Examining the role of budgeting and institutional factors on funding of public medical education in Nigeria

by

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ABSTRACT

There is a dearth of literature on the role that funding plays on public medical education in Nigeria, whereas this area of study occupies a pre-eminence in the social and economic lives of the populace. This thesis examines to what extent budgeting and institutional factors affect funding of public medical education in Nigeria, using College of Medicine of the University of Lagos (CMUL) as a case study. This impact was investigated through the use of an Autoregressive Distributed Lag (ARDL) model; upon which short-run and long-run dynamics were analysed. As a precursor to ascertaining the current practices and to also identify important variables, the output-oriented Data Envelopment Analysis (DEA) was employed to examine the current level of efficiency in the teaching and learning of medical education at the CMUL.

The results obtained show that government involvement positively and significantly impact on funding of medical education in the country in the short-run but excessive involvement could be detrimental in the long-run situation. The role of budget is found to be highly significant while school fees and other internally generated revenue were found to be substitutes to the funding of medical education by the federal government. The government is advised to sufficiently fund medical shools in the country or it provides autonomy to these schools to appropriately charge tuition to achieve its objectives of teaching and learning.

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DEDICATION

This thesis is dedicated to Almighty Allah who has made everything possible.

DECLARATION

I confirm that the thesis is my own work; and that all published and other sources of material consulted have been duly acknowledged. I also confirm that the thesis has not been submitted elsewhere for a comparable academic award.

LIST OF PUBLICATIONS

Lawal, Olalekan Nurudeen (2016). Examining the impact of budgeting and funding on service delivery in medical education in Nigeria, Leeds Beckett University, United Kingdom, Ph.D Conference. 26th – 29th January, 2016. (Paper Presentation)

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Chapter One: Introduction

1.1 Background to the study

The focus of this study is to examine the role of budgeting and institutional factors on funding in federally-owned medical institutions in Nigeria. Of specific importance is the implication of the allocated financial resources on the delivery of effective teaching and learning environment in these institutions. Johnstone (2003) identifies that the financial problems faced by higher institutions worldwide have two broad dimensions:

1. High (and increasing) unit or per-student cost of higher education.
2. Pressure from increasing enrolments.

According to Johnstone (op. cit), these exacerbating conditions are more prevalent in Sub-Saharan Africa (SSA) than in other parts of the world. Whereas the quantum of funding available may play a significant role in the ability of an institution to carry out its services, the efficiency of the fund utilisation is central to the measurement of institutional performance (Lindsay, 1982). According to Mirabent (2012), universities and their medical schools operate in a turbulent environment and, therefore, adapt to changes to position them to deliver optimally on their core mandates of teaching, research and service.

Globally, financing for higher education has undergone significant change during the 21st century. Traditionally, higher education costs tend to rise over and above the rate of increase of resources available to educational institutions (Knight, 2009). Johnstone (2009) demonstrated that a consequence of this has been a shortfall in the revenue required to meet the increasing costs of instruction and research, as well as the increasing revenue needs of rising enrolments. Both developing and developed economies require adequate funding to operate since through globalisation, the world indeed has become a global village. Globalisation, and its accompanying changes, has also brought the improvement in the quality of students' learning and learning experiences to the attention of higher education managers (Stukalina, 2011; McRoy and Gibbs, 2009). A growing awareness by students of the responsibilities of higher educational institutions towards the provision of effective teaching and training of medical students, has served as an impetus for quality service delivery by medical schools. The concept of globalisation has influenced many governments to shift from an industrial-based economy to a knowledge-based economy, driven by both scientific and technological advancement (Saint et al, 2003).

Globalisation has also ensured that individuals and countries keep abreast of developments, within their immediate environment and the world at large to ensure competitiveness and continued relevance. Consequently, no country can run a competitive economy in the world today without a significant proportion of its population participating in higher education (Collings and Rhoads, 2008). Also, knowledge increases capacity for improved productivity and it promotes a country's competitive advantage (Porter, 1990). According to a World Bank report (1999), higher education is the bedrock of a knowledge economy and society in all nations. The age-long militating factors against higher education in developing countries in fulfilling their responsibility has been finance and efficiency (Saint et al, 2003). This study therefore sets out to critically investigate finances available to public medical institutions in Nigeria as well as to examine the level of efficiency on the utilisation of funds deployed by the medical institutions.

The funding of higher education involves a huge deployment of financial and human resources. According to Chiang (2004) and Williams (1992), governments acknowledge the importance of financing and investing in higher education system, including the ability to influence educational activities and pursue efficiency and social equality. Studies show that universities play a catalytic role in rapid economic development since the emergence of a knowledge-based economy (Duderstadt, 2000; Kerr, 1995). For this reason, knowledge has become one of the most important factors for economic development and prosperity in the 21st century. This is more evident in Organisation for Economic Cooperation and Development (OECD) countries, where investments in the intangibles (the knowledge base of a country) exceed investments in tangible assets (OECD, 2010a). The implication is that the developed and developing economies have realised that education holds the key to rapid economic and social development and, consequently, there is a general consensus that investment in tertiary education is the catalyst for full employment, competitiveness, growth and social cohesion (Asplund et al., 2008). As earlier pointed out by Teixeira et al. (2006), the funding of higher education has a direct relationship with accessibility by students, whether in public or private schools.

The broad ramifications and resultant implications of the financing of higher education, and the participation in and accessibility of higher education, are articulated by Johnstone (2009) who identified some key attributes of good quality tertiary education, which he describes as:

- The costs involved in teaching per student, which has steadily assumed an increasing dimension.
- Increasing enrolment.
- The role expected of higher education in facilitating rapid economic development, as well as individual betterment, consequent upon the transformation of world economies into knowledge-based economies.
- The failure of governmental or public revenues to maintain their share of cost increases due to the pressures of higher educational expenditures.
- The trend towards increased globalisation, which contributes to the increasing cost trajectories and faltering governmental revenues.
- The pattern of increasing liberalisation of economies and the resulting decentralisation, devolution, and privatisation of public and private systems, including institutions of higher education.

The basis for funding of tertiary education has been established as reported in various studies earlier discussed. The critical consideration is how to allocate the contributions among the various stakeholders. For education to be accessible and promote equity, the responsibility of providing higher education for society needs to be shared among stakeholders in the educational sector; as the federal government alone may not have the capacity to adequately fund public tertiary education (Henry et al., 2001). This lack in funding is seen to be the result of declining resources accruable to the federation account and the competing social and developmental commitments to be provided simultaneously for the entire country at large. As a result, federal tertiary institutions need to be empowered by their proprietor(s) to identify and access other sources in order to raise funds, ensuring that the educational system runs effectively and in the most efficient manner, guaranteeing relevance and competitiveness, both locally and internationally.

In the specific case of medical education, Malu (2010) emphasises that universities constitute the mainstay of medical education in Nigeria. Governmental policies on medical education are translated into reality through the universities and regulatory bodies. A medical school, in turn, is the arm of a university that inculcates the skills and knowledge to educate medical doctors who are able to compete internationally with their counterparts in the provision of health care delivery (Shehu, 2002). In the same vein, Catto (2000) established the idea that the relationship between a medical school and a university is complex, with the role of the medical school underappreciated in many cases. Catto (op. cit) describes a medical school as an integral part of a university, which is a school with a curriculum leading to the award of a medical degree.

The mission of every medical school includes medical teaching, research and patient care. Medical schools run expansive curricula for the training of medical doctors. For relevance and competitiveness, the syllabus is constantly reviewed and updated, requiring a huge financial commitment. The curriculum of undergraduate training in medical schools is typically divided into preclinical and clinical phases. Courses taught at the preclinical undergraduate level include; anatomy, biochemistry, physiology, general pharmacology, psychology, medical sociology, bio-statistics, genetics, morbid anatomy, clinical pathology, medical microbiology and parasitology, special pharmacology, clinical pharmacology, environmental health, epidemiology and control of communicable diseases and immunology. The clinical phase courses are; pediatrics, internal medicine, psychiatry, surgery, obstetrics and gynaecology and community health. While on placement at a teaching hospital, students work under the supervision of physicians (known as consultants and residents) and other members of the healthcare sector. Tertiary institutions usually have medical schools, where courses and programmes of education are taught leading to the production of medical doctors and other health practitioners.

