyses of the study, literature searches and revised the manuscript. All authors critically reviewed and approved the final manuscript.

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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. The implementation of Business Intelligence (BI) for Institutions of Higher Learning (IHL) is still at the early stage for most IHL organizations. Results of previous studies have found that more than half of BI projects fail to meet their objectives even though a lot of money is spent. Based on that problem, it is important to identify the readiness level of BI for IHL in order to reduce the risk before the actual BI project is implemented. In this paper, a rigorous literature review on success factors such as Critical Success Factors (CSFs), Readiness Factors (RFs), Success Factors (SFs) are discussed by different authors.

Aims: The aim of study is the Business Intelligent Readiness Model (BIRM) as a guide for IHL before implementing the BI system.

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Study Design: For this study, semi-structured interviews 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 ensures that information is captured from the respondent's perspectives rather than being imposed by the researcher.

Place and Duration of Study: The study will be conducted at Malaysian Institutions of Higher Learning (IHL). This study is expected to finish within a 12-month period.

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

Results: The result of the data collection will be analyzed using the causal modelling 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 implementing 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]. The BIS trend has for many years been rated as one of the highest priority information system (IS) applications by the top management of companies [2] and [3]. In addition the survey result from Gartner (2014) predicts 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 resources continue until the year 2017. The expenses for BI deployment in most organizations are very high. According to analysis released by the Gartner firm, overall spending on the application of the BI market will increase from USD\$ 13.8 billion in 2013 to USD17.1 billion by 2016 [4].

Even though BIS are synonymous with business organization, other organizations such as institutions of higher learning (IHL) also need business intelligence to manage their daily activities in administration, teaching and learning, research and publication, key performance index (KPI) and other areas [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. Strategic BI is used to support long-term corporate goals and objectives, which usually drive the short-term initiatives via tactical BI applications. Common data operations behind these applications include aggregations, statistical analysis, multidimensional analysis, data mining and exploration [10]. Business purpose includes trend and pattern discovery, development of business and behavioural models and what-if analysis. 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].

1.1 Problem Statement

BI implementation is a challenging and costly task as it involves multiple stages and various data from internal and external sources to provide the right information to the organization for organizational performance. According to analysis released by the Gartner firm, overall spending on the application of the BI market will increase from USD\$ 13.8 billion in 2013 to USD17.1 billion by 2016 [4]. Even though BI influences the performance of the organization, a review of previous studies found that a significant number of companies often fail to utilize the benefit of this technology [12,13]. The latest information from [14], concludes that 60% of BI projects fail due to "inadequate planning, poor project management and undelivered business requirement". Similarly, the failure rate for BI and

data warehouse projects is estimated at between 50-80% [15–17]. The organization must understand BI stages, multiple data sources and users' various needs to make BI a success [18].

One of the reasons for this problem is the readiness level of the BI implementation stage. Failure to understand the organization-readiness level of BI will influence the wrong decision in implementing the BIS [19]. This scenario is related to the organizational readiness toward 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 on 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 [20].

2. BACKGROUND OF THE STUDY

2.1 Business Intelligence

The term business intelligent (BI) was first introduced by Howard Dresner in 1989. He was the analyst of the Gartner group, an information technology research firm that implemented BI in the ICT industry. He then coined the term BI 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 fields 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].

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 systems have been deployed in various types of organization, such as governmental, private companies, manufacturing and other related organizations. 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 organizations 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

Approach	Managerial/Process	Technological	Enabling approach
Definition	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.
Author	[32,33,34]	[33,23,32]	[35,36,32]

(Source: Adapted from [31,26])

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 involves 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 involves five (5) business areas; 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 needs to be integrated and has many application systems to support their daily tasks. The data from each application will produce useful information that can be accessed by various groups such as by the universities' top management, faculty members, administrators, researchers and other relevant parties [38].

In general, the use 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 universities' KPI. Data from different applications, such as student registration, course registration, research and publication, teaching and learning, financial system, examination results and others are extracted, transformed and loaded (ETL) before being visualized using BI tools [39] and [40]. In Thailand, a BI project has been funded by the Higher Education Commission (OHEC), Ministry of Education Thailand since 2005 for developing the higher learning database that involves Thailand's 147 higher learning institutions [40].

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

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

3. READINESS AND SUCCESS FACTORS OF BI IN IHLS

3.1 Theoretical Framework

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

the cost and return on investment (ROI). To date, in the literature, there is no accurate scientific model or standard measurement that can be used as a tool to measure the readiness of BIS implementation in an organization. Developing a research model for assessing IHL readiness is not an easy task. The clues 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 BIS readiness 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. Success factors term from difference 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 considered as a series of steps to analyze several important 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 scholars such as [19,48,56] categorize BI readiness into technical aspects and non-technical aspects. Technical aspects include hardware, middleware and database management system (DBMSs) while non-technical aspect involve management issues such as standards, meta-data, business rules, KPI (ROI) and policies as shown in Fig. 1 [33].

