Determinants of Big Data Adoption for Higher Education Institutions in Malaysia

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Abstract: Big Data enables higher educational institutions the ability to efficiently use the information technology resources to enhance the effectiveness of education and performance. This research explores the characteristics of big data applicable to educational institutions, identifies the factors that affect the adoption of big data approach in higher education institutions, especially for strategic management purposes and aims to examine the challenges of adopting big data in higher education institutions. The literature references sources are from journals on scientific studies and articles, plus research papers. To achieve all of the objectives, the researcher uses qualitative research methodology for interviewing and analyzing the data from fifteen identified organisations, including authority, consulting firm, public and private universities. This research is expected to conclude the most important determinants, which is evincing the fact that big data management is essential for providing higher education institutions with enhance educational quality and to guide students, colleges and universities to better experience.

Keywords: Big data, Higher education institution, Adoption, Factors, Challenges

1. Introduction

This section begins with the research background, the significance of Big Data and the adoption of big data in Higher Education Institutions are discussed. Subsequently, the problem statement was based on reality, ideal and consequence in Malaysia. The problem statement focuses on the existing theoretical gap in the literature between the data measurement, implemented technological features, and enhance the quality of learning outcomes. The research questions were further identified and the research objectives outlined. Besides that, the research scope explains limitations and the significance of the analysis, highlights the research's importance.

1.1 Research Background

The principle of Big Data Analytics has supported all industries to identify the best trends and improvements in the industry for many decades. This definition has grown over the years and the techniques of massive data analysis have changed as well. The analytics provide an effective way for the user to remain agile. Big data is an area that treats ways of analyzing, systematically extracting information from, or otherwise dealing with data sets that are too broad or complex for conventional application software for data processing to manage. Big data issues include data capture, data storage, data analysis, scanning, sharing, uploading, visualizing, querying, updating, privacy and source data (Cavanillas *et al.*, 2016). The higher education institution retains a huge amount of student and faculty-related data. This data will be analyzed to gain insights that could enhance the educational institutions' organizational effectiveness. Variables such as the actions of students, the results of tests and the progress of each student, as well as their educational needs, would be focused on changing educational needs. Most of the institutions of higher education collect more data than ever. Nevertheless, this research found evidence that most of these data used to meet credentialing or reporting requirements rather than to address strategic questions, and that much of the data collected is not used at all. Analytics is mainly used in the fields of enrolment management, student progress, and institutional finance and budgeting. The Industrial Revolution 4.0 (IR 4.0) provided a new impetus for the transformation of education. The immense influence of a multitude of ICT technical advances on education has been noted by educational experts in recent years. They agree that innovation will shape Education 4.0 and indeed, they will have to train students to produce innovations.

1.2 Problem Statement

All Data measurement is increasing rapidly across different sectors worldwide. With this development, there is a direct need to develop a system that enables assimilation and data review for better decision-making. It could be noted that there are various procedures for developing data covering issues such as consolidation, isolation, naming, searching and access to unstructured and structured data (Patel *et al.*, 2012). The main challenge is to manage and analyze the large measure of data in order to recognize critical trends in decision making.

The significant point is that previous work through big data concentrated mainly on technological features such as machine learning or software algorithms and system development (Haddad *et al.*, 2018). However, not much research is found on how factors affect big data adoption or the challenges encountered during implementation for higher education institutions (Santos *et al.*, 2018). Nowadays, many academic institutions are heading to cloud architectures and with users ' increased use of digital devices in these ecosystems, many data is collected in these institutions than ever before, creating significant opportunities to use big data to analyze and compare information that improves decision making.

In order to enhance the quality of learning outcomes, it is important to evaluate effectively large volumes of data produced by educational systems to promote suitable responses to new challenges (Murumba & Micheni, 2017b). Big data poses many technical problems that include constant upgrading of resources and expertise, meaning higher education institutions need to have sufficient budgets to overcome these concerns. Legitimate concerns about privacy do exist, particularly regarding data from online sources. This combined with the digital divide in many nations poses barriers to using Big Data's power for the benefit of educational system users.

