Projecting Enrollment for Effective Academic Staff Planning in Nigerian Universities

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ABSTRACT

Student enrollment in Nigerian universities has grown tremendously in the past one decade due to the increased demand for university education. The new development could be attributed to the policy of free, universal and compulsory education at the primary to junior secondary, coupled with the high population of Nigeria, with an annual growth rate of 3.2%. This has given rise to the school enrollment in the universities. Nevertheless, there are strong indications that the trend in demand for and supply of university education seems not to match, so also are the resources available in the universities (human, facilities and fund). For this paper, data on the existing student enrollment trend and academic staff on roll were collected through checklist from records of relevant bodies. The data were analyzed through extrapolation equation and staff-student ratio for each discipline. This study examined the pattern of enrollment in the Nigerian universities and made projection for the academic staff and student for the future years.

The results showed that enrollment of 1,417,080 is expected in the universities in 2010, while in the year 2020 the enrollment will be 5,732,878. The corresponding ideal number of academic staff required will be 70,854 and 286,644 for 2010 and 2020 respectively. It was suggested that proactive actions should be taken by the managements and councils of the various universities at meeting the demand-supply staff needs of the university system.

Introduction

Making projection in education has been regarded as the centerpiece of quantitative aspect of educational planning. As such, educational planners are to be grounded in the techniques of making projection. Projection informs the educational planner of a future pattern and trend of education parameters, especially the resource requirements in the educational system. These include enrollment, staffing, facilities, funding, etc. Projection also acquaints the institutional managers with the number of students and staff that would be expected in the system at a future period, assuming no change occurs in the educational system.

Projection in the educational system is therefore, a conditional forecast based on explicit assumptions and it holds true if the assumptions are realized (Nwankwo, 1981). All levels of education require timely projection of resources for an effective operation and sustainable development. According to (Mehta (2004). projections are conditional statements about the future and they refer mostly to the exercises of extrapolation of the past trends into the future, which oftentimes do not take into account changes in the policy parameters, nor take into account changes in the government policies, programs, etc. in projecting the future population growth. Often times the reliability and usefulness of projections depend on the assumptions and their closeness to reality.

In Nigeria, university education has grown into a complex system over the years. The structure, program and management are all affected. The resource inputs have also grown tremendously. The numbers of universities, the enrollment and staff have all gone up in comparison to the situation during the pre-Independence era. The number of the nation's universities have increased from one University College in 1948 to one hundred

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and two in 2009, with a total student population of about 1,218,312 (Joint Admission Matriculation Board, JAMB: 2009). Despite this number, it was affirmed that more than double the country's present number of universities will be required to meet the general perception of Nigerians that believed that only university degree could give them a good future. This assertion could be seen in the ever increasing gap between demand and supply of university education in the country (Ehiametalor, 2005).

The Joint Admissions and Matriculation Board (JAMB, 2009) report had revealed that between 1999 and 2009, the universities in Nigeria have not admitted up to twenty percent (20%) of the applicants demanding for university education. The reasons adduced for this trend was that there are limited available space, human and material resources in the nation's universities (Adeyemi, 2001; Aghenta, 2006).

Student enrollment at any level of education is very crucial to the achievement of the nation overall goals through education. There is need to know the actual number of students that are enrolled in the educational system because other school characteristics such as human, facilities, funds depend on it. Population of a country at any given time is also important because enrollment of school age is a function of a nation's demographic characteristics. Enrollment changes every year because of population dynamics. Increase or decrease in population could have direct impact on enrollment. Aghenta (1993) reported that out of the nation's population, enrollment of students from year to year is expected to be in ratios of primary: 15.5-16.5%, secondary: 12% and higher education: 7.5-8%. In the same vein, the International Comparative Higher Education and Accessibility ICHEFA (2004) proposed that 8% of the total population of a country is in the age bracket to undergo a 4-year university program. With a 5% current university enrollment rate in Sub-Saharan Africa, the total number of university attendees can be estimated as (N students = Total population x .08 x .05).

