The Relation Between TOE, Big Data Adoption and Organizational Impact in Malaysia's Government Linked-Agencies

Hasnah Hashim, Mohd Sazili Shahibi, Norhayati Hussin
Universiti Teknologi MARA (UiTM), Selangor, MALAYSIA

Abstract
Big Data Adoption (BDA) is the technological procedure for social changes regardless of implementation, application, or strategy for data analytics. BD has great potential to exploit its unique characteristics and could transform at the lowest cost and gain significant meaning and insights into everyday operations. This study's gap indicates that no indicator exists to highlight guidelines for implementing BDA in Malaysia's Government Linked-Agencies (GLAs). The purpose of the present study is to see how the BDA factors will significantly affect the Organizational Impact (OI) with the TOE approach in Malaysia's GLAs context. To this end, we developed a research model that posits these constructs as direct to antecedents OI, thus completing the effect of the TOE and its sub-dimensions for BDA. Therefore, the objective of this study, first, is to measure the perceived level of BDA in GLAs. Second, to examine the relationship between technology (relative advantage, security and privacy, compatibility), organizational (skills, top management support, financial readiness, firm size), and environment (competitive pressure, government support, market turbulence) to BDA. Third, to develop and validated a BDA model in Malaysia's GLAs. This study applied a survey as the method approach, and a total of 134 data were collected. It is the result that TOE factors influence BDA and give OI. The validation of the structural model of six hypotheses developed in this study has demonstrated satisfactory results and exhibits six significant effects. This study contributed the theoretical, empirical and practical, which offers the organizations a better understanding of important aspects by optimizing technology from BD initiatives.
Keywords: Adoption, Big Data, Organizational Impact, Government Linked Agencies

Introduction
The growing capacity of voluminous data in the organization promotes Big Data Adoption applied in information system (IS) domains. Regardless of massive data in the organization, BDA offers better solutions to facilitate the evolution environment through capability enhancement, enabling control and managing the expansion of the magnitude of work. Thus, BD can improve business organization prospects by creating new growth opportunities and

entirely new categories of companies (Vassakis et al., 2018). According to AlSai et al. (2019), the global development of BD has become more interesting to its capability for innovation, productivity, competition, and quality specifications for consulting corporations such as SAS Institute, Gartner, IBM, and McKinsey.

Recently, BD research and applications have become a major concern for industries and government agencies as the prominence of BD is much more related to digital transformation. The public and private sectors play an essential role in investing in BDA initiatives to ensure the benefits for organizations and society, improve the services, and increase effectiveness and efficiency. However, BDA requires investments in costly technology (Kumar et al., 2021), constantly changing and offering new opportunities for information processing at increasing speeds. It requires investments in developing analytical skills that are precise to a context-specific task and intensified data collection and storage. Moreover, organizations are not only harnessing and analyzing BD for improved transparency and decision-making but also for improving collaboration (Dubey et al., 2019).

Research Problem

The growth of the big data phenomenon and the accessibility of technology have enabled new innovations and the opening up of government and their agencies to enhance the quality of services provided to the public. The literature review reveals there are study on BD in public sectors, HEI, public libraries, ministries or public agencies in Malaysia (Andrian, 2016; Hanapiyah et al., 2018; Sahid et al., 2021; Sani et al., 2021; Salman et al., 2022) which most of study more only focuses on determinant factors of adoption. Meanwhile, this study focusing on BDA in GLAs become more crucial and the study on impact of BDA not yet explore in this similar setting before.

