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Challenges of Implementing Big Data Technology in Higher Institutions

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Abstract

The aim of this study is to investigate the challenges of implementing Big Data Technology (BDT) in Higher Educational Institutions (HEIs) in Namibia. The study further undertook quantitative surveys with staff of the three (3) higher institutions in Namibia. A sample of 345 participants from International University of Management (IUM), Namibia University of Science and Technology (NUST), and The University of Namibia comprising the study's population (UNAM) were selected for this study using the simple random sampling technique. The data collected was analysed for descriptive statistics using the Statistical Package for Social Sciences (SPSS). The finding indicated that there are challenges such as lack of awareness of BDT, lack of support for management and inadequate IT infrastructure. The study further recommended strategy that will enhance the implementation of BDT in HEIs.

Keywords: Big Data Technology, Information Technology, Higher Educational Institutions

1. INTRODUCTION

Big Data is formed from large quantities of knowledge consisting of various data types and accumulating at a rapid velocity (McAfee and Brynjolfsson, 2012; Provost and Fawcett, 2013). Big Data is one of the most well-liked Internet technologies which will allow businesses to control information round the physical environment for a more accurate analysis of company performance in response to today's fierce competition (Provost and Forest, 2013).

Big Data Technologies (BDT) blossomed as a promising technology for analysing and managing the Big Data generated in the digital world (Alsheikh, 2019). BDT as a technology, seems to have been developed to handle the tremendous volume of various data produced by users or technology environments. Thus, Big Data could be referred to as the amount of data that eclipsed the processing abilities of current database systems. Big Data is generated by storing large quantities of data in one main storage facility that supports special transactions (Picciano, 2012).

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According to Banik and Bandyopadhyay (2016), Big Data is a term for massive data sets having large, more varied, and complex structures with the difficulties of storing, analysing, and visualizing for further processes or results. The data storage technique used for Big Data includes multiple clustered network-attached storage (NAS) and object-based storage. The process of research into massive amounts of data to reveal hidden patterns and secret correlations are named as Big Data analytics. Big Data consists of large data sets that cannot be handled by traditional application systems.

The educational sector is seen as one of the domains where the characteristics of big data such as volume, variety and velocity have an overwhelming impact Osakwe et. al (2020). This is because the educational ecosystem is known to generate large amount of data from a variety of sources and in different formats on daily basis. These data could come from students' usage and interaction with different types of learning platforms, usage of online learning materials, examination results, etc. On the other hand, data could also come from administrative processes and other numerous areas where educational data is generated. The role of big data in education notwithstanding, implementation has always been a stumbling block. If big data technology is fully implemented in education, there is every possibility that the benefits that come with it will change the face of education globally.

Furthermore, education across the globe today seems to have become a competition to the extent that institutions vie for the attention of prospective students in order to increase the number of prospective candidates seeking admissions. Rapid innovation in technology appears to have made it easier for schools and colleges to reach out to more candidates as the urge to market them intensifies. In order for advanced education institutions to receive the maximum number of accepted candidates, they are now adopting the ability to analyse, access, and manage vast volumes of data (Schmarzo, 2014). As a result, colleges seem to now have more complicated ways of collecting and reacting to data about students, and as a result are able to target students in more specific ways than ever.

2. PROBLEM STATEMENT

BDT appears to be beneficial to HEIs. Notwithstanding this, BDT use by various industries including HEIs, seem to face a series of challenges. Rabella, (2016), argues that not all IT systems can process, organize, and present a large amount of data. There is also a problem of getting users to accept BDT due to the fact that most management find it difficult to adopt new processes since they feel that change management leads to major expenses (Daniel, 2014). Daniel and Butson (2013) further stated that aggregating administrative data, classroom, and online

data pose a challenge as most of the institutional data systems are not interoperated.

There are several universities operating in Namibia. Due to the high demand for the new students securing places in universities, the growth of educational data is rapidly increasing. High volumes of data need to be secured by using Big Data as it can help universities improve results, help identify students they want to enrol, and improve higher educational performance (Murumba and Micheni, 2017). Students' grading, student performance, and learning performance will be poorly performed if Big Data adoption is not implemented.

