A TOE Approach for Big Data Adoption Factors Towards Organizational Impact in the Malaysia's GLAs: A Conceptual Review

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Abstract

Having large volumes of data enable the organization to exploit them in the operational activities. However, the organization face challenges to have accurate data for right purposes at the right time. The purpose of the study is to develop a model of Big Data initiative which will provide the government agencies with a guide to evaluate the comprehensive criteria on the implementation. The outcome also will able to facilitate government on focusing to enhance or improvise the crucial aspect in management. This conceptual paper extends the technology-organization-environment model integrate with few other theories. This study extends it with data-driven culture as a mediating variable to investigate the relationship between Big Data Adoption factors and organizational impact in Government-Linked Agencies in Malaysia. The expected findings will then be assisting to provide guidelines in policy makers, opportunities to the newly creation position in the organization. The outcome also will able to facilitate government on focusing to enhance or improvise the crucial aspect in management especially in Big Data initiative as a whole and their interrelationships. This study not just focus of personal routines in operational activities, but also to come out with a guide to assist organization in utilize the good insights of Big Data.

Keyword: Big Data Adoption, Organizational, Government-Linked Agencies, Impact, Factors

Introduction

The rapid advent of technology and new peripherals become factors of the Big Data pouring and increasing in the organization. The ability of technology to capture, manage, store and processing data becomes great opportunities for organization to take an advantage. Recently, the development of data resources that enable communication through internet, sensor device, social media and user generated accelerate the producing and collecting of real-world data (Brous et. al., 2017). Most of large organization depends on high end software, tools, powerful network connection for the possibility of collecting and analysing large amounts of data easily and rapidly.

High-performing organizations believe that BDA is a critical differentiator and a key to growth (Thirathon et. al., 2017). Big Data in the organization should be managed strategically to

optimize the use of analytics in business management and to overcome the risk of turning the advantages offered by the technology become negative. Big Data capabilities knowns to give many advantages to the organizations in different areas of fields such market segmentations, consumer characteristics, plant operations, pattern and trends for patients (Collymore et al., 2017). Leveraging the uniqueness of Big Data with competencies, capabilities, gaining insights, practices with advance technologies and application, skills provided has given opportunities to the organization to sustain in the business landscape for competitive advantage.

Thus, continues iterative of Big Data insights provide actionable in responding to the constant changing of business environment specifically the challenges of advent technologies.

Objectives of the Study
- The huge potential of Malaysia's GLAs in their business operation for profit making and supporting to Federal Government for public delivery seems crucial for accelerating of Digital Economy. Due to the fact, it is important to measure the perceive level of BD adoption in Malaysia's Government-Linked Agencies (GLAs).
- The adopting of technology is closely related to a group of community which constitute to achieve the same objective and goals. In this BDA context, several factors which considered to take into account for the diffusion of technology at the firm level. Therefore, it is significant to examine the relationship between technology, organizational, environment and BDA in Malaysia's Government-Linked Agencies (GLAs).
- The organization that capable of utilizing and optimizing firm's resources, has ability for being competitive, sustain and overcome peers. As BD become one of important resources, organization need to ensure the adoption give a good in returns. Therefore, it is significant to examine the relationship between TOE, BD and OI in Malaysia's Government-Linked Agencies (GLAs).

Literature Review
In this section the main concepts about BDA are discussed. Thereafter, theories on BDA are reviewed and propositions are formulated to guide the investigation and attain the purpose of this study.

Big Data
Definition of Big Data has got attention from both academia and industries. Amount of data exponentially poured in organization created the condition of 'data rich' in the database system. Organization depending on data in operational activities, interaction, communication, decision process and many more. According to Haddad et al (2018) Big Data is related to combination of sources and unstructured data accumulate with large sizes and complex that needs beyond the ability of typical database of software to capture, store and manage. Thus, those datasets become inadequate for traditional processing (Lombardo, 2018). In addition, phenomenon of Big Data created from the trends of computing, data and convergence. All these trends contribute to the variety and velocity of datasets in the organizations which difficult to handle somehow requires advance tools and techniques (Atyeh, 2017).

