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Big Data for Sustainability: Examining the Role of Big Data Governance in Enhancing Sustainable Performance

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Abstract

The aim of this study is to identify the gap in the literature regarding the role of big data characteristic on the sustainable performance of the organization. In this research, the data were collected from public and private hospitals of Malaysia that were used big data techniques for sustaining the performance of hospitals. For this, questionnaire method for data collection was utilized and applied the structure modeling technique by using SPSS software. The results of 330 valid questionnaires disclose the effect of 3V's on the data veracity, value and also on sustainable performance. The distinctive contribution of this research is to generate effect and novelty of the big data governance as a moderator between the data characteristics and value of data as well as data veracity. These findings help the management of hospitals to properly manage and understand the capabilities of the organization through which the organization could enhance its sustainable performances.

INTRODUCTION

The healthcare industry plays a vital role in the world economic system that provides services to patients with rehabilitative, preventive, curative, and palliative care. The healthcare industry is one of the fastest-growing and world largest industries(Wang, 2021). The Healthcare industry contributes over 10 percent of the GDP of developed nations(Varpio et al., 2021). The Healthcare industry of Malaysia has an efficient and extensive system of healthcare, which is divided into public and private subdivisions. The government of Malaysia feels importance on the development and expansion plans of healthcare, using 5% of the development budget of the social sector into healthcare which leads to improving overall 47% of the previous figure. The government wants to improve the quality of existing hospitals and building new hospitals. The major problems of the healthcare industry of Malaysia are to manage the quality and valuable data of patients and to sustain the organizations' performance. In healthcare industry, the purposes of using big data are to conduct health research to improve the efficiency of diagnosis and medication About 80% of the patient's service interaction determination be completed with the support of the internet of things (IoT) and big data, which could enhance the quality, value, and

correctness (Miranda, 2020). Well-being organizations can communicate to different data collectors to combine them and unified them to execute research, analysis and to sustain the performance of the firm. The data gatherers can be government officials, social patrons, patients, and medical systems, etc. Organizations can enhance their quality of decision making and performance through the development of a progressive system with the help of Big data on artificial intelligence (Makridakis, 2017). In the last decade, extraordinary progress in data has provided a thrilling opportunity and growth for organizations to sustain its performance (Acharya, Singh, Pereira, & Singh, 2018; Ghasemaghaei & Calic, 2019). Latest studies emphasize mainly on the anecdotal indication, and slight is identified the key role of 3 V's (data volume, velocity and variety) could increase the organizational performance (Gawankar, Gunasekaran, & Kamble, 2020; Kamble, Gunasekaran, & Arha, 2019; Maroufkhani, Wagner, Wan Ismail, Baroto, & Nourani, 2019; McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012). By using big data characteristics could help the organization to gain a competitive edge by enhancing its sustainable performance So, big data characteristics might be create value for an organization and also enhance the organization's sustainable performance (Ghasemaghaei, Ebrahimi, & Hassanein, 2018).

In previous literature, researchers didn't focus on big data governance between big data characteristics and sustainable performance of the organization. Big data governance means the guidelines and principles for managing the data in a firm (Chamberlain, 2013). The current study emphasizes the moderating role of big data governance between the key data characteristics and on the organizational sustainable performance which distinguishes the organizational growth and profitability of an organization from its rivals (Powell, 1995). The purpose of the study is toward identify the relationships of data value, velocity and volume on a organization's sustainable performance, data veracity, and value, by the moderating role of big data governance between data characteristics (volume, velocity, variety), data value, and data veracity. This paper is categorized into five sections: Section two comprises of literature review, 3rd section is related to data collection and methods, section four focuses on results & discussions. Last section belongs to conclusion, limitations and future recommendation.

LITERATURE REVIEW

Theoretical background

The present study uses the Dynamic capabilities theory (DCT) as a base. Dynamic Capabilities are related to the company's capacity to arrange with the competencies by developing companies' capabilities, participating in them, and reorganizing them for the energetic professional scenario. Dynamic Capabilities theory highlights the conversion of the present capabilities based on the current era's requirements(Shamim, Zeng, Shariq, Khan, & Management, 2019). Furthermore, Dynamic Capabilities, highlighting that the ability to respond timely and effectively to changes requires adopting capabilities that could improve the performance of the firm.The current study focused on the role of key organizational capabilities that create value for the organization because improving the value of BD can improve the sustainable performance of the organization. As key characteristics of BD are identified as data velocity, variety, and volume are the complementary capabilities.

