BENCHMARK REGULATION AND DELIVERY OF STATISTICS EDUCATION AT THE UNIVERSITY LEVEL IN NIGERIA

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The Benchmark Minimum Academic Standards (BMAS; National Universities Commission, 2014) is a gauge for the quality of academic programmes taught in Nigerian universities. This study analyzed published administrative data and survey data that covered personnel, physical facilities, equipment, and library and information support systems. Results show that the mix of academic staff in statistics was 20% Professors/Readers, 21% Senior Lecturers, and 59% Lecturers compared with the proposed BMAS mix of 20%, 35%, and 45%, respectively. The survey among 29 universities showed that internet access was available for education support services, and 55% of the universities adopted a 6-month industrial training as stipulated by the regulatory body. There is an urgent need to revise the BMAS and to engage senior personnel with improving the quality of statistical training.

INTRODUCTION

Quality assurance of tertiary education systems is germane to ensuring the delivery of sustainable and high-quality education of international repute for societal needs. This can be achieved through updating teaching curricula to reflect current trends, providing facilities for teaching and research, hiring high-quality teaching and non-teaching staff, and producing graduates with requisite skills (cognitive, analytical, creative, etc.) in their chosen disciplines.

The National Universities Commission (NUC) is the regulatory agency responsible for approving and ensuring quality assurance of all academic programmes in Nigerian universities. The Benchmark Minimum Academic Standards (BMAS) produced in 2014 serve as a guide to universities in the design of curricula for their programmes in terms of the minimum acceptable standards of process, knowledge, skills, and competencies expected to be acquired by the average graduate of each academic programme. An overarching issue is the level of implementation of provisions in the minimum standard for the rank of faculty and staff in statistics programmes for universities in Nigeria. The analysis of the benchmark regulation for statistics undergraduate programmes by ownership and the quality of delivery of statistics education in the universities compared to the benchmark is conducted.

LITERATURE REVIEW

Benchmark Regulation in Tertiary Education

Benchmark regulation is an essential tool for improving performance and ensuring quality. Benchmark regulation in the tertiary education sector provides a quality standard for producing capable graduates (Erdil & Erbiyik, 2019). Al-Khalifa (2015) and Pop et al. (2020) posited that benchmarking in tertiary education helps in identifying discrepancies between an organization's performance and minimum standards to ensure that best practices are duly followed or adhered to. Global discussions emphasizing the importance of quality education have prompted national governments and regulatory bodies worldwide to establish higher education benchmarks for sustaining educational practices.

Quality Assurance in Curriculum Implementation

One of the significant indicators of quality in higher education is graduates' success in joining the labour market (Kis, 2005). Preparing students for success in the labour market is not limited to

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classroom teaching; it requires adequate compliance with the approved programme curriculum. Students' Industrial Work Experience Scheme (SIWES) is part of the minimum academic standard (MAS) for science-based programmes in the Nigerian tertiary education system. The impacts of SIWES have been discussed extensively in the literature. For example, Ojokuku et al. (2015) presented a case of the professional development of library and information science students in south-western Nigeria. Staffing is another area of quality assurance of interest to the regulatory body, focusing on the mix of academic staff in terms of both the non-teaching versus teaching staff ratio and the staff to student balance. Various studies have emphasized the impact of adequate staffing on teaching (see, for example, Azikuru et al., 2017; Figlio & Schapiro, 2021; and Wolf & Jenkins, 2020.) The goal of this study is to assess progress towards meeting the BMAS for teaching statistics across higher institutions in Nigeria.

METHODOLOGY

Study Design

There are two hundred and seventeen (217) universities in Nigeria as of August 16, 2022 (National Universities Commission, 2019). Among these, 22.6% are owned by the federal government; 26.3% are owned by the state government; and 51.2% are owned by individuals. Distribution of universities in Nigeria for universities offering statistics as single programme and ownership status reveals that 49.1% are owned by the federal government; 40.4% are owned by the state government; and 10.5% are owned by individuals. Equally, about 71.4% of all universities that offers statistics as a combined programme are owned by the federal government, whereas the remaining portions are shared equally by state and private owners, respectively. In all, only 64 (29.4%) Nigerian universities offer a statistics degree (Bachelor of Science in Statistics)

Given these statistics and the spatial distributions of the universities, the authors developed a questionnaire with six sections (general information about the university, SIWES requirement, equipment for teaching statistics, infrastructure availability, personnel, and library and information support system) for online administration. The survey aligns with the minimum input enunciated in the BMAS document that covers issues relating to personnel, physical facilities, teaching equipment, and library and information support systems.