1.3 Research Questions

(i) In what way can Malaysia Higher Education Institutions create value from new integrated big data competence model for their institutions?
(ii) What are the supportive factors that may influence the adoption of new integrated big data competence model in Malaysia Higher Institutions?
(iii) What are the challenging constraints that may affect the adoption of new integrated big data competence model in Malaysia Higher Education Institutions?

1.4 Research Objectives

(i) This section should include research objectives. To study the method that Malaysia Higher Education Institution able to create value from new integrated big data competence model.
(ii) To explore the supportive factors that able to influence the adoption of new integrated big data competence model.
(iii) To investigate the challenging constraints that may affect the adoption of new integrated big data competence model.

1.5 Significance of the Study

Big data has made significant changes in many aspects of education. One of the most significant change that big data has brought to education is the ability to monitor education systems. The transformation of education in the near future will be significantly different from that of today. Big data analytics uses specially designed methods and software to examine constantly growing data. To analyze it, data scientists take into account its three basic characteristics: volume – refers to the amount of data; velocity – the speed at which data moves and is processed; and variety – refers to data types and attributes. The enhanced quality of learning outcomes shall focus in education system that revolutionize the way it creates student from higher education which profession to choose, guiding them to develop skills in any course. Formed based on collected data and analytics, educational software shall meet the needs of both learners and professors. The development of facial recognition and voice-based learning in the classroom as an example that would change the approach and speed of learning.

1.6 Scope of the Study

This research focuses on the determinants of big data adoption for Higher Education Institutions in Malaysia. The first step of this study is via observation. The researcher defined the issue via always pause and ask as many of the 5W/H questions as common sense and context allow in order to set the objectives in conducting this research. Secondly, the next step is to review literature. It is important because the researcher can base on the relevance of previous studies to gain an understanding of the existing research and debates relevant to a particular topic or area of study and to present that knowledge in the form of a written report. Other than that, from the previous articles list out the limitation of study, it provides the golden opportunity to improve in the new research.

The instrument of qualitative analysis that would be applied is via interviews. This study is based on the targeted, related population shall be concentrated on institution top management group. The population number is 15 institutions. After collecting the data from the interviewees, the tools for analyzing the data used is ATLAS.TI. This software shall be the latest method for computer-assisted qualitative data analysis. Furthermore, the final findings obtained in this research shall be discussing the most significant determinants of big data adoption for Higher Education Institutions in Malaysia. The conclusion shall include the contribution, limitation, implication, and summary of this research.

2. Literature Review

All in this section, the discussion of the related literature reviews of this study is presented. Basically, the chapter explores the relevant research about the determinants of big data adoption for higher education institutions in Malaysia. Big data aims to improve advancement of the established models to enhance the policy determination and decision making. This research will aim to recognize and incorporate the main key factors and challenges the adoption of big data in higher education institutions. Research is being developed with the purpose of exploring the adoption big data for higher education institutions. In addition, there has been demand from economic and social changes for advanced education institutions to respond effectively and in a timely manner to these rapid changes.

2.1 Data

Data are piling up in dizzying amounts and it can be found everywhere. According to (Data - Wikipedia.), data is information or features that are numerical, and it collects the characteristics through observation. Moreover, data is a set of values of qualitative or quantitative variables value set through by data which consist of one or more persons or objects, whereas a single value of a single variable is a datum. Data can be defined as measured, collected, reported, and analyzed, it can present by different ways which can then be viewed using images, graphs, or other methodologies.

2.2 Big Data

There are three features that can help break the word down. The "3Vs" are called, volume, velocity and variety, and these are crucial to understanding how to evaluate massive data, and how much big data is different from old-fashioned data. Big Data as defined by the "3Vs" (volume, velocity, and variety) but now there is "5Vs" (Volume, Veracity, Velocity, Value, and Variety) of Big Data which are also termed as the characteristics of Big Data.