According to the National Universities Commission (2002b) cited in Williams, Theresa and Eric (2004) the enrollment growth rates witnessed in the last decade exceeded government policy guidelines. Enrollments in the federal universities in Nigeria have grown at a rapid rate of 12% annually during the 1990s and the situation appears not to have changed. Okebukola (2004) attributed the trend to the expansion of the system in term of courses, departments, schools and faculties. Holm-Nielson (2001) also attributed the increase to the social demands for university education, because of the benefits accrued from it on one hand, and the completion rates and transition rates from secondary to tertiary education on the other hand.

However, the gap existing between demand and supply of university education in Nigeria showed that not all the supposed school-age group is enrolled (JAMB, 2009). Therefore, in an attempt to boost enrollment in the university system in Nigeria, the National Universities Commission and Joint Admission and Matriculation Board stipulated 20% admission ratio to universities of the number of qualified applicants (Ajayi & Adeniji, 2008).

Experience have shown that enrollment trend does not occur in isolation, increases and decreases in enrollment are correlated with multiple influences such as labor markets trends, social and economic factors. Identifying factors that could influence enrollment in the university system therefore become crucial as this would not only allow governments and institutions to forecast enrollment more effectively, but also permit them to make adjustments to meet current or future labor needs.

Financial constraints was identified as one of the major factor that have influenced enrollment rate and inhibit further expansion of the tertiary education system, while retaining satisfactory levels of quality in the university system (World Bank, 2000; Varghese, 2000).

Gender imbalances of student enrollment and high student-staff ratios across discipline were also observed across the universities in Nigeria, (Adeyemi, 2001; Adeyemi & Akpotu 2004). In contrast, Ajayi and Adeniji (2008) noted that while there is upsurge of enrollment in the public universities, private universities in Nigeria recorded low enrollment.

Presently, student enrollment and the dwindling number of academic staff in the Nigerian university system have been of great concern to all stakeholders in education, because the enormous resources, especially funds expended on university education and the attendant quality of graduates produced by the system seems not to meet their expectations. In the developed countries, educational policy formulation and provision of resources are based on accurate and reliable projections. This appears not to be the situation in Nigeria, as it is often difficult to obtain accurate projected figures, which could be due to the absence of reliable data base. This could have plunged the nation's educational system into needless crises. However, in order to provide information for decision making and budget planning on higher education, enrollment projection is very important.

In the light of this, the objective of this paper is to analyze the past trend and existing situation of academic staff and student enrollment in the nation's universities; and make projections for the future that would guide educational planners to effectively calculate the required school indicators as well as stimulate various scenarios for policy alternatives for effective planning. Furthermore, it would serve as a tool for the government to implement effectively policies on university education that could bring about expansion of access, improve enrollment, staffing and funding in the Nigerian university system.

Academic Staff Requirement of Universities

Academic staff planning is concerned with the knowledge about current manpower resources and capabilities and setting objectives to meet manpower problems as well as specific training needs for maximum productivity. In addition, it involves the projection of manpower demand, supply and the action to bring demand and supply to a desirable state of equilibrium (Aghenta, 2006). The purpose for staff planning is to ensure that adequate staff of right quality and quantity is provided for the university system. To obtain equilibrium in the school system, growth in student enrollment must be accompanied by a proportionate growth in academic staff strength (Osahon, 1997).

Efforts to expand enrollments and improve educational quality are constrained by growing shortages of qualified academic staff. The NUC (2002b) reported that the number of academic staff between 1997 and 1999 declined by 12%, while enrollment expanded by 13%. The trend in the 2000s has not changed considerably. Staff scarcity was attributed to long-term brain drain, insufficient output from national postgraduate program, and cost of procuring higher degree in the face of economic recession. In addition, many universities in Nigeria have not yet developed the Ph. D programs, either because of inadequate experienced academics or physical facilities.

Projection Models

Projection serves as the basis for determining the available resources, other school characteristics and how well they could be distributed and utilized (Aghenta, 2001). Furthermore, enrollment projection vis-à-vis the actual academic staff required enables the government to assess the performance of its policy objectives and determine the cost of education program; and consequently make adequate plans for the system. However, projection of education requires accurate aggregate enrollment data for at least five to ten years, which is often difficult to obtain in Nigeria. According to Black (2004), without data, enrollment management plans can only be tactical, not strategic. Even at tactical level, the absence of data will result in plan, which is predicated on intuition and wishful thinking, with a low probability of success. The importance of projection in planning has made researchers to propose many forecasting methods to improve accuracy. However, obtaining accuracy is not an easy task, as many factors have impacts on enrollment numbers.

