SURVEY OF THE CHALLENGES CONFRONTING THE APPLICATION OF BIG DATA IN NIGERIAN HIGHER EDUCATION

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Survey of the challenges confronting the application of Big Data in Nigerian Higher Education

Abstract

The thrust of the study was to assess the challenges inhibiting lecturers in higher education institutions in North Central Nigeria from benefiting from the advantages of Big Data assessment. Three research questions and four null hypotheses facilitated the study. Using cross-sectional survey design a sample of 350 lecturers was selected from public tertiary institutions comprising universities, polytechnics and colleges of education using multistage stratified random sampling procedure. Stratification ensured the inclusion of male and female staff in varied faculties and disciplines. A 30-item structured questionnaire developed and validated by the researchers was used for data collection. Descriptive statistics were used to answer research questions while t-test and ANOVA inferential statistics were used for testing null hypotheses. Findings show that lecturers are ready to benefit from the advantages of Big Data assessment but for prohibitive challenges surrounding application of big data including issues of skill gap for factorial analysis; lack of ICT infrastructure and lack of opportunities for capacity-building. Recommendations include the need for governments of Nigeria to improve budgetary provisions to higher education institutions to facilitate domestication of Big Data.

Key words: *Big data, factorial analysis, privacy, skill gap,* ICT infrastructure

Introduction

Big data is currently attracting interest in higher education institutions probably because it holds a great promise in providing an opportunity for educational institutions to use their information technology resources strategically to improve the quality of education and enhance students' completion rates, improve their resilience as well as performance. Big data refers to datasets that are too large and complex that traditional data processing applications cannot handle. The use of big data analysis techniques for addressing contemporary challenges facing higher education is a current trend that requires attention of the academia. There is growing interest in exploring and revealing the value of the increasing data within higher education institutions (Görnerup, Gillblad, Holst and Bjurling, 2013). As concluded by Dnuggets (2018), the key benefits of assessing the value of Big Data to organizations include improved and timely access to decision-making information, greater transparency, scalability and better change management.

The concept of 'big data' might not be completely novel to teachers in Nigeria since they at various levels of education might be familiar with handling bulky data emanating

from handling large classes and scoring their test scripts. However, in practicality, only few lecturers can claim full insight into the sophistication involved in assessment and analysis of voluminous and complex datasets. Hence, the challenges confronting the application of Big Data in Nigerian Higher Education could be expected to be monumental and intimidating. However, it is possible that the scare could be only in one's imagination since there is no locally-based empirical evidence known to the researchers concerning involvement of lecturers in handling Big Data. There persists what Okereke (2014) described as skill gaps consequent upon rapid technological advancement compounded by the challenges posed by cost implications of handling Big Data analytics. The need to explore the potentials of Big Data analytics for addressing contemporary challenges facing higher education in Nigeria motivated this study. To address the problem, the following research questions were posed:

1. To what extent do lecturers in North Central Nigeria have access to ICT infrastructure for involvement in big data assessment as moderated by gender and status?
2. What are the major challenges confronting the use of Big Data as perceived by lecturers in North Central Nigeria?
3. To what extent are the lecturers, segregated by sex and status, involved in handling big data?

The purpose of the study was to assess the readiness of lecturers in North Central geo-political zone of Nigeria to benefit from the advantages of Big Data assessment; and specifically to: (1) determine the extent to which the lecturers disaggregated by gender and status have access to ICT infrastructure; (2) identify major challenges confronting use of Big Data as perceived by the lecturers; and (3) assess the involvement of the lecturers segregated by sex and status, in handling big data.

The following null hypotheses were formulated:

1. There is no significant difference between male and female lecturers' access to ICT infrastructure in Big Data Assessment in tertiary institution in North Central Nigeria.
2. There is no significant difference between male and female lecturers on involvement in Big Data Assessment in tertiary institution in North Central Nigeria.
3. There is no significant difference due to the status/rank of lecturers in their access to ICT infrastructure in Big Data Assessment in tertiary institution in North Central Nigeria.
4. There is no significant difference due to the status/rank of lecturers in their involvement in Big Data Assessment in tertiary institution in North Central Nigeria.

Review of Literature suggests that higher education data, when properly analysed, can play a vital role in deciding how certain contentious issues could be addressed (Marsh, Maurovich-Horvat & Stevenson, 2014). Also Murumba and Micheni (2017) posit that it is absolutely important for universities to use Big Data Analytics in order to deliver the very best of learning environments for the good of society. Besides using data to provide insight into the often contested nature of higher education governance, Gibson (2017, p.1) believes that fine-grained data captured during digital learning could assist stakeholders "to gain highly detailed insight into student performance and learning trajectories as required for personalizing and adapting curriculum as well as assessment". Daniel (2015) suggests that IT analytics could be employed to cover usage and performance data that help with monitoring required for developing or deploying technology, developing data standards, tools, processes, organisational synergies and policies. Thus, IT analytics can integrate data from a variety of systems such as student information, learning management and alumni systems.