Stated in one report from the Ministry of Energy and Natural Resources (NRE, 2016), data created in each ministry and agencies intentionally for their own for decision process. Thus, the biggest challenge, data has been collected are not integrated, not updated and unable to share within agencies. There is no policy exist for best practices of data governance in sufficient research and development to innovate local technologies and inadequate collaboration with stakeholders. In one study Abdullah et al., (2017), state that most of challenging part facing by National Hydraulic Research Institute of Malaysia (NAHRIM) is unable to identify the reliable data sources from various sensors, social media and others during disasters for disaster management plan. Meanwhile, in the study by Kushairi et al., (2017), in Malaysia Palm Oil Board (MPOB) incapable to provide sustainable food production if no implementation of BD analytic s for the need of systematically building of a rich resource within the country. Up to this point, BD have typically been related to large enterprises due to the extensive capabilities and resources (Ciampi et al., 2021). However, the lack of utilization strategies represents a concrete barrier that GLAs are required to fully optimize the BD capabilities. According to study by Bujang et al., (2019), reported that from a production of about 1.6 million, an estimated of 3 to 20 percent was lost due to issues related to post harvest losses were attributed to deficiencies in post-harvest management and processing practices borne out of inadequate knowledge, training and information in Malaysia. In the Green Highway Project, Malaysia Highway Authority (MHA) and highway concessionaires triggered issues on data integration, analyze, control and protecting data (Yousif & Zakaria, 2022) as well as decision making among the management. Yet, the issue on highly claims tax return from non-compliance case faced by Malaysia Inland Revenue Board (IRBM) stated by Wahab and Bakar (2021). The problem addressed in this study is lack of strategies available

to support the implementation of BDA in GLAs, a subject on which studies have not sufficiently concentrated.

Hence, the utilization of BD has triggered questions about the adoption by Malaysia's GLAs. To date, Malaysia's GLAs have yet to explore effective ways to better understand factors to adopt BD. Despite the imperative of such technologies and their global reach, they are still in their nascent stages in Malaysia and there is little research on discovering the BDA specifically by GLAs. A comprehensive study is therefore required to identify the determinant factors to develop a model to fully optimize the benefits of BD. This research aims to address this gap in the literature by developing a model based on TOE, to enable adequate the most important factors influencing the adoption of BD by Malaysia's GLAs. In addition, this research provides clear understanding by examining three organizational impacts namely productivity, cost-savings and innovation from the implementation of BD.

Research Questions
- What is the perceived level of BDA in Malaysia's GLAs?
- How do technology, organization, and environmental factors significantly contribute to BDA and OI?
- How can BDA model be developed and validated for Malaysia's GLAs?

Research Objectives
- To investigate the perceive level of BD adoption in Malaysia's Government-Linked Agencies (GLAs).
- To examine the relationship between technology, organizational, environment factors and BDA as well as OI.
- To develop and validated a BDA model in Malaysia's GLAs.

Literature Review
Big Data Adoption
The term adopts, in general, to take formally and put into effect that brings changes in the early year's technology adoption by popular scholars. In this study of BD, the most closely related is on technology and innovation adoption. Researchers study adoption in various areas to understand how an organization accept or refuses something, whether hardware or software that may transform the organization processes. Adoptions studies have been varied since they may assist the business owner in carrying out business operations. Much of the research on technology adoption outside the academic environment focused on consumer behavior (Li, Chung, & Fiore, 2017; Muñoz-Leiva, Climent-Climent, & Liébana-Cabanillas, 2017). Some touched on employees and technology adoption and several were focused on mobile applications or devices (Muñoz-Leiva et al., 2017) cloud computing (Hassani et al., 2017; Malak, 2016), information systems (Zabadi, 2016), Business Intelligence (BI) systems (Qushem et al., 2017), green supply chain model (Hwang et al., 2016), blockchain (Wang et al., 2016), business model (Altunay et al., 2021; Ritala et al., 2018).

Organizational Impact
In this study, organizational impact describes the changes, variations, transformation, effect, effect and implication in the output, outcome and new income from the BD activities that give variations to the organizations. In the recent business environment, organizations are competitively looking for an advanced strategy to sustain the market. Thus, any factors that

bring advantages or benefits to the organizations will be explored for a valuable impact. Therefore, organizational impact on the structure, nature of work, knowledge and culture approaching from inside or outside of the firm (Bianca, 2017). In other words, organizational impact emphasizes the transformation in firm performance and competitive advantage in a global business environment (Curry, 2019; Schull and Maslan, 2018).