The population of interest for this study are universities offering statistics as a degree, $N = 64$. Our study design aimed for total coverage of this population; however, due to time constraints, the study obtained data from only 45.31% of the population [$N = 64$; $n = 29$]. Out of the 64 universities offering statistics programmes, 51.56% [$n_F = 33$] are universities owned by the federal government; 37.5% [$n_S = 24$] are universities owned by state governments; and 10.94% [$n_P = 7$] are owned by individuals or private bodies. Table 1 provides a detailed summary of the distribution of the universities.

Table 1. Distribution of universities in Nigeria by ownership status

Ownership	Number		Prop. offering Statistics		
	Previous (2019)	New (2020 - 2022)	Total	Single (%)	Combined (%)
Federal Universities	43	6	49	28(49.1)	5(71.4)
State Universities	49	8	57	23(40.4)	1(14.3)
Private Universities	79	32	111	6(10.5)	1(14.3)
Total	171	46	217	57	7

The questionnaire contains thirty-one (31) questions in all. Respondents are either the Head of the department (HOD), the SIWES programme coordinator, an academic advisor, or a student (postgraduate or undergraduate) familiar with the department SIWES programme module and assigned by the HOD. We are very familiar with all statistics departments across the Nigeria institutions given that we are from the premier university where statistics programme commenced. To gain wider coverage, we contacted institution HODs and requested email addresses of all participants (often SIWES coordinators) and followed up with phone calls.

Our analysis and results are based on published administrative data and data collected from the structured questionnaire that was administered online.

ANALYSIS AND RESULT

Published Administrative Data

There were 171 universities in Nigeria in 2019, of which 25.1%, 28.7% and 46.2%, respectively, were owned by federal, state, and private entities. Between 2019 and 2022, the number of federal, state, and private universities increased by 6 (14.0%), 8 (16.3%), and 32 (40.5%), respectively. Table 1 shows the number of universities that offer statistics programmes as a single degree. Out of sixty-four (64) universities that provide a statistics programme, 51.6% are owned by the federal government, 37.5% by the state government, and 10.9% by private institutions. Only seven (7) institutions offer statistics as a combined major.

The total enrolment of undergraduate students in Nigerian universities was 1,930,598 (National Universities Commission, 2019). This number is made up of 1,849,965 (95.8%) full-time students and 80,633 (4.2%) part-time students. The enrolment of males is higher at 56.4% than that of females at 43.6% across the three categories of universities. In total, 1,260,065 (65.27%) students are enrolled in federal universities; 566,619 (29.35%) in state-owned universities; and 103,914 (5.38%) in private universities. In terms of ownership, academic staff distributions show that 39,856 (54.3%); 21,426 (29.2%); and 12,161 (16.5%) are employed by the federal government, state government, and private institutions, respectively.

Table 2 shows the breakdown of academic staff in statistics departments by rank. There are 69 professors (Male = 67, Female =2); 34 associate professors (Male = 30, Female = 4); 107 senior lecturers (Male = 90, Female = 17); and 308 lecturer I and below (Male = 255, Female = 53). The staff mix in the statistics department was found to be in a ratio of 20 : 21 : 59, respectively (approximately 1 : 1 : 3), for professors/reader, senior lecturers, and lecturer I and below. The NUC (2014) BMAS regulation is 20% professor/reader, 35% senior lecturer and 45% lecturer one and below.

Table 2. Academic staff broken down by ownership, rank, and gender

Ownership	Professor		Reader		Senior Lecturer		Lecturers 1 and below		Total		
	M	F	M	F	M	F	M	F	M	F	Total
Federal	5,943	1,167	2,628	748	5,455	1,894	16,038	5,983	30,064	9,792	39,856
State	2,601	439	1,468	330	3,397	882	9,340	2,970	16,805	4,621	21,426
Private	1,531	196	678	184	2,333	553	4,652	2,034	9,194	2,967	12,161
Total	10,075	1,802	4,774	1,262	11,185	3,329	30,030	10,987	56,063	17,380	73,443
Academic Staff by rank in Science Discipline and Statistics Programme											
Sciences	2008	343	915	208	1904	531	6011	2153	10838	3235	14073
Statistics	67	2	30	4	90	17	255	53	442	76	518