Generally, the growing of Internet of Things (IoT) and Industrial 4.0 (IR 4.0) applications has contribute to the massive data in organization's database generated from sensors, embedded devices, RFID, GPS systems, mobile devices, cameras in highly volatile. Moreover, the trend of

Smart City comprises of various smart applications connected with IoT communicates in real-time and advancement physical infrastructure created velocity of poured unstructured data in the company databases (Mohbey, 2019). While, IR 4.0 introduce automation in activities including production arrangement has led to the generating of new business model (Jayashree et al., 2020). Thus, this situation gives impact the rapid development of technology in computing. Besides, Big Data enabling technologies such Artificial Intelligence (AI), Machine Learning, Deep Learning provides advancement with various datasets that allows organizations to manipulate for in business activities. Clearly, the current trends of those applications give dramatic impact in managing companies' data.

Big Data Adoption
Big Data adoption emphasizes the organization acceptance to the technological procedures of BD for the social changes that includes implementation, application, strategy and analytics. It is aim to increase the abilities in various process for the operational activities. Organization's initiative on Big Data adoption always have high expectation on the return. However, solutions on investing to BDA may bring transformation in many ways of process, decisions regardless of financial matters. In the process of implementation Big Data initiative involves certain commitment such financial to support the activities (Tabesh, 2019). Thus, utilizing this type of investment is crucial since it requires various challenges such people, technologies, organization, process and data management challenges (Al-Sai et al., 2019).

According to Ijab et al (2017) Open Data initiative by Malaysian Administrative Modernization and Management Planning Unit (MAMPU) has given opportunities to the people and the business community to increase creativity and innovation in developing new products and services through high quality data. Other that than, Malaysia's Digital Economy introduced in 2016 provides various platforms, opportunities, programmes, strategies, policies for the digital transformation towards establishing dynamic digital ecosystem (World Bank Group, 2018). Essentially, Government Link Agencies (GLAs), public and private sectors must be smarter to take the opportunities utilizing the investment in Big Data to get benefits in returns for their organizations and society, improving the services, and increasing the effectiveness and efficiency (Zainal et al., 2016).

Unlock the potential of Big Data globally, numerous organizations, industries, institutions explore the insights to get fully harness of it. Undeniable, in business world BDA not only assist on market intelligence (Paajanen, 2017) also gain insights on customers to enhance various process that involving consumers (Vinod, 2016). In manufacturing and operation management BDA believes to strengthen business process, enhance supply chain and industrial automation (Wamba, 2017). In addition, the multiple of BD analytics platforms offers opportunities to the fuzzy multi-criteria group of decision-making problem which given an option to evaluate, select and adopt (Atyeh, 2017). Undoubtedly, the devastating of Big Data in healthcare since its capability in understanding patterns and trends at different volumes, types and speed of data (Hariri et al., 2019).

Despite its significance, BD does bring issues to the organizations. According to Lunde et al (2017), there are two major types of challenges faced by organization in BDA. First challenge is related to Big Data itself which comprises technology management, Big Data analytics capabilities, Big Data management capabilities and Big Data analytic strategy; on the second

issue the challenge list as, organizational culture contains organizational learning, management and data-driven culture. Likewise, as stated by Reggio et al (2020) the high failure of Big Data projects causes by data-driven culture. That statement supported with the attitude on relying to the prior experiences in decision process rather than evidence-based or data-driven (Rousseau, 2018). generally, data-driven culture describe emphasizes on judgment and beliefs being accepted by organizational members on decision process from systematic computational analysis. One study by Ferraris et al (2018) identified in daily operations, huge amount of decision made by high performing analytical companies compared to low performing analytical companies. Thus, data-driven organizations accepted any data-based decision even though resulted failure to learnt the process as it goes through testing and experimentation (Berndtsson et al., 2018). Therefore, organizations adopting a data-driven approach have opportunities to improve their business and outperform in many ways such in clinical decision making in healthcare, predictions in student's academic performance, transportations for urban zones and energy savings for electricity (Basile et al., 2022; Gil et al., 2021; Du et al., 2020; Teng et al., 2021).