2.3 Big Data Management

Big data is economically and scientifically important. BDM is focused on big data processing skills and techniques to collect, organize, store and strengthen relevant information. Big data integration, manipulation, quality, and management are important issues that should be analyzed when creating a big data management solution (Kaur & Sood, 2017). The efficient of big data management is a time-consuming activity that frequently encounters intermittent disruptions or underwhelming performance. Some of the main aspects of Big Data Management is to keep up with the new developments in the same way (Almeida, 2017).

2.4 Big Data Management in Education Sector

Big data help institutions to use existing data efficiently to explore new domains for development opportunities and to enhance knowledgeable sector (Martin & Thawabieh, 2017). On the report of Ruddle (2009), a specific demand for the quality of education of today's global community is widely available worldwide. Higher education institutions retain always operated in an information-rich landscape, generating and collecting massive amounts of data on a daily basis. Data as an significant tool for institutions used to guide the regular operating and long-term operational and organizational decisions. There is include student record data, staff data, admissions and applications data, financial data, alumni data, course data and estates and facilities data.

2.5 Technology Organisation Environment (TOE) Framework

The Technology Organization Environment (TOE) is a theoretical framework developed by Thornatzky and Fleischer in 1990, which identified the behavioural traits of technology, environmental conditions is a key driver of technology adoption for the organizational readiness of the institutions

(Chong & Olesen, 2017). The adoption of technological innovation can be identified by a 3-stage technique for initiation, adoption and implementation. At the initiation phase involves the classification and evaluation of technological innovation that meets the needs of the organisation. The phase of adoption needs to making decision determination for adopt the innovation based on the distinctive conditions of adoption (Lippert & Ph, 2006). The phase of implementation helps to introduce innovation into the development activities. The TOE framework is capable of supporting an effective theoretical framework for higher education institution considerate the internal and external factors to investigate the use of technological development (Wahab & Olugu, 2019). Furthermore, this study will focus on the development of the following conceptual framework that integrates the TOE framework. The adopted the variables from TOE framework as the independent variables and actual usage of BDM as the dependent variables in the conceptual framework. The adopted the TOE framework variables as the independent variables and the actual use of BDM as the dependent variables in the conceptual framework.

2.6 Factors Adopted Big Data in HEIs Malaysia and Conceptual Framework

In this theoretical framework (Figure 1), there are including five independent variables which is Technology Awareness, Technology Readiness, Reliability Technology, Top Management Support and Technology Infrastructure. The dependent variable which is intention to adopt BDM from the TOE framework has influenced the theoretical framework.
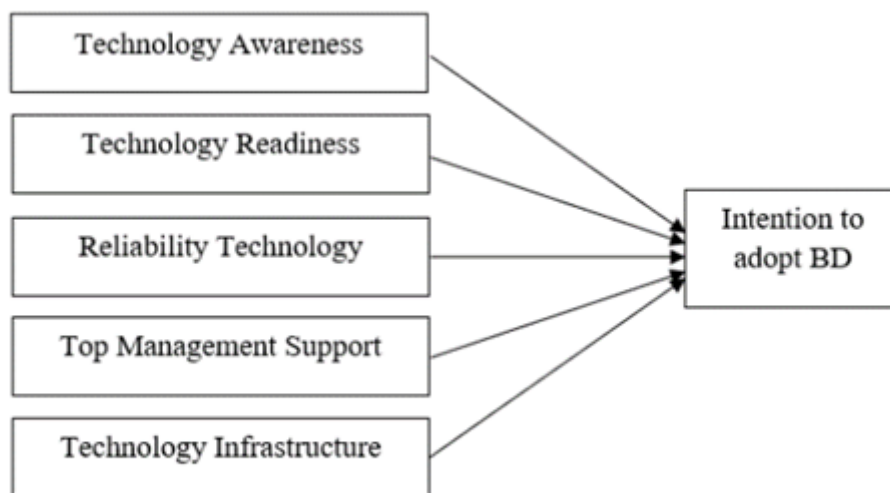

