Curriculum Management and Graduate Programmes' Viability: The Mediation of Institutional Effectiveness Using PLS-SEM Approach

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Abstract

This study used a partial least squares structural equation modelling (PLS-SEM) to estimate curriculum management's direct and indirect effects on university graduate programmes' viability. The study also examined the role of institutional effectiveness in mediating the nexus between the predictor and response variables. This is a correlational study with a factorial research design. The study's participants comprised 149 higher education administrators (23 Faculty Deans and 126 HODs) from two public universities in Nigeria. A structured questionnaire designed by the researchers was used for data collection. The questionnaire was duly validated with an acceptable scale and item content validity indices. The dimensionality of the instrument was determined using exploratory factor analysis (EFA). Convergent validity was based on Average Variance Extracted (AVE), whereas discriminant validity was based on Fornell-Lacker criteria and the Hetero-Trait Mono-Trait (HTMT) ratio. Acceptable composite reliability estimates of internal consistency were reached for the three sub-scales. Following ethical practices, the questionnaire was physically administered to respondents and retrieved afterwards. Smart PLS (version 3.2.9) and SPSS (version 26.0) programs were used for all the statistical analyses. This study uncovered significant direct and direct effects of curriculum management on the viability of graduate programmes. Institutional effectiveness significantly impacted graduate programmes' viability while mediating the nexus between curriculum management and graduate programmes' viability. Curriculum management and institutional effectiveness jointly explained a significant proportion of graduate programmes' viability variance. The result of this study proved that graduate programmes' viability depends, to a great extent, on how much curriculum is managed and how effective institutions are with their services. The result of this study can enable institutions seeking to run viable graduate programmes to re-evaluate their curriculum management practices and the effectiveness of their services.

Keywords: EFA, higher education, instrument validation, Smart PLS, structural equation modelling, universities

1. Introduction

Graduate programmes train individuals for the inculcation of good research and problem-solving skills. Effective management of these programmes, following global best practices, should promote efficiency, increased enrolment, competitiveness and viability. However, in recent times, the viability of graduate programmes has become a significant concern for educational stakeholders in Nigeria and beyond. Universities tend to be experiencing a decline in their enrolment rates. A study revealed severe fluctuations in the enrolment trends of three federal universities in South-South Nigeria between 2010 and 2015 (Ameh, 2018). Another study forecasted that enrolment in federal universities in Nigeria will fluctuate increasingly trend from 2010 to 2031 based on gender, merit and catchment area criteria (Owan et al., 2021). This predicted increment in enrolments will impose additional challenges

for universities to provide more manpower and material resources to meet them. Even though enrolment is increasing and will continue to do so in universities, there seems to be a decline in the quality of most postgraduate students churned out from some public universities in Nigeria. Postgraduate students should be able to conduct laboratory experiments and empirical surveys and report the same. They should also be able to engage in active correspondence and ensure that research outputs are disseminated in reputable scientific platforms, such as journals, conferences and online repositories.

What is common tends to show an apparent deviation, as many postgraduate students appear uninterested in acquiring these essential skills. Some studies in higher education, for instance, have indicated that the quality of most graduates has continued to decline in terms of after-school productivity due to corrupt practices, poor performance evaluation and short vocational training durations (Arop et al., 2018; Bassey, Owan, & Agunwa, 2019; Odigwe et al., 2018). This downtrend affects society, which expects so much from graduates as channels of socio-economic advancements. The issues in postgraduate programmes also seem connected to educators providing instruction to students. For example, the utilisation of ICT resources for teaching records management and research by university academic staff in Nigeria was found to be very low (Akah et al., 2022; Odigwe & Owan, 2020; Owan & Ekpenyong, 2022).

Consequently, obsolete approaches that pose threats and make it uneasy to retrieve data are used to manage information instead of computerised systems that offer a higher level of reliability (Ogbeche et al., 2021). More so, there seems to be increased use of ineffective methods for teaching and research supervision of graduate students. Poor supervision and guidance of postgraduate students undertaking research have also been identified as a current problem in research practice by other scholars (Hon Kam, 1997; McCallin & Nayar, 2012; Muraraneza et al., 2020; Murphy et al., 2007).

A similar trend observed in Bolonia, Spain, revealed that the curriculum was substantially modified to raise more specialised labour professionals, especially at the Master's degree level (Costa et al., 2014). This provides a narrative that poor management of graduate programmes is gradually becoming a matter of international concern. The situation in Nigeria is also attributable to the government. There are problems of staff mismanagement through delayed promotion, inconsistent payment of salaries, and poor provisions of educational support like grants to conduct research and other fringe benefits (Anakwe, 2002; Bassey & Owan, 2018). Graduate programmes in Nigerian universities do not appear adequately funded. Learning plans do not seem fully implemented and evaluated. Physical facilities look inadequate to ensure smooth running. Issues of national insecurity are commonplace, hindering personnel safety.