This staff mix (in terms of the ratio of Professors/Readers to Senior Lecturers to Lecturers I and below) does not comply with BMAS regulations. Hence, the distribution is middle–low and bottom–heavy. This could perhaps mean that some lecturers in the rank of Lecturer I that should have been promoted to the rank of senior lecturer have not been promoted or have been delayed. About 14% of lecturers due for promotion to the rank of senior lecturer have not been duly promoted. This inference is drawn from the lesser ratio of senior lecturers (and higher ratio of lecturers I and below) in comparison with the NUC BMAS recommendation. Concerning teacher to student ratio in the statistics department, the analysis showed that the ratio of 1 : 20 (that is, one lecturer to twenty students) was in line with the regulatory body BMAS.

Survey or Questionnaire Data

Out of the twenty-nine (29) universities that responded to the online questionnaire, 68.97% [$n_F = 20$] are owned by the federal government; 27.59% [$n_S = 8$] are owned by the state government; and only 3.45% [$n_P = 1$] are owned by a private body. Most respondents are department academic staff and HODs. Table 3 presents the summary of the respondents' distribution.

Among these, 6.9% [n_{2L} = 2], 20.69% [$n_{2L\&3L}$ = 6], 48.28% [n_{3L} = 14], and 20.7% [n_{4L} = 6] reported their students embarked on industrial training courses at the 200, 200 and 300, 300, and 400 levels, respectively, and 3.45% [n_{op} = 1] opined that SIWES is optional. The unit of SIWES (also known as industrial attachment or training (IT)) varied from one university to the other, with five (5) units required among 55.2% [n_u = 16] of the universities, followed by four (4) units required by 20.7% [n_u = 6] of the universities, and by three (3) units, two (2) units, and one (1) unit used by 17.2% [n_u = 5], 3.4% [n_u = 1] and 3.4% [n_u = 1] universities, respectively. See Table 4 for a more detailed summary.

Table 3. Distribution of respondents

Respondent	Frequency (%)	Ownership
HOD	7 (24.14)	5 F, 1 P, 1 S
Academic staff	17 (58.62)	11 F, 0 P, 6 S
Non-Academic staff	1 (3.45)	0 F, 0 P, 1 S
Post graduate student	2 (6.90)	2 F, 0 P, 0 S
Undergraduate student	2 (6.90)	2 F, 0 P, 0 S

Key: F–Federal, S–State, P–Private

Table 4. Academic level of SIWES, Units and Durations

SIWES Level	Frequency (%)	Ownership	Course Category	Units [n_u]	Duration [n_u] in month
200 (n_{2L})	2 (6.90)	2F, 0P, 0S	2 Sin	3 [1] & 4 [1]	4 [1] & 3 [1]
200 & 300 ($n_{2\&3L}$)	6 (20.69)	5F, 0P, 1S	5 Sin, 1 Com -F	2 [1], 3 [3] & 5 [1]	3 [3], 4 [1] & 6 [2]
300 (n_{3L})	14 (48.28)	7F, 1P, 6S	12 Sin, 2 Com - S	3[1], 4[2] & 5 [11]	2[1], 3 [4], 4[1], & 6 [8]
400 (n_{4L})	6 (20.69)	6F, 0P, 0S	4 Sin, 2 Com - F	4 [3] & 5 [3]	6 [6]
Optional (n_{op})	1 (3.45)	0F,1P,0S	1Sin	1 [1]	2 [1]

