UITM TOWARDS BIG DATA ADOPTION

Zuria Akmal bt Saad[1*], Dr. Siti Norbaini bt Sarmin[2]

[1] *Department of Applied Management, Faculty of Business Management, Universiti Teknologi MARA Pahang,26400 Bandar Jengka, Pahang, Malaysia*

[2]*Department of Wood Industry, Faculty of Applied Science, Universiti Teknologi MARA Pahang, 26400 Bandar Jengka, Pahang, Malaysia*

*Corresponding author: zuria@uitm.edu.my

Abstract: The objective of this paper is to review the readiness of UiTM towards Big Data (BD) implementation. In the era of the Industrial Revolution 4.0, more organizations are moving towards BD analytics, including the education sector. Datafication of education, which comes from the diversity of systems and practices, has great significance when analyzed. Numerous data in higher education will be useful for the university in planning for future direction. However, past study has discovered that most of the data collected are only for reporting purposes, and some of it are not even used. Thus, this study attempts to review the readiness of UiTM according to the recent five critical success factors of BD which are the organization, people, technology, data management, and governance. The findings of this paper will reveal the progress of BD at UiTM and access the level of the implementation and the action taken to ensure the successful implementation of BD in university environments.

Keyword: Big Data, Higher Education, Big Data Adoption, Critical Success Factor, UiTM

Introduction

The Ministry of Education (MOE), through ICT Plan Transformation (2019-2023), aims to enhance the use of ICT in education. The use of technology, such as big data (BD) and artificial intelligence, is one of the initiatives from the government in ensuring future Malaysian careers and avoiding mismatching issues (Malay Mail, 2020). The implementation of online learning has been adopted by UiTM long before the pandemic happened. UiTM has started a blended learning approach where half of the learning sessions are conducted through an online platform known as UFUTURE. Therefore, in early 2020 the implementation of online learning was fully implemented due to the outbreak of the pandemic Covid-19 which required all the operations of the university to be shifted online.

Online Learning Distance, which is known as ODL, has been introduced as an approach for UiTM online learning. In the early implementation of ODL, no specific platform has been stated to be used in conducting the online learning. Thus, this has made the use of numerous systems and technology to support the operation of the university and the increase in the available structured and unstructured data that could be utilized for useful information. UiTM is Malaysia's largest institution of higher learning in terms of size and population. Thus, this could lead to the 3Vs (velocity, volume, and variety) situation or BD.

This is supported by Siemens and Long (2011), Greller and Drachsler (2012), and Nguyen, Gardner, and Sheridan (2017) which mention that the use of the system in the daily operations of a higher institution will lead to producing more datasets and the needs of well-established and management of the data as the analysis will produce development and evolution of teaching and learning (Nguyen, Gardner & Sheridan, 2020). Complex commitments, such as new technology and organization approaches, are required as BD implementation is different from the other projects as the implementation is risky and costly (Cato, Golzer & Demmelhuber, 2015).

The statement above derives the question, "Are we (UiTM) ready for the BD implementation? Will we reap the benefits of this technology and become the winner? Or still, struggling in adoption to BD?". Thus, this study attempts to review the readiness of UiTM according to the recent Critical Success Factors (CSF) of study adopted by Zaher et.al (2020), Nasrollahi (2020), and Feliks (2020), as all of these models have been developed by reviewing all the journals related to the BD readiness. In implementing BD in the organization, three assessment methods can be applied which are the 'Benefits

Risk Analysis' (Polonetsky, Tene & Jerome, 2014), 'Return on Investment' (Russon, 2011), and the last is the 'Critical Success Factors' (CSF). However, the most significant method is CSF (Eybers & Hattingh, 2017) as it is the most relevant method in addressing challenges related to Information Systems (Caralli, Stevens, Willke & Wilson, 2014).

The methodology for this study is using qualitative research and the desk research approach. Qualitative research can be described as a description of the phenomenon under investigation using an explanatory approach. Meanwhile, using a collection of secondary data and information from published resources from libraries and the internet is referred to as the desk research approach (Falendra Kumar Sudan, 2021). In this study, the authors have referred to several collections of past journals regarding BD for higher education, model of BD readiness, the current situation of UiTM towards BD implementation, and in concluding this paper.

This paper is divided into three parts. The first part will be discussing BD in the higher education context. Next, is the model approach for BD implementation, and the last part will cover the situation of UiTM according to the model proposed in adopting BD.