The College of Medicine is an integral part of the University of Lagos which, in turn, is a part of the larger global community. The University of Lagos is a federally-owned institution and it is one of the first generation universities in the country. Developments in almost all facets of life, including health and medical services, are instantly reported and accessed through the medium of technological advancement. Medical institutions, being subsets of the global community, need to constantly update the quality of their functions and service delivery to maintain their relevance. The accomplishments of this task require availability of funds as a major resource item. This was corroborated by Cooke et al (2006), who affirmed that the universal goal of medical education is to train excellent physicians who will maintain the health of the population. To perform this function effectively, medical institutions require adequate financing. To achieve this, the funding base of medical schools and their parent universities must be broadened, not only to ensure wider sources of raising funds, but also to assist in protecting the university's autonomy (Chiang, 2004; Goedegeburre, 1994; Caglar, 1993). According to Nkrumah-Young and Powell (2008), the missions of higher education institutions may be accomplished through adequate funding sourced through private, state and shared financing. Public funding influences how public higher institutions function since, typically, the government that makes the funds available determines the resource allocation models to be used by the institutions (Orr, 2005).

The government (fund providers) and tertiary institutions are responsible and accountable for the resources entrusted into their care (Nkrumah-Young, 2005). Without accountability, institutions may become inefficient. Being accountable means that institutions must focus on the efficient and effective deployment of funds in their care in the discharge of their statutory functions. The British economy provides an excellent example of this, with medical education and research funded jointly by the Department for Business, Innovation and Skills (BIS) and the Department of Health (DH).

Funding for medical education in the United Kingdom comes from a variety of sources:

- The government
- The dual support system for research funding
- The National Institute of Health Research
- Major medical charities
- Industry

The economic trend for funding in developed countries is that the government is not solely responsible for funding tertiary education. Other stakeholders, such as the alumni associations, parents, students and the private sector contribute significantly towards the funding of education, generally, and medical education in particular. Most developed economies generate a sizeable portion of finances for tertiary institutions through tuition fees. In Japan, according to Burden (2008), student tuition is a major source of revenue to universities. Also in England, 60% of funds for higher education come from the government while the rest is made up of other sources, one of which is tuition fees from students (Prowle and Morgan, 2004). The current trend is that tuition fees have become popular in tertiary institutions (Bou Habib, 2010) and an important source of raising funds (Teixeira and Koryakina, 2011). For example, in China the government has shifted its funding system from a state supervised model to a diversified funding base, using mixed sources from government grants to charging fees (Chow and Shen, 2006; Tilak, 2004).

The introduction of tuition fees and greater commercialisation of university services have been adopted as strategies for supplementing funding sources in Higher Education Institutions (HEIs) (Vidovich et al., 2007). Generally, countries that desire to be competitive as well as aspire for growth ensure that sufficient funds are budgeted and released for tertiary education and medical training facilities in their domains.

The situation with the funding of public tertiary institutions in Nigeria is less than satisfactory. Odusote (2013) reported that from 1990 to 2001, only 58% of the funding recommended by the National Universities Commission (NUC), to be released to federal universities and medical schools, was actually released to the universities and their medical schools. Furthermore, the percentage shortfall in 2003 was 24.6% and in 2004 it was 43.5%. With such gross deficits in the funding of the parent universities, Odusote (op. cit) argued that public medical schools were, and are still, inadequately funded. He recommended that as medicine is a public trust, the leadership of the medical schools and the medical profession should be innovative and determined in their quest for sourcing additional funds to run their programmes.

The same is also the case with the teaching hospitals as training of medical personnel takes place in the medical schools and the teaching hospitals which serve as the laboratory for practical exposure. Hashim (2002) recognised that a major policy for the development plan of the health sector in Nigeria should involve measures designed to coordinate and intensify the development of training programmes aimed at accelerating the production of health personnel in the country. Medical schools and teaching hospitals have funding challenges, however, neither set of institutions in Nigeria has made significant efforts to scientifically determine how to utilise available funds in the most efficient manner in the discharge of their daily activities. In hospitals, for example, the consumption of a large number of inputs has not frequently corresponded to the production of the same or more proportion of outputs. Sometimes, the outputs even declined with increase in inputs due to the influence of the congestion effect on efficiency (Clement et al., 2008). In the case of medical schools, a myriad of problems have been identified as issues impeding access to university education in Nigeria. Idogho and Imonikhe (2012) highlighted the major areas that hinder the provision of quality education in Nigeria as:

- Carrying capacity
- Infrastructural/facilities
- Inadequate public financing
- Economic constraints
- Labour market failure
- Curriculum development
- Curriculum delivery.

Training facilities in Nigerian medical schools require upgrading and expansion to enhance the opportunity for the education of more doctors. This requires huge financial resources. Where the government is unable to fund tertiary institutions and medical schools appropriately, an enabling environment is required to allow the institutions to raise funds and financial resources that would be adequate to render the services optimally to the public. In order to provide an enabling environment, one that facilitates an improvement in the revenue generation capacity of higher institutions, then the legal and regulatory framework for funding these establishments has to be reviewed. According to Fafunwa (1971), the subsisting Federal Government's policy of free tuition and lodging charges, among others, at the undergraduate level of university education, has resulted in a sharp deterioration in the funding of universities and a pegging of boarding fees.

This study examines the role of public finance in the provision of teaching and learning in public medical schools in Nigeria. The philosophical stance of the researcher is positivism. A case study of the College of Medicine of the University of Lagos (CMUL), a federally owned medical school, is undertaken to study the impact of funding utilised by the institution as it affects teaching and learning in the institution. According to Johnes (1992), the mission and objectives of an organisation are established before performance evaluation can be carried out. Universities are complex organisations, comprised of various faculties, departments and units, with each having its own goals and accomplishments. Concurrent with this, the primary functions of a university and its medical school are to promote teaching, research and community service (Catto, 2000). This mission becomes realisable only when there is adequate funding available to the institution to execute this mandate of producing graduates that could provide quality medical services to the citizens of the country. This study essentially is an attempt to investigate how improved funding could enhance teaching and learning in CMUL.

CMUL has been chosen for this case study due to its age and the location of the medical school in Lagos State, the commercial nerve centre of Nigeria and a cosmopolitan city. Findings from this study may be representative of other federally-owned medical schools in Nigeria due to the fact that they all adopt a similar funding model, as prescribed by the federal government of Nigeria. Accordingly, this study also discusses further the results achieved by medical institutions in other parts of the world where adequate financial resources are available to facilitate effective teaching, research and community service to form the benchmark upon which CMUL may develop its funding threshold.

1.2 Statement of the research problem

The tertiary educational system in Nigeria has been beset by inadequate financial resources to provide quality education to the citizenry; a situation prevalent more than the last two decades (Odusote, 2013). Dugas et al (2018) also observed that shrinking budget allocations have been made to public universities by US government since 2008 and this has decreased per pupil funding allotments with grave consequences for quality and cost efficiency. Ahmed (2011) argued that underfunding is a major challenge facing tertiary institutions in Nigeria. Earlier study by Nwangwu (2005) emphasised that poor funding of education brings about products (graduates) that are weak in intellectual competence.

As observed by Johnstone (2009), federal universities have had to cope with rapid growth in the student population since the restoration of democracy in Nigeria in 1999, when a larger number of the population had the opportunity to pursue higher education. The Federal Government of Nigeria runs a policy of free tuition at the undergraduate level and assumes the responsibility for financing the tertiary institutions owned by it. However, the percentage increase in student enrolment is not matched by commensurate public funding. This has led to inadequacies, such as overcrowded classes, a shortage of library and laboratory facilities as well as poor hostel conditions, which have ultimately affected the quality of education in the country. Of equal importance is the requirement of ensuring judicious utilisation of the available resources. This places the onerous responsibility of attaining efficiency in the funds utilised in running the activities on the education managers.