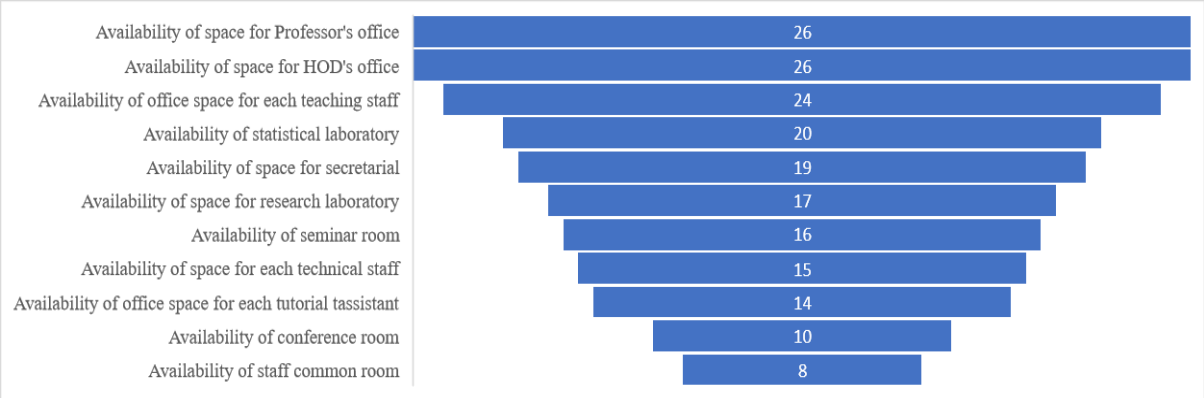
Key: Sin–Single, Com–Combined, F–Federal, S–State, P–Private & n_u = Number of universities

The success of the SIWES programme is assessed based on students' reports, presentations, and supervision during the training. Consequently, 37.93% (11) out of the twenty-nine (29) universities assessed students based on industrial visitation by supervisors, seminar presentations, and reports after the programme and grading were completed. This assessment method allows departmental scoring of candidates at the seminar. However, some institutions—34.48% (10)—based student SIWES success mainly on the supervisor's visit during training and student reports and logbooks. Only 6.90% (2) based the outcome mainly on the report of the visiting supervisor and 20.69% (6) based the outcome mainly on students' logbook or reports.

The distribution of the length of SIWES experiences showed that the majority, 55.2% [n_{6m} = 16] of the universities adopted the 6-month duration stipulated by the BMAS. At the same time, 27.6% [n_{3m} = 8], 10.3% [n_{4m} = 3], and 6.9% [n_{2m} = 2] included on three-month, four-month, and two-month experiences, respectively. The distribution of who takes responsibility for SIWES placement showed that the University–27.6% [n_u = 9], Department–24.1% [n_d = 7], Students–27.1% [n_s = 8] and industry demand–17.2% (n_I = 5) were dominant in sourcing SIWES placements.

In terms of physical facilities, it is evident that universities have space for personnel, seminar rooms, lecture rooms, a departmental library, and a statistical laboratory, as displayed in Figure 1. Also, the majority–58.6% [n_u = 17] of the university respondents indicated that free internet connectivity was available within the department. The survey data also revealed that more than half–

55.2% [n_u = 16] of the respondents reported the availability of a department library; 62.1% [n_u = 18] claimed that internet and wireless facilities were available in the library; and 72.4% [n_u = 21] posited that students had access to online journals.



Key: 89.66% (n = 26) of the universities have space for professor offices, etc.

Figure 1: Availability of space for personnel, lecture room, statistical laboratory, etc.

Table 5 shows the statistics for personnel and facilities across departments of statistics at various universities. On average, each department has at least three (3) professors' offices, one (1) large laboratory, four (4) large capacity lecture theaters, and twelve (12) academic staff of which at least seven (7) are Ph.D. holders. On the high side, some statistics departments have up to eight (8) professors, four (4) large laboratories, ten (10) large capacity lecture theaters, and twenty-two (22) academic staff, of which seventeen (17) are Ph.D. holders. The distributions look evenly distributed because the numeric differences between the mean, median and mode are insignificant. Going by this, we can infer that the distribution of personnel and facilities are a function of the departmental size and university.

Table 5. Statistics of Personnel & facilities

Facilities	Mean	Median	Mode	Min.	Max.
Prof Offices	3	2	2	1	8
Large Lab	1	1	1	1	4
Lecture theater with 60-person capacity	4	4	4	1	10
Academic staff	12	11	11	2	22
Academic staff with PhD	7	7	5	0	17

CONCLUSION AND RECOMMENDATION

In assessing the extent to which statistics undergraduate programmes implement benchmark regulations, it was discovered that out of 64 universities that offer statistics in Nigeria, approximately 50% belong to federal universities. In other words, the number of federal university programs almost equals the number from state and private universities together. This is evidenced in Table 1, which shows the number of universities that offer statistics as a single major. It also showed that only seven Institutions offer statistics as a combined major, which is in the minority.