Unfortunately, lack of capacity and capability to handle Big Data within institutions and inadequate Information and Communication Technology (ICT) infrastructure has led to the inability to leverage or support IT and failing to make informed decisions (Daniel, 2014). The is also the case with Universities in Namibia where Big Data is just finding its feet. According to Michael and Miller (2013), there is a rapid expansion of data that exceeds the organization's ability to design appropriate systems that can handle Big Data effectively and analye it in order to make meaningful decisions. Daniel (2014) believes that security and privacy issues pose additional challenges to the implementation of Big Data in higher education. The aim of this study is to investigate the challenges faced by Namibian universities in the implementation of Big Data Technology.

3 BIG DATA TECHNOLOGY DEFINITION

Sin and Muthu (2015) refers to big data as structured and unstructured data sets that are too large and complex for traditional and conventional applications to process or handle. Big Data refers to the large volume of data generated because of the development of technology and the continuous actions and interactions of users in digital environments (Husan and Erik, 2018). Big Data Technologies (BDT) blossomed as a promising technology for analysing and managing the Big Data generated in the digital world (Alsheikh, 2019).

Research analyst Kiran (2019) explains BDT as a utility software designed to analyze, process, and extract information from complex and larger data that traditional data software cannot deal with. BDT involves the two types of technologies of operational and analytical BDT, where operational BDT is about the day to day data that is generated (online transaction and social media), and analytical data technologies involve the real-time business operation such as weather forecast and the stock market. The most important top BDTs are; data storage, data mining, data analysis, and data visualization (Kiran, 2019). BDTs in education is implemented for several purposes such as Detection of learners dropping out risk rates, Performances prediction, Behaviours investigation, Absences tracking, Courses recommendations, Instant assisting and assess in

HEIs, Visual analytics on learner's interaction with a discussion forum, Improvement of accessibility, Research and development, Evaluation, and accountability, Identification of learners at-risk of failing, and at the course level (Bamiah, Brohi, & Rad, 2018).

4. CHALLENGES OF BDT.

Despite the benefits that HEIs can get from using Big Data, it has faced a series of challenges. According to Rabella (2016), not all IT systems are capable of processing, organizing, and presenting massive amounts of data. Agrawal and Nyamful (2016) argue that data storage and management are a major concern of big data. They further stated that the ability for storage devices to meet the rate of data growth, enhanced access time and data transfer are challenging (Agrawal and Nyamful, 2016). Pawar (2016), states that traditional domain and security model as well as security design is a challenge to big data, this is the reason why his research intends to provide security to infrastructure of big data. Padgavankar and Gupta (2014) explain that big data is becoming the most difficult problem in the industry, science and education. The researchers further explained that traditional relational database management systems cannot handle the huge volumes and heterogeneity of big data (Padgavankar and Gupta, 2014).

Furthermore, security and privacy issues are also challenges in the implementation of BDT in HEIs. Daniel (2014) believes that security and privacy issues pose additional challenges to the implementation of Big Data in higher education. There is a challenge of big data veracity that involves the trustworthiness of data and how to secure the data that is received, stored, processed and transmitted (Shobha and Dhamadaran, 2016). Current security mechanisms such as firewalls cannot be used in big data infrastructure (Maura and Serrao , n.d.). Bamiah, Brohi & Rad (2018) states that traditional security systems are not sufficient enough to secure technologies such as Big Data, Internet of things and cloud computing.

Lack of professionals has also been noted and a challenge for implementing BDT in HEIs. According to Boulton (2015), there is a lack of talented professionals when it comes to using BDT and this is the reason why businesses continue to struggle with hiring talented data scientists. Although there are a number of universities offering analytics and data science programmes, there is still a problem of cranking out enough trained people to meet the demands (Business.com educated staff, 2016). The researcher thinks that this is one of the reasons why institutions cannot adopt big data technology in their institutions. Bamiah et al. (2018), further explains that there is a shortage of experienced professionals to work on big data, this is causing a barrier for big data. They further explained that the cost of implementing BDT, unsavoury policies and lack of management support could reduce the motivation of implementing and using BDT in HEIs.

5. METHODOLOGY

This study was carried out in the three universities in Namibia: the International University of Management (IUM), Namibia University of science and Technology (NUST) and University of Namibia (UNAM). As illustrated in Table 1, a sample of 100 academic staff, and 9 administrative staff within the examination department, 6 IT personnel were selected from each university through simple random sampling, giving a total of 345 respondents.