Furthermore, Burns (2016) insists that Big Data has come of age and State policymakers, university leaders, and entrepreneurs should necessarily set new standards and expectations for data in this new era. State regulators and auditors should equally begin to clarify some basic compliance standards for data collection, management, security, interoperability, privacy, and more, the humungous costs notwithstanding (Samiddha & Ravi,

2016). Additionally, new data-management techniques are inevitable for handling big data. Kellen, Reektenwald and Burr (2013) acknowledge that the thickness of data and the difficulty in bending them into shape has constituted a perennial impediment for organizations, requiring a class of people with specialised knowledge and skill to bring data together from different sources, combine them, analyze them, and find patterns previously hidden.

Method

The investigators adopted cross-sectional exploratory survey research design. A population of about 15,000 lecturers distributed among 13 universities, 16 polytechnics and 14 colleges of education (COEs) in the North Central zone of Nigeria was targeted. Multistage stratified random sampling procedure was adopted in selecting 350 lecturers from the three types of tertiary institutions. Stratification ensured inclusion of male and female lecturers in varied faculties and disciplines. A 30-item Likert scale was developed and validated by three experts who appraised the items in terms of relevance, clarity, accuracy and consistency in supplying needed data, comprehensiveness of the scope and appropriateness for the stated purpose using the 5-point scale. Their logical consensus gave a rational validity index of 0.87. Data from pilot-testing with a sample of 30 lecturers outside the scope of the study, analysed with Cronbach alpha yielded 0.83 coefficient of internal consistency.

Results

Descriptive statistics were used to answer the research questions while t-test and ANOVA were used for testing null hypotheses at the 0.05 level of significance. For research question 1, the frequencies of respondents were transformed into numerical scores and used to compute mean and standard deviation for each item as portrayed in Table 1.

Table 1:
Distribution of lecturers on access to ICT infrastructure by Status and by gender

Variables	Type of Lecturers	N	Mean	SD	Std. Error
Access to ICT Infrastructure by Status	Professor	32	32.06	4.38	.77
	Senior Lecturer	88	31.00	3.81	.41
	Lecturer 1	79	33.05	3.92	.44
	Below Lecturer 1	151	31.65	4.92	.40
	Total	**350**	**31.84**	**4.44**	**.24**
Access to ICT Infrastructure by Gender	Male	221	31.65	4.90	.33
	Female	129	32.16	3.51	.31
	Total	**350**	**31.84**	**4.44**	**.24**

The result reveals that the mean scores for all categories of lecturers' access to ICT were below 3.50 (mid-point between Agree and Undecided). Professors' access = 32.06±4.38, Senior Lecturers = 31.00±3.81, Lecturer I = 33.05±3.92, Below Lecturer I = 31.65±4.92. The result shows no gender segregation of the lecturers' access to ICT infrastructure for big data analysis.

For research question 2**,** the frequencies of respondents were transformed into percentages under a dichotomy of Agreement and Disagreement as presented in Table 2.

Table 2:
Distribution of respondents' perception on major challenges confronting use of big data

Items on Challenges of Big Data Assessment	Agree	%	Disagree	%
I have no idea of what Big Data means	171	48.8	179	51.2
Sophisticated statistical analysis is disgusting to me	141	41.1	203	59
I prefer qualitative research but I am ready to learn quantitative analysis	228	65.2	97	27.2
The greatest challenge I have with Big Data assessment is with storage and privacy	214	51.4	130	47
I enjoy the ease of processing data from survey research	286	81.6	60	16.4
My experience in processing multivariate data is very woeful	158	45.1	122	55.1
One thing is to acquire sophisticated software and another to use it	282	80.5	63	18.2
My problem is with factorial analysis of data	194	56.3	137	38.9
We lack infrastructure for capturing and processing large amounts of data	267	76.4	77	22.5
Information from big data is not for decision making in my institution	191	54.5	150	43.1
We lack opportunities for training on use of big data for decision making abut students in my institution	270	77.1	80	22.9
There is non-availability of big data quality assessment framework for use in my institution	264	74.5	86	23.7

The findings reveal that most of the challenges confronting the use of Big Data Analysis in higher institutions surround the issues of factorial analysis of data (56.3%); lack of ICT infrastructure (76.4%) and lack opportunities for training on use of big data for decision-making (77.1%), and non-availability of big data quality assessment framework (74.5%). About 81% of the respondents agreed that it is one thing to acquire sophisticated software and another to make effective use of it.

Descriptive statistics for answering **research question 3** are portrayed in Table 3.