Staff mixes in statistics departments (from Table 2), were found to be in a ratio of 20 : 21 : 59 for professors/readers, senior lecturers, and lecturer I's and below, respectively**,** as opposed to the NUC BMAS ratio of 20 : 35 : 45, respectively.

Hence, the distribution of staff in statistics programmes was middle–low and bottom–heavy. This could mean that some lecturers in the rank of Lecturer I have not been promoted to Senior Lecturer or have been delayed in their promotions. Concerning teacher to student ratios in the statistics department, the analysis showed that the ratio of 1 : 20 (that is, one lecturer to twenty students) was in line with the regulatory body BMAS. Table 3 presents the summary of respondents' distributions.

Among the universities whose data are presented in Table 3, 6.9%, 20.69%, 48.28% and 20.7% reported that their students embarked on industrial training at the 200 level, 200 & 300 level, 300 level, and 400 level, respectively. However, 3.45% of the sampled institutions indicated that SIWES was optional. The distribution of the length of SIWES showed that the majority, 55.2% of the universities adopted the 6-month duration stipulated by the BMAS as shown in Figure 1. Students' SIWES success mainly depended on the supervisor's visit during the training and students' reports and logbooks.

As evidenced in Table 5, the distributions of personnel and facilities look evenly distributed because the numeric differences between means, medians and modes are not statistically significant. Going by this, we can infer that the distribution of personnel and facilities were a function of the departmental size and university.

The quality of delivery of statistics education in Nigeria to some extent is laudable; however, improvement is necessary. It was obvious from this study that internet access was not a major challenge because students have access to free internet and online journals. The engagement of more senior teaching and administrative staff is necessary to meet the minimum benchmark for input and progress. This research could serve as reference material for NUC in revising the BMAS document to reflect the latest trends in the discipline and for universities to improve the quality of statistics training offered. There is an urgent need to revise the BMAS and engage senior personnel to improve the quality of statistical training.

REFERENCES

Al-Khalifa, L. A. (2015). Benchmarking as a means to gauge and improve academic standards in higher education within the Arab Region. *International Journal of Higher Education Management, 2*(1), 52–62. https://ijhem.com/cdn/article_file/i-3_c-23.pdf

Azikuru, L. M. E., Onen, D., & Ezati, B. A. (2017). Staffing and quality of teaching in universities. *European Journal of Education Studies, 3*(3), 21–36. https://doi.org/10.5281/zenodo.268381

Erdil, A., & Erbiyik, H. (2019). The importance of benchmarking for the management of the firm: Evaluating the relation between total quality management and benchmarking. *Procedia Computer Science, 158*, 705–714. https://doi.org/10.1016/j.procs.2019.09.106

Figlio, D., & Schapiro, M. (2021). Staffing the higher education classroom. *Journal of Economic Perspectives, 35*(1), 143–162. https://doi.org/10.1257/jep.35.1.143

Kis, V. (2005*). Quality assurance in tertiary education: Current practices in OECD countries and a literature review on potential effects*. Organisation for Economic Co-operation and Development Thematic Review of Tertiary Education. https://www.oecd.org/education/skills-beyond-school/38006910.pdf

National Universities Commission. (2014). *Benchmark minimum academic standards (BMAS) for undergraduate programs in Nigerian universities. Sciences.*

National Universities Commission. (2019). Nigerian university system statistical digest. https://www.nuc.edu.ng/

Ojokuku, B. Y., Emeahara, E. N., Aboyade, M. A., & Chris-Israel H. O. (2015). Influence of students' industrial work experience scheme on professional development of library and information science students in South-West, Nigeria. *Library Philosophy and Practice (e-journal)*, Article 1330. http://digitalcommons.unl.edu/libphilprac/1330

Pop, E. S., Baesu, V., & Mnerie, D. (2020). Benchmarking in higher education institutions. In *Proceedings of the 6th International Conference of Knowledge Management and informatics* (pp. 228–234). Technical College of Vocational Studies in Novi Sad. http://kmi.vtsns.edu.rs/KMI_2020/radovi/4-KMI_Obrazovanje/KMI_obrazovanje-1.pdf

Wolf, A., & Jenkins A. (2020). *Why have universities transformed their staffing practices? An investigation of changing resource allocation and priorities in higher education. A research project funded by the Nuffield Foundation*. University College London; King's College London. https://www.kcl.ac.uk/policy-institute/assets/why-have-universities-transformed-their-staffing-practices.pdf