Figure 1: Theoretical framework

(a) Intention to Adopt BD

The intention to use in this study refers to the extent to which higher education institutions are determinant to incorporate the adoption of BDM into the system. The intention to adopt BDM formed by five factors which are Technology Awareness, Technology Readiness, Technology Reliability, Top Management Support and Technology Infrastructure. According to previous studies, the institutions regard that the use of BDM technology will help the system enhance the performance and endeavour the outcome with minimizing the attempt.

H1: The behavioral intention to use BD has a positive significance affects its use.

(b) Technology Awareness

The knowledge of technology through awareness in the higher education institution is required. The aim is to understanding or needing to exploit its potential within an institution context (Verma, 2017). Technology awareness is a factor in which big data integration processes suitable for efficient decision-making are used as a basis for awareness. Big data can be viewed as significant for determining the degree of big data awareness, as experience can help the institution build effective big data management strategies (Izhar & Shoid, 2016).

H2: Technology Awareness has a positive significance influences the behavioral intention to use BD.

(c) Technology Readiness

The technological readiness theory is used to measure an institution's competency which to adapt big data Technology readiness also knows as technology competence (Huda *et al.*, 2017). The recognition and implementation of various forms of technological applications of big data as a key element of the ionization achievements have played a vital role in understanding (Izhar & Shoid, 2016). The institution is required to find out how simple the big data solution is and how consistent the solution works with existing systems and to determine the potential benefits of this new technology (Sam & Chatwin, 2019).

H3: Technology Readiness has a positive significance influences the behavioral intention to use BD.

(d) Technology Reliability

Reliability analysis of Big Data is imperative. Reliability technology enhances product reliability through assessment and analysis. It also able avoiding to produces a faulty product. Big Data receives enormous data and analyzes it to produce some excellent results with efficient way. Reliability Technology engineers would only be able to perform comprehensive reliability studies when the data is searchable and accurately explained across the entire system (Williamson, 2018).

H4: Technology Reliability has a positive significance influences the behavioral intention to use BD.

(e) Top Management Support

Top management support to technology adoption is exceptionally significant for small and medium-sized enterprises. Top management involvement is essential to enhance executive support and approval for the endorsement of Big Data for higher education institution (Sun *et al.*, 2018). Besides that, the involvement of top management in implementing and using big data is essential both for supporting and sponsoring a new technology and for helping to overcome potential barriers. According to the previous study, it found that top management support has a positive influence on the adoption of big data (Chong & Olesen, 2017). The involvement of top management in the implementation and use of Big Data is important both to support and sponsor a new technology, as well as to help to overcome obstacles to change.

H5: Top Management support has positive significance influences the behavioral intention to use BD.

(f) Technology Infrastructure

Technology infrastructure defines as the tangible resources of the institution. For example, the physical assets, which institution need to have in order to adopt technological innovations. Technology Infrastructure carries out the critical project of proceeding advance digital universities while at the same time reforming the higher education and building a hidden marketing system in higher education. Building higher education Technology infrastructure needs outsourcing organizations from the private sector, software developers, cloud hosting companies, data analytics designers and a host of other technical specialists (Williamson, 2018). Technology infrastructure are able to complex the big data for Higher Education.

H6: Technology Infrastructure has a positive significance influences the behavioral intention to use BD.

2.7 Challenges of big data management in HEIs

Big data has become a significant trend for a large variety of research fields, including knowledge fusion, machine learning, computer science, data mining, semantic website and social networks (Ruiz-Palmero *et al.*, 2020). There is a range of predicted challenges related to the implementation of big data in higher education institution. Big Data provides institutions with a strong structure for using a wide variety of data effectively in advancing the future of higher education institution (B. Daniel, 2015).