Table 1 Population and sample of the study

Population	Sample
IUM:	
IT personnel	6
Administrative staff	9
Academic staff	100
NUST:	
IT personnel	6
Administrative staff	9
Academic staff	100
UNAM:	
IT personnel	6
Administrative staff	9
Academic staff	100

This study employed a quantitative approach and as part of the approach, a closed-end questionnaire was used as an instrument for data collection. Questionnaires encourage respondents to express their views openly, without the feeling that they are being monitored and consisting mainly of closed questions (Cohen, Manion & Morrison, 2011). The data was analysed for descriptive statistics using the statistical Package for Social Sciences (SPSS) and the results are presented in the section below.

7. ETHICAL CONSIDERATIONS

The researcher will be ensured that the following principles were adhered to:

- Participant privacy
- Freedom of participation
- No underage participants.
- Informed consent
  Confidentiality and Anonymity

7. RESULTS AND DISCUSSIONS

The challenge faced by the Namibian HEIs on the use of BDT were divided and analysed in the following categories

a). Environmental challenges
b) Technological challenges
c) Organizational Challenges

7.1 Environmental challenges

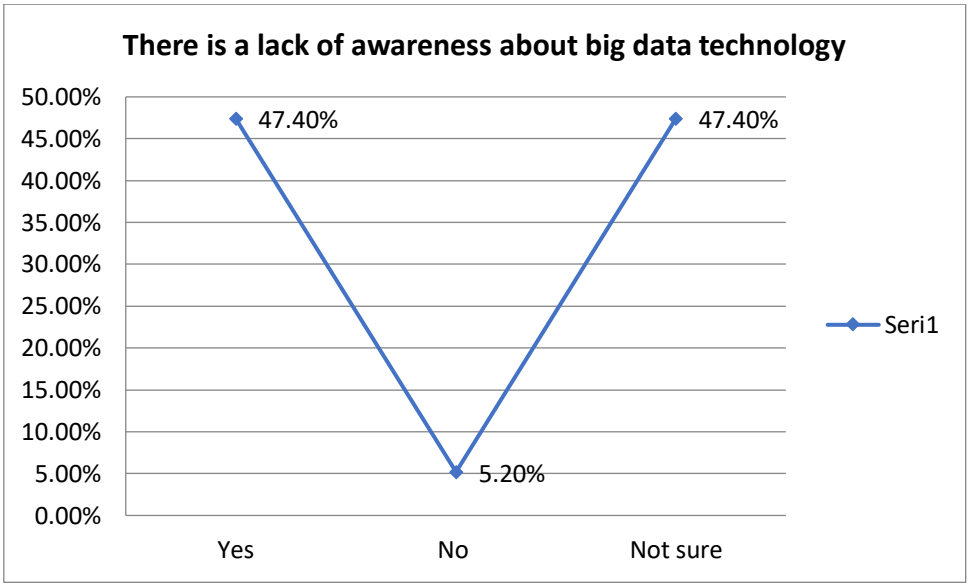

Figure 1 Lack of awareness about BDT

It is worthy to note the awareness of technology counts greatly when it comes to its usage. If individuals are not aware that there exists a particular type of technology, there is the possibility that they would not have the knowledge of that technology. According to the results presented in Figure 1 it shows that 47.4% of the respondents agreed that they are aware of BDT while 47.4% were not sure and 5.2% further indicated that they are not aware of BDT. The gap between the respondents who are aware of BDT and those whose and not sure od=s too wide and may be a challenge. Therefore, it is suggested that something needs to be done to bridge the gap.