Research Framework
TOE Framework
This study decides to measure BDA with the TOE (Tornatzky & Fleischer, 1990) approach in Malaysia's GLAs. Based on discussed literature in prior works, this study emphasizes certain dimensions that suit in this setting. The assessment begins by considering the definition of BDA and the theory underlying the TOE framework. Later, a comprehensive set of decision factors drawn from contrary, yet related theories is explored; these factors determine the decision model specifically at the firm level. The TOE framework identifies three context groups (technology, organization, environment) that may influence organizational adoption of technology and innovation. The technological context refers to technological attributes that describe condition technologies both internal and external to the firm (AlHujran et al., 2018). The technology context in this study comprises relative advantage, security and privacy, and compatibility. The organizational context emphasizes the organization's features that may give impact the adoption. In this study technology/innovation adoption refers to BD. It is important to know the organization's features as it represents the organization towards adoption. This study highlights top management support, skills, financial readiness and firm size. The environmental context refers to the circle of firms conducting their business including industry, competitors and entities' dealings with the government. This study highlights competitive pressure, government support and market turbulence as factors in BDA in Malaysia's GLAs. The variables in OI, measured in terms of productivity, cost-savings, and innovation (Adrian et al., 2016; Himmi et al., 2017) as shown in Figure 1.
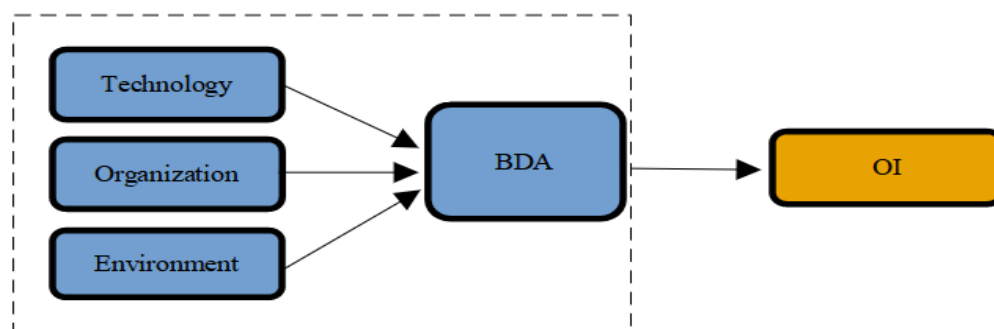

Figure 1 Research Framework

Technology Context
The technology context in this study (relative advantage, security and privacy, compatibility) emphasizes any characteristics of technologies to the firm including existing or current technology used in the business operation. Relative advantage: The capability of Big Data being explored to get great value and experience unique discovery, improved at another level than the previous system. Sam & Chatwin (2018) refers to relative advantage as the ability of

BDA to process and manage data with high technology offers the greatest productivity for China's firm. Security and privacy: It refers to the safety aspect of a company's data, compliance and System Operating Procedure (SOP) in the usage of Big Data in an organization. With the condition of data increasing in every single minute, security and privacy in healthcare refer to the concern of personal patient data (Mgudlwa & Iyamu, 2017). Compatibility: the ability of an organization to exploit Big Data with existing technology in the organizations without having any new addition of ICT hardware in the business activities. A study by Malak (2016) refers to compatibility as existing infrastructure, working culture and experiences in the organization is appropriate to adopt a Big Data environment.

Organization Context
The organizational context in this study (skills, top management support, financial readiness, firm size) refers to organization features, attributes and surroundings to the adoption of BD. Skills: It refers to a qualified human expert that well trained to handle Big Data from the foundation until the complex process. According to Wamba et al. (2017), Big Data analytic skills refer to data analysts with capability in management, infrastructure and talent (technical and business relation). Top Management Support: Encouragement in BDA from upper-level management by providing a necessary mechanism to the business operation. Sufficient resources allocated, fast approval for new resources, data-driven culture in the process of Big Data implementation in the organization (Bremser et. al,2017; Sun et al., 2018). Financial Readiness: According to Bremser et al. (2017) financial readiness carried out the Big Data tasks when an organization afford to provide their own lab for use cases and partner with its trading partners. Firm size: Describes well-established firms that may support the BDA as could support in various aspects (Sun et al., 2018).