Generally, the proportion of education budget to total budget of the federal government of Nigeria increases from 3.22% in 1991 to 9.31% in 1996 and hovers around 7% – 9% for the other periods till 2016. It was discovered that only two years of 1999 and 2006 are the periods which budget on education reached a double digit of approximately 11%. Specifically, education funding of the College of Medicine of the University of Lagos (CMUL) suggests that the subventions allocated to it from the federation account decreased for most of the periods. A decline of 33.42% in 1995 and a further reduction in subvention by 18.12% in 1996 with 9.87% reduction in 1998 as compared to their previous year's values. The years 2001, 2002 and 2004 also have reduced subventions to the tune of 25.73%, 17.88% and 18.68% respectively from their previous year's values. However, astronomical increase in subvention was identified for the years 1992 with 208.6%, 1994 with 115.7% and 1997 with 113.93% increase respectively. Correspondingly, the state of medical education in Nigeria indicates an astronomical increase in the number of student enrolments for the period under review. According to the National Bureau of Statistics (NBS, 2016), the number of student applicants given admission by the Joint Admission and Matriculation Board (JAMB) was 20,543 while the number of successful student applicants in 2013 and 2014 were 22,624 and 18,540 respectively. Funding clearly is a major challenge in the provision of tertiary education in Nigeria.

The Federal Government of Nigeria applies normative and contractual funding model for the public universities and medical schools in the country. The normative funding model adopts an objective and standardised criterion to determine and distribute funds among universities. The contractual funding model involves the adoption of mutually agreed criteria between government agencies in charge of universities (the NUC, in Nigeria) and the universities themselves, about the objectives to be achieved by those institutions, measures of achievement and resources attached to the improvement of quality (Lopez, 2006; 2003). This funding approach was similarly adopted by Latin American countries, such as Brazil, which changed its model of funding during the 1990s from a historical block funding model to a more rational model, using some formulae and the contract model (Abadie, 2009). Similarly, Argentina's model evolved from a historical model to a model which combines historical allocations and formulae programmes (Carlos, 2002; 2000).
CMUL, being a federally-owned medical institution, adopts the normative and contractual funding model. The federal government, as the proprietor, requests the universities and the medical schools to prepare and submit financial estimates at the beginning of each academic year. The submissions by each university is made through the NUC, a supervisory agency which usually fine tunes the figures to the level upon which the universities benchmark the preparation of the annual domestic budget.

According to Manasan (2012), normative funding refers to the application of a set of prescribed objective criteria and norms, designed to promote and reward quality instruction, research and extension services as well as financial prudence and fiscal responsibility.

The criteria used in the normative funding formula include the:

(i) full-time equivalent enrolment in each programme level and discipline
(ii) number of graduates in each programme level and discipline
(iii) measures of the State Universities and Colleges' (SUCs) inputs to extension services
(iv) measures of SUCs extension services' outputs
(v) measures of quality of teaching personnel
(vi) measures of quality of SUCs graduates as proxied by their performance in licensure examinations
(vii) number of the SUCs colleges/departments, recognised as Centres of Excellence (COEs) or Centres of Developments (CODs)

Funding for the smooth running of CMUL is sourced from the federal government subventions; intervention funds and grants; obligatory fees paid by undergraduate and postgraduate students; tuition fees paid by post-graduate students; endowments and internally generated revenues (IGRs). In 1977, the Federal Government of Nigeria abolished the payment of tuition fees in all undergraduate programmes of federal universities and medical schools. This policy curtails effectively the ability of federally-owned medical institutions to raise adequate funds that could have accrued from the payment of tuition fees payable by undergraduate students. The universities are allowed to collect service charges for facilities, such as accommodation, sports and health services, from these students. Only postgraduate students could pay tuition fees and the amount paid by such postgraduate students are grossly below the current market rates payable at state and private universities. The policy of free education was strongly criticised by Adaralegbe (1990), who questioned the so-called right to free education in a depressed economy such as Nigeria and further argued that the government, parents or the people must pay for education for it not to amount to an empty promise and a futile exercise. Bello (2014), at the Annual Memorial Lecture delivered at the University of Lagos, cited Adesina (1990), who had noted that other countries which ran free education programmes provided opportunities for raising funds by the students, directly or indirectly within the system, to finance education. This opportunity, which could allow students to access adequate loans to finance their education, does not exist in Nigeria.

Government releases of subventions and grants to federal medical schools have been reducing on a yearly basis due to the limited resources accruing to the government from crude oil sale; the mainstay of Nigeria's economy. Although this is not peculiar to Nigeria, the worldwide trend in funding tertiary education is that rising costs are not fully covered by the government due to the competing needs from other sectors of the economy, that also require adequate federal government attention on funding obligations. Such areas include primary and secondary education, public health, public infrastructure, economic development and safety and security (Johnstone, 2006). According to Wangenge-Ouma (2008), state funding for higher education per student in real terms, in England, Botswana, Jamaica, Hungary, New Zealand and South Africa, have been declining and there have been inconsistencies in terms of the expectations placed on the universities, compared with the limited budgetary support they derived from the public. This development propelled the universities to design strategies to generate additional funds for economic self-determination and survival. It also impacted negatively on the ability of universities and medical schools to generate large pools of funds to execute their capital and recurrent expenditures maximally. Similarly, Center on Budget and Policy Priorities (CBPP, 2016) reported a consistent drop in per pupil funding allotments to state colleges and universities in US since 2008, with median decrease of 21 per cent across states. Yearly, the federal universities in Nigeria do not receive all their requests for funds in full from the Federal Government. The other window to charge fees on undergraduate programmes is lost at public tertiary institutions in Nigeria. Similarly, unlike their counterparts in state and private universities, federal institutions are precluded from charging market rates for postgraduate programmes. This is a challenge which requires decisive action to boost revenue generation capacity of federal tertiary institutions in Nigeria.

In tandem with the old dictum of "He who pays the piper dictates the tune", the Federal Government does not only have functional as well as operational control on public educational institutions in Nigeria but also the personal independence of the individuals running the affairs of these institutions are subservient to the philosophy and direction of the ruling political class from time to time. The Pro-Chancellors of these educational institutions in Nigeria are appointed by the executive and ratified by the legislature. Also, principal officers running the day-to-day affairs of these institutions such as the Vice-Chancellor, Registrar, Bursar, and the University Librarian are finally ratified by the executive with the institutions only having a choice of recommending three (3) outstanding individuals in each case.

Arising from the foregoing, the objectivity and autonomy with which these officers can assume to independently discharge their avowed responsibilities would be subjected to the manifestoes drafted by these political office holders. Also, of concern is that these institutions are aligned to the political dynamics of the electioneering processes whereby the political office holders try to retain power at all costs; a fallout of which could be that agreement may be reached to divert public funds for political aggrandisement and selfish purposes. Therefore, the issue of funding of public educational institutions in Nigeria cannot be discussed without understudying the possible political factors that are capable of undermining the impact which the allocated fund from the federation account could have on the improvement of tertiary education in general and medical education in particular. As a result of this challenge, most of these institutions crave for financial autonomy from the federal government in order to have enough funds to operate and also attain maximum efficiency.

With particular reference to the University of Lagos, the CMUL has a semi-autonomous status as it was created by an Act of Parliament. It has a responsibility to source and manage its funds optimally in the discharge of its statutory obligations of training medical students to world standards. With the goal of attaining the mission and objectives of HEIs, it is implied that education managers devise strategies and programmes that enable them to raise adequate finances to deliver on their core mandate (teaching, research and community service, in the case of CMUL). According to the Organisation for Economic Cooperation and Development (OECD) report (1990), public universities must embrace change to realise a more efficient use of the limited financial resources accruing to them from the public treasury. There can be little doubt that the ways in which HEIs receive their funds affect their incentive, and hence influence their internal organisational behaviour and the composition of the academic services they provide. Kitagawa and Woolgar (2008) in Japan, found, as in many OECD countries, that policy makers and university administrators had embraced change which accorded universities greater autonomy and an independence that engendered responsiveness to students' needs. Williams (1992) reiterated that various policy makers on education have been introducing new resource allocation mechanisms to bring out the maximum benefits from the limited funds available, to achieve the educational goals and objectives that they have set and increase competitiveness and financial autonomy. The regulatory authorities in Nigeria could benefit from this global phenomenon by creating an enabling environment, encouraging medical schools to raise adequate funds for running the academic programmes efficiently and effectively. CMUL, like other medical schools in Nigeria, could justifiably embrace these changes, premised on being a member of the world's global village.

