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BUSINESS INTELLIGENCE READINESS FACTORS FOR HIGHER EDUCATION INSTITUTION

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ABSTRACT

Higher Education Institution (HEI) have embarked on the new style of decision-making with the aim to enhance the speed and reliability of decision-making capabilities. One of the hardest challenges in implementing Business Intelligence (BI) is the organization's readiness towards adopting and implementing BI systems. Currently, few published studies have examined BI readiness in HEI environment. Seeing this challenge, this study aims to contribute in determining the BI readiness factors in HEI specifically in the deployment strategies. Through inductive attention to BI in HEI environment, three broad factors have been identified: a) Organizational – that concerning on business strategies, process and structure, b) Technology – involves the BI system and knowledge for managing including the sources and c) Social – the culture within organization that may influence decision-making and its processes. This paper also makes recommendations for future research.

Keywords: *Business Intelligence Readiness, Technology Readiness, Business Intelligence in University, Readiness Factors*

1. INTRODUCTION

Business Intelligences (BI) is a new business technology that is defined as "a *collection of tools and technologies that involves the data analysis and query to produces rich reports presentations given a high accuracy in decision-making"* [1]. The use of BI in the organization can gives huge impacts not only to the enterprise organizations that contain clear intentions on Return on Investment (ROI) [2, 3] but to the academic institutions as well. The Higher Education Institution (HEI) considers the capabilities of BI are able to support the HEI management's with their business process in making decision [4]. Therefore, the level of readiness has become an important element of HEI for implementing BI. Therefore for this study, the terms readiness can be defined as *"level assessments of projects with no error by the organizations*" [5] which links to the organization's objectives and goals. There are few studies discussed the readiness of an organization to adopt BI from the perspective of various technologies such as E-Learning [6, 7] and Enterprise Resource Planning (ERP) [5]. This proves that the study of BI readiness is crucial for an organization before they decided to adopt BI.

Potential values of BI for the universities have been extensively discussed in the previous studies [8-10]. A successful implementation of BI project enables university's top management make and take better decisions. However not all BI projects have been implemented successfully [11, 12]. The ability to implement BI project really depends on readiness of organization. Hence, evaluation of BI readiness is vital because it able to identify gaps before the organization proceed with the BI project. Anecdotal evidence suggests that universities are good candidates for implementing BI project [13] and have much potential to further exploits the values of BI. Environmental drivers contributing to increased interest in BI within the HEI sector include continuing growth in student numbers and staffs, increasing competition between institutions, government pressure to improve operational efficiency, and the diverse and shifting expectations of stakeholders to support future excellence of HEI [14]. This has been stated by Sujitparapitaya, et al. [15] where "*one important reason why organizations (HEI) adopts innovative technologies, models, and business practices is to support in accomplishing organizational objectives at strategic, tactical, and operational levels"*. Furthermore, thorough understandings of readiness

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factors are vital for the preparation before progressing with the BI project [16].

Therefore, this study aims to review previous studies that reported readiness factors in implementing BI for HEI. Since BI is fresh know-how technology in HEI, the authors chose the technology readiness as one of the main readiness factors. The technology readiness is defined as "*people's propensity to embrace and use new technologies for accomplishing goals in home life and at work"* [17]. Three main readiness factors were derives from the definition of technology readiness as presented earlier. The three factors are Organizational, Technology and Social [5-7] that suitable with HEI and decision-making environments.

The remainder of this paper proceeds as follows. First, the research method is described. Next, findings from the literature review are discussed. The paper concludes with a summary and suggestions for future research.

2. RESEARCH METHODOLOGY

BI readiness factors are the main concern for the authors to searching the literature that has reported from previous studies. In line to get the point, this manuscript has adopted the qualitative approach referring to the principles of the systematic review as recommended by Bandara, et al. [18]. Therefore, the principle of conducting systematic literature reviews consists of four stages where the first stage is an identification and extraction of articles. The second stage is the preparing the analysis and the third stage is actual coding of the reviews. The last stage is the analysis and write-up the findings.