Evidence of underfunding (Asplund et al., 2008; Ekaette et al., 2019; Odigwe & Owan, 2019) is the poor state of lecture venues with inadequate facilities such as lighting, ventilation, instructional materials, and learning resources, among others (Mbon et al., 2019). The available ones tend to give the impression that they are in a deplorable state without proper maintenance. Consequently, common cases abound where graduate students were forced to learn under tree shades, open spaces, public places, lecturers' offices, car parks, and pavilions instead of a comfortable environment that should promote effective teaching, learning and research.

From the 23rd of March 2020 until the end of November 2020, university academic staff stayed at home due to several unresolved issues between the Federal Government of Nigeria (FGN) and the Academic Staff Union of Universities (ASUU). These include non-payment of Earned Academic Allowances (EAE); inadequate funding for the revitalisation of universities, refusal to set up visitation panels to institutions; fulfilling agreements signed in 2009 between the two sides (FGN and ASUU) aimed at fostering better conditions of service; non-provision of assistance to state-owned universities by the federal government, as well as, disagreements in the use of the Integrated Personnel Payroll and Information System (IPPIS) as the platform for staff salaries payment. Consequently, Nigerian universities' academic staff were not paid salaries and other dues from February to November 2020 except for a few who had earlier enrolled in IPPIS. This ugly scenario exposed academic staff to severe hunger and lack. Amidst the COVID-19 pandemic, many could not even provide basic and recurring household needs. The same unresolved issues led to another strike which started on the 14th of February 2022, lasting for over months. Even at the time of this writing (11th July, 2022), the strike is ongoing. Does this situation provide a mental picture of a system ready to achieve effectiveness or drive towards viability? The lessons from this experience prove that all is not well with Nigeria or her higher education system. How can such programmes achieve stated aims if staff implementing the programmes' policies are not adequately catered for? How can viability be achieved if stated purposes are not attained in the first place?

The viability of graduate programmes could be viewed from two perspectives – as a mechanism and a state. As a

mechanism, the viability of graduate programmes refers to all activities and inputs rendered and provided in universities to ensure that graduate programmes are effectively tailored towards the realisation of stated objectives and guarantee continuity. As a state, viability refers to the measurable outcomes of all inputs and processes invested into the programmes that can enable stakeholders to determine if stated goals are attained and the extent of consistency in goal attainment, which should aid in predicting futuristic events. In general, graduate programmes may be viable if they have proven beyond rational doubts that they have the requisite standard of educators, learners, and facilities to fulfil the various needs of the courses at present and in the future. Based on these definitions, the continued persistence of poor sustainable practices suggests that future products from graduate programmes may not lack competitive skills to function in a dynamic society. They will struggle to contribute meaningfully to knowledge creation, problem-solving, and the generation of testable data for inventive purposes, which are critical indices of research effectiveness (Odigwe et al., 2020). This, therefore, challenges the position of universities as objects of knowledge production and citadels of advanced learning. Notwithstanding the government's failure, the ineffectiveness of Nigerian higher education (Owan et al., 2020) is both internal and external.

This study focuses on curriculum management (an internal practice), which the researchers presumed to be likely associated with the viability of graduate programmes in universities. Curriculum management involves a range of operational methodologies to ensure correct and up-to-date documentation on courses offered. Curriculum managers should focus on curriculum preparation, execution and development, with administrative leaders at the forefront in fulfilling this essential role (Owan & Agunwa, 2019). The following are critical standards for curriculum management – curriculum choices should only be reached on appropriate educational grounds. They should be made within the general educational priorities in national and state education policies. Decisions of a lasting nature should be supported by considerable evidence. Previous findings should be matched with recent amendments to protect the general operation of the organisation; decisions should be taken collectively and participatory; the proliferation of new information should be factored into the equation (Verma, 2018). Studies in Nigeria tend to show underlying issues affecting curriculum development. For example, a study found that programme material, pedagogy, and assessment methods, among others, are insufficient, impractical and should be checked (Emeh et al., 2011).

Similarly, another study showed that most teachers do not change their teaching/ methodologies in line with the new developments in the curriculum; the shortage of funding adversely affects the application of the overall curriculum in learning and teaching sciences (Tshiredo, 2013). These issues in curriculum management seem to affect the quality of instructional delivery. This is because available empirical evidence indicates a significant relationship between curriculum management and the quality of teachers' instructional supervision and motivation (Etor & Osim, 2014). The results of quasi-experimental research indicated a positive impact of using the proposed strategy of curriculum integration on students learning achievement (Amani, 2017). This study has implications for the present study because a sustained positive achievement of students because of curriculum integration could lead to the viability of graduates' programmes. However, the present study presupposes that the developed curriculum has already been implemented (Idowu & Adeleke, 2017) but needs to be well-managed.

The goal of the present study is to see if curriculum management may contribute to the viability of graduate programmes. The present study also aims to link curriculum management to the viability of graduate programmes by introducing institutional effectiveness as the mediator. Previous studies have not focused on the viability of graduate programmes as a correlate of curriculum management, nor has institutional effectiveness been used as a mediator variable on the relationship in past studies. Thus, the present study could break new grounds due to these few identified critical gaps in knowledge. Therefore, the central goal of this study is to examine the extent to which curriculum management (CM) predicts graduate programmes' viability of (GPV) using the partial least squares structural equation modelling (PLS-SEM). The study also examined the mediation effect of institutional effectiveness on the link between CM and GPV within the PLS-SEM framework. The PLS-SEM is a second-generation statistical/modelling procedure that offers many benefits.