The researcher's personal experience, in his capacity as the Chief Financial Officer of the CMUL over the last two decades, revealed a dearth of funds needed to effectively run the institution in terms of consumables required on a routine basis for student training, funds needed to maintain existing infrastructure as well as the replacement of old and obsolete equipment required for teaching and learning. A major source of concern also is whether conscious efforts are made by education managers at CMUL to ensure value for money in respect of teaching and learning. This implies that efficiency in funds utilisation must be measured as a deliberate policy of the medical college. The researcher also observed a decline in services and research activities during the study period, in contrast to the 70's and 80's when numerous technological developments took place in our medical and health institutions in order to solve local health challenges. Currently, and in contrast, there are very few learned journal publications in this direction. The quantum of funding available, however, has been increasing in absolute terms over the past two and a half decades, but declining in real terms due to inflationary pressures. The funding available to train students optimally has thus been inadequate to support the level of consumables and other training costs needed to cater for rising student enrolment and the maintenance and upgrading of a decaying infrastructure. This brings to fore the need to ensure judicious utilisation of the meager available funds in the training of the medical students in general.

The motivation for this study, therefore, is based on the fact that there has been an increasing number of medical institutions in Nigeria, all of which seem to be suffering from the same funding issues in terms of non-availability of modern equipment for teaching and research, decaying infrastructure, and improvement in services. This study attempts to explore the means through which financial resources of public medical institutions in

Nigeria could be enhanced using CMUL as a case study. Also, cognisance was given in the study for mechanisms for measuring efficiency in funds utilised in the discharge of services by the medical institution. Hence, the output of this study will bring to the fore the extent of this problem and proffer appropriate solution.

1.3 Research Objectives

The broad objective of this study is to examine the role of budgeting and institutional factors on funding of public medical education in Nigeria, using College of Medicine of the University of Lagos as a case study.

Specifically, the study is designed to:

(i) Ascertain the trends in budgeting and funding structure of public medical education in Nigeria.

(ii) Examine the efficiency of budgeting and fund utilisation on public medical education in Nigeria.

(iii) Investigate the impact of funding requirements on public medical education in Nigeria.

(iv) Assess the significance of institutional factors on budgeting and funding on public medical education in Nigeria.

1.4 Research Questions

The following research questions are posed to guide the investigations for the study:

1. Are there structural changes in the trends of budgeting and funding of public medical education in Nigeria?
2. How efficient has budgeting and funding been utilised on public medical education in Nigeria?
3. To what extent has more funding requirements been suggested for public medical education in Nigeria?
4. What roles do institutional factors play on budgeting and funding of public medical education in Nigeria?

To address the above stated broad and specific objectives, the study would:

- Examine stylised facts of medical education;
- Adopt the Data Envelopement Analysis (DEA) to measure the efficiency of funds utilisation. The use of likert scale questionnaire would also be employed to analyse the perception of key stakeholders which serves to further support or otherwise, the results obtained through DEA technique.
- Multivariate analysis would be computed for impact assessment and measurement of institutional factors respectively.

1.5 The conceptual framework

According to Vrasidas (2001), the conceptual framework guides the process of enquiry of a study, provides a road-map and communicates the purpose of the study to the relevant stakeholders. A conceptual framework is a set of related ideas behind the research design. It may be a simple list of concepts and their possible associations or a more elaborate schematic diagram of key influences, presumed relations and possible outcomes of a research problem. Literature reviews can identify findings from previous research that will suggest ways of conceptualising the current problem (Ulin et al., 2005).

Traditionally, the funding of a medical school is achieved through budgetary provision, which derives from the budgeting method adopted by the institution in relation to the sources of raising revenues (Lopez, 2006). Strategically, the conceptual framework sets the stage for providing a clear focus for research. The conceptual framework for this study is based on the Resilience and Youth Development Module (RYDM) model to assess the efficiency of operations within a school system. It clearly establishes the interrelationships of budgeting and funding inputs and their transpositions into various processes to generate the outcomes produced by the CMUL.

1.5.1 The Resilience and Youth Development Module (RYDM) model

The RYDM is a component of the California Healthy Kids Survey. The emphasis of the RYDM model is to assess the strength, competencies, risks, problems, positive social and health attitudes as well as the behaviours of youths. The model has been applied to schools, community development, learning organisations and research institutes; hence its relevance to medical schools such as CMUL. The model focuses on the relevance of the key functions of medical schools towards the realisation of producing well trained medical doctors and allied medical professionals. This is the outcome of the activities of a public medical school (i.e. CMUL). The RYDM model documents the transformation of input variables through processes, so as to achieve the expected outcomes. This conceptual framework is relevant for this study but most suitable in addressing the second research objective, specially to examine the efficiency of budget and fund utilisation on public medical education in Nigeria.

Empirical studies carried out by scholars in this respect have shown that university administrators seek to improve resource utilisation and, consequently, found efficiency analysis an important aspect of managing financial resources (Caroline et al., 2007; Fandel, 2007; Caballero et al., 2004; Avkiran, 2001; Chalos, 1997; Glass et al., 1995; Cohn et al., 1989). The thrust of most of these studies has been the distribution pattern of educational resource inputs in an efficient manner to improve outcomes performance (Sacoto et al., 2015). The input variables generally comprise factors employed in service delivery of the educational institutions. These inputs comprise human, financial and materials resources (Martin, 2006).

In the case of CMUL, the components of input variables, processes and expected outcomes are tested using DEA model to establish the efficiency of resources utilised to provide medical education. This relationship works in the manner as presented in Figure 1.1