Big Data in Higher Education

Nowadays, the implementation of big data analytics (BDA) in higher education is viewed as a resolution for challenges. Transformative, altering the existing process of administration, teaching, and learning, and contributing to the policy outcomes are the benefits of adopting BDA (Riffai, David, Peter & Al-Bulushi, 2016). Large-scale analysis on the data of student performance, sentiment, engagement, and satisfaction have become an indicator of the quality of higher education. This is because, measurement of student data at the same time reflects the performance of staff, courses, schools, and institutions as a whole (Williamson, 2019). Even though universities retain a lot of valuable data for its improvement, it is reported that most of the universities are using the data for reporting purposes only and some of the data collected are not being used at all (Rosmaini Tasmin & Tan Lay Huey, 2020). Datafication of education, which comes from the diversity of systems and practices, has a big significance when analyzed. The benefits are not only for the university itself but for the whole society as education is viewed as a public good and not as a commercial enterprise. Thus, the study of data and consequences is important in the education field (Zuboff, 2019). The need to analyze data is more vital since the Covid-19 pandemic has increased the need for data collected as university are closed and run through online operation (Williamson, Bayne & Shay, 2020).

Model of BD Readiness

This study is based on three recent papers that analyzed systematic literature reviews of BD implementation. The first is by Nasrollahi and Ramezani (2020) on the study of a model to evaluate BD readiness. The authors have listed 50 factors that need to be considered in implementing BD and to select twelve important criteria based on Fuzzy Based Worst Method (FBWM). The twelve criteria that have been ranked by the panel of experts are Technological, Wisdom, Feature, Cultural, Financial, Skills, Shareholders, Managerial, Utility, Environmental, Organizational and Processing. The next study by Feliks, Wei Wanga, Marta Indulskab and Shazia Sadiq (2020) focus on factors influencing the effective use of BD. A research framework has identified seven main factors from the systematic literature review which are organizational aspects, systems, tools and techniques, people aspects, data privacy and security and governance, data quality, process management and perceived organizational benefit. Then the authors divided all the factors into three main themes: namely support mechanism, operational, and motivational. Lastly, the study of critical success factor of BD from Zaher Ali Al-Sai, Rosni Abdullah and Mohd Heikal Husin (2020) list out 72 critical success factors for BD and divide them into five main factors which are Organization, Technology, People, Data Management and Governance. The study is based on 16 related journals of BD critical success factors from 2014-2018.

However, from all the listed criteria above, this paper refers to CSF for BD based on the study by Zaher et al (2020) as the other listed elements are in the same category, as in Figure 1. The criteria listed in the study by Narollahi et al. (2020), such as wisdom (IT expertise, Knowledge about BD and BD readiness), skills (HR, Staffing and Training), and managerial (leaders' attitude), are all related with people while processing falls under the technology factor. Culture (Decision making culture and organizational culture), Financial (Cost), shareholder (vendor support, government support),