The general procedure for projection was to express the variable to be projected as a percentage of a "base" variable. These percentages are then projected and applied to projections of the "base" variable. However, the techniques of projecting enrollment could be mathematical, economic and component methods. Shuqin (2002) gave three projection models as linear regression, auto regression and three-component models. In recent times, there are new dynamic and systematic approaches and techniques used to make projections which include: longitudinal observation, statistical and comparative analyses such as exponential smoothing, multiple linear regression and Meta analysis (analytical methods) (Gerald and Hussar 2008). However, without comprehensive educational data projection of education using the above statistics seems difficult.
Projection using either of these models will depend on the type of projection and the available data.

Theoretical Framework

The rational comprehensive (Synoptic) planning and comprehensive system theories propounded by Faludi and Needham (1973) and Immegeart and Pilecki (1973) respectively formed the framework for this paper. The rational comprehensive theory is the most widely used approach because of its fundamental classical elements: (1) goal-setting, (2) identification of policy alternatives, (3) evaluation of means against ends, and (4) implementation of policy that is a point of departure for most other planning approaches. It is the kind of planning process that permits multiple iterations, feedback loops and elaboration of sub-processes. The use of the theory allows for the evaluation that consists of procedures such as benefit-cost analysis, operations research, systems analysis, and forecasting (projection) research. Forecasting in rational planning can further be broken down into deterministic models or can consist of purely descriptive analysis (trend extrapolation, econometric modeling, curve-fitting through multiple regression analysis); or probability envelopes and contingency models to accommodate foreseeable variations in patterns.

Furthermore, the comprehensive planning theory typically looks at problems from a systems viewpoint, using conceptual or mathematical models relating ends (objectives) to means (resources and constraints) with heavy reliance on numbers and quantitative analysis. It is also an *algorithm* which is a set procedure for solving a known class of problems. It generally involves quantitative methods, and by definition it is capable of arriving at an optimal solution. The algorithm is often employed in linear programming and input-output analysis, operations research, and trend projections. This paper therefore adopted rational comprehensive planning theory that seeks to provide a framework of

objective decision rules and analysis. The theory is more robust than others in the scope of problems it addresses and the diversity of operating conditions it can tolerate. Similarly, the theory has an internally consistent, self-reinforcing network of methods and data requirements.

The theory advocates a total view of planning at once without limiting the scope of planning. That is, it allows for planning for the entire educational system of a country for five or more years through the use of trend extrapolation and quantitative analysis and this is applicable in this paper, as the projection plan is for the entire university system and it spans over five years. The comprehensive system theory was also adopted because the nation's population census figure and the component student enrollment are known. Based on this, the paper was explained in sub-headings.

Methodology

One enrollment projection method (linear extrapolation equation) was examined in the study and was applied to all the universities in Nigeria. Five years of enrollment data and the records of stock of academic staff in the Nigeria universities were collected from the data system at the Federal Ministry of Education and the National Bureau of Statistics and National Universities Commission. Population information was used as an impact factor. To derive the student enrollment from school-age distribution, the population data for the country were obtained from the National Population Office through checklist. This paper uses 'Extrapolation of Past Trend' of enrollment approach, which was developed by (Chesswas, 1969) as presented by Mehta (2004) to make total enrollment projection using compound growth rate. The method was selected on the basis that it allows the researcher to do long-period projections; it is manageable in the temporal sense as the enrollment projection is a yearly routine and needs to be done in a specific period of time, and it's theoretically and statistically sound.