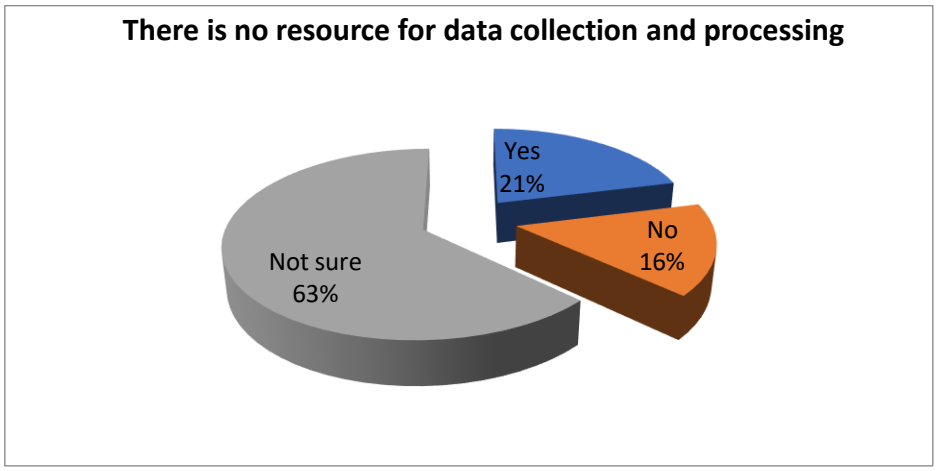

Figure 2: No resource for data collection and processing

Where there are no resources to carry out activities, there is every tendency that the activity may not be successful. According to Bloge (2019), When resources are available, activities are sped up and carried out to its logical conclusion. The results presented above in Figure 2 shows 63% of the respondents indicated that they were not sure if their university has enough resources for data collection and processing, while 21% responded noted that there are resources in their university for data collection and processing and only 16% of the respondents agreed that there are resources. Judging from the responses only few (16%) of the respondents indicated that there are resources for data collection in their universities. The is too small compared to the percentage of respondents who gave negative responses. Therefore, one can conclude that efforts should be made to provide resources for data collection and processing in these universities.

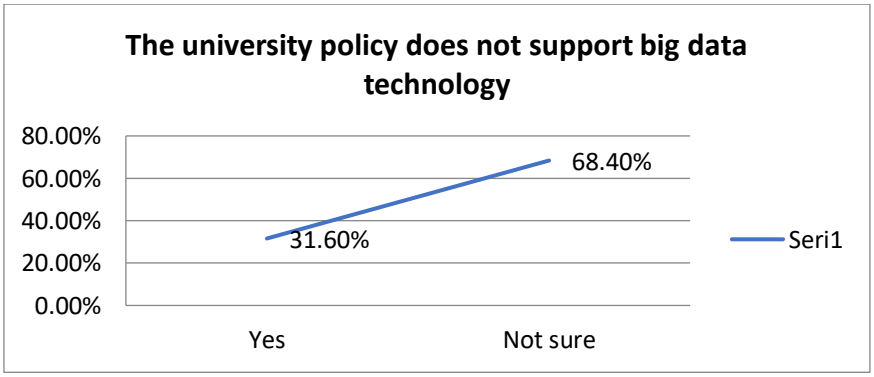

Figure 3 University policy does not support BDT

It is important to note that policies guide the day to day running of every organisation. Where there are no policies, it will be difficult to control and organise the various activities in an organisation. The result presented above in Figure 3 shows that 68.4% of respondents said they were not sure if the university policy supports big data technology, while 31.6% said yes to that.

7.2 Technological Challenges

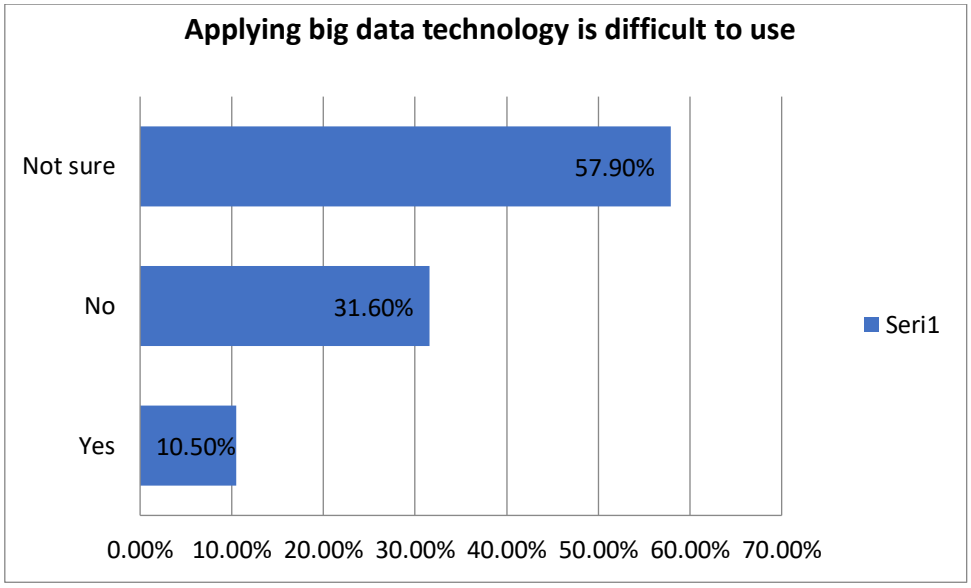

Figure 4: Applying BDT is difficult to use.