2. Methods

2.1 Research Design and Participants

This is a correlational study with a factorial research design (Fisher, 1937). The study's participants comprised 149 higher education administrators (23 Faculty Deans and 126 HODs) in the Faculty of Education across two public universities. These respondents were considered since they occupy administrative positions in the university system and are vested with the activities of graduate programmes. There was no need for sampling because the researchers considered the population to be of a manageable magnitude and deserving to be studied entirely.

2.2 Measures and Instruments

Three variables were of primary concern in this study - an independent variable (curriculum management), a mediator variable (institutional effectiveness), and the dependent variable (graduate programmes' viability). Curriculum management (CM) is a series of activities or processes to develop and implement lesson contents and experiences for students and evaluate the extent to which such plans are attained. Institutional effectiveness (IE) refers to the degree to which institutions successfully promote programmes, processes, events and courses to achieve predetermined goals. Graduate programmes' viability (GPV) is defined as the state where institutions are confident that they possess the capacity to ensure the smooth running of graduate programmes at present and in the future.

A structured questionnaire designed by the researchers was used for data collection. Section A of the questionnaire was used to collect biographic information from respondents. Section B comprised five 5-point Likert-type scale items that collected information on curriculum management (CM). Items in section B were generated based on an extensive literature review and the operational definition of the variable. Besides, there was no existing scale previously developed to measure the variable (CM). A sample item for CM is "*Stakeholders are actively involved in developing curriculum plans.*" Section C of the questionnaire comprised six 5-point Likert-type scale items adapted and modified from previous instruments – The "School System Effectiveness Scale" (Bassey, Owan, & Eze, 2019) and the "Institutional Effectiveness Scale" (Dhir, 2020). A sample item for this section is "*New ideas, initiatives and research projects by the faculty are valued.*" Section D of the questionnaire comprised five 5-point Likert-type scale items, which collected information on the viability of graduate programmes. Section D's items were developed from a literature review, owing to a lack of an existing instrument previously validated for this purpose.

2.3 Validity and Reliability

Five quality assurance professionals and three psychometrists assessed the instrument's first draft for content validity. As a result of their examination, the items were given clarity, relevance, and ambiguity scores. Following the Lawshe technique, their ratings were utilised to assess content validity (Lawshe, 1975). The scale content validity (S-CVI) was .96, while the item content validity indices (I-CVI) varied from .89 to .99, based on the average ratio procedure. Based on the degree of universal agreement, the S-CVI was .92, whereas I-CVIs ranged from .84 to .95. These values were within the acceptable range suggested by experts (Hadi et al., 2020; Zamanzadeh et al., 2015). We altered items that were found to be unclear and removed those that were considered irrelevant. The second draft of the instrument was examined for face validity through a focus group session with 10 non-participating academic staff of the universities under investigation. These respondents were not of the education faculty but took the survey as would the actual respondents. After that, they were interviewed to share their opinions on the scale length, response times, and comments on the items. Their opinions and suggestions improved the questionnaire's clarity and objectivity. A pilot study was carried out on 150 lecturers teaching graduate students in the two universities, from non-participating faculties. The pilot sample was greater than the ratio of five respondents to one item in the questionnaire. Since there were a total of 24 items in the third draft of the questionnaire, a pilot sample of 150 respondents was considered more than adequate, following the golden rules (Boateng et al., 2018; Mundfrom et al., 2005). The responses from the pilot study were used to determine the dimensionality, construct validity (convergent and discriminant) and reliability of the scales (See Tables 1 and 2 in the results section).

2.4 Ethical Consideration and Data Collection

Each participant provided their consent in writing before data collection began. Participants signed or thumbprinted an informed consent form before taking part in the research. It was clear to everyone who participated in the study that it was entirely up to them whether or not they chose to participate. All the respondents made an educated choice about whether or not to participate after they were provided with the study's objectives. Ethical approval was not required for this research based on national and institutional regulations since filling out a questionnaire did not represent a significant health risk, and the questions were not self-directed (see page 13 of http://www.nhrec.net/nhrec/NCHRE_10.pdf). Participants' names, email addresses, and phone numbers were withheld to protect their privacy. Participants were confident that their information was protected in this manner. Both electronic and locked fire-proof closets were used to store the data acquired. Only raw data was available for use by the researchers of this study. Respondents' data were treated aggregately, with all self-identifying information anonymised. Finally, respondents granted that their responses could be used for publication as long as their identity remains anonymous.

After seeking their consent to participate in the exercise voluntarily, administration commenced on the intended respondents, with the assistance of three research assistants, who were aware of the purpose and procedure of the research. To prevent issues that might emerge during data collection, an explanation was included in the

questionnaire to guide the ticking of the items. After the conclusion, completed copies of the questionnaire were retrieved from the respondents after two days window period. The data collection process was very straightforward, and we recovered all the 149 administered copies of the questionnaire. This represented a rate of return of 100 per cent of the instrument's copies.