In addition, the Sprague's Multipliers based on linear regression model was used to determine the school-age population from the 2006 census population figure. Total enrollment was linearly regressed on the population of ages 16 to 55. The academic staff required for the projected enrollment was determined by using the average teacher-student ratio method (TSR) as recommended by NUC (2004) for the nation's universities. To determine the enrollment and staff growth rate, the enrollment for two consecutive years were analyzed through linear extrapolation using compound growth rate, which was expressed in the following equation.

$$r = \frac{1}{n} ((En/Eo)1/n - 1) \times 100; \qquad r = antilog \frac{(\log En - \log Eo)}{n} - 1 \quad \text{(See Appendix)}.$$

The University School-Age Population in Nigeria

The Sprague's Multiplier using linear regression model was applied to the 2006 census to derive the age distribution. From the higher school age population was also derived out which 20 % is expected to enroll in the university (NUC, 2008). The higher education school age population as at 2006 was 11,568,100, (representing 8.2% of the total population), while the expected enrollment in the universities was 2,313,620. Tables 1 and 2 present actual student enrollment, staff and the actual and the ideal academic staff required for the student enrollment.

Table 1: Enrollment and the Academic Staff Growth Rate in Nigerian Universities

Year	Actual Student Enrollment	% Growth rate	Number of Academic Staff	% Growth rate
2000/01	358,758		18,867	
2001/02	444,949	24.03	18,426	-2.37
2002/03	606,104	36.22	22,046	16.85
2003/04	720,393	18.86	23,871	8.28
2004/05	780,001	7.23	23,535	-1.41
2005/06	810,220	3.87	27,482	16.77

Sources: Federal Ministry of Education and National Universities Commission (FME and NUC 2007).

Table 1 shows an increase in enrollment and the number of academic staff. It shows that there was gap between the actual and the expected enrollment and staff. In addition, academic staff grew by about 6.4%, while enrollment growth rate was 15%. Figure 1 shows further illustration.
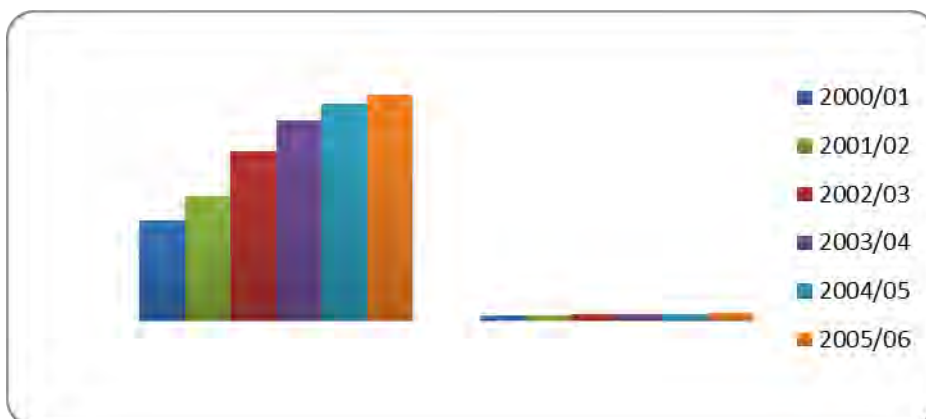

Figure 1: Enrollment and number of Academic Staff

Table 2: Enrollment and Actual-Ideal Academic Staff between 2001 and 2006

Year	Student Enrollment	Actual number Of Academic Staff	Ideal number of staff	Number Difference
2000/01	358,758	18,867	17,938	-929
2001/02	444,949	18,426	22,247	3,821
2002/03	606,104	22,046	30,305	8,259
2003/04	720,393	23,871	36,020	12,149
2004/05	780,001	23,535	39,000	15,465
2005/06	810,220	27,482	40,511	13,029

Source: FME, 2007

In Table 2, average Teacher Student Ratio (TSR) of 1:20 was derived from the NUC recommended TSR for various disciplines in the university and was applied to the student