Table 3:

Distribution of lecturers' on involvement in big data assessment by status and gender

Variables	Category	N	Mean	SD	Std. Error
Involvement of lecturers in Big Data by Status	Senior Lecturer	88	41.13	4.29	.46
	Lecturer 1	79	40.75	7.43	.84
	Below Lecturer 1	151	40.86	4.24	.35
	Total	**350**	**40.81**	**5.04**	**.27**
Involvement in Big Data by Gender	Male	221	42.14	4.83	.33
	Female	129	38.52	4.55	.40
	Total	**350**	**40.81**	**5.04**	**.27**

The result shows that the mean score for professors' involvement in big data as 39.81±2.60; senior lecturers' involvement = 41.13±4.29, lecturers' I involvement = 40.75±7.43, and below lecturer I = 40.86±4.24. Evidently, the findings reveal that there is a significant difference between male and female lecturers on involvement in the use of big data for research and analysis [N = 350, t = 6.90, df = 348, p = .000 (p<.05)]. The second null hypothesis was therefore rejected.

The study also shows marked gender difference. The test of the first hypothesis shows that there is a significant difference between male and female lecturers on access to ICT infrastructure for big data analysis [N = 350, t = -1.04, df = 348, p = .299 (p>.05)]. The first

null hypothesis was therefore rejected. The findings suggest that male lecturers show more interest when it comes to involvement in big data assessment.

For testing the third and fourth hypotheses, ANOVA multiple comparison shows that there is a significant difference between different ranks of lecturers on access to ICT infrastructure in handling of Big Data assessment and analysis [N = 350, F = 3.192, df (3,346), p = .024 (p<.05)]. The third hypothesis was therefore rejected. Evidently, the professors and senior lecturers are at advantage on access to ICT infrastructure compared to their junior colleagues. Contrariwise, there is no significant difference involvement of lecturers and access to ICT infrastructure in handling of big data assessment and analysis [N = 350, F = .540, df(3,35), p = .655 (p>.05)]. The fourth hypothesis was therefore accepted. Nevertheless, the professors and senior lecturers are at advantage end compared to assistant lecturers that are in the low academic ranking.

Discussion

Evidence from the study suggests that the lecturers in tertiary institutions in North Central Nigeria are confronted by monumental challenges regarding big data assessment. Major challenges include the scare of factorial analysis of data, lack of infrastructure for capturing and processing large amounts of data, lack of opportunities for training on use of big data for decision making, non-availability of big data quality assessment framework, disgust for sophisticated statistical analysis, and skill gap for utilizing sophisticated software. These challenges are in agreement with the views of Kellen, Reektenwald and Burr (2013) and Dnuggets (2018). The prohibitive cost implications of acquiring the software and the cost of storing such humungous amounts of data corroborate the position of Samiddha and Ravi (2016). The study further revealed lecturers' poor access to ICT infrastructure in addition to IT skill gaps; thus confirming the concerns of Akinnagbe and Baiyeri (2011) for training needs of lecturers on ICT skills.

The study also revealed poor involvement of lecturers in handling big data, as about 81% of the respondents agreed that skill gap exists between acquiring sophisticated software and making effective use of it. This confirms the position of Okereke (2014) about ICT skill gap, a deplorable situation irrespective of status or rank of lecturers. There seems to be difficulty in imbibing digital technologies and a scare of complex processing techniques of big data analytics that appear intimidating and obsessive. This is in contradistinction to the assertion of Marsh, Maurovich-Horvat and Stevenson (2014) as corroborated by Murumba and Micheni (2017) that it is absolutely important for universities to use big data analytics in order to deliver the very best of learning environments for the good of society. Findings from this study suggest that possibilities for using big data to link research to education exist, but are achievable only when disgust for sophisticated statistical analysis has been overcome.

Variations in ICT access and usage between male and female lecturers have been observed. Hence, the researchers recommend a policy of special interventions to ensure that both women and men benefit equally from the information society. For tertiary education institutions in Nigeria, such intervention becomes a necessity. Other recommendations include that lecturers should try to conquer the phobia of the stress involved in processing humungous data in order to exploit the benefits derivable from big data management; Institutions to allow lecturers liberal access to available ICT infrastructure with intent to improving interactions that enhance social integration issues and access to self-service information; and the need for universities and other higher education institutions to embrace collaboration in sharing best practices in order to tap into new insights about how to help struggling students (Burns. 2016).

Conclusion

In the study area, unlike in advanced economies, there prevails a paucity of ICT infrastructure coupled with low-level computer literacy, even among lecturers in higher

institutions. The study provides evidence that many lecturers do not engage much in big data handling either due to poor ICT infrastructure, skill gap for dealing with sophisticated statistical analyses, or intimidating cost implications. This seems to compound the challenges of treading the rugged paths of big data assessment and utilization. Nonetheless, many participants indicated willingness to learn despite slim opportunities for capacity building.

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