This paper is specifically devoted to searching and reviewing the literature on readiness factors for implementing BI project reported by previous studies. The first stage involved identifying the articles to be included in this review. In identifying the articles to be included in this review, several online databases such as Ebscohost, Science Direct, Elsevier, Springer-Link, IEEE, Sage Journal, ProQuest and Taylor Francis Online were considered as the searching sources. The extraction of relevant papers was focus readiness factors in implementing BI in the HEI sector. For the second stage, the searching search strategies use "Business Intelligence Readiness" AND "Higher Education" OR "Academic Organization" were searched for in the title, abstract and keywords of the sampling frame described above. This has yielded only 35 papers. As this yielded only 35 papers, the authors extended the search to a second step, this time the authors broadened the published year of literature up to the year 2000. 25 further papers were identified through this effort. Thus, the authors commenced the analysis phase with a sample paper pool of 60 papers.

Third stage is the actual coding (including the analysis) which took place in multiple rounds. In Round 1, any direct or indirect mentions of 'readiness', were identified. In Round 2 the authors focused on distilling core themes observed across the Round 1 results (based on technology readiness definition identified from this round); a master list of themes was extracted, which pointed to elements such as the organizational, technology and social. In Round 3, the articles was revisited searching for further evidence of the master list of themes identified in Round 2; the purpose of this round is to capture maximal relevant data pertaining to each theme identified in Round 2. In Round 4, the master list of themes and related supporting data were re-assessed, in search of a parsimonious set of factors (based on themes distilled from the early phases) that could best differentiate the readiness factors. In this phase, relevant literature from the generic BI, Business and IT domains were reviewed to further understand the themes as synthesized, to derive a more parsimonious list of meta-themes (factors), to better rationalize the observations made through triangulation, and to provide content validity to the resulting dimensions. This resulted in the identification of three main factors (meta-themes) namely; organizational, technology and social. These three main factors are clarifies in details at the next section.

For the final stages is the write-up of the result. The authors presented the result in a manner of an objective of the literature. From the Introduction section, paper issues and objectives are clarified. Besides that, the definition on the preferred subject (BI readiness factor) is explained for reader to get pre-idea for this paper. In Analysis and Finding section, using tables helps the authors to describe the effect of reviews on the results. The justification on each finding has written for the reader to get clear view on the readiness factor of BI for HEI. Finally, this paper ends with conclusion and recommendation of outlook contributions

3. ANALYSIS AND FINDINGS

The aim on BI readiness is to determine which degree of an organization changes fully becomes familiar for the business value. Through assessments of BI readiness factors also, it helps organization to examine any risk, strength, executes BI planning to improve the readiness, develop competencies to drive BI into centre of process and

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managing BI that will cause the productivity of BI success [2].

According to Keramati, et al. [7], the three readiness factors aforementioned appears from their empirical studies that identify the role of readiness factor for E-learning outcomes. They mentioned, the Organizational readiness includes the experts, organizational rules, organizational culture and management permanence. For the technology readiness consider hardware, software, content, internet access, bandwidth and school's space while in social factors, includes the society's conception of E-Learning, governmental rules and administrative instructions. This readiness factors plays moderates roles for HEI to measuring the E-Learning system outcomes. However, the study finds out, these readiness factors have strengthened the system factor and system outcome. Similar readiness factors has been categorized by Darab and Montazer [6] for E-Learning system where these readiness factor helps the readiness assessment more completes to ensure the implementation of new system or technology is in ready modes. Meanwhile, Ahmadi, et al. [5] mention, the readiness should happen in pre-implementation stage, meaning the organization requires to recognize the activities involved for further implementations. In order to achieve the readiness, the organization needs to know which indirect or direct activities that should performed later as well as the current state of the organization. Moreover, the practices and social elements are required as it relates to those activities. The activities, practices and social elements are categorized into three factors that consist few sub-elements as to support it.

The three readiness factors recognized above hold few sub-elements to sustain the factors accordingly. However, the previous researcher has found this readiness in the different system, such as E-Leaning and ERP. Here, it is clearly shows that the readiness factor involves the type of system, the system function, the system capabilities and the surrounding components for completing them as factors for readiness assessment. As for that, in this study, the author using BI as the technology and correlating with other two factors by identifying and interpreting the sub-elements towards BI. Table-1 classifies the three general readiness factors discussed from previous literature in order to help HEI consider the readiness sub-elements surrounding them for BI implementation.