However, recent research shows, even though organizations had developing quantitative models or embed Business Intelligence tools, they still preferred intuition rather than fact-based decision and culture barriers amongst the challenges need to be faced (Omar et al, 2019; Bean and Davenport, 2019). Clearly, data-based culture throughout the organization need attention to full harness of BD potential (Zerbino et al., 2018). Due to that fact, Storm and Borgman (2020) conducted case study resulted, the most success factors such top management's roles, clear transformation's goals and the openness to experimentation to the organization's challenges on creating data-driven culture in the organizations. Importantly, organizations need to coordinate key strategies where data-based culture need to be initiated from the top followed by management and operational level (Côrte-real et al., 2019). Further, culture barriers found to be most related to BD rather than technological whenever top management weaknesses on the value of BD reduces confidence in BD capabilities may resulted to the resilience on data-driven development and gaining competitive (Alharthi et al., 2017). Thus, management strategy suggested by Tabesh et al (2019) may facilitate the decision process for management level for the data-driven culture in the organizations.

This paper reviewed the existing literature on Big Data to achieve three objectives: first, to highlight the definitions and challenges of Big Data adoption and to summarize the most common definitions of existing works; second, to present and identify the factors influencing Big Data in organization; third, to present the theoretical background of the study and fourth, methodology of the study and five, conclusion.

The Research Framework
Figure 1 shows the research framework on the factors influencing BDA in Malaysia's GLAs.
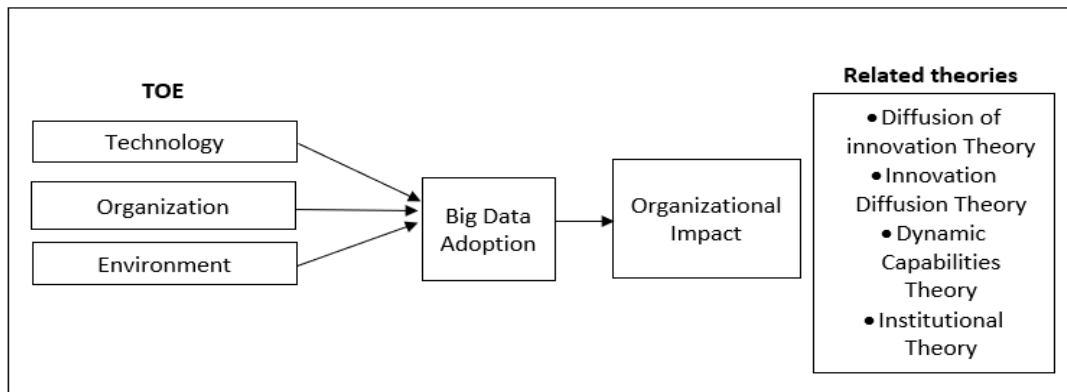

Figure 1 The Research Framework

Basically, this study focusing on TOE (Tonartzky & Fliescher, 1990) model with three main contexts namely technology, organization and environment as independent variables consists i) technology context describes any characteristics of technologies to the firm includes existing or current technology used in the business operation: ii) organization context refers to organization features that may influence to integrate Big Data within their members; and iii) environment context covers the circle of firms conducting its business includes partners, vendors, suppliers, competitors and industry. While, BDA emphasizes the organization acceptance to the technological procedures for the social changes that includes BD implementation, application, and strategy for analytics. Yet, organizational impact describes the changes, variations, transformation, effect, affect and implication in the output, outcome and new income from the BD activities that gives variations to the organizations.

Evaluation Factors Influencing Big Data Adoption
This section provides definitions to the evaluation factors that influencing BDA in Malaysia's GLAs.

Table 1
TOE Approach

TOE	Sub-dimension	Description
Technology context	Complexity	define as BD technology is something that very solid and tough to be used, understand and learn in the organization
	Relative Advantage	any opportunities, advantage, prospects for the organization in the current business landscape benefited from Big Data implementation
	Security and Privacy	emphasize the aspect of security and privacy of company data when adopting BD
	Compatibility	describe as the ability of organization to exploit BD with existing technology in the organizations without having any new other ICT hardware in the business activities
Organization context	Skills	describes the ability of organizations to have specific expertise employee (internal or outsource) to handle the BD activities
	Top Management Support	Upper level management in the organizational structure gives encouragement in implementing BD by providing, investing and planning variety of courses for the company
	Financial Readiness	describes the willingness of organization in investing money to facilitate the process of BD activities in the organization
	Firm Size	ability to take any action on BD purposes in the section, unit or department for the business operations
Environment context	Competitive Pressure	describes as the situation of surrounding entities of the organization such suppliers, vendors, partners and competitors already get benefit and resourceful with BD activities
	Government Support	any acts, policies, guidelines and initiative develop by government and its associates to encourage BD eco system for business organization in the country
	Market Turbulence	condition when fluctuation on customer's preferences in Big Data environment (contemporary on preferences, demand and needs on product and services)