Environment Context
This study describes the environmental context (competitive pressure, government support, market turbulence) as the chain of firms operating their business includes partners, vendors, suppliers' industries, and competitors in the system. Competitive pressure: It describes the situation of surrounding entities of the organization such as suppliers, vendors, partners, and competitors that already get benefits and are resourceful with BD activities. Government support: related to any acts, policies, guidelines, and initiatives developed by the government and its associates to encourage the BD ecosystem for the business organization in the country. Market turbulence: The condition when fluctuation in customer's preferences in the BD environment.

Methodology
Population
Malaysia's GLAs are selected based on the premise that they are equipped and supported with significant IT infrastructure and computer configuration. In addition, these organizations are highly dependent on IT in doing their business scaling up their business and competitiveness which suits the purpose of this research. Purposive sampling was used to ensure the sample's representativeness of the sample size. The main objective of purposive sampling is non-probability sampling is selected based on the characteristics of a population and the objective of the study. The total population of GLAs Malaysia was around 342. Upon selection to the criterion, the total of GLAs in the study is 186.

Sample

In this study, IT professionals in Malaysia's GLAs are selected as participants. As the main objective of this study is to understand the BDA factors that apply in Malaysia's GLAs and further analyzing its relationships with the OI. Thus, only qualified respondents who can provide the required information are selected as respondents. Sampling is the process of selecting a number of subjects from the population as research respondents. Sampling is an important aspect of research because the selection of unsuitable samples will reduce the validity and reliability of the research regardless of the quality of the research findings. Understanding the sample's characteristics, allows the researcher to generalize it to represent the population (Sekaran, 2003).

Techniques

The questionnaire was developed to achieve the objectives based on a literature review of the study. A scale must accompany all measurements in the questionnaires. Therefore, a seven-point Likert scale was adopted as the instrument response format to allow variability in the results. All other measures used the seven Likert levels of the following scale: (1) Strongly Disagree, (2) Disagree, (3) Sometimes Disagree (4) Not Sure, (5) Sometimes Agree, (6) Agree and (7) Strongly Agree. The Likert scaling is a measured response option when checking "opinions, beliefs, and attitudes or feelings" (DeVellis, 2003) as latent variables are directly measured. The Likert also offers a "discrete approximation of continuous latent variables" (Clason & Dormody, 1994). The seven-point Likert scale used in this construct contains a neutral midpoint, which has been shown to be the most acceptable among participants of the survey as it covers a variety of opinions. The inclusion of a midpoint has been proven to contribute to the social good of bias caused by the participant's desire to avoid a decision that cannot be accepted socially (Garland, 1991).

Software

The data collected from the study were analyzed with SPSS for descriptive and inferential statistics. PLS (Partial Least Square) was applied for the correlation for constructing predictive models when the factors are many and collinear in this study for the TOE subdimensions, BDA and OI.

Result

Response Rate

The response rates show the responses from respondents who were involved with BDA and answered the questions provided in the questionnaire.
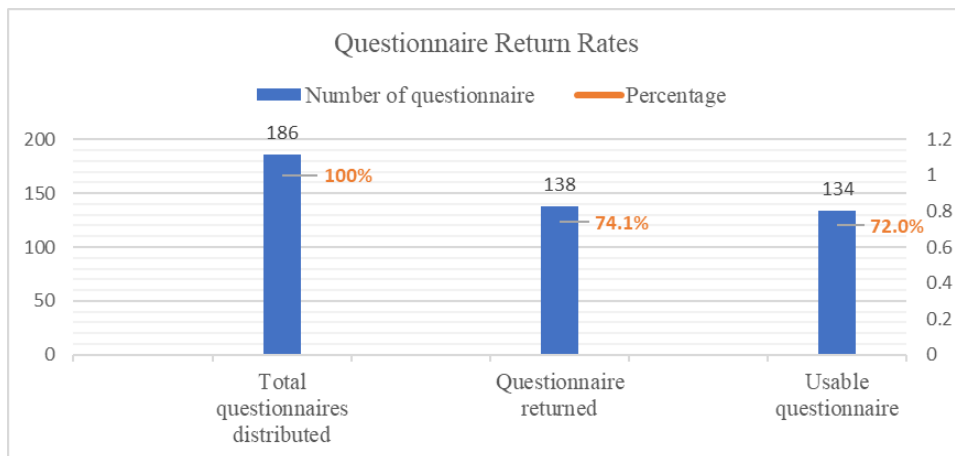
Figure 2 Response Rates