According to the results presented in Figure 4, 57.9% of the respondents were not sure if BDT will be difficult to use. This percentage of respondents could be part of those in Figure 1 Who indicated that they are not aware of BDT. This is because they may not have used it. On the other hand, 31.6% of the respondents indicated that applying BDT will not be difficult to use while 10.5% of the respondents are of the opinion that BDT will be difficult to use. This boils down to training. According to Osakwe et al, (2017) training increases the skills and the ability of individuals to use technology.

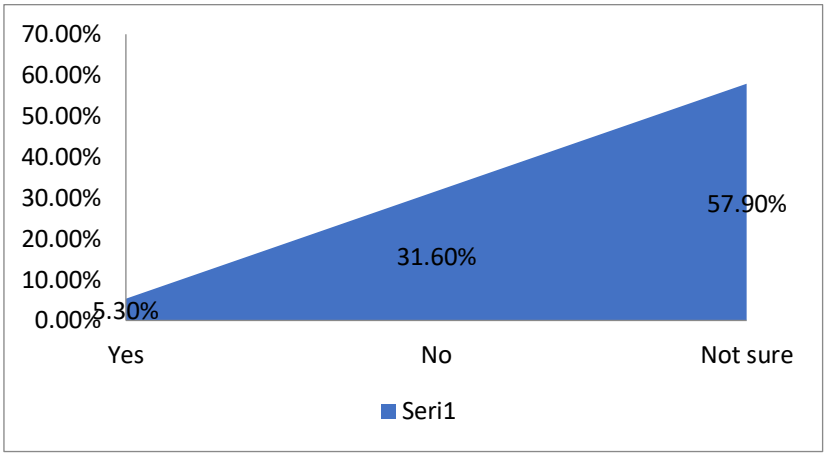

Figure 5: IT infrastructure not supporting BDT

For any institution to use BDT, the institution must as a matter of importance, have IT the relevant IT infrastructure that will power the innovative technology. Osakwe, et al. (2017) noted that IT infrastructure is a necessity for any institution that wants to use technology for teaching and learning. The results presented in Figure 5 shows that the majority of the respondents (57.9%) are not sure if their institutions have IT infrastructure that will support BDT, while 31.6% of the respondents noted that they are not sure if their institution has IT infrastructure that will support BDT. Interestingly, only 5.3% of the respondents indicated that their institutions have enough IT infrastructure to support BDT. The percentage is very small compared to the responses from other respondents on the question. Therefore, there is a need to look at the area of providing adequate IT infrastructure to enhance the use of BDT in HEIs.

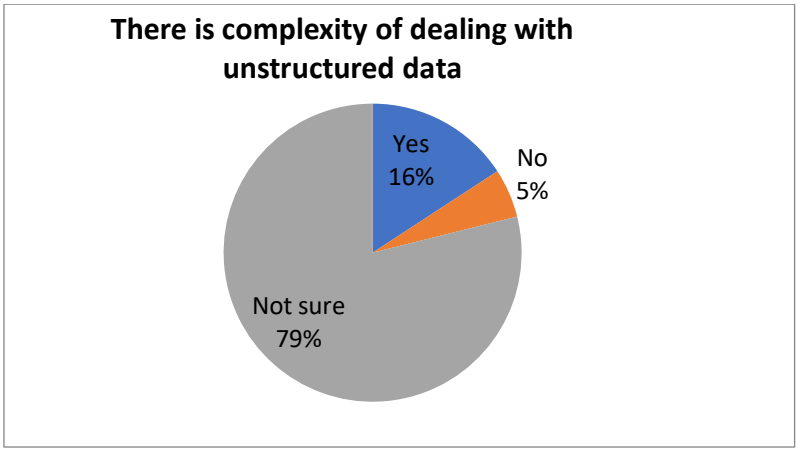

Figure 6: There is complexity of dealing with unstructured data.

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Structured data is highly organized and formatted in such a way that it can be easily searched in relational databases. Because there is no predefined format or organization for unstructured data, it is much more difficult to collect, process, and analyse (Pickell, 2018). According to the results presented in Figure 6, it shows that 79% of respondents were not sure if their university can handle the complexity of unstructured data while 16% were positive. On the other hand 5% of the respondents indicated that their institutions can handle the complexity of unstructured data.