environment, and, lastly, utility as perceived as benefits and they are related with the organization. Next, three themes are listed from a study by Feliks et al (2020) where motivational theme (perceived organizational benefits) is part of organization aspect under CSF for BD (Zaher et al, 2020). Next is an operational theme (process management, data privacy, security and governance) that falls under governance and the last theme is supporting mechanism (people aspect, organization aspect, system tools, and technology) also listed in the CSF from Zaher et al (2020).
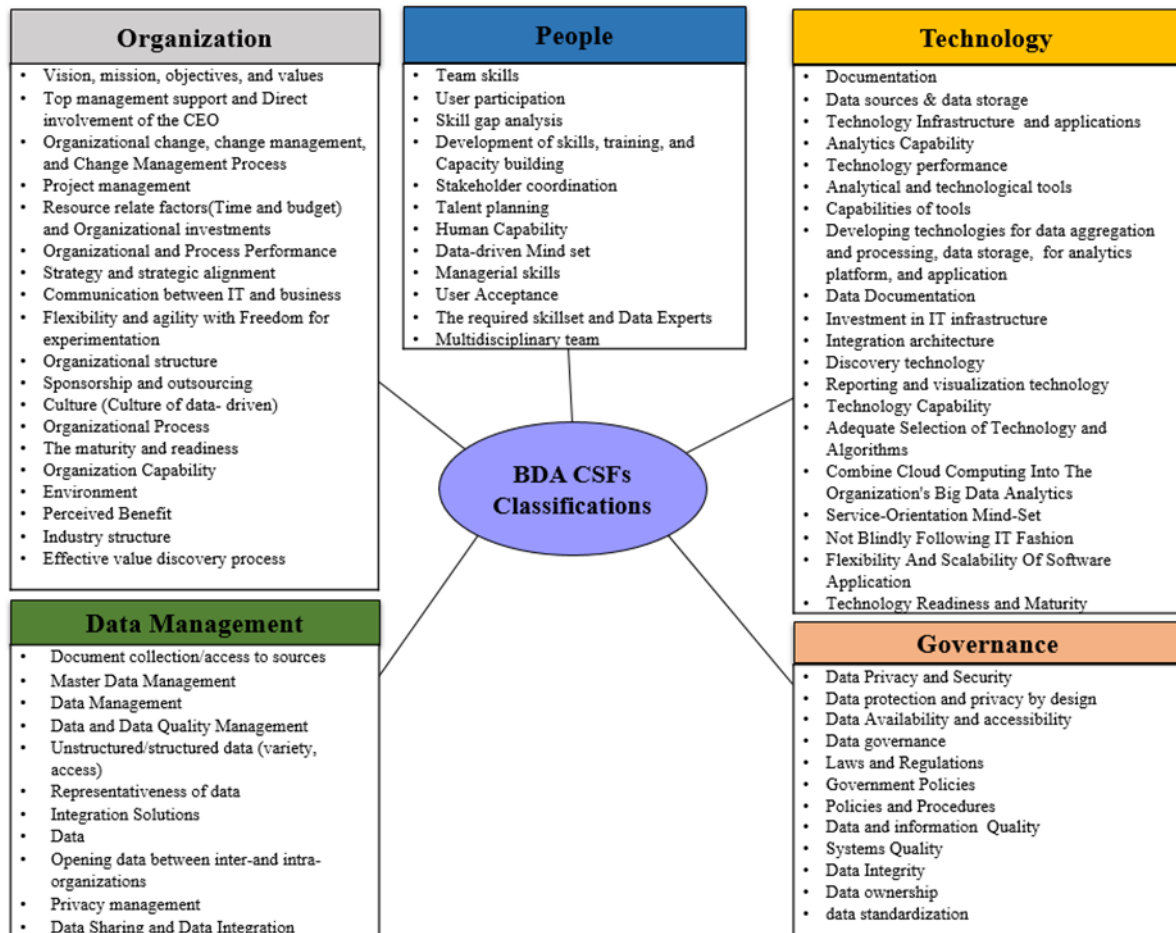

Figure 1: BDA CSF's Classification (Zaher et al, 2020)

Organization

The most highlighted in the literature for CSF of BD is the organization. The objective of the organization needs to be aligned with BD implementation. Being aware of what the organization has, what aim(s) to achieve, and aligning objectives with BD are the important factors of successful implementation of BD (Eyebers & Hattingh, 2017; Al Sai, Abdullah & Husin, 2019). Correlation between business and IT, organizational characteristics, and structure are amongst other related factors with the organization that need to be considered in implementing BD (Cato, Golzer & Demmelhuber, 2015).

Generally, the UiTM BDA initiative has been implemented in early 2017 with the launch of the Big Data Lab at UiTM Shah Alam. The lab has been officiated by former Minister of Education, YB Dato Seri Jusoh Idris. In support of the BDA initiative, the other 13 branch campuses have also set up data analytics laboratories in the same year.

The adoption of BD in higher education is something that cannot be avoided. The performance of organization nowadays has simplified the complex process into ranking and numerical indicator by the introduction of "governance by numbers". International and national comparisons, university rankings, obligatory reporting of working hours, publications count, impact factors, financialization, pupil testing,

and credentialization are the examples of how individuals, schools and universities are rendered as subject to number technologies.

Technology

Data collection, storage, processing, analysis, and applications are the categories that are related to technology to support the use of BD (Zaher et.al, 2020). According to Franco, Alves, Pedrosa, Varanda Pereira and Can~ao (2021), there are different uses of data for institutions where fully implemented online learning is done as compared to the traditional style of education. Fully online institutions offer more refined and evolved data which can be detailed out for improvements.

In UiTM, the establishment of the Centre for Innovative Delivery and Learning Development (CIDL) is viewed as the organization's strategy to adopt the current technology. Covering all areas of the latest technology (smart classroom, big data and learning analytic, learning design, virtual and augmented reality that needs to be adopted by higher education, MOOC, e-portfolio, teach me online, global learning and etc.) UiTM is showing its initiative in aligning itself to the objectives of BD (www.cidl.uitm.edu.my).

People

In discussing the category of people or human side, the success of the BD implementation also depends on people who have the skills of managing big data (Hayen, Rutashobya & Vetter, 2017). Human capabilities, analytical skills, and team skills are critical amongst the category needed for CSR under people. Having expertise in the analytic field is one of the CSF for the BD. However, the priority concern during the implementation is the lack of management experience and use of data for strategic decision among data scientific or BD expertise (Al-Rousan & Al-Shargabi, 2017).