The quality data are typically considered as one of the challenges of big data adopting in higher education institution (Murumba & Micheni, 2017a). Data unavailable may occur which the required data either do not exist or not generally available. In certain cases, data providers may take "just fill in something" engage in fulfilling data storage sources, attempting to create mistakes (Bello-Orgaz *et al.*, 2016). Poor quality of the data will cause misleading analysis. It is possible to give rise to inaccurate results and inadequate judgements with inaccurate and low-quality data can erode ROI in the data collection system. Besides that, data are integrated inaccurately. Reporting inaccuracy may occur at any stage of the process. For example, the evaluation feedback from student to the state government 's report may happen data entry errors. Therefore, determining data quality is one of the big data challenges in higher education institution.

Furthermore, barriers to data integration are prominent. Data integration is a crucial phase in the management of big data and takes regarding integrating data from different sources into a coherent framework. Big Data Integration (BDI) has no common approach. Acknowledgement that big data compose the structured, semi-structured and unstructured in different formats. The incorporation of data from databases of different structural and storage systems contributes to the loss of essential data and often from data cleaning during incorporation. A further obstacle for cross-institutional data integration, similarity can be the lack of data sharing agreements and data management models (B. K. Daniel, 2019). It is because of the absence of techniques or practical applications, and thus the quality of data obtained from big data is based on the data quality collected, it is an issue for comparison (Lorenzo, 2013).

Last but not least, the major challenges are obstacles that are facing professionalisms in using these techniques are lacking person who owns required expertise, despite the substantial improvement of new technology, analytical instruments and applications. Big data education is in need for some special skills which are limiting in some researchers of science. Notably, the employment of data visualization demands for visualization of information and a good understanding of statistics and which limits access for several professional educators (Mikalef *et al.*, 2018).

3. Research Methodology

Methodology is one of the main stages in collecting research data. This chapter shall focus on discussing the crucial components which are including research design, research methodology, research population and sampling, data analysis method, data collection and procedures and. The aim of this chapter is to discuss the approach to accomplish the objective of this study. In this chapter, the factors of adoption big data for higher education institution in Malaysia will be investigated and this will be the proposed research conceptual model of the study. In particular, this chapter will consist of investigations of factors for intent to use BD established by other researchers and the summary of different actual theories. Therefore, the purpose of Methodology is to build the analytical procedure effectively and to collect and analyze data consistently to achieve research objectives.

The data for this research will be collected from primary sources that data that is collected by a researcher from first-hand sources which is a face-to-face interview. . The data collection was about to identify the factor of adoption of big data for higher education institution in Malaysia. In this study, the researcher will use purposive sampling or also known as judgmental, selective sampling, which is a form of non-probability sampling that researcher relies on their judgment when choosing to participate in this study from the members of the population. There will be 15 samples being used in this case study which are The Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), MIMOS Berhad, Accenture Big Data Analytic Solutions Malaysia, Malaysia Digital Economy Corporation (MDEC), 5 Malaysia Public Universities and 5 Malaysia private Universities. In this research study, it will focus on the interview as a tool to collect data. The tools for analyzing the data used is ATLAS.TI. This software could be the latest method for computer-assisted qualitative data analysis.

In conclusion, this study shall be using the inductive approach and a qualitative method to answer this research question to be explored. The face-to-face interview will be used for collecting data. The target population of this study will be the top management of strategic decision-makers in organizations and higher education institutions. The data collection was about to identify the factor of adoption of big data for higher education institution in Malaysia.

4. Conclusion

This research examines the attributes for higher education institutions of big data, the factors influencing the adoption of big data and research in higher education institutions. The challenge of adoption of big data for higher education institution research is to explore the ways to gain the knowledge to develop its reliability in educational. In approaching education, big data can be incorporated by adopting a framework by accommodating the existing higher education institution and practice that to figure out the way that can overcome existing challenges in the field of HEIs.

Acknowledgement

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