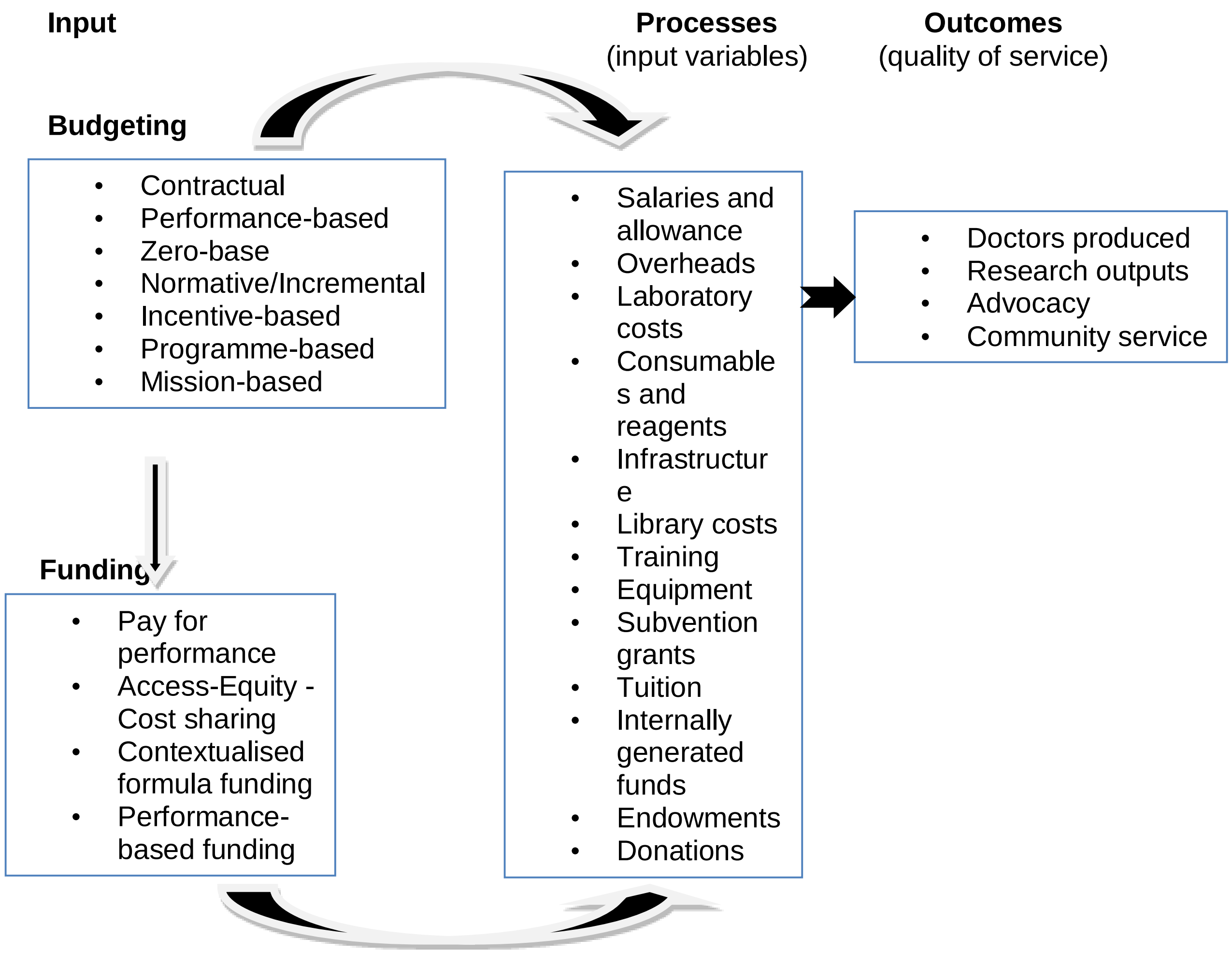

Fig. 1.1: Conceptual Framework

Source: Adapted from the RYDM conceptual framework

1.6 Originality of research

The funding of education, generally, and medical education, in particular, has been a worldwide phenomenon (Nuwagaba, 2013; Ibrahim, 2007). Though it has been a major issue around the world, given the fact that a government has a duty to make equitable allocation of funds to all sectors of the economy, medical education in Nigeria has been bedevilled with inadequate funding; exacerbated by the fact that federal tertiary institutions, including their medical schools are not allowed to charge tuition fees at the undergraduate level (Okojie, 2014). Ironically, the federal government, that prevented public institutions from charging tuition at the undergraduate level, failed to make adequate budgetary allocation for funding of these federal government-owned tertiary institutions and its medical schools in its annual budgetary documents. This has led these federal institutions to resort to exploring other income generating activities to augment the subventions, which are, for the most part, not released in full by the government due to the competing needs to be met at the national level, given the limited resources available to the treasury (Akintoye, 2008; Jones–Esan, 2007; Henry et al., 2001; Odebiyi and Aina, 1997).

The question arises as to whether the dwindling revenue profile of CMUL has any relationship with the effectiveness of the medical school in the discharge of its basic responsibilities of teaching, research and community service. Some federally-owned tertiary institutions have been swayed from their primary role, of delivering qualitative educational services, in their quest of pursuing commercial business activities completely at variance with their core mandate. The effect is that the students trained may not acquire all the necessary skills and training needed in becoming medical doctors, with dire consequences to the citizenry.

Most related studies in Nigeria are on the funding of tertiary education in general. There have been limited studies on medical education whereas it occupies a preeminent position in the social and economic wellbeing of human lives (Ibrahim, 2007). The few studies completed on the funding of tertiary and medical education in Nigeria were done some years ago. Ibrahim (op. cit) and Akintoye (2008) are prominent among the recent studies conducted in Nigeria, specifically on medical education. Studies by Obansa and Orimisan (2013) and Adewuyi and Okemakinde (2013) examined healthcare financing and trends on higher education financing in Nigeria. Both studies used secondary data sourced from public institutions such as Federal Ministries of Education (FME), Federal Ministry of Finance (FMF), National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN) and found out that federal tertiary institutions were not adequately funded and this had negative implications on the quality of tertiary education provided in Nigeria.

These studies emphasised the need to appraise the present role of the Nigerian Government regarding the funding of higher education with a view to finding alternative mechanisms towards financing the educational system in general.

The summary is that those studies on Nigeria are fundamentally situational reviews, lacking in detail or rigorous academic content. Whereas, this thesis, on the other hand, is based on a theoretical foundation of the negotiated funding model and robust quantitative analysis to verify the result obtained from the secondary data of CMUL and questionnaire administered. This is novel on its own in terms of studies in developing economies, such as Nigeria.

1.7 Significance of the study

Funding of medical education is a contemporary area of research in the world. It is topical in the developing world, especially in Nigeria, where most studies that have been done are on funding of tertiary education with little focus on public medical education. Also, limited research had been carried out on the possible implications of gradual decline in funding of higher education by government on quality and service delivery (Zhao, 2001; West, 1998; Miller and Pincus, 1997). In order to sustain quality of training of medical students in the wake of shrinking budget allocations to public universities by the government, institutions have devised means to increase revenues and decrease costs as much as possible (Dugas et al, 2018; Yilmaz et al, 2017; Scott, 2016). The use of DEA technique becomes apt in this study. Consequently, this study attempts to provide a template on utilisation of funding by public medical institutions using DEA technique to highlight the efficiency in the funds utilisation.

Accordingly, this study will benefit:

i. Government - It would assist the federal government of Nigeria in terms of policy formulation and implementation with a view to improving overall funding of public medical institutions.
ii. Public - The public would benefit when there is improved funding in all federal medical schools in the country.
iii. Other researchers - Further studies that may be carried out by other researchers in this area would rely on quantitative analysis of using DEA technique complemented by use of questionnaire and multivariate analysis of data.

1.8 Methodology

Data for the study were obtained from primary and secondary sources; the former were the questionnaires administered while the latter were the books of the medical school, academic journals and relevant books. The study is predicated on negotiated funding model. The study adopts quantitative research paradigm. Output-oriented Data Envelopment Analysis (DEA) technique was employed to measure the extent to which budgeting and funding affected teaching and learning at the CMUL. According to Lee (2009), DEA promotes efficiency in data management and opens new application areas in statistical inferences for users. The study commenced with baseline efficiency estimations; this was extended through sensitivity analysis to determine the effect of budget and funding on the model. The analysis was strengthened with the use of primary data analysis to achieve one of the stated objectives. This was through the administration of questionnaire to targeted respondents. Questionnaires were administered to the key stakeholders of CMUL to ensure robustness of the results obtained through DEA technique. Following similar studies conducted by Alshamy (2011) and Sharifabadi (2012), questionnaires were used to complement findings from secondary data. A total of 423 questionnaires were distributed to cover a total population of 10,327. Data obtained from the questionnaire were analysed with the aid of scientific procedures, namely SPSS package.

Additionally, multivariate analysis was used to evaluate the impact of budgeting and institutional factors on funding of public medical education. Further detailed methodological stance and procedures for the study were discussed in chapter 3 of this thesis.

1.9 Limitations of the study

This research has achieved its aim and answered the research questions raised; there are some limitations encountered in the course of conducting this research. The quantitative approach was adopted and had been justified in chapter three. However, a number of limitations encountered are as highlighted below:

- The study adopts a case study approach as College of Medicine of the University of Lagos (CMUL) was chosen to represent federally-owned medical institutions in Nigeria.
- Again, the scope of this study is on federally owned medical institutions. Time constraints forestalled the inclusion of state and private medical schools.

There is no doubt that CMUL well represents federally owed institutions in Nigeria as it is located in the metropolitan part of the country; Lagos State. As one of the second-generation higher institutions established in Nigeria, it has midwifed different patterns and attributes of a typical higher institution of learning in Nigeria as suggested by its historical antecedents and current modes of operations. However, the propositions of the central limit theorem suggest that as a sample moves closer to the population, it more reflects the outcomes of the population. As such, the time constraints could not afford the researcher the opportunity to expand the sample scope to include state and private medical schools in Nigeria.