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enrollment and staff on roll for the academic years. There were differences between the ideal and actual academic staff requirements of the universities.
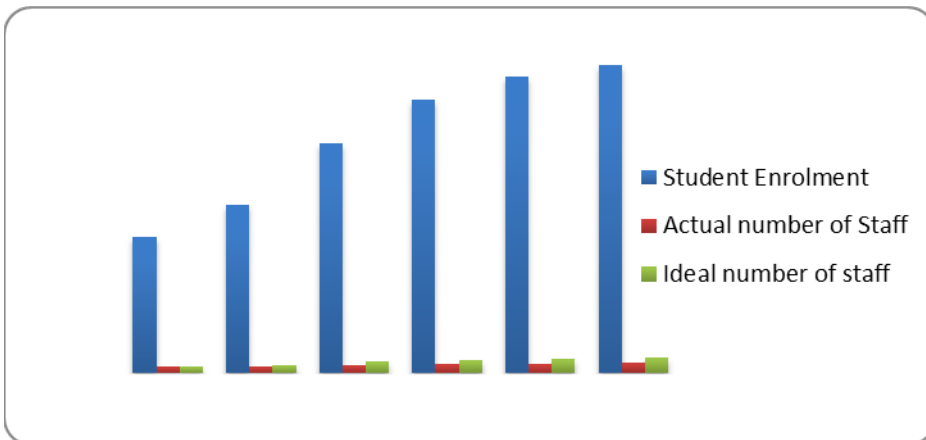

Figure 2: Actual and ideal staff needed for student enrollment

Projected Enrollment for the Nigerian University System between 2010 and 2020

To project student enrollment in the university system in Nigerian, the 2005enrollment was taken as the base year. Making use of the extrapolation equation as provided earlier, the obtained figures are presented in table 3.

Table 3: Projected Student Enrollment in Nigerian Universities.

Year	Enrollment
*2005	810,220*
2010	1,417,080
2011	1,629,641
2012	1,874,088
2013	2,155,201
2014	2,478,482
2015	2,850,254
2016	3,277,792
2017	3,769,461
2018	4,334,880
2019	4,985,112
2020	5,732,878

Key: *2005 = 810,220* = base year.

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The above projection showed that in the 2010 school year, about 1.42 million students are expected in the universities, while over 5million students are expected in the year 2020. This further illustrated in figure 3.
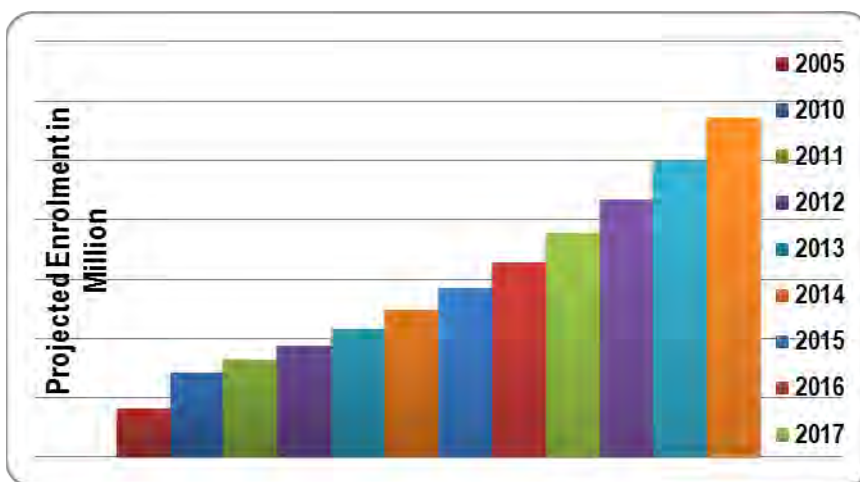

Figure 3: Student Enrollment Projection from 2010-2020

The Academic Staff Requirement for the System for the Periods 2010 - 2020

The academic staff projection for the universities was made based on the past enrollment, stock of staff, and the NUC's average recommended Teacher Student Ratio (TSR). The annual rate of growth was held constant for the study. The result as shown in Table 4 revealed that the university system would require about 70,854 academic staff for a projected student enrollment of 1,417,080 in 2010 and 286,644 staff for 5,732,878 students in 2020. Figure 4 shows a further illustration