Big data characteristics and sustainable performance

Data, velocity, variety, and volume are the main challenges of managing the data (Laney, 2001). Later, these 3 V's were declared as the major elements of huge data (H. Chen, Chiang, & Storey, 2012; Kwon, Lee, & Shin, 2014). Big data characteristics can be defined as higher data velocity, variety, and volume. Similarly, another definition explains big data characteristics as the characteristics which have greater volume, variety, and velocity which required modern technologies to manage and analyze the data The sustainable performance of an organization can be defined as the ability to manage the short-term as well as long-term future goals and financial objectives of the organization(Bansal & DesJardine, 2014). If the organizations do not focus on sustainability then major stakeholders can be forced to focus on the sustainable performance of the organization(Carvalho & Rabechini Jr, 2017). So, the current study emphasizes that firms should focus on sustainable performance through big data characteristics. According to Dynamic Capabilities theory, big data characteristics can be used as capabilities that can enhance the sustainable performance of the organization.

H1. There is a positive association between big data characteristics and the sustainable performance of the organization.

Big data characteristics and Value of data

Data with less reliable sources is unfeasible for utilization and could affect on value generation of the organization(Warth et al., 2011). Furthermore, when organizations have relied on reliable data, they realize such data is more beneficial in creating value for the organization. Brynjolfsson, Hitt, and Kim (2011) claim that the value of data produced through data compelled results might be improved an organization's productivity by 5 to 6 percent. (Ghasemaghaei & Calic, 2019) also claims that organizations gain more monetary worth than peripheral worth and rivals will not in a position to replica such abilities, organizations might be able to improve sustainable performance than other organizations. According to DCT, an organization's capability to create benefits from the value of data could have a positive effect on big data characteristics(Wamba et al., 2017). So, big data characteristics have a positive relationship with the data value.

H2. There is a positive association between big data characteristics and data value

Data characteristics and Veracity of Data

The disorderliness of data makes the usefulness and credibility of the records problematic. The organization's expenses will enhance if the firm uses low veracity of data(Ghasemaghaei & Calic, 2019). Other scholars claim that data with low quality is a barrier to new opportunities for organizations and creates a doubtful situation for management for decision making. While progressive improvement in technologies could determine patterns and outlines in data, the true awareness created from data be contingent on the quality of data(Lycett, 2013). So big data volume, variety, and velocity's outcomes dependent on the veracity of data. Hence big data characteristics are positively associated with data veracity.

H3. There is a positive association between data characteristics and veracity of data.

Data value and sustainable performance

As we discussed earlier, sustainable performance is the ability to deal with the short- and long-term future goals and economic objectives of the organization(Bansal & DesJardine, 2014), and data with less reliable sources is unfeasible for utilization and could affect value generation of the organization(Warth et al., 2011). So, the value and performance of the firm could be achieved when organizations rely on the data value. Data value and sustainable performance of the organization are the key elements for stakeholders to rely on the organization. With errors in data, sustainable performance could not be achieved so sustainable performance depends upon the data value. According to DCT an organization's capabilities to maximize the profitability from data processing (i.e., data value) might have an optimistic impact on the organization's performance(Wamba & Mishra, 2017 & Khan et al., 2024)

H4. There is a positive association between the value of data and the sustainable performance of the organization.

Data veracity and sustainable performance

As discussed earlier the messiness of data is a major problem for the trustworthiness of organizations. With the use of low-quality data, a firm's expenses could be increased gradually, as it is challenging to manage this kind of data and it may yield ambiguous consequences(Ghasemaghaei & Calic, 2019). Other researchers argue that low quality of data could be the obstacle of novel opportunities for the firms and barriers for better decision making. Whereas advancement in technologies could control patterns and framework in data, the awareness bent from data is dependent on the high quality of data(Lycett, 2013). On the other hand, sustainable performance is the capacity of dealing with the future goals and monetary objectives of the firm(Bansal & DesJardine, 2014). The performance of the organizations is dependent on the high quality of data. So, sustainable performance could be achieved through data veracity.