The researcher used an introducer to contact targeted respondents in GLAs. The survey was distributed through emails and WhatsApp links. In the conditions of Movement Control Orders (MCO) all over the country, the constraint for the researcher was unable to be at any GLAs offices to pass the hardcopy questionnaire. In order to increase the rate of responses, the researcher makes an announcement on social media (Facebook, Instagram and WhatsApp groups) to get respondents from GLAs to participate in the study. An email to invite respondents to participate in the survey was sent to all 186 Malaysia's GLAs as mentioned. In total, 138 were returned, of which 4 responses were excluded due to an empty dataset and not completed. As a result, 134 (72%) usable responses were used for further analysis as in Figure 2.

Perceived Level of BDA
The perceived level of BDA was examined using the statistical software SPSS version 22.0 on the mean, standard deviation, minimum value and maximum value of each indicator.

Table 1
Summarize of Perceived Level of BDA

	Items	Min	Max	Mean	Std. Error	Std. Dev.	Var.
BDA1	We use BD technology	1	7	4.6716	0.12569	1.45497	2.117
BDA2	We feel our computational needs can be meet by BD	1	7	5.0746	0.10887	1.26031	1.588
BDA3	We feel management accept the change	2	7	5.3060	0.09127	1.05651	1.116
BDA4	We feel BD use proven technology	3	7	5.3806	0.08527	0.98710	0.974
	Overall Mean = 5.1082						

There are four (4) items used to measure the perceived level of BDA in Malaysia's GLAs. The data shows the BDA acceptance to be implemented as part of technology in the organization. The result in Table 1 shows the mean and standard deviation for the four items in BDA constructs listed as the use of BD technology, BD meets computational needs, management accepts the change and BD as proven technology. The mean score for BDA1, BDA2, BDA3 and BDA4 was 4.6716, 5. 0746, 5.3060 and 5.3086 respectively. The average mean of overall items stated at 5.1082 gives a good interpretation of the BDA in Malaysia's GLAs.

Construct Reliability and Validity
In summary, the next assessment is for construct reliability and validity which investigates how an item performs in relation to other variables.

Table 2
Summarize Construct Reliability and Validity

Variable	Construct	CA	CR
BDA		0.836	0.890
Technology	Relative Advantage		
	Security and Privacy	0.937	0.927
	Compatibility		
Organization	Skills		
	Top Management Support	0.926	0.937
	Financial Readiness		
	Firm Size		
Environment	Competitive Pressure		
	Government Support	0.939	0.947
	Market Turbulence		
Organizational Impact	Productivity	0.914	0.936
	Cost-savings	0.951	0.962
	Innovation	0.936	0.951

Literally, one of the most widely used measures of reliability in the social and organizational sciences is Cronbach's alpha. On top of that, composite reliability is practical to support Cronbach alpha value in SEM. Both are used to measure the internal consistency of the construct, whereby it is suggested that the value 0.7 is the benchmark of modest composite reliability (Hair et al., 2011). This study resulted in the range of Cronbach alpha between 0.836 to 0.951 as illustrated in Table 2.

Besides that, a measurement model is said to have satisfactory internal consistency when the composite reliability (CR) of each construct exceeds the threshold value of 0.7. For this study, all the CR values ranged from 0.890 to 0.962 which is above the recommended threshold value of 0.7. Thus, indicates that the items used to represent the constructs have satisfactory internal consistency reliability. CR in this study is as shown in Table 2.