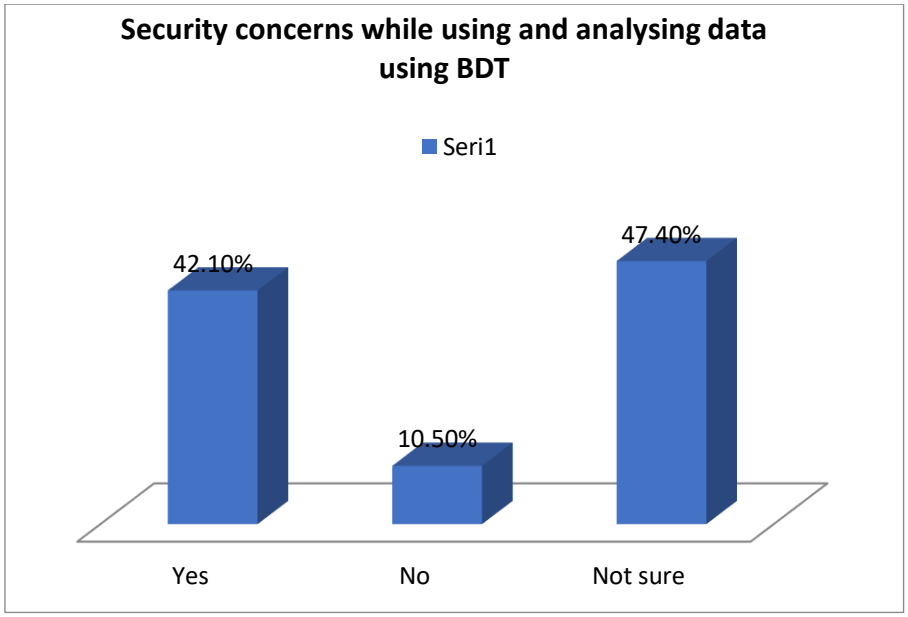

Figure 7: Security concerns while using and analysing data using BDT

Big Data security is the process of protecting data and analytics processes, both in the cloud and on premises, from a variety of threats that may jeopardize their confidentiality. Figure 7 presented above shows that 47.4% responded that they are not sure if there will be security concerns while using BDT, while 42.1% are of the view that there will be security concerns while using and analysing data using Big Data Technology. On the other hand, 10.5% noted that there will be no security concerns.

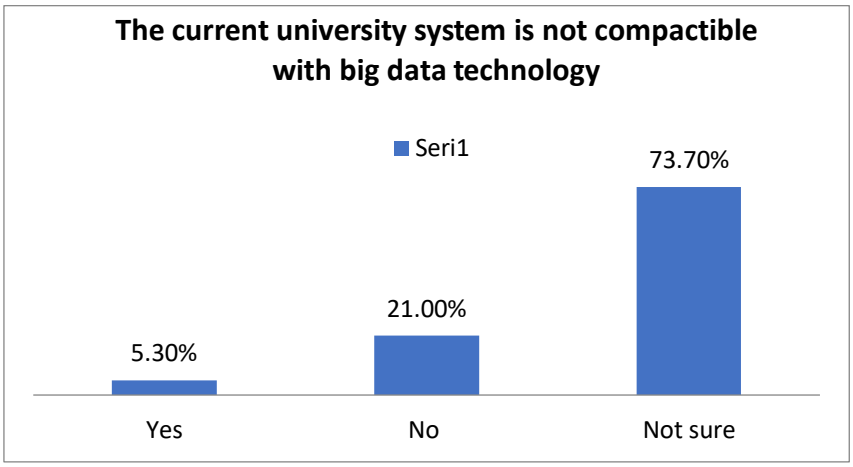

Figure 8: Current university system is not compatible with Big Bata Technology

According to the result produced above in Figure 8, it shows that 73.7% of respondents were not sure if the university system is compatible with BDT. This could be true judging from some of the responses of the respondents in the area of awareness and the universities not having enough IT infrastructure for. This also goes for the 5.3%% of the respondents who indicated that the current university system is not compatible with big data technology. However, 21.1% noted that their current university system is compatible with BDT.