H5. There is a positive association between data veracity and the sustainable performance of the organization.

Data characteristics, Data governance, and the value of data

Data governance denotes the rules and regulations for managing the data in an organization(Chamberlain, 2013). Big data governance offers the correct set of data to the correct people when the need ascends so that the correct conclusions can be made(Riggins & Klamm, 2017). Data governance could help a firm with the standardization of data, formulation of efficient business policy, and describe the role of major stakeholders(Kim & Cho, 2017). The big data executives face complications in governing, cleaning, and managing the data(Armes & Refern, 2013). It is essential to set out new rules and regulations of governance for the organizations that applying big data(Alnafoosi & Steinbach, 2013).

Data governance is decisive to the success of the organization, where an enormous amount of data is processed. As the study mentioned earlier, 3 V's are measured the key elements of big data characteristics(H. Chen et al., 2012; Kwon et al., 2014), and data with less reliable sources is unfeasible for utilization and could affect on value generation of the organization(Warth et al., 2011). According to DCT, an organization's capability to create benefits from value of data might have a optimistic influence on big data characteristics(Wamba et al., 2017). So big data characteristics

could be positively associated with a data value, the current study uses big data governance as a moderator, which is related to the fit between the BD characteristics and Data value, because without data governance vale the valve of data could not be achieved.

H6. Big data governance has significantly moderated the association of big data characteristics and data value.

Data characteristics, Data governance, and veracity of data

Big data governance is defined as, the various techniques and procedures that safeguards the important data properties are to all over the organization(Sarsfield, 2009). Big data governance requires a system for dealing with the information(Borkar, Carey, & Li, 2012). BDG is significant in making policies, procedures, and ethics for effectively managing and safeguarding the usability, availability, consistency, integrity, and suitability of big data. As discussed earlier Big data characteristics can be defined as higher data velocity, variety, and volume, and messiness of data is a major problem for the trustworthiness of organizations, so big data characteristics are positively associated with data veracity because without producing quality data we could not get better results from big data characteristics, the current study uses big data governance as a moderator, that is related to the fit between the BD characteristics and Data veracity, because without data governance quality in data could not be achieved.

H7. Big data governance is significantly moderates the association between characteristics of data and veracity of data.

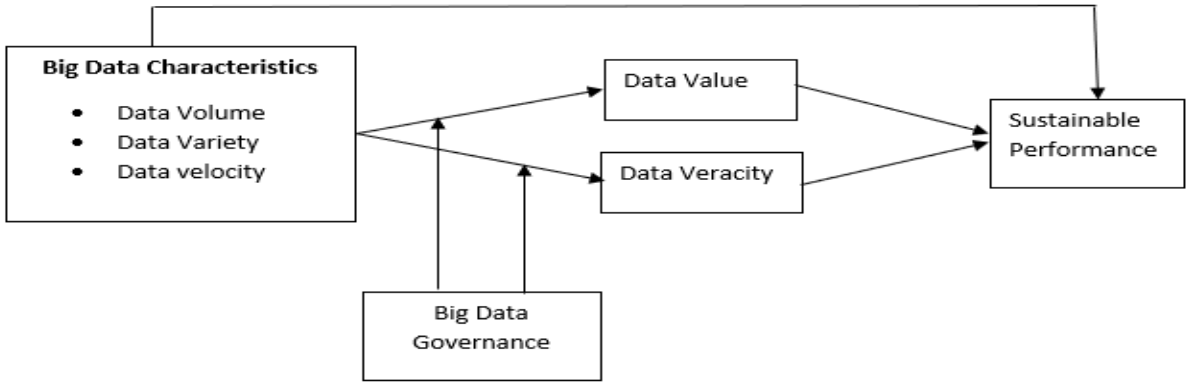

Figure 1.
Theoretical Framework

DATA COLLECTION AND METHODS

Data Collection

The data have been collected from public and private hospitals of Malaysia through quantitative survey approach, checking the sustainable performance of the hospitals. The hospitals were considered as a unit of analysis, and the respondents were IT experts of big data management. For this, Questionnaires were designed to fill from the IT experts of private and public hospitals in Malaysia. As reported by the Malaysian Health Ministry, there were 404 hospitals in Malaysia. For conducting this survey, only 322 hospitals were showed their attention to take part in this study. On September 2024, this survey was launched by questionnaire methods for data collection. Firstly, Surveyors were trained and appointed for gathering the data. They distributed 250