Aligning with the government's effort to fulfill the need for professional data entry, UiTM has introduced the Big Data Analytics Collaborative Group. The aim of this group is to educate and support staff and students with the knowledge of BD. Therefore, through the introduction of the Data Camp module, 23 lectures have been educated and 1000 students have finished the program periodically during the semester break. Thus, all of the candidates from this program have been recognized as professional data analysts by the Malaysia Digital Economy Corporation (MDEC) (www.cidl.uitm.edu.my).

Data Management

Due to significant efforts from political centers, supporting businesses, think tanks, consultancies, and sector agencies, there has been a growing use and transformation of data in higher education over the last two decades (Williamson, 2018). Data management refers to how the organization manages or analyzes the data. This includes how the organization captures, processes, validates, stores, and protects the accessibility, reliability, and timeliness of the data (Zaher et.al, 2020).

A large set of data is increasing with the widespread use of Learning Management System (LMS) such as Blackboard and Moodle. Data such as student interaction, personal data, system information, and academic information are increasingly collected each day by LMS (Romero et al, 2008). In UiTM, the type of LMS that has been used is UFUTURE. In the old day, the use of UFUTURE is just as an option as UiTM has implemented blended learning for certain courses/subjects only. However, after the pandemic, the use of UFUTURE is fully utilized especially in monitoring students' attendance. Similar to other LMS, UFUTURE functions as the platform to connect students and lecturers online.

Features such as downloading notes and video, online discussion, submission of assignments, and other asynchronous activities are provided in this platform. These general functions of LMS are also the same as mentioned by Lin Ming Angg, Feng Lu Ge and Kah Poi Seng (2020). The details of data captured by the LMS system can be valuable information for the university in order to explore more about student behavior, learning environment, and learning effectiveness through analytical learning.

Other than that, through BD, universities can predict the next innovation as needed and improve in the research area. Issues such as inadequate data, increasing generalizability confidence, and enhancing validity can be overcome (Daniel, 2017).

Governance

Having a legal framework, security, and being analyzed properly are related to the governance and policy for handling BD (Veeneman, Voort, Hirschhorn, Steenhuisen, & Klievink, 2018). The sharing of data across various organization, departments, or public-private requires governance process which is critical as it will affect the effectiveness and efficiency of BD (Al Sai, et al., 2019 & Veeneman, et al., 2018).

In support of the implementation of BD in UiTM, Bahagian Hal Ehwal Akademik (BHEA) has issued a circular on Guidelines for the Implementation of the Public Data Analytics Talent Development in 2018. Thus, in aligning with the approach towards BDA, UiTM has offered courses and subjects that are related to the BD implementation. For example, Master of Data Science, Managerial Business Analytic (MOOC), and several more. Besides that, UiTM also has become the world's first varsity offering SAS Academy for Data Science in Malaysia. This collaboration shows that UiTM is ready and committed to the implementation of BD in supporting the national goal to strengthen the talent pool.

Conclusion and Future Work

The implementation of BD requires a critical approach as there are numerous models and frameworks being created to formulate in a real situation. This paper previews the picture of BD adoption by using the qualitative desk approach from the systematic literature review. Five elements of critical success factors (organization, technology, people, data management, and governance) have been highlighted in the readiness level of UiTM towards BD. In exploring the real implementation level of UiTM towards BD adoption, the authors have plans to explore detailed elements of CSF using quantitative approaches.

Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

References

A. Caralli, F. Stevens, J. Willke, and R. Wilson (2004). "The critical success factor method? Establishing a foundation for enterprise security management" Carnegie-Mellon Univ. Pittsburgh Pa Softw. Eng. Inst., Pittsburgh, PA, USA, Tech. Rep. CMU/SEI-2004-TR-010.

B. P. Russom (2011). "Big data analytics" TDWI Best Practices Rep., vol. 19, no. 4, pp. 1-34, 2011.

Falendra Kumar Sudan (2021). Fourth Industrial Revolution and Future of Work in Asia. Global Economics Science. DOI: https://doi.org/10.37256/ges.222021783

Greller, W. & Drachsler, H. (2012). Translating Learning into Numbers: A Generic Framework for Learning Analytics. Educational Technology & Society, 15(3), 42–57.

J. Polonetsky, O. Tene, and J. Jerome (2014). ''Benefit-risk analysis for big data projects,'' in *Future Of Privacy Forum*. Retrieved from https://fpf.org/wp content/uploads/2014/09/FPF_DataBenefitAnalysis_ FINAL1.pdf

Malaysia on right track for big data, AI in education, says minister. Malay mail, 20 November 2019.