Heterotrait-Monotrait Ratio (HTMT)
Another assessment is HTMT used to indicate whether measurements have a higher correlation with another latent variable that, with is a respective latent variable, at item should not load higher on other constructs.

Table 3
Summarize of HTMT

	BDA	Cost-Saving	Environment	Innovation	Organization	Productivity	Technology
BDA	0.819						
Cost Saving	0.398	0.915					
Environment	0.616	0.534	0.762				
Innovation	0.543	0.377	0.624	0.892			
Organization	0.676	0.492	0.646	0.542	0.715		
Productivity	0.566	0.433	0.638	0.675	0.56	0.863	
Technology	0.63	0.381	0.658	0.626	0.593	0.663	0.718

The following Table 3 shows the result of the HTMT analysis. The acceptable value of HTMT should be below 0.85 (Kline, 2015) or below 0.90 (Gold, Malhotra, & Segars, 2001; Henseler et al., 2015). In this study, all HTMT values for each construct range fulfil the recommended criterion (Gold et al., 2001) and (Kline, 2011) at 0.90, and 0.85 respectively. Thus, it indicates that the discriminant validity has been ascertained.

In this PLS-SEM algorithm, estimates are obtained for the structural model relationship for path-efficient which signify the hypotheses relationships among the constructs of the study. The indicator for path-coefficients values between -1 and +1 represents a strong positive relationship, while -1 represents strong negative relationship (Hair et al. 2018).

The path coefficients in the structural model show how the significance of the relationship among the constructs. In this part, the researcher may have realized the significant of path coefficients interpreted relative to one another, thus suggesting that if one path coefficient is larger than another, then its effect on the endogenous latent variable is greater. According to Ramayah et al. (2018), PLS is a non-parametric test that does not assume on the distribution of data.

a) The Relationship Between Technology and BDA

The significance of technology and BDA was shown in the results where t-values appeared to have strong values on all technology relationships **(technology-> BDA)** (*f*=0.09, t=2.494*, **p=0.006)** thus, indicates the combined effect of sub-dimension in technology factors positively and has a significant impact on the BDA practices in Malaysia's GLAs as shown in Table 4.

Table 4
Summarize the Relationship Between Technology and BDA

Hypothesis	Relationship	Coefficient	Std Deviation	t-value	p-values	Decision
H1	Technology -> BDA	0.279	0.112	2.494	0.006	Supported

The importance of BD in organizations is widely discussed in IS literature (Abbasi et al., 2016). Based on the results of data analyzed from PLS, the combination (RA, SAP, CO) gave significant impact causes from several conditions. Firstly, technology brings many relative advantages to organizations as it resulted in varied outcomes such as improved performance and increase savings in cloud computing adoption (Malak, 2016; Senarathna et al., 2016) and competitive advantage (Sun et al., 2020). Secondly, BD technologies are concerned with the data that emerges from different sources, as well as procedures in transmitting and managing data which led to the highest effect in adoption in this setting. To that fact, when organizations find the aspect of security and privacy increased, it is a secure environment to adopt BD for Malaysia's GLAs as the business ecosystem has to get involved in different level processes such as outsourcing and the third-party company. Thirdly, understand the existing infrastructure is importance as it could the process of implementation. In Malaysia's GLAs context, BD technologies easily blend into current technology that which bring to positive influence. The Malaysia's GLAs always consistent with current industry practices that makes the well match of existing ICT infrastructure with new adoption BD and facilitate the implementation. Hence, the combination effect in this technology context positively contribute to BDA in Malaysia's GLAs.

b) The Relationship Between Organization and BDA
The study indicates significant effect of sub-dimension in organization and BDA where t-values appeared to have strong values **(organization-> BDA) which (f=0.187, t=4.274*, p=0.000)** as shown in Table 5.