and 350 questionnaires in private and public hospitals respectively and received 140 and 190 valid questionnaires from private and public hospital respectively. Furthermore, we struggle to sustain homogeneity amongst the respondents who belonged to private and public hospitals in Kuala Lumpur. In the questionnaire, we used common method bias to control issues. So, it is cleared that CMB was not an issue in the study. Furthermore, SPSS was used for analyzes the data. The current study tried to predict and clarify the study variables with the help of the based theory. For applying the structure modeling technique, SPSS software was used by explaining the main objectives and predictions of variables (Hair Jr, Sarstedt, Matthews, & Ringle, 2016). For complex theoretical model of the current study, SPSS software is appropriate for a complex structure model with numerous variables.

Measures and Questionnaire

There were 39 items in questionnaire of big data management, data governance, and environmental performance (De Giovanni & Management, 2012; Ghasemaghaei & Calic, 2019; Green, Inman, Brown, Willis, & Marketing, 2005; Nisar et al., 2020; Sezen, Cankaya, & Sciences, 2013) as they established these scales based on many studies, four items for BG volume, four items for BD velocity, three times for BG veracity, three items for Data variety, four for a data value, and four for BD governance were used for this study to measure the Big Data management challenges. Finally, the sustainable performance was measured by three factors (Environmental, economic & social) with seventeen items that were designed by De Giovanni & Management (2012); Green et al. (2005); Zhu et al. (2008). They established these scales especially to measure the performance and we used these items in the framework of hospitals. Further, we sent the questionnaire for pretesting to five big data experts and they confirmed that more amendments are not needed and the respondents were used to measure the reliability for underlying constructs.

RESULT & DISCUSSION

In this section, the findings of this study present with appropriate discussion. The variable sustainable performance (SP) was used as dependent variable. In 1st table, the variables big data characteristics (BDC) like data volume, data velocity and data variety were entered in model one as independent variable.

Table 1.
Variables

Model	Variables Entered	Variables Removed	Method
1	BDC[b]	.	Enter

Dependent Variable: SP

Model Summary

In table 02, we can see the regression analysis as a model summary. The value of correlation coefficient (R) indicated a moderate positive relationship between the dependent variable and predictor (BDC). The R Square value of 0.524 suggests that approximately 52.4% of the variation in the dependent variable is explained by BDC. The Adjusted R Square (0.523) is close to R Square, confirming the model's stability. The Standard Error of the Estimate (SEE) is 0.39616, reflecting the average deviation of actual values from the predicted values. The R Square Change (0.314) and the F Change value of 260.212, with a significance level of 0.000, indicate that the model is statistically significant, meaning that BDC has a significant impact on the dependent variable.

Table 2.
Model Summary

Model	R	R Square	Adjusted R Square	SEE	R Square Change	Change Statistics F Change	df1	df2	Sig. F Change
1	0.724[a]	0.524	0.523	0.48626	0.524	361.212	1	328	0.000

a. Predictors: (Constant), BDC

Analysis of Variance (ANOVA)

The table 03 shows the overall regression model' significance. The regression sum of squares indicates the variation explained by the BDC, while the residual sum of squares represents the unexplained variance. The total sum of squares reflects the total variation in the dependent variable (SP). The F-statistic with a highly significant p-value confirms that the regression model is statistically significant, meaning that BDC has a significant impact on SP. The high mean square for regression (85.408) compared to the mean square for residuals (0.236) further reinforces the model's explanatory power.

Table 3.
ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	85.408	1	85.408	361.212	0.000[b]
	Residual	77.555	328	0.236		
	Total	162.963	329			

a. Dependent Variable: SP

b. Predictors: (Constant), BDC

Regression Analysis

The coefficients table provides details on the relationship between the predictor **(**BDC**)** and the dependent variable **(**SP**)**. The constant (1.919) represents the expected value of SP when BDC is zero. The unstandardized coefficient (β = 0.542) indicates that a one-unit increase in BDC leads to a 0.542-unit increase in SP. The standardized coefficient (Beta **=** 0.724) shows that BDC has a strong positive effect on SP. The t-values (19.138 for the constant and 19.006 for BDC), along with their highly significant p-values (0.000), confirm that both coefficients are statistically significant. This suggests that BDC is a significant predictor of SP for the validity of the regression model.