Table-1. Broad Readiness Factors and Its Descriptions.

Factor	Descriptions	Authors
Organizational	Known as the soft infrastructure that involves the organizational structure and goals, the organizational business process including the business value and its sub-units such as finance, human resource, and others as well as organizational rules. A part from that, supportive from external and internal stakeholders and IT partnership that includes the Government requirements	Keramati, et al. [7], Ahmadi, et al. [5], Darab and Montazer [6].
Technology	Known as the hard infrastructures holds with the technical readiness, technical knowledge and skills in handling the technical specifications and requirements. The facilities in technical (hardware) and software aspects, as well as the networks infrastructures, need to consider.	
Social	Known as supportive infrastructure can be describe as decision-making environment that holds the readiness factors. Besides that, the supervision and coordination among employees consist of the culture readiness and communications activities are included in this factor.	

Table-1 describes the three general factors had given wide knowledge of readiness factor for HEI. In Organizational factor, the readiness is concentrate on organization strategies and organization structures that comprise the management level and business process activities. Meanwhile for Technology factor, the readiness

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was focus on organization's technology with technical knowledge and technology capabilities. Apart from that, the Social factor focuses readiness on organization's staff motivation, which involves the cultural readiness and level of communications among employees.

BI is implicating further than the technical and analytical skills. It entailed the responsible person to appreciate the business desires, construe the analysis performed on big data and provide leadership for decision-making in an organization. In academic organization, there are some familiarities and abilities that are needed to deliberate which are analytical skills, Information Technology (IT) knowledge and skills as well as business knowledge and communication skills [19]. Those familiarities and abilities are important features that follow accordingly to the three readiness factors previously mentioned. They need a deeper review in supporting the correlation with readiness factors of BI.

The readiness factor and its details have established in the education sector since the HEI becomes an organization that facing the technology challenge of deployment and changes. Referring the Table-2, there are sub-elements categorized within the three main BI readiness factors from previous researchers. These sub-elements rationalize the readiness approach for HEI to put BI into practice.

Table-2. Sub-Elements for Each Main Readiness Factors For HEI

Sub-Elements	Sources
Factor 1 : Organizational	
1. Strategic Alignment	Williams and Williams [2], Barneveld, et al. [20], Kashorda, et al. [21], Anjariny and Zeki [16]
2. IT Partnership	Williams and Williams [2], Barneveld, et al. [20], Mutula and van Brakel [22], Anjariny and Zeki [16]
3. Education Requirements and Policies	Kleesuwan, et al. [23], Guster and Brown [24], Mutula and van Brakel [22], Komarraju, et al. [25], Sujitparapitaya, et al. [15], Nordin [26]
4. Management & Leadership	Powers [27], Guster and Brown [24], Barneveld, et al. [20], Nordin [26], Anjariny and Zeki [3], Chang, et al. [28]
Factor 2 : Technology	
1. Technical Readiness	Williams and Williams [2], Xuemei Tian, et al. [29], Anjariny and Zeki [16] Kashorda and Waema [30],
2. Data Source / Information	Powers [27], Guster, et al. [31], Mutula and van Brakel [22], Anjariny and Zeki [16]
Factor 3 : Social	
1. Decision Process Engineering Culture	Williams and Williams [2]
2. Culture Around Use of Information and Analytics	Williams and Williams [2], Barneveld, et al. [20], Hooi, et al. [32], Anjariny and Zeki [16]
3. Continuous Process Improvement Culture	Williams and Williams [2], Guster and Brown [24]

Table-2 summarizes the sub-elements identified from the literature. The sub-elements cover the area of BI awareness, BI benefits and performances, and implementation strategies. Details on each sub-element are describes as follows:

3.1 Organizational

There are four sub-elements of readiness factors in organizational categories identified in this review. Each factor identified in Table-2 are discussing as follows:-