Furthermore, it is crucial to see how BDA impacted the organization as the initiatives involved various aspects. While other studies focusing on how BDA impacted to the organization in firm performance and competitive advantage, this specifically giving attention the productivity, cost-savings and innovation. Productivity describe to measure on non- financial output for organization from BDA activities. While, cost-savings explains the organization utilize all

internal and external resources without adding more capital or expenses for the business operation. Yet, innovation define as the ability to the organization to have new product development and services, any co-creation and new joint-venture business.

Theoretical Background

This study is based on TOE model integrated with four other theories to have comprehensive understanding on the BDA in Malaysia's GLAs. The TOE (Tonartzky & Fleischer, 1990) model basically used to see the overview of three major factors on influences of technology and realize their capabilities in the adoption at the firm level. Rogers (1962) introduced IDT to expand the attributes of innovation to the technology. The IDT is appropriate in tested the aspect of innovative ideas and technologies spread in the social system at individual and organizational level later than expanded to DOI (Rogers, 1995) with the ability to describe the technology being accepted, connected members using formal networks working on the technology and how size affected to the implementation. The DCT (Teece, 2007) emphasizes more one sustainable competitive advantage; dynamic capabilities views on the issues of survival that response to the constant changing contemporary business environment. Thus, DCT explains how firm adapt to the turbulent environments and has potential to improve performance with BD capabilities. The three main elements in IT (DiMaggio & Powell, 1983) consists of mimetic pressure explains how organization adopt new practice and imitate their competitors. Then, coercive pressure describes the formal or informal forces exerted on firms by other firms. In this IT, existing relationship between organizations could bring to the sharing of information rules and norms as normative pressure.

Methodology

This quantitative approach study is chosen for measure the framework by testing theory, exploring an area and developing hypotheses. Researchers will test the theory by indicating hypothesis and data that had been collected will specify whether to support or contradict the hypothesis (Creswell, 2014). The structured questionnaire is designed by literature review. In this study, the research questions make clear references to understanding the level of Malaysia's GLAs BDA factors in organization and its impact. For this study, the IT professionals, person in-charge in the Information System and information managers will be responded to the online survey to represented their organizations. Due to the global pandemic conditions, the most restrictions faced by researchers such communicating with samples of the study whereby the new norm of working is from home. Initially, the effort of distributing questionnaires via Google Form for four months of duration seem success with permissions from top level management. The findings of the pilot study explored statistically using SPSS and SmartPLS to ensure that instrument is acceptable without further improvements.

Sample and Population

This study approached with purposive sampling sample is to produce a sample that can be logically assumed to represent of the population (Etikan & Bala, 2017). The Malaysia's GLAs are selected as the population for this study due to several justifications of similar characteristics and several reasons; i) they are not restricted to the government mission, vision and goals ii) they are supporting Malaysia's Government objectives by promoting, conducting programmes and aware on the constant changes environment to balance the needs of public delivery iii) they have reached the formal operational level of thinking in the organizations iv) they use the intellectual capacities in discussing issues regarding

organizations strategies and directions v) they are group of highly potential organizations that works in highly competitive business environment. As the main objective of this study is to understand the BDA factors applies in the Malaysia's GLAs and further analysing its relationships with the OI. Thus, only qualified respondents who can provide the required information are selected as respondents.

Significant

First, the research method applies in this study had clearly provided a significant knowledge contribution from the methodological perspectives as there is no readily available instrument to gauge the integration of the concepts within this study until it is completed. Second, this study identifies BDA practices that are critical to organization's aspects have been empirically verified. Thus, the findings of this study can offer practical guide to the Malaysia's GLAs in implementation of BD to better understand which part that impacted. The implication of this study is useful for policy makers in providing guideline for how BDA thereby the main aspect in organization could be improved through the persistent use of related IS.

Conclusions

The research framework developed in this paper provides an opportunity to improve implementation of Big Data in Malaysia. The highlights to important factors may facilitate to BDA in Malaysia's GLAs will then provide a guideline to set up a new framework for accomplishing post implementation condition.

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