2.5 Procedure for Data Analysis

A partial least squares structural equation modelling (PLS-SEM) was performed to assess the causal linkages in the hypothesised model (See Figure 1). PLS-SEM is a second-generation statistical procedure developed by Wold (1974, 1980, 1982), which uses an iterative approach to maximise the degree of variance accounted for by endogenous variables (Fornell & Bookstein, 1982). This method is similar to multiple regression analysis, unlike Covariance-Based Structural equation modelling (CB-SEM), which attempts to validate theories by testing the model's ability to generate a covariance matrix for the test data (Hair et al., 2011). Its primary use is in data-rich and theory-skeletal contexts (Hair et al., 2014). The model building becomes an evolving process, a dialogue between the computer and the researcher. Using the data as input, the model generates new insights, allowing it to fill out previously abstract concepts.

Even though CB-SEM is more widely used, PLS-SEM has recently attracted considerable attention in various disciplines such as accounting, management information systems, marketing, operations management and strategic management (Hair et al., 2014). In the field of education, PLS-SEM has also been applied to higher education research (Ghasemy et al., 2020), entrepreneurship education (Boubker et al., 2021), students' quality assurance perspectives (Gora et al., 2019) and vocational education (Chatterjee et al., 2021), among others. PLS- SEM's growing popularity is well-suited to social science problems like dealing with odd data features (such as non-normal data) and complicated modelling problems like those that arise with extremely complicated models (Hair et al., 2014). In the current study, we used this approach for two primary reasons, the data collected in the main study violated the normality assumption, and the sample size of 149 respondents was relatively small to conduct a CB-SEM. Excel (2019 version), Smart PLS (version 3.2.9) and SPSS (version 26.0) programs were used for all the statistical analysis.
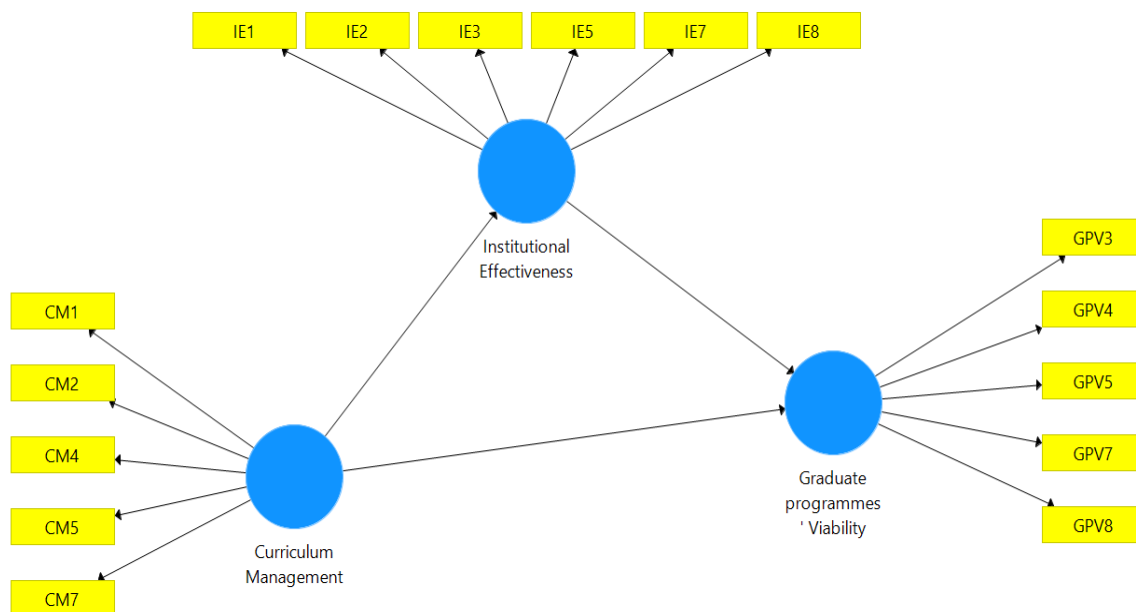

Figure 1. Hypothesised Cause-effect Model of the Study

Based on the model in Figure 1, we formulated the following hypothesis:

1. Curriculum management (CM) has a significant direct effect on institutional effectiveness (IE).

2. Curriculum management has a significant direct effect on graduate programmes' viability.

3. Institutional effectiveness has a significant direct effect on graduate programmes' viability.

4. Institutional effectiveness significantly mediates the nexus between curriculum management and the viability of graduate programmes.

5. There is no significant joint effect of curriculum management and institutional effectiveness on the viability of graduate programmes.