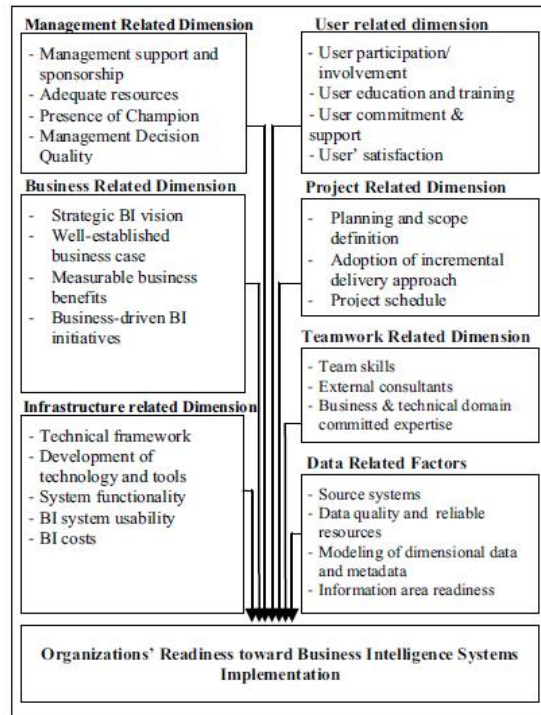


Fig. 1. Organizational BI readiness BIS framework [59]

The reason for readiness assessment is, 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 where the IHL is not ready to proceed with BI and identifies the area that needs to improve without wasting time and resources. Secondly, the evaluation will guide the universities on what they need to do before implementing BI at a higher success level [43].

4. RESEARCH PROCESS AND PLANNING

The aim of this work is to investigate the readiness of BIS in the institution of higher education in Malaysia and develop the possible readiness model that can be used as a 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 consisting of qualitative and quantitative as established 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-objectives are as follows; 1.To determine the requirement for the 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 a qualitative and quantitative research process will be conducted in two sequential phases that involve eleven (11) steps as shown in Fig. 2.

4.1 Qualitative and Quantitative Field Study Method

This study endeavoured 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 the 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 in the first phase and 6 to 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 BIS readiness 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

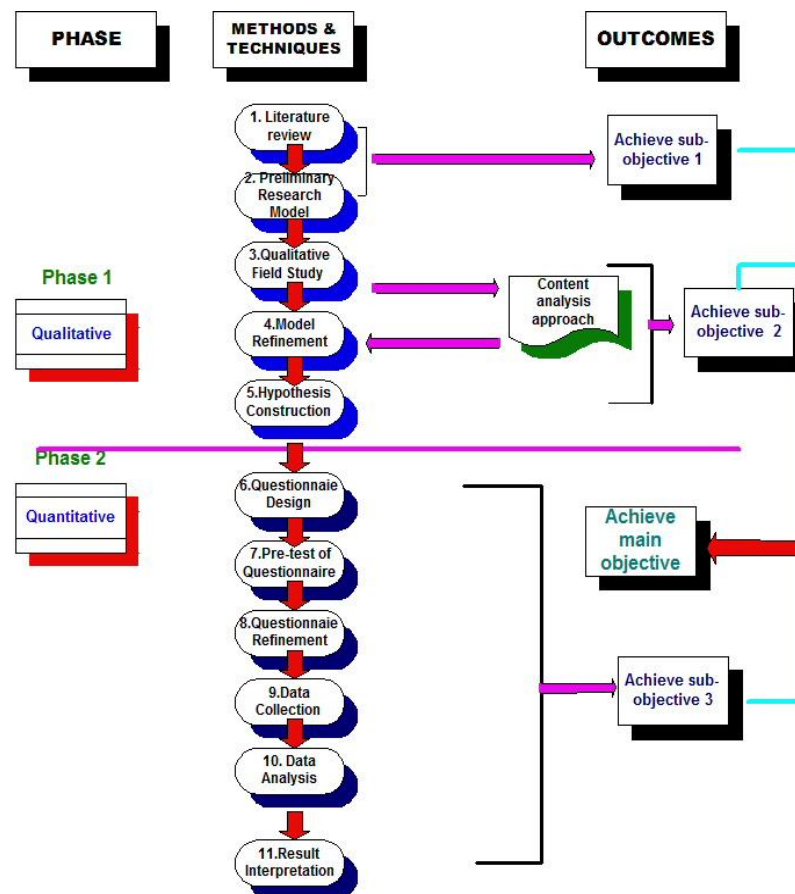


Fig. 2. Research phases and outcomes

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 of this method is the BI readiness model that needs to be tested. Next, the questionnaire will be designed and the data will be collected based on the variance from the BI readiness. Stakeholders from different university agencies, including computer centre managers, technicians 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 interviews on a voluntarily basis. Data collection and analysis methods in qualitative studies are different from those used in 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 ensures that information is 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 modelling 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 steps 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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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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