Table 4: Projected Academic staff for Nigerian Universities by Year 2020

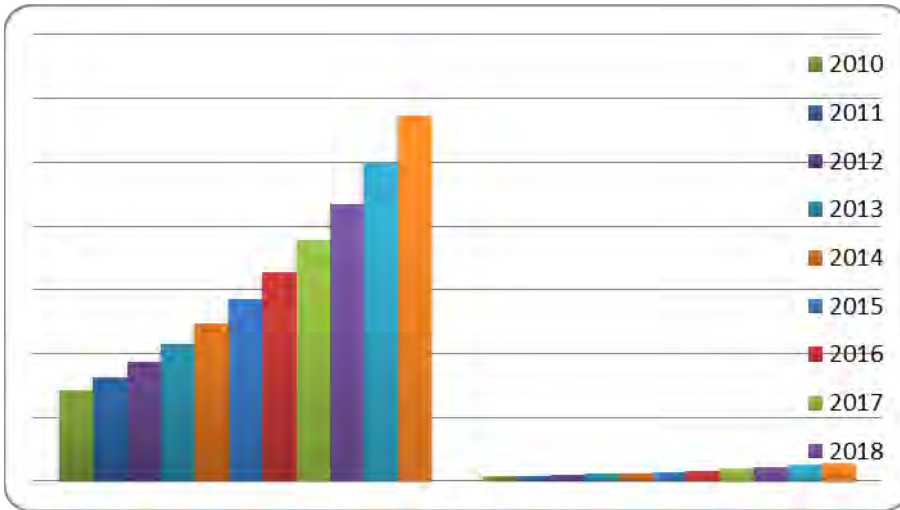| Year	Projected Student Enrollment	Projected Academic Staff	Yearly additional required Academic Staff
2009	1,232,243	61,612	-
2010	1,417,080	70,854	9,242
2011	1,629,641	81,482	10,628
2012	1,874,088	93,704	12,222
2013	2,155,201	107,760	14,056
2014	2,478,482	123,924	16,164
2015	2,850,254	142,513	18,589
2016	3,277,792	163,890	21,377
2017	3,769,461	188,473	24,583
2018	4,334,880	216,744	28,271
2019	4,985,112	249,256	32,512
2020	5,732,878	286,644	37,388

Figure 4: Projected Student Enrollment and Academic Staff

Discussion of Findings

The focus of this paper was to project student enrollment for the Nigerian universities as well as determines the required academic staff needs. From the analysis of the existing trend, there was fluctuation in the growth rate of both students and staff. Based on the existing university admission policy, it was found that there was gap between the actual and expected enrollment and staff on roll in 2005/06 session. This finding was supported by NUC (2002b) and Adeyemi and Uko-Aviomoh (2003). They reported that the universities in Nigeria lack enough academic manpower and the capacity to absorb the qualified candidates. They asserted that the number of academic staff between 1997 and 1999 declined by 12%, while enrollment expanded by 13%. The trend in the 2000's has not changed considerably. Consequently, many universities have high teacher-student ratios.

The projections for the student enrollment and number of academic staff required from 2010 to 2020 showed that in 70,854 academic staff will be the ideal staff requirements for the projected 1,417,080 enrollment in 2010, while 286,644 academic staff will be required for the projected 5,732,878 enrollment in 2020. There exists gap that should be filled between the expected enrollment and the number of staff requirements for the future years. This will cause the university a fortune in terms of funding. Huge sum of money will be required to train and retrain staff, pay their salaries and allowances. This could be burdensome on the government. This is because government is largely responsible for the financing of university education in Nigeria. Tuition is made free in public universities and many families are poor to foot the bill of university education.

Supporting this position, Holm-Nielson (2001) and World Bank (2004) affirmed that financial constraints experienced in recent years in most African countries have lower enrollments in most tertiary institutions. Total annual cost of university education spending in Africa each year is about $7.5-$11 billion of which about $2 billion is borne by students and their families and most of these families fall between low-income groups. Consequently, the poor economic state makes most students to drop out of the universities soon after enrollment.

Implications for Strategic Planning

The findings of this paper revealed that most problems that are related to enrollment and other inputs in the Nigerian universities are the result of the difficulty in obtaining accurate data on the true situation of the system. With the huge projected student enrollment and the required staff between 2010 and 2020, the fear is that the capacity of the existing structure may be inadequate to cope. Effective functioning of the system will require more schools, funding, staff development, infrastructures, facilities etc., which portends serious material and financial implications for all stakeholders. This therefore calls for urgent plan of action that will facilitate adequate supply of education resources and services that will be needed on regular basis and in right mix. The government should increase the funding of the university system. It should ensure proper monitoring of fund released to the school administrators for accountability.