3. Results

3.1 Exploratory Factor Analysis (EFA)

This method (EFA) was used to examine the dimensions and internal structure of the questionnaire. Principal axis factoring (PAF) was performed based on a promax rotation. A KMO sampling adequacy value of .87 was obtained with significant Bartlett's sphericity test, $\chi^2(120) = 2525.51$, $p < .001$. This indicates that the pilot sample (n = 150) was sufficient for EFA deployment. The initial test of the EFA revealed eight factors with many dysfunctional items such as those that single-loaded to five different factors (e.g., GPV6, IE6, IE4, CM6 and CM 3) and those that did not load on any factor (e.g., GPV1, GPV2 and CM8). After removing these eight dysfunctional items, the analysis was re-performed following the earlier procedure. A three-factor solution was obtained, with eigenvalues greater than one. These three factors cumulatively explained 79.21% of the total variance. Comparatively, factors 1, 2 and 3 accounted for 32.90, 24.18, and 22.14% of the shared variation. The scree plot also found three factors with eigenvalues higher than one. Findings from the factor and pattern matrices indicated that all factor loads throughout the three extractions varied from .81 to .95. By following a careful examination of the items in each factor in Table 1, the latent traits were designated as factor 1 (institutional effectiveness), factor 2 (graduates' programme viability) and factor (curriculum management).

3.2 Convergent, Discriminant Validity and Composite Reliability

Table 1. Exploratory Factor Analysis Results of the Questionnaire

Item	Item description	λ	λ²	ε	Factor
IE3	Instititional objectives are highly pursued in my institution	.95	.90	.10	Institutional
IE7	Conflicts are resolved by considering stakeholder's interests	.94	.88	.12	Effectiveness
IE8	There is a strong cohesion among staff whilst discharging duties	.91	.83	.17	AVE = .83
IE5	Most students' research papers are published in prestigious journals	.91	.83	.17	CR = .97
IE1	The school environment is safe for everyone	.89	.79	.21	$\sqrt{AVE}$ = .91
IE2	New ideas, initiatives and research projects by the faculty are value	.88	.77	.23	
	Sum (∑)	5.48	5.01	.99	
GPV4	My institution attracts lot of research funding for graduate students	.94	.88	.12	Graduate
GPV7	Many academic staff offer mentorship services for students	.91	.83	.17	Programmes'
GPV5	There is persistent procurement of facilities to support programmes	.89	.79	.21	Viability
GPV3	There is a stable enrolment of students into different programmes	.89	.79	.21	AVE = .81
GPV8	Graduate programmes of my school produce patentable research	.87	.76	.24	CR = .96
	Sum (∑)	4.50	4.05	.95	$\sqrt{AVE}$ = .90
CM2	Stakeholders are actively involved in developing curriculum plans.	.89	.79	.21	Curriculum
CM7	Formulated curriculum plans are highly implemented	.87	.76	.24	management
CM1	Curriculum implementation processes are often evaluated	.85	.72	.28	AVE = .73
CM5	Societal needs are often considered when initiating curriculum plans	.84	.71	.29	CR = .93
CM4	Students' co-curricular needs are captured in curriculum plans	.81	.66	.34	$\sqrt{AVE}$ = .85
	Sum (∑)	4.26	3.63	1.37	

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

Convergent validity refers to the degree to which we may ensure that a variable is accurately measured by its indicators. Different elements that are conceptually unrelated may be differentiated if they have a high degree of discriminant validity. We used the Fornell-Larcker criteria in this investigation (Fornell & Larcker, 1981) to prove the instrument's convergent validity. The Average Variance Extracted (AVE) and Composite Reliability (CR) measures are utilised in this technique to see whether the measurement model is valid and convergent. The AVE is the disparity between the degree of variation captured by a construct and measurement error. AVE values more than 0.70 are considered exceptionally good, while values less than 0.50 are considered sufficient. The AVE for construct ξv is defined mathematically as:

$$\text{AVE}\xi v \ = \ \frac{\sum\lambda^2_{vk}}{(\sum\lambda^2_{vk})+\sum\varepsilon_{vk}}$$

Where:

$\sum\lambda^2_{vk}$ = Sum of the squared factor loadings for construct ξv with k indicators

$\sum\varepsilon_{vk}$ = Sum of error variance of the k indicators for construct ξv

But, $\varepsilon_{vk} = 1 - \lambda^2_{vk}$

The Fornell-Larcker testing approach was used to assess discriminant validity by determining how much variation ($AVE\xi v$) it captures and how much variation it shares with other constructs (ϕ_{iv}). The a priori assumption is that the square root of the AVE values for each factor should be greater than the inter-factor correlation. That is,

$$\sqrt{AVE\xi v} \ \geq \ \phi_{iv} \ \forall_i \neq v$$

Considered a more precise estimate than Cronbach's alpha, CR is a measure of internal consistency. CR values of at least 0.7 are deemed acceptable. CR for construct ξv is mathematically expressed as:

$$\rho c\xi v \ = \ \frac{(\sum\lambda_{vk})^2}{(\sum\lambda_{vk})^2+\sum\varepsilon_{vk}}$$

Where:

$\sum\lambda_{vk}$ = Sum of the factor loadings for construct ξv with k indicators

$\sum\varepsilon_{vk}$ = Sum of error variance of the k indicators for construct ξv

Because all the AVE values in Table 2 are greater than .50, convergent validity was attained for the three factors – institutional effectiveness, graduate programmes' viability and curriculum management. Because their CR values were all over the .70 criterion, all factors exhibited adequate reliability of internal consistency. Since all the bolded values in the leading diagonal are greater than the correlations below, discriminant validity was likewise attained (see Table 2). Table 2 further shows that discriminant validity was achieved under the Hetero-Trait Mono-Trait (HTMT) criterion (Henseler et al., 2015). The HTMT values are all below the .90 threshold.