3.1.1 Strategic Alignment: In BI strategic alignment, there are three fundamentals should have to avoid the risk and ensuring the BI initiative provides a business value for an organization. The fundamentals are: a) the consistency and reinforcing of business strategies and business process, b) improving the management and business processes that boost up the productivity and services (public sector), c) BI initiatives that supported by IT infrastructure and IT organization [2]. A part from that, the analytics in HEI also helps to establishing the financial or the operation efficiency, measure the local and global impacts and fulfils the industry demand that affect the changing economic world [20]. This also agreed by Kashorda, et al. [21] in their study for improving the education quality of Kenya. Meanwhile, Anjariny and Zeki [16] claimed that it is an organization action to analyzing the business value through BI initiatives.

3.1.2 IT Partnership: Business and IT are required to create the business value [2]. Reliance's on these two elements creates the broad collaboration among the partnerships. Market share and endorsement activities are important for creating wealth in business value. External environments that involve the partnerships activities connects the

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organizational management is vital [22]. The strong and commitments of sponsorship criteria such as an effectiveness of information and technology partnerships would make the system deployment is possible within the organization [16]. This readiness factor supports the BI readiness deployed in organizations.

3.1.3 Education Requirements and Policy: In the contexts of HEI, the government requires the continuity and ongoing reports that charter for funding and accreditation level for HEI [15]. The strategy of BI at all level of operations in academic is reliance to managing the analytics data contained in HEI. This helps the teaching and learning activities as well as the programs more effective and efficient. Besides, it is important for top management of HEI, prepares and provides the policies toward the changing adoption of technologies or new systems [22-26]. Even though the process of creating policies is hard but it is better approach for HEI to be ready in deploying BI. Through these policies, it may help HEI to sustain the business value and its authentication data as well as producing better results.

3.1.4 Management Support and Leadership: The top level management roles are very important to ensure the readiness of BI deployment [3, 20, 24, 26, 27]. The leader's' responsibility has recognized at all level of management. Thus, the top management should identify the motivational aspects for the manager at all level in order influenced them for making reports through BI [28]. As a result, this helps for each leader from each department to be very clear in the intensity of BI deployment.

3.2 Technology

According to the analysis for Technology factor, there are two sub-elements identified.

3.2.1 Technical Readiness: In order to reduce the risk, it is critical to know how the BI in technical factor. As state by Williams and Williams [2] "*an effective BI readiness assessment should be assessed from BI and DW (Data Warehouse) technical readiness*". Technical acceptances may influence the management to produce better decision-making that will affect external and internal organization [29]. A knowledge in solid technical infrastructure becomes as BI readiness factor toward the BI success in deployment strategies [16].

3.2.2 Data Source and Information: The data warehouse for HEI is getting bigger and nowadays known as "Big Data" [31]. Thus, it needs data in real time and easily in accessing to ensure the efficiency in managing the outputs [27]. Mutula and van Brakel [22] have pointed out that, the richness of information from relevant sources were fulfil the needs of a user that satisfying according to the requirements.

3.3 Social

For Social factors, there are three sub-elements identified in Table 2. The details are as follows:

3.3.1 Decision Process Engineering Culture: Through BI application the organization able to answering the questions in a decision process that appears structurally. The questions such are, a) Who is notified of unfavourable variance? b) What needs to be analysed and by whom, and using what tools? c) How will decision turn into action? d) What decisions needs to be made and by whom? e) What is the decision time frame? and f) Who is responsible for monitoring decision impacts? [2]. Thus, it helps the organization to embed the BI application in core business process. As been claimed by Williams and Williams [2] the decision process may involve " *the use of information, analytical applications, and/or quantitative methods as appropriate for the type of decision to be made*".

3.3.2 Culture Around User of Information and Analytics: In this sub-elements, Williams and Williams [2] clarify the culture readiness factor as *"the culture around the use of information and analytical applications"*. Meanwhile, Anjariny and Zeki [16] use this culture readiness factor in his study as to support with the BI success factor by recognizing the readiness for successful of BI system. In addition Barneveld, et al. [20] also agree, where he mention the analytics culture only happens to the organization and it is surroundings that dedicated for increasing their productivity, innovation and performance through BI. In direction to achieve this analytics action, HEI must focus on leads and navigates the significant changes of organizational cultures and behaviours rather than technology. Moreover, the state of "readiness" among participants is important as to ensure the new system implementations are able to accepted [32].