Table 4.
Coefficients[a]

Model		Unstandardized Coefficients β	Std. Error	Standardized Coefficients Beta	T	Sig.
1	Constant	1.919	0.100		19.138	0.000
	BDC	0.542	0.029	0.724	19.006	0.000

a. Dependent Variable: SP

The findings of this study show that data characteristics (Data volume, velocity, variety) have a favourable effect on the sustainable performance (SP) of private and public hospitals in Malaysia. Further findings explore that big data characteristics have an opposing impact on data veracity but have an optimistic impact on value of data. This is because the issue of big volumes of data is commonly confused which could lead to lower data consistency and reliability within the organization. Moreover, the result shows that data veracity and value have a positive influence on the sustainable performance of the organization. It means that the sustainable performance of the

organization in BG management depends upon the data veracity, value, and BD characteristics. The findings also show that the organizations that use the maximum level of big data characteristics have the maximum means of data veracity and value and sustainable performance. Moreover, the study shows that big data governance moderates between data characteristics and value of data. The findings show that big data governance enhances the value of data and velocity, and when the value of data and veracity increases the organization's performance will also be increased.

Theoretical Contribution

The results of the study indicate the significant academic implications of big data characteristics have the potential to enhance the sustainable performance of the organization, however current studies discuss that the big data characteristics possess many challenges to achieving sustainable performance. In the past research no practical study is available that tested the moderating role of data governance among data characteristics and organization veracity and value, and sustainable performance without governance is not possible. This gap is that the current study is investigated. To address the objectives of the study, we use DCT to test the big data governance impact on the firm's value and veracity and also on organization performance. The study provides some theoretical contributions. First, from the dynamic capabilities theory, the study highlights the significance of utilizing big data as an organization's important capabilities that can enhance the performance of the firm. The findings of the current study indicate the need for data volume, variety and velocity could enhance the sustainable performance of the organization. Secondly, the results show valuable understandings of the BG literature for the value of data and veracity. The findings indicate that data value and veracity could enhance the organization's performance. These results contribute to literature of big data by investigating the data value and veracity's impact on an organization's capabilities. Third, big data governance's impact among data value, data characteristics, and veracity is also an important and new contribution of the current research to the literature of big data management.

PRACTICAL CONTRIBUTION

This research highlights some useful contributions. Firstly, the findings shows that organizations those are skillfully managing the organized and unorganized data from the different sources actually can rise their capability to use any kind of big data to increase their performance. But collecting huge data does not enhance an organization's data veracity. This is due to the issue of the large volume of data that could create a mess for organizations. The results also indicate that organizations that have capabilities for gathering structured and unstructured data can create better insights. The results also indicate that just focusing on the fast collection of data from various sources could not enhance the value generation of the organization. So the big data governance can create an impact on the data value and veracity.

CONCLUSION

The objective of the current study was to identify the gap in the literature regarding the role of big data characteristic on the sustainable performance of the organization. The results disclose the effect of 3 V's on the data veracity and value and also their impact on sustainable performance. The distinctive contribution of the study is to generate impact and novelty of the big data governance as a moderator between the data characteristics and value of data as well as data veracity. These

findings help the management of hospitals to properly manage and understand the capabilities of the organization through which the organization could enhance its sustainable performances.

LIMITATIONS & FUTURE RECOMMENDATION

The current research has some limitations. Firstly, the cross-sectional data were used in the study to investigate the hypothesis in the model. The future researcher can use panel data to test our results again as in current study's results show insufficient relationships between construct in the research model. Secondly, the study explored the major role of "data" as a key capable source of an organization in the framework of big data characteristics on the sustainable performance of the organization. Future researchers could also explore the other capabilities of big data (tangible, human etc.) and examine their impact on sustainable performance. Thirdly, the study focused on the participants of hospitals in Malaysia. Future researchers could also authenticate the findings of the study by with contributors from outer Malaysia. Finally, the study focused on exploring the role of the 3 V's on the firm's sustainable performance and future researchers could discover the impact of the 3 V's on the operational and patient's perspective.

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