1.10 Delimitation of the Study

This research also recognises the limitations inherent in quantitative approach. As a result, the study is an integration of both qualitative and quantitative analysis. The research, in addressing the limitation of quantitative methods, employed the use of questionnaire to address the human aspect that may not have been captured by the use of both DEA model and multivariate analysis. More so, the investigation on the institutional factors that affect public financing of medical education in Nigeria suggests that the study also analyses the political economy of public finance. This is an aspect of the empirical literature that this study has made a significant contribution. This is highly imperative, as the role of political factors as well as the institutional issues bedeviling public finance in a developing economy such as Nigeria cannot be totally discounted.

1.11 Scope of the study

The scope of the study is to examine the impact of public finance on public medical education in Nigeria. The study is delimited to CMUL due to the twin constraints of time and fund (Njiru, 2002; Easterby-Smith et al, 1999). Consequently, the study examined critically the effect of budgeting and institutional factors on the adequacy of funding requirements for effective delivery of medical education in Nigeria, using CMUL as a case study.

The CMUL was taken as the case study; being one of the pioneer medical institutions in Nigeria, situated in a metropolitan part of the country, where demand for medical education is assured. Although this medical school is not the first in Nigeria, Lagos State remains the commercial nerve centre of Nigeria with a metropolitan status where a complete sphere of factors that affects the service delivery of an educational institution has a realistic outlook. It is envisaged that findings obtained from this research will serve as a good generalisation for other public tertiary medical institutions in the country. The study covers 25 years; from 1991/1992 to 2015/2016 academic sessions. This coincides with the period when the institution began full financial autonomy of budget allocation and funding releases from the Federal Government to run the medical school as an integral part of the university.

1.11.1 Structure of the thesis

The structure of the thesis is as presented in Figure 1.2 below.

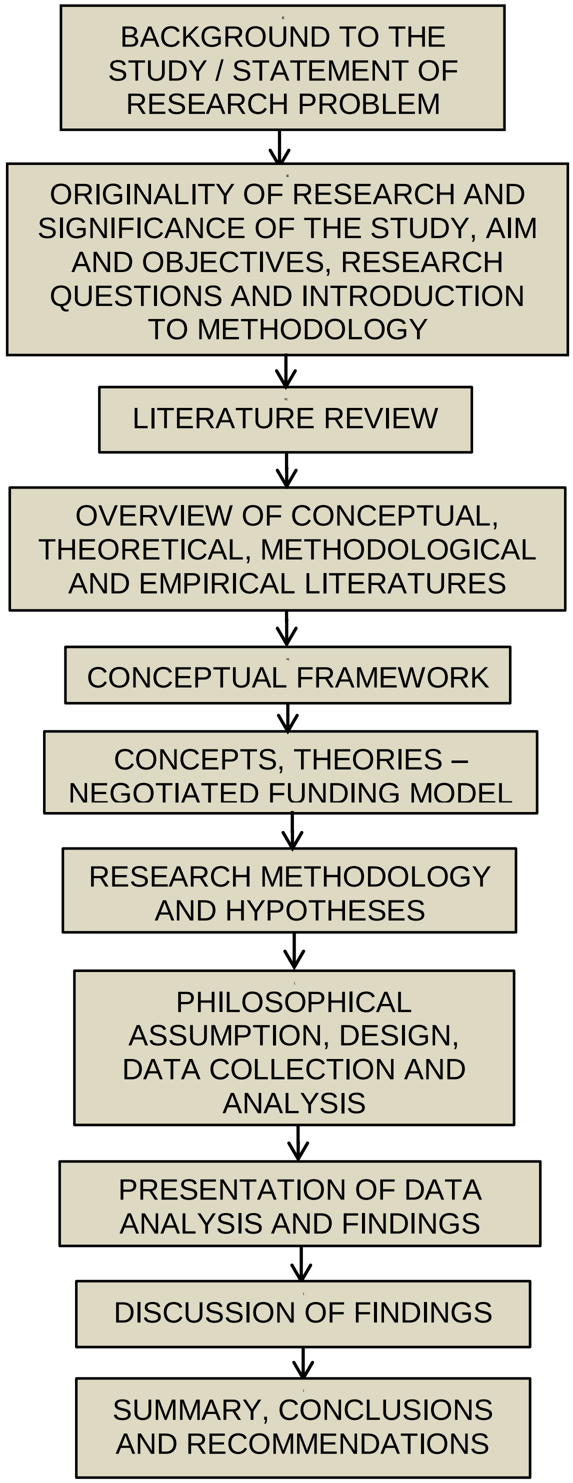

Fig. 1.2: Structure of thesis

The structure of the thesis is also represented diagrammatically below:

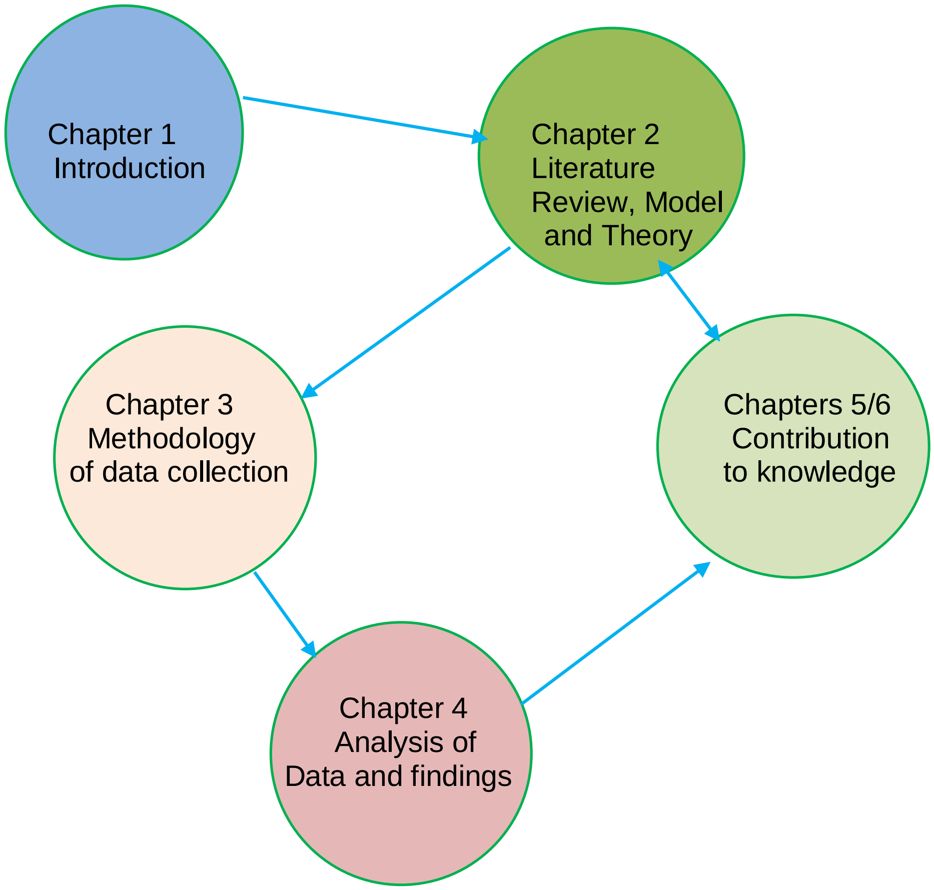

Fig. 1.3: Diagrammatic presentation of the thesis structure

1.12 Plan of study

Chapter one of the study is the Introductory Chapter. It provides a brief background to the study, a statement of the problems and the scope of the study. Key research questions and the broad and general objectives of the study are also highlighted. This chapter also discusses the conceptual framework, originality of research and the significance of the study. The chapter also provides a definition of key terms used in the study. A brief mention of the methodology adopted in the study is also made.