Table 2. Convergent, Discriminant Validity and Composite Reliability of the Instrument

Factors	AVE	CR	1	2	3
(1) Instiutional Effectiveness	.83	.97	**.91**	*-.05*	*-.03*
(2) Graduate programmes' viability	.81	.96	.12	**.90**	*.12*
(3) Curriculum management	.73	.93	-.03	-.05	**.85**

AVE = Average variance extracted. Values above .50 are evidence of convergent validity

CR = Composite reliability estimates. Values above .70 are acceptable

Bolded values are square roots of AVE. The square root of AVE must be greater than the correlation estimates off the diagonal for discriminant validity to be achieved.

Values above the diagonal (in italics) are HTMT values. Discriminant validity is achieved if HTMT values are < .90

3.3 Hypothesis Testing

Hypothesis 1

Curriculum management (CM) has a significant direct effect on institutional effectiveness (IE). The result of the analysis in Table 3 revealed that curriculum management has a significant effect ($\beta = .54$, $SD = .08$, $t = 8.98$, $p < .001$) on institutional effectiveness. The former explained 12% of the total variance in the latter (*Adj. R^2* = .12, 95% *CI*[.04, .26], $p < .05$). This implies that we can hold other predictors not included in the model accountable for 88% of the unexplained variance. Furthermore, the result suggests that other things being equal, a 1% increase in the management of curriculum will cause a 0.54% increase in the effectiveness of institutions. Therefore, there is sufficient statistical evidence to retain our hypothesis.
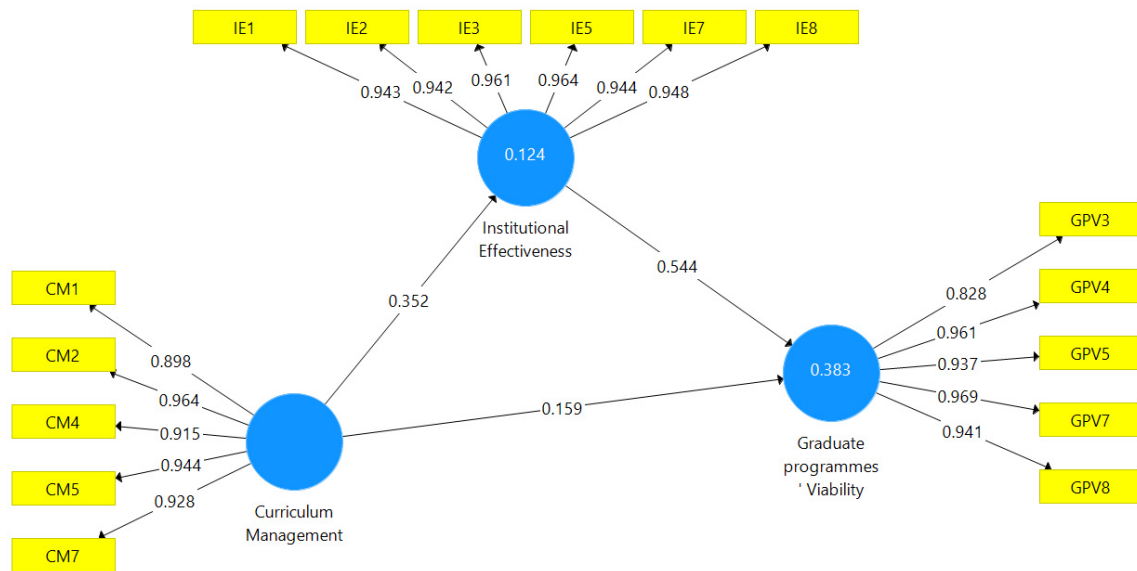
Figure 2. Measurement Model Showing the Direct and Indirect Effects of Curriculum Management on Graduate Programmes' Viability

Hypothesis 2

Curriculum management has a significant direct effect on graduate programmes' viability. The result in Table 3 shows that curriculum management has a significant direct effect (β = 0.16, *SD* = .06, *t* = 8.98, *p* < .001) on graduate programmes' viability. The result implies that a 1% increase in curriculum management practices will cause a 0.16% increase in the viability of graduate programmes if other variables do not change. Based on the available evidence, our hypothesis was confirmed.