3.3.3 Continuous Process Improvement Culture: It is important for an organization to improve the

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business process however; the changing is quite tricky to happen in short time. BI readiness, helps the organization to search out the change management and continues to improve the challenges [2]. Guster and Brown [24] mention "*the multiple layers of bureaucracy clouded who was responsible for making the important decisions relates to supporting a BI system and creates a risk adverse culture whereby no one was willing to make such decisions"*. Thus, the communication is a vital strategy for an organization for continuing the improvement culture.

In summary, the study suggested three main factors with their sub-elements of readiness for BI in HEI. Table-1 and Table-2 present supporting evidence for these factors from the literature data and the list of sub-elements that form the main factors. Figure-1 provides the summary results for this analysis.

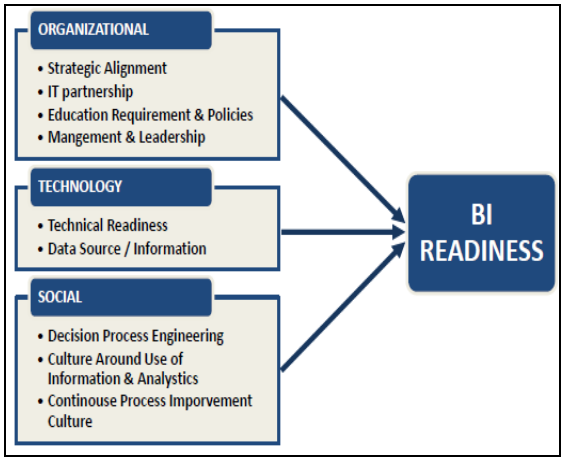

Figure-1. BI Readiness Model For HEI

4. CONCLUSION AND FUTURE WORK

With the increasing amount of data being collected from internal and external sources, HEI sectors are constantly seeking new technical approaches to making better use of data and information available. Therefore, BI as a tool has significant potential in transforming data from distributed and heterogeneous sources into useful information for supporting organisational decision-making, management and strategic planning. This paper attempts to report on the readiness factors of BI from the systematic literature review. Within the context of the currently available academic literature, the authors identified three major factors, which are Organizational, Technology and Social. The top management commitments and the strong sponsorships [33] especially in BI project are known as the strong factor in Organizational. The readiness in this factor may lead the acceptance of deployment of BI. A part from that, HEI is attaching with the government policies that pursue them to present the improvement of academic and education sector. The issue that HEI should consider in reporting is the quality of data inside the report more important rather than a number of reports produced.

Knowledge on technical aspects of BI system is something that HEI must be concerned on too. The technical factor not only focuses on the technical side of BI but the way data is collected and the arrangements of data become the main discussion that need to be the focus. According to Aruldoss, et al. [34], there are two approaches in data collections of BI. The traditional way is comprehensive data collections that cause the time-consuming and very expensive. The driven data collections become the second approach that developed based on the competitive pressure faced by an organization. As a result, the strategies in collecting data for BI should well organize and aligning with the resources and timeframe for deploying BI.

In social factor, the connection between superior and operational level are important to ensure the BI strategy is successful. For instance, the advantages and desirable of BI usage for an organization help the superior to influence their workers to use BI in their practice. This creates the social influence that develops the willingness to adopt BI system [1].

Understanding these factors is critical for the progression of the implementation of BI in both academia and practice. Though there are numerous publications on BI, there is a limited study about BI readiness factors for HEI. This study addresses this gap by investigating the readiness factors and deriving a BI readiness factors model based on a detailed deductive and inductive analysis of previous literature of BI within the HEI sectors.

Three major readiness factor identified above must turn out to be the core elements and supported by their sub-elements for HEI to ensure the deployment of BI will meet the institution's objective. This model can be use as input to construct operationalization for a global survey intended to validate the BI readiness factors model and this will yield insights on the relative importance of the readiness factors

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