Following this introductory chapter is chapter two, which contains the literature review guiding the study. The chapter looks at the conceptual framework and productivity and efficiency concept guiding the study. Theoretical literature on budgeting and funding methods are reviewed. Various theories of public expenditure, human capital theory and negotiated funding model are examined. Methodological literature review covers Data Envelopment Analysis (DEA), Stochastic Frontier

Analysis (SFA) and Financial Ratio Analysis (FRA). The empirical literature involves evidence gathering from developed economies, emerging and developing economies as well as evidence from Nigeria.

The last section presents the evolution of medical education in Nigeria, a history of medical education, a review of existing institutional frameworks, an overview of medical education and sources of funding.

Chapter three is about the methodological approach of the study. Trends of budgeting and funding of medical education at the CMUL are critically evaluated in Chapter four. Also, the presentation of data analysis and findings are presented. Chapter five discusses the findings contained in chapter four, while the summary, conclusions and recommendations of the study are contained in chapter six.

1.13 Operational definition of terms

The operational definitions of terms used in this study are as follows:

College of Medicine of the University of Lagos (CMUL)	This is the medical school of the university which conducts training of medical personnel at the university.
Medical and Dental Council of Nigeria (MDCN)	This is the regulatory body that certifies students produced by the medical school as having acquired the necessary skills and competences to practice as medical doctors and dentists in Nigeria.
National Universities Commission (NUC)	The regulatory agency acting as a catalyst for positive change and innovation for the delivery of quality university education in Nigeria.
University of Lagos Act 1967 (as Amended)	The law that established the university as well as the medical school as a constituent part thereof.
Service Delivery	This represents the core mandate of the medical school which comprises teaching, research and community service.
Internally Generated Revenue (IGR)	The commercial activities of CMUL comprising guest houses and accommodation, printing press and hall rentals.

Association of American Medical Colleges (AAMC)	A regulatory agency for medical schools in the United States of America.
Full-time equivalent (FTE)	Full-time equivalent reflects how students register for academic programmes undertaken across inter-disciplinary course-offering units within the university system.
Lagos University Teaching Hospital (LUTH)	This is the sister institution established by federal government to provide the platform for clinical training of medical students in CMUL.
Ontology	Ontology relates to the nature of reality (Saunders et al. 2009, p.110). Objectivism position underlining the study relates to the gathering of secondary data on key variables. Objectivism phenomenon relates to the administration of likert-scale questionnaires to respondents on their perceptions on key variables in the study, measured in specific and quantitative terms.
Gross Domestic Product (GDP)	The monetary value of all the finished goods and services produced within a country's borders in a specific time period and usually calculated on an annual basis.
Tertiary Education Trust Fund (TETFUND)	An intervention agency set up to provide supplementary support to all levels of public tertiary institutions with the main objective of using funding alongside project management for the rehabilitation, restoration and consolidation of tertiary education in Nigeria.
New Funding Framework(NFF)	New funding framework (NFF) adopted in South Africa links the award of government grants made to universities to national and institutional planning.
United Nations Educational, Scientific and Cultural Organisation (UNESCO)	A global coordinating organisation with a mandate to allow each child and citizen have access to quality education, basic human right and an indispensable prerequisite for sustainable development.

Chapter two: Literature review

2.1 Introduction

The previous chapter examined the introduction and background of the study and statement of the research problem. The conceptual framework and theoretical underpinning of the study were also discussed. The motivation for this study was discussed alongside the significance of the study. The research objectives and questions were discussed. Definitions of key terms used in the study were provided. The chapter concluded by briefly discussing the methodology adopted for the study.

This chapter covers a review of the literature in the area of study. Literature review comprises of evaluation of the related studies that have been undertaken in the chosen area. According to Saunders et al. (2009), a critical review conducted on a study must include an evaluation of key academic theories relevant to the area of study. This thesis is a case study of CMUL; a medical school funded by the federal government of Nigeria. The critical review carried out in the study includes an in-depth evaluation of budgeting and funding concepts. Also considered are the productivity and efficiency concepts, theories of public finance relevant to the study as well as negotiated funding model. The methodological and empirical literatures were reviewed, leading to a review of the evolution of medical education in Nigeria.

2.2 Review of conceptual literature

Conceptual framework represents a set of interrelated theories that form the basis for a research. According to Vrasidas (2001), the conceptual framework is connected to a research because it guides the process of inquiry, provides a roadmap for the study and helps in communicating the purpose of the study to the researcher’s audience.

To highlight the link and relationships of key areas covered in this study a diagrammatic representation is shown in Fig. 2.1.

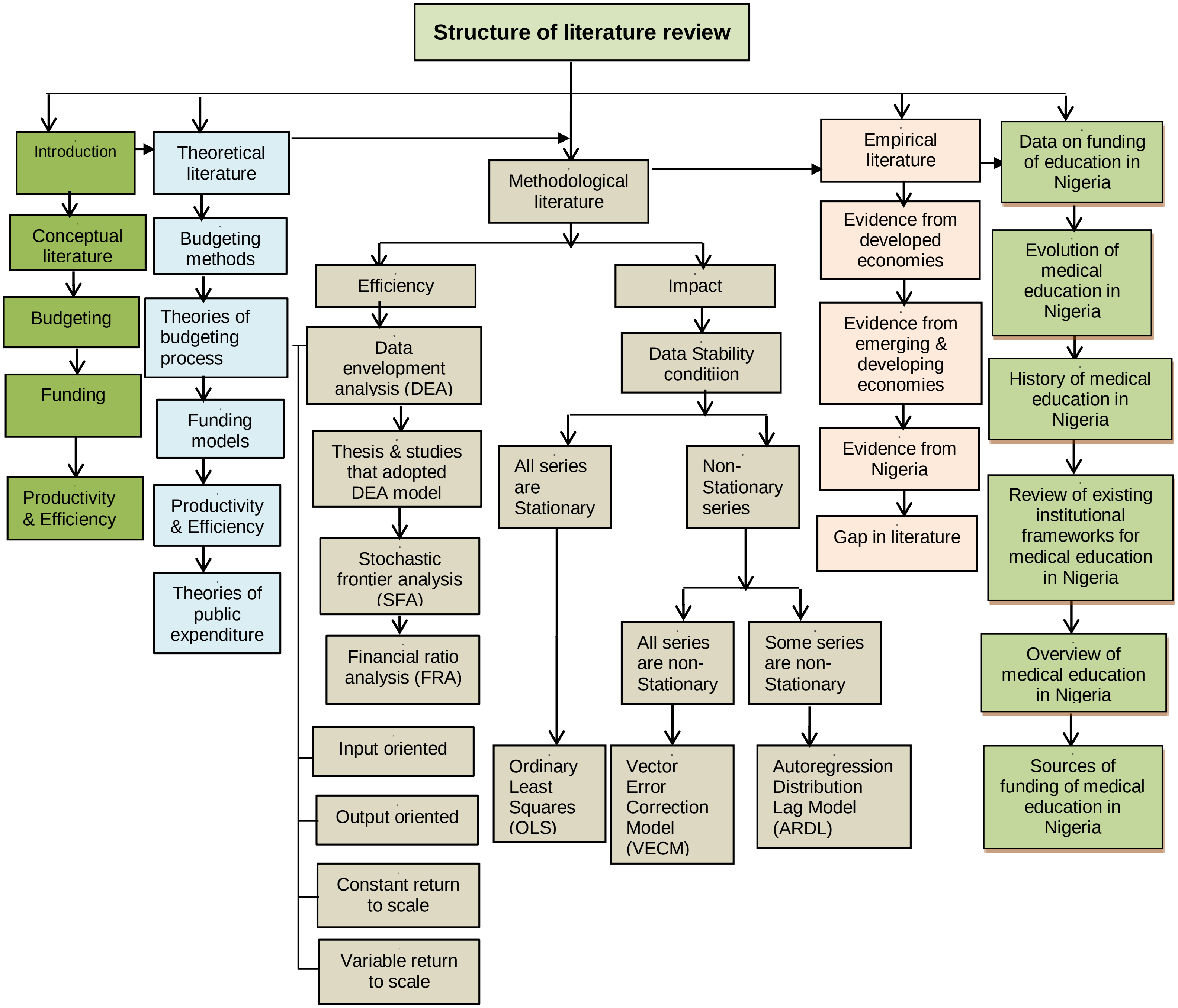

Fig. 2.1: Structure of literature review

The review of the literature is divided into theoretical, methodological and empirical literature. Under theoretical literature, various theories on funding were reviewed. The main theoretical foundation is negotiated funding model.