Nguyen, A., Gardner, L., & Sheridan, D. (2017). A Multi- Layered Taxonomy of Learning Analytics Applications. In Proceedings of the Pacific Asia Conference on Information Systems, Article 54.

Nguyen, A., Gardner, L., & Sheridan, D. (2018b). Building an Ontology of Learning Analytics. In Proceedings of the Pacific Asia Conference on Information Systems, Article 158.

Nguyen, A., Gardner, L., & Sheridan, D. (2020). Data Analytics in Higher Education: An Integrated View. Journal of Information Systems Education, 31(1), 61-71.

P. Cato, P. Golzer, and W. Demmelhuber (2015). An investigation into the implementation factors affecting the success of big data systems, in Proc. 11th Int. Conf. Innov. Inf. Technol. pp. 134-139, doi: 10.1109/INNOVATIONS.2015.7381528.

Piattoeva, N., and R. Boden. 2020. "Escaping Numbers? The Ambiguities of the Governance of Education Through Data." International Studies in Sociology of Education. doi:10.1080/ 09620214.2020.1725590.

P. Cato, P. Golzer, and W. Demmelhuber, ''An investigation into the implementation factors affecting the success of big data systems,'' in Proc. 11th Int. Conf. Innov. Inf. Technol. (IIT), Nov. 2015, pp. 134– 139, doi: 10. 1109/INNOVATIONS.2015.7381528.

Riffai. M.M.M.A., Edgar David, Duncan Peter, Ahmed Hassan Al-Bulushi, 2016 3rd MEC International Conference on Big Data and Smart City The Potential forBig Data to Enhance the Higher Education Sector in Oman.

R. L. Hayen, C. D. Rutashobya, and D. E. Vetter, ``An investigation of the factors affecting data warehousing success,'' Int. Assoc. Comput. Inf. Ation Syst., vol. 8, no. 2, pp. 547553, 2007

Rosmaini Tasmin & Tan Lay Huey (2020). Determinants of Big Data Adoption for Higher Education Institutions in Malaysia. Research in Management of Technology and Business Vol. 1 No. 1 (2020) 254–263. Universiti Tun Hussein Onn Malaysia Publisher's Office. Retrieved from https://doi.org/10.30880/rmtb.2020.01.01.021

S. Eybers and M. J. Hattingh (2017). "Critical success factor categories for big data: A preliminary analysis of the current academic landscape," in Proc. ISTAfrica Week Conf. (IST-Africa), pp. 111, doi:10.23919/ISTAFRICA.2017.8102327.

Siemens, G. & Long, P. (2011). Penetrating the Fog: Analytics in Learning and Education. EDUCAUSE Review, 46(5), 30-40.

T. Al-Rousan and B. Al-Shargabi (2017). "A new maturity model for the implementation of software process improvement in web-based Projects," J. Digit. Inf. Manag., vol. 15, no. 2, pp. 66-75.

Van Barneveld, A., Arnold, K., & Campbell, J. P. (2012). Analytics in higher education: Establishing a common language. EDUCAUSE. Retrieved from https://library.educause.edu/resources/2012/1/analyticsin-higher-education-establishing-a-common-language.

Williamson, B., Bayne S, & Shay, S (2020). The datafication of teaching in Higher Education: critical issues and perspectives. Teaching In Higher Education 2020, Vol. 25, No. 4, 351–365. Retrieved from https://doi.org/10.1080/13562517.2020.1748811

Williamson, B. 2018. "The Hidden Architecture of Higher Education: Building a Big Data Infrastructure for the 'Smarter University'." International Journal of Educational Technology in Higher Education 15 (12). doi:10.1186/s41239-018-0094-1.

Williamson, B. 2019. "Policy Networks, Performance Metrics and Platform Markets: Charting the Expanding Data Infrastructure of Higher Education." British Journal of Educational Technology 50 (6): 2794–2809.

W. Veeneman, H. van der Voort, F. Hirschhorn, B. Steenhuisen, and B. Klievink (2018). PETRA: "Governance as a key success factor for big data solutions in mobility" Res. Transp. Econ., vol. 69, pp. 420-429.

Z. A. Al-Sai, R. Abdullah, M. H. Husin, and S. M. Syed-Mohamad (2019). "A preliminary systematic literature review on critical success factors categories for big data," in Proc. AiIc, pp. 2320 2324.

Zuboff, S.2019. The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. London: Profile Books.

.