Table 5
Summarize the Relationship Between Organization and BDA

Hypot hesis	Relationship	Coeffici ent	Std Deviation	t-value	p-values	Decisio n
H2	Organization -> BDA	0.396	0.093	4.274	0.000	Supporte d

In the context of Malaysia's GLAs, the ability to provide expertise and human resources influences the BDA. As the adoption is closely related to decisions from the top-level management in the organization, in this context the ability to provide facilities, and resources assists in the diffusion of technology. Yet, top management develops a clear mission to accomplish goals as the initiative can be comprehended across the departments. On top of that, this BD initiative is the best way since there are ready to accept any additional cost involved. On the other matters, the large size of firms can accept any risk during the implementation. In this context, large firms are willing to explore more opportunities from BDA as they are provided with more resources if there are any consequences. As for that, the combination sub-dimension in organization for this study contributes a significant impact to the BDA.

c) The Relationship Between the Environment and BDA
The significance of environment and BDA was shown in the results where t-values appeared to have strong values on all technology relationships **(Environment-> BDA) (f=0.032, t=1.449*, p=0.074)** as shown in Table 6.

Table 6

Summarize the Relationship Between the Environment and BDA

Hypot hesis	Relationship	Coeffici ent	Std Deviation	t-value	p-values	Decisio n
H3	Environment -> BDA	0.176	0.122	1.449	0.074	Supporte d

In this context, technology adoption influences others to do similar things. Malaysia's GLAs prepared to adapt to new technology, agile and react to the many changes in the marketplace. Being customer-oriented always be a good decision for them to be sustained in the competitive business. Similarly, competitive pressure as a firm's market and competition as an indicator of sensing capability for SME owners/managers show that competitive pressure significantly contributes to the adoption of ICT in the fashion industry (Setiowati et al., 2016) in the environmental context. It is found that the government has played their roles in the BDA in this context. The importance of protecting intellectual property derives from the development of laws and regulations and the introduction of policies across the country that influence the adoption. On top of that, the government encouraged the BDA to accelerate the digital economy by providing centralized infrastructures as this new technology highly needed cost. Similarly, government regulations were found significant to influence the green supply chain adoption for Taiwan's firms (Hwang et al., 2016). However, in this modest environment, the organizations felt that being the first to know about service or product demand offered them better opportunities to expand their business at the international level. Thus, in Malaysia's GLAs context, a combination of environmental subdimension has a less significant impact on the BDA.

d) The BDA Factors and Productivity

The fourth hypothesis (H4) in this study is to see the relationship between BDA factors and OI. However, the first element in OI in this study namely productivity. There are five (5) items in productivity to have a precise understanding of the relationship among them. The result shows that the combined effect of technology, significantly affects productivity where t-values appeared to have strong values **(Big Data Adoption -> Productivity) (f=0.47, t=9.506*, p=0.000)** as shown in Table 7.

Table 7

Summarize the Relationship Between BDA Factors and Productivity.

Hypot hesis	Relationship	Coeffici ent	Std Deviation	t-value	p-values	Decisio n
H4	BDA -> Productivity	0.566	0.06	9.506	0.000	Supporte d

Evidently, BDA in Malaysia's GLAs brings improvise in marketing and increases productivity and efficient performance. Based on Ragueso (2018) adoption of BD brings several impacts on financial performance and company productivity. It makes them aware that BD technology can create business value through unique analytics as well as decision support capabilities. As Malaysia's GLAs, readily expertise in BDA may be an advantage, yet the skill and expertise

need to be more specific, oriented and have advanced knowledge that is currently demanded by BD. Equally, based on Baig et al., (2019) stated in data from Pakistan university campuses resulted in expertise and skills in the organization as trained and skillful people determinant factors for providers or institutions to have permanent or contract staff. Hence, the ability of Malaysia's GLAs to provide financial resources as well as full commitment from management, seeing that they are ready as fact-based organizations that cover the entire organization. Yet, Maroufkhani et al., (2020) stated Iranian SMEs' challenges in BD analytics adoption namely a lack of financial resources, IT infrastructure, analytics capability, and skilled resources. This study stands that BDA mediates the significant relationship between organization and productivity whereby having skillful people and ready financial resources and commitment at the management level encourage to productivity.

e) The BDA Factors and Cost-savings
The BDA positively and significantly affects the cost-savings where t-values appeared to have strong values **(Big Data Adoption -> Cost Savings)** which **(f=0.188, t=4.149, p=0.000).** This is indicating that the combined effect of technology and BDA positively influence the cost-savings of Malaysia's GLAs shows in Table 8.