The methodological literature review comprised non-parametric techniques. In specific terms, data envelopment analysis, stochastic frontier analysis and financial ratio analysis were considered in detail. The parametric technique discussed is the multivariate analysis. The empirical review covered evidence from developed economies, developing economies as well as evidence from Nigeria. In this way, the reader has a full grasp of the theoretical foundation of this study complemented by an understanding of the methodology used.

2.2.1 Concept of budgeting

There are numerous definitions of a budget which have been espoused in various studies by different scholars. The definition which suits the public sector segment, relevant to federally-owned medical schools and the focus of this study, was suggested by Henley et al. (1992). In it, "budgeting" was defined as a process of measuring and converting plans for the use of real (physical resources) into financial values. It is the classic problem of how to add quantities of apples and oranges into a meaningful economic measurement. The only practical way for everyday use is to express their economic values in terms of monetary costs and revenues. Through the process of budgeting, the finance function provides the essential link between management planning and management control.

Many scholars have suggested the principal issues relevant in developing a plan that would guide the operation of an organisation. According to Kovner and Lusk (2010); Kolb and Pile (2009); Finkler et al. (2007); Finkler (2005) and Lusk and Lusk (1980), these issues include:

- Unpredictability of the institution's inflows and outflows streams;
- Periodicity of recording those inflows' and outflows' variables by the institution; and
- Congruence calibration - This relates to the choice of measurement parameters on the expected performance profiles that characterise each of the proposed projects.

Budgetary control is one of the most important forms of management controls used by organisations. The budgeting method adopted by an institution plays a significant role regarding the level of funding that may be available to execute the functions of such an organisation. Historically, budgeting has been synonymous with financial planning. Arising from this, Marti

(2006) reasoned that the budget is the most important financial document of public sector organisations that needs to be made available to spell out clearly the expected streams of revenue derivable to any institution in any financial year. Higher education institutions (HEIs), comprising of the universities and medical schools in Nigeria, are entering a phase where they need to seriously consider their choice of budgeting methods in order to improve fund availability. The appropriate choice of budgeting method will ensure that adequate financial resources are generated to carry out their mandates of teaching, research and community service. This task is not only about sourcing adequate financial resources but, also to monitor that those financial resources are judiciously utilised.

According to Goldstein (2005), the efficiency in utilisation of scarce resources available to an organisation, as well as the effectiveness of the output, contributes towards the realisation of the vision and missions of the entity. This interrelationship is embedded in the budget document, which in itself influences the level of performance of businesses and organisations. According to King et al (2010), the choice of budgeting practice of an organisation has a direct relationship with the performance of the institution. The relative “fit” of a business’ management control systems (MCS) and its contingency factors, is argued to impact on performance, with performance increasing with the degree of “fit” (Chenhall, 2003). Where the budgeting system has been properly installed, evidence also affirms an impact on the performance levels of such organisations. Sharifabadi (2012) established a positive relationship between budgeting and performance. The findings by Sharifabadi (op. cit) supported previous studies, by King et al (2010); Lau and Tan (1998); Aranya (1990); Brownell (1982) and Kenis (1979). Milani (1975) could however, not establish such relationships.

Sharifabadi (2012), using questionnaire and secondary archival data of universities in Iran, came up with findings that supported the priority of budgeting practices over other accounting aspects. Based on the responses from the questionnaire completed, it was evident that a competitive position might have been impacting universities’ accounting systems and performance management, as it is associated with technical improvement in the accounting system. Also, decentralisation of accounting systems was found to have a positive relationship with performance management. Again, improved accounting systems and use of accounting information in performance management was perceived as more important for a finance department., Conversely, the effect of participative budgeting and use of comprehensive performance measures on the performance of the research and education department is greater than in the finance department.

2.2.2 Concept of funding

Funding relates to the provision of financial resources, usually in monetary terms, to execute a project or programme designed by an entity, organisation or government. Funding could be obtained through various sources, such as donations, grants, savings or taxes. Organisations could also access funding through internal activities undertaken to generate income. Funding can be either short-term or long-term in nature. Research funding could further be for commercial and non-commercial purpose. Commercial research funding is provided by the research and development departments of private organisations, while non-commercial research funding comes through charities, research councils or government agencies (Imperial College London, 2014). Government allocations of funding are based on benefits derivable to the public and are extended to students or researchers.

In his study of funding of early care and education programmes in Sweden, 1845 – 1943, Westberg (2011), identified fund raising events, large donations, bequests and regular donations through annual subscriptions as the important sources of raising finance. Income from tuition fees were regarded as comparatively small as part of the total income available to run the education programme. Frolich and Strom (2008) noted the transition of higher education to “mass education” in many European countries, where higher education is considered as public good; tuition fees are kept at zero or low levels. Consequently, the issue of funding schemes continues to occupy a prominent attention. Using a survey to collect data among faculty members, it was discovered that systematic differences arose across institutions in their adjustments to the funding reforms in Norway. The funding system introduced was output-based and was intended to increase the number of students and also the study credits and degrees awarded. This was meant to increase the overall effectiveness of teaching methods in public higher educational institutions.

2.2.3 Concept of productivity and efficiency

Productivity is the ratio between output and input. The term “productivity” has different interpretations to different people. But today, there is a consensus of opinion that productivity is the ratio of output to input. According to the International Labour Organisation (ILO), productivity is defined as the ratio between output of wealth and input of resources used in the process of production. The Organisation for European Economic Cooperation (OEEC) defined the concept of productivity, in its broadest sense, as the measurement of economic soundness of the nations. On the other hand, the European Productivity Agency (EPA) defined productivity as an attitude of mind; as a mentality of a process; as the constant improvement of that which exists. It was defined as the certainty of being able to do better today than yesterday and continuously.

It is important to mention the difference between the productivity of enterprise as a whole, or industrial productivity and labour productivity. The increase in the 'productivity of the enterprise as a whole' is a simple function of factors, such as technological advancement, improved managerial or organisational skills, better entrepreneurial ability, positive attitude of all concerned, good industrial relations and the like. Conversely, the productivity of labour depends on the stimuli or incentives available to human efforts (Malhotra, 1987). The International Labour Organisation (ILO) pointed out that productivity does not mean mechanisation. It means development of scientific attitude on the part of management and that of labour through the adoption of scientific principles and techniques (Malhotra, op cit.). According to Rathnam (1990), productivity refers to the determination of the quality or state of production process. The concept enables organisations to measure production systems and determine the successes recorded. It is the quality that indicates how well labour, capital, materials and energy are utilised.

Increasing productivity is a goal advocated by business, organised labour and government. A change in the productivity of a system results from the combined effect of all the factors contributing to the system's performance (Roslas, 1948). The concept of productivity in educational systems is the ratio of output to input measured in physical or monetary terms, appropriately adjusted to be independent of change in price (Lindsay, 1982). An element that is held constant is the quality of services provided. Changes in productivity over time are meaningless unless the inputs and outputs are measured in terms of constant quality (Blaug, 1969; Kneller, 1968 and Barron, 1967).

Economic efficiency is a major objective for all economies. Education and health sectors are central to the production of medical doctors and other allied professionals produced by medical schools. In recent times, the concept of quality affects the health sector, in respect of the service delivery, to the extent that clinical training of medical students are done at the teaching hospitals (Navarro-Espigares et al., 2011). According to Castelli et al. (2007), there is a clear relationship between quality and efficiency in the health sector. This relationship is influenced by the globalisation process and the "health paradox" (Barsky, 1988), defined as strong budgetary pressure and increased demand for quality services, necessitating institutions to seek improvement on