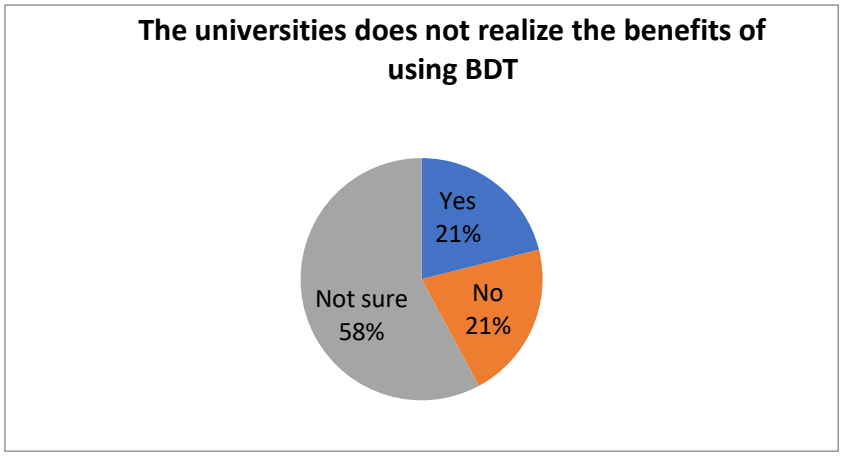

Figure 9: Universities does not realize the benefits of using BDT

With higher education institutions increasingly connecting with their students via the internet, opportunities for big data collection and use in university recruitment and pedagogical innovation are expanding. These are some of the ways in which

big data technology can benefit the university: student recruitment, improved student performance, and teacher effectiveness (Baker & Baker, 2017). The result displayed above in Figure 9 shows that the majority of 57.9% of respondents were not sure if their university realised the benefit of using Big Data Technology. 21% were positive while 21% were negative.

7.3 Organizational Challenges

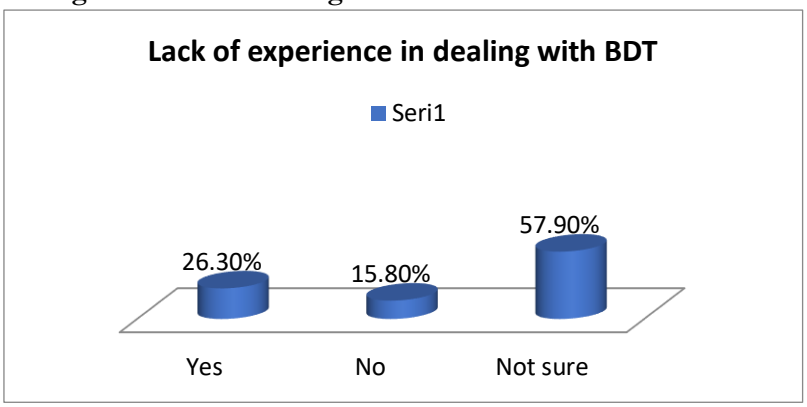

Figure 10: lack of experience in dealing with BDT

According to the researcher, big data technology is one of the new technologies that has been recently used by developed countries. It is recommended that one needs to be qualified in order to use BDT. The results presented above in Figure 10: shows that 57.9% of respondents were not sure if they have the experience in dealing with big data, while 26.3% indicated that they have the experience on the other hand 15.8% of the respondents do not have the experience in dealing with BDT.

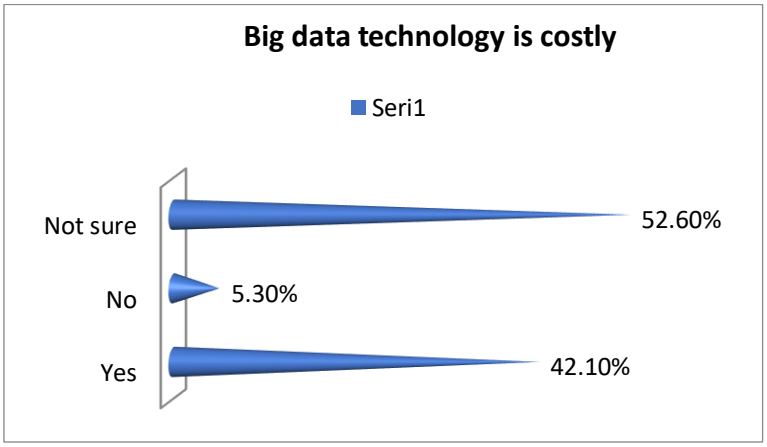

Figure 11: BDT is costly

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Big data analytics refers to data sets that are excessively large in number, generated at a high rate, and come in a variety of formats. As a result, these data sets are referred to as "big data." Because of their poor algorithms, high costs, and other factors, they are difficult to manage using conventional methods and may be expensive to maintain (*Big data analytics*, 2018). From the results presented in Figure 11:, it shows that 52.6% of respondents were not sure if BDT is costly. This could be because they are not too familiar with it and its operations as can be seen from their responses in previous sections. Furthermore, 42.1% noted that BDT is costly to implement, 5.3% disagreed,