Table 8
Summarize the Relationship Between BDA Factors and Cost-savings

Hypothesis	Relationship	Coefficient	Std Deviation	t-value	p-values	Decision
H5	BDA -> Cost-savings	0.398	0.096	4.149	0.000	Supported

The BDA in Malaysia's GLAs allows them to reuse the organization data to be used across the department (Falahat et al., 2022). Similarly, BD analytics with integration model in healthcare support aggregation data from various sources, interpretation techniques and evidence-based decision-making gives to reduce inventory and cost-savings (Wang et al, 2018). As Malaysia's GLAs, provided with stable ICT infrastructures, this study hypotheses evident that BDA have significant relationship between technology and cost-savings.

f) The BDA Factors and Innovation
The BDA positively and significantly affects the innovation where t-values appeared to have strong values **(Big Data Adoption -> Innovation)** which **(H6: Supported, t=6.837, p=0.000).** This is indicating that BDA positively influence the innovation of Malaysia's GLAs as shown in Table 9.

Table 9
Summarize the Relationship Between BDA Factors and Innovation.

Hypothesis	Relationship	Coefficient	Std Deviation	t-value	p-values	Decision
H6	BDA -> Innovation	0.543	0.079	6.837	0.000	Supported

The Malaysia's GLAs may adopt BDA business may adopt an innovation because of pressure, demand or reference from their competitors and partners. However, BDA in Malaysia's GLAs

settings offers good opportunities as they able to imitate what competitors has been doing to be adapted in their organization. To that fact, Malaysia's GLAs have chances to existing product or services for enhancement as BD offers primary data and can be exploit for the innovation purposes. Similarly, based on Mikalef et al., (2019) BD analytics capabilities have significant impact to the radical innovation such development of novel products and genomics with electronic health record data to provide more effective treatments in healthcare settings. After all, from six hypothesis developed in the study, all of them supported in the study of the relationship between BDA factors and OI in Malaysia's GLAs context.

Conclusion

The findings in this study extend theoretical perspettive, a TOE framework has consistently provided a conceptual foundation for understanding the variables influencing BDA. Other research has predominantly concentrated on BDA in sectors such a healthcare, manufacturing, SMEs, HEI and public sector. No research has been discovered that specifically addresses Malaysia's GLAs. This is despite the fact, that BD has gained acceptance in Malaysia ever since the government announced the Digital Economy initiative, which presents significant opportunities.

While there have been global studies on BD analytics applied in various domains, most have primarily assessed its impact in general performance and competitive advantage. Surprising, there has been lack of research specifically connecting BDA to productivity, cost-savings and innovation. This particular focus makes this study distinct and novel. The uniqueness of this research lies in its emphasis on these three key elements, and it offers a contemporary theoretical framework underscores the importance of TOE framework in the context of BDA and OI within Malaysia's GLAs.

This study builds upon prior research regarding the relationship between TOE in their impact on organizational performance in the context of BDA. It offers a dual contribution to the existing body knowledge: firstly, it expands the examination of variables within TOE model specific to the Malaysian context and secondly, it integrates organizational dimensions into this analysis.

In practice, this study offers organizations with crucial implications. Although BDA has been widely applied, many organizations may not be able to distinguish which the most influencing factors impacted in the implementation. Building BD as a culture oriented in the organization are too complicated if the investment does not give any return. Utilizing BD in the organization need to be strategically to avoid the project become abandon and failure. Therefore, the clear guidelines on BDA-OI are most required. 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. Moreover, this study provides insights and guidelines to management in maximizing the BDA value for affective in decision process.

Acknowledgement

Corresponding Author

Hasnah Hashim

College of Computing, Informatics and Mathematics, Universiti Teknologi MARA (UiTM) Selangor, Malaysia.

Email: hasnahhashim@uitm.edu.my

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