Table 3. Path Analyses of the Direct Effect of Predictors on Their Outcome Variables

Paths	β	95% *CI*	*SD*	*t*	*p*
GPV ← IE	.54	.01, .29	0.06	8.98	.000***
IE ← CM	.35	.21, .51	0.08	4.47	.000***
GPV ← CM	.16	.43, .66	0.07	2.29	.023*
CM1 ← CM	.90	.87, .93	0.02	59.35	.000***
CM2 ← CM	.96	.94, .98	0.01	102.49	.000***
CM4 ← CM	.92	.87, .95	0.02	47.14	.000***
CM5 ← CM	.94	.91, 97	0.02	61.93	.000***
CM7 ← CM	.93	.89, .95	0.02	56.31	.000***
GPV3 ← GPV	.83	.77, .88	0.03	30.32	.000***
GPV4 ← GPV	.96	.94, .98	0.01	102.81	.000***
GPV5 ← GPV	.94	.91, .96	0.01	76.93	.000***
GPV7 ← GPV	.97	.95, .98	0.01	135.26	.000***
GPV8 ← GPV	.94	.91, .96	0.01	78.47	.000***
IE1 ← IE	.94	.89, .98	0.02	44.07	.000***
IE2 ← IE	.94	.91, .97	0.02	58.53	.000***
IE3 ← IE	.96	.94, .98	0.01	104.02	.000***
IE5 ← IE	.96	.94, .98	0.01	110.44	.000***
IE7 ← IE	.94	.91, .97	0.02	56.66	.000***
IE8 ← IE	.95	.92, .97	0.01	69.08	.000***

***Significant at p < .001

*Significant at p < .05

Hypothesis 3

Institutional effectiveness has no significant direct effect on graduate programmes' viability. Table 3 shows a significant direct effect of institutional effectiveness on graduate programmes' viability ($\beta = .54$, $SD = .06$, $t = 8.98$, $p < .001$). The result implies that a 1% increase in institutional effectiveness is associated with a 0.54% increase in the viability of graduate programmes, other things being equal. Following this result, the third hypothesis received empirical backing.

Hypothesis 4

Institutional effectiveness significantly mediates the nexus between curriculum management and the viability of graduate programmes. The total and indirect effects were used from a bootstrapping solution to determine the mediation effect. The result of the analysis revealed that curriculum management has a significant total effect ($\beta = .35$, $95\%CI$ [.19, .50], $SD = .08$, $t = 4.39$, $p < .001$) on graduate programmes' viability. However, the indirect effect of curriculum management on graduate programmes' viability, through the mediation of institutional effectiveness was proven to be statistically significant ($\beta = .19$, $95\%CI$ [.11, .28], $SD = .05$, $p < .001$). Therefore, institutional effectiveness significantly mediated the nexus between curriculum management and the viability of graduate programmes' effectiveness. Hypothesis four was also supported by available evidence.

Hypothesis 5

There is no significant joint effect of curriculum management and institutional effectiveness on the viability of graduate programmes. According to Figure 2, CM and IE jointly explained 37% of the variance in graduate programmes' viability ($R^2 = .38$, *Adj.* $R^2 = .37$, 95% CI [.25, .52]). A bootstrapping procedure proved the result statistically significant ($p < .001$). This result suggests that 63% of the unaccounted proportion of the variance is explainable by other predictors extraneous to the model. Thus, our hypothesis was supported.

3.4 Model Evaluation/fit Assessment

Although it has been warned that researchers exercise extreme caution when reporting and using the PLS-SEM model fit (Hair et al. 2017). This is because suggested criteria are in their infancy of development, making them incompletely understood and often ineffective for PLS-SEM. Nevertheless, the model's goodness of fit was evaluated using the default options available in Smart PLS 3, such as SRMR, NFI, and RMS theta. The results of the model fit assessment reveals that an SRMR value of .07 < .08 indicates a good model fit. The NFI value of .77 approaches 1 but does not meet the recommended cutoff value of ≥ .90. The RMS theta value of .10 is less than .12, suggesting a fitting model (Henseler et al., 2014).

4. Discussion

This study proved that curriculum management directly affects institutional effectiveness. This result implies that improvements in the management of curriculum plans and implementation processes are strongly connected to the effectiveness of universities. This result is not surprising because the central aim of establishing universities is to equip students with the requisite knowledge, values and skills. The curriculum is the blueprint that determines the contents and learning experiences that will be presented to learners to achieve stated goals. As discovered in this study, the curriculum can be effectively managed by considering societal and students' needs when initiating curriculum designs, actively involving stakeholders in developing curriculum plans, implementing formulated curriculum plans and evaluating the curriculum implementation process to determine the degree of success. This result strengthens the finding of a previous study which found a significant relationship between curriculum management and the quality of teachers' instructional supervision and motivation (Etor & Osim, 2014). The result also corroborates the findings of Torkzadeh and Keshavarzi (2018a), which revealed significant improvements in the accomplishment of objectives, national self-sufficiency, proper performance and education system reforms, social development, strategic success, students' knowledge, attitudes and abilities after the evaluation of a medical education curriculum. The results of quasi-experimental research also indicated a positive impact of using the proposed strategy of curriculum integration on students learning achievement (Amani, 2017). Furthermore, the study of Torkzadeh and Keshavarzi (2018b) found that considering the environmental dynamics of higher education curriculum and mapping an acceptable mission and outlook helps identify the challenges and possibilities that lie ahead and offer the essential planning requirements for the desired strategy to be implemented. The fulfilment of such a significant problem leads to accountability adapted to environmental needs, production and development of knowledge, coherence and correct development of the efficacy of curricula relevant to the environmental dynamics and capacities.