The projection made also has implication for the Information and Communication Technology (ICT) system. The ICT could provide vital data and information required by planners and its knowledge affords the planners to simulate, forecast and project for the future use of resources with precision, thus avoiding the pit-fall of resource wastage. Consequently, the sector needs to be developed properly by all stakeholders to meet future challenges.

Conclusion and Recommendations

Based on the findings of this paper, it can be concluded that the present student enrollment in the universities in Nigeria is still low as asserted by Ajayi and Adeniji (2008). There is also shortage of academic staff. According to Mehta (2004) projection of teaching staff at the higher level of education, subject specialization is important and hence the use of teacher-student ratio may be inappropriate. It can also be concluded that based on the projected enrollment vis-à-vis academic staff that will be required, there is going to be serious upsurge in both enrollment and staff requirement in the Nigerian universities in the nearest future. The paper also conclude that the use of linear regression model in this study could be prone to error as the regression gives the same weight to the data of each year and for the projection of long term enrollment at a time when such factors of new students become unknown, the model may lose its power (Shinquo, 2002).

Therefore the following recommendations are made based on the findings of this paper: To have accurate data that will improve on student enrollment projection and other resources, there is need for new strategies in collection and retrieval of enrollment data, while management strategies such as identifying academic barriers affecting admission and completion rate be developed.

Expand postgraduate programs in the university system through adequate provision of funds and facilities that would enhance the admission capability of the university, and improve the quality of the postgraduate programs. In addition, grants, soft-loans and scholarships awards should be given to both undergraduate and postgraduate indigent students to cushion the effect of high tuition fees. Furthermore, the staff on roll should have access to better training. Induction and mentoring support should be given during the early years of the young academics. There should be improvement in the working conditions of the lecturers to attract brilliant academics across the table.

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APPENDICES

$En = Eo (1+r)^n$ (Chesswas, 1996)   Where:

Eo = the enrollment for base year of the period considered

En = the enrollment in the final year of the period considered.

r = the rate of growth of enrollment during this period.

n= the number of years between the base year and the final year.

r = Antilog $\frac{(\log En/Eo)}{n}$-1 = Antilog $\frac{(\log 444949-\log 358758)}{1}$-1

 = antilog (5.64831-5.55480)-1
 = antilog (0.09351)-1 = 1.24025-1

 = 0.24025 i.e. r = 24.02% etc.

Enrollment Projection:

Average growth rate = 15.0%, If base year = 2005/06 session.

$En = Eo (1+r)^n$ Eo = 810220, En =2009, n =4

E2009 = 810220 (1+ .15)4 = 810220 (1.15)4 = 1,417,080

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Academic Staff Projection.

The teacher-student ratio formula is given as:

$$T_s^t \;=\; \frac{E_s^t}{R_s^t}$$ Where:

T_s^t = Number of teacher at a particular time (t) and for particular stage or school (s);

E_s^t = Enrollment at particular time (t) for particular stage or school (s), and

R_s^t = Teacher-Student Ratio at a particular time (t) for particular stage or school (s).

Average teacher-student ratios by discipline = 1:20, Base year 2005, student enrollment = 810220.

Number of staff required = $\frac{810220}{20}$ = 40511

2008, student enrollment = 1,232,243

Number of staff required = $\frac{1,232,243}{20}$ = 61612

2009, student enrollment = 1,417,080

Number of staff required = $\frac{1,417,080}{20}$ = 70854

Yearly additional required = 70854-61612
= 9242

Sprague Multipliers

fo = fa x f-1 +fb x f-2 + fc x f+1 +fd x f+2 +fe x f+3 Where:

fo is the number of age group being considered;

f-1, f-2 is equal to the number of the two preceding age group;

f+1, f+2, f+3 etc equal to numbers in the three following age group.

fa, fb, fc, fd, fe etc is the number in the first to the fifth single year panel.

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