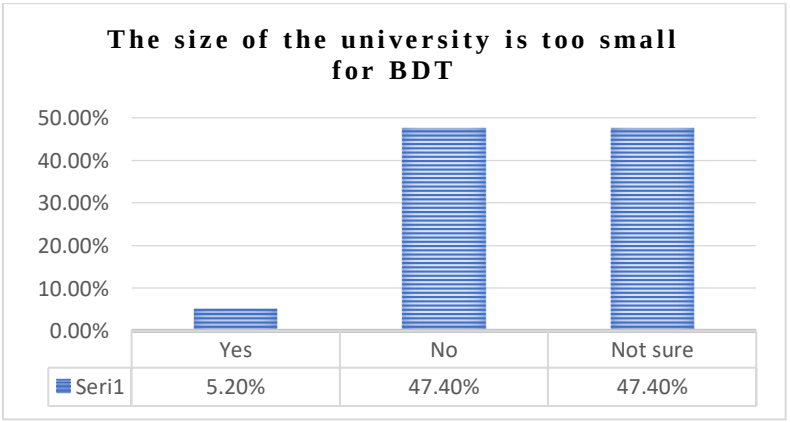

Figure 12: University size too small for BDT

The results presented in Figure 12: shows that 47.4% of respondents do not agree that the size of their university has anything to do with the implementation of BDT, while 47.4% were not sure and 5.2% indicated that the size of their university has a role to play in the implementation of BDT.

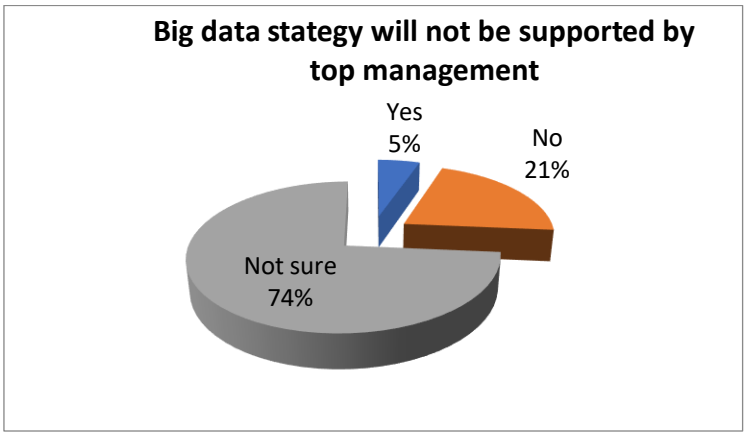

Figure 13: Big data strategy will not be supported by management.

Scholars in the area of strategic management have a unique opportunity to help create a better understanding of how the rise of big data is altering the competitive landscape (Mazzei, 2019). According to Mazzei (2019), despite recent developments in big data analytics, there is evidence that many organisations have struggled to successfully convince management to implement BDT. The results above in Figure 13 shows that 74% of respondents were not sure if BDT strategy will be supported by management. 21% disagreed, while 5% are of the view that management will support BDT strategies.

8. DISCUSSION AND CONCLUSION

As seen in the analysis, the respondents noted that there are so many challenges that can inhibit the implementation of BDT in HEIs. These ranges from environmental, technological to organisational challenges (sections 7.1, 7.2 and 7.3) On the environmental challenges, a majority of the respondents indicated that there is lack of awareness (47.4%), Not sure if there is enough resources for data collection and processing (63%) and not sure if the university policy supports BDT (68.4%). In the aspect of technological challenges, 57.9% of the respondents are not sure if the technology will be easy to use, while 31.6% of the respondents indicated that the technology will be difficult to use. Furthermore, 31.6% of the respondents indicated that their universities do not have enough infrastructure for BDT. Security concerns were also stated as part of their concerns if BDT is implemented. On the aspect of Organizational challenges, Lack of experience in dealing with BDT, cost of implementation and management support were among those challenges that may inhibit the implementation of BDT in HEIs.

This study looked at the challenges of implementing Big Data Technology in Namibian Higher Educational Institutions. It enumerated the factors as environmental, technological and organizational factors. The respondents indicated that most of these various factors are lacking in their universities which means that BDT may be difficult to implement unless these challenges are taken care of. Therefore, universities are encouraged to find a way to tackle all grey areas by putting all necessary infrastructure, creating adequate awareness, training of staff and generally, giving support for the implementation of BDT. If this is done, universities will benefit from the value which this innovative technology possesses.

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