This study also found a significant direct effect of curriculum management on the viability of graduate programmes. The result suggests that the degree of the viability of graduate programmes can be substantially determined by how much curriculum is managed. Being a positive prediction, the result suggests that proper curriculum management can promote the viability of graduate programmes in universities. Since viable graduate programmes are defined (by the measures of this study) as those that can attract a lot of research funding, offer mentorship opportunities, persistently procure facilities, produce patentable research outputs and enjoy stable student enrolment. Without proper curriculum management, no graduate programme or institution can demonstrate these effectiveness indices. The production of patentable research, for instance, presupposes that a quality research curriculum must have been developed and implemented to fortify students with the appropriate thinking and skills needed to engage in high-level research undertakings. Curriculum management can also promote enrolment if attractive academic and non-academic facilities are provided in pursuing stated goals. The results of the second finding align with Owan and Bassey (2021), who found a significant prediction of curriculum management proxies on the proxies of graduate programmes' sustainability. The result also tallies with the position of Owan et al. (2022) that curriculum management is one leadership attribute of administrators needed to create effective school-community ties for sustainable schools.

The third finding of this study disclosed that institutional effectiveness has a significant direct effect on graduate programmes' viability. The result implies that improvements in institutional effectiveness can cause graduate programmes in universities to become viable. This result is explainable because an influential institution is one with effective teachers, students and leadership (Bassey, Owan, & Eze, 2019; Mbon et al., 2020). No graduate programme can be viable if teachers, students and administrators are ineffective in their service discharge. Therefore, the result of the third hypothesis is not a surprise since institutional effectiveness revolves around pursuing institutional goals, conflict resolutions, maintaining cohesion among staff, ensuring environmental safety, and promoting quality research and publication culture. These indicators are fundamental to sustaining graduate programmes in the long term. Consequently, such programmes may be better disposed to attracting research funding, maintaining continuous enrolment of students, making an impact on society and producing new knowledge. This corroborates the position of Shattock (2000) that competitiveness, cost reduction, excellence, income generation, opportunism, relevance and reputation are essential phrases for successful universities in the modern environment. These keywords are indicators of effectiveness needed to drive university activities and programmes forward.

The fourth finding of this study showed a significant mediation effect of institutional effectiveness on the nexus between curriculum management and graduates programmes' viability. Although curriculum management significantly affects the viability of graduate programmes, this result implies that institutional effectiveness can further strengthen the relationship between curriculum management and graduate programmes' viability. Put differently; institutional effectiveness could be used as a hub to strengthen the effect of curriculum management on graduate programmes' viability. This finding agrees with other studies that ecological literacy and curricula, sustainability education in all disciplines, promotion of sustainable research, and support for sustainable university operations are important ways to promote sustainability in universities (Filho et al., 2019; Khan & Henderson, 2020; Wals, 2014). Shalabi (2019) work presented key academic indicators of sustainable universities, including providing students' support programmes, curriculum, research and services. Furthermore, the result of the fifth hypothesis showed a more significant effect of the joint prediction of curriculum management and institutional effectiveness on graduate programmes' viability. This implies that when the curriculum is appropriately managed in effective institutions, it will have a rippling effect stronger than practising just one of the variables. This means that institutions seeking to improve the viability of their postgraduate programmes could promote curriculum management and institutional effectiveness together, rather than chasing just one of the variables.

5. Limitations and Research Implications

This research is limited by its scope and a small sample of respondents. Although this weakness does not affect the quality of the research, it limits the degree to which we can generalise the results. Future research needs to cover a broader scope and a large-scale sample of respondents. Secondly, the study considered just one mediating variable, whereas many other factors could mediate the nexus between curriculum management and graduate programmes' viability. Since no one study can address all the questions surrounding a question in one short, it implies that future studies are needed to cover these other possible mediating variables not included in the study. Lastly, by using a quantitative methodology, the study is limited in the wealth of information provided. Quantitative studies are often known to be skeletal, even though they possess greater strengths in the validity of their process and in coving a large number of respondents. Therefore, this study calls for qualitative and mixed-methods studies to offer more flesh to

the results of this study.

6. Conclusion

This study used a quantitative technique to estimate the degree to which curriculum management predicts the viability of graduate programmes in universities. The study used institutional effectiveness to mediate the nexus between the predictor and outcome variables. The result of this study proved that graduate programmes' viability depends, to a great extent, on how much curriculum is managed and how effective institutions are with their services. According to this study, a viable graduate programme attracts a lot of research funding, enjoys a stable enrolment of students, offers mentorship services for students, persistently procures facilities to support programmes, and produces patentable research. Institutions that pursue objectives, resolve conflicts, possess a cohesive workforce and offer a safe learning environment successfully bridge the link between curriculum management and the viability of graduate programmes. This study has provided value to lecturers, departmental heads, deans, university administrators, regulatory bodies, policymakers, educational researchers and other stakeholders. The result of this study can enable institutions seeking to run viable graduate programmes to re-evaluate their curriculum management practices and the effectiveness of their services. Therefore, higher education leaders have evidence to readjust or correct their management deficiencies (if any) for sustainability. This study has extended the higher education literature, particular on postgraduate studies, and has offered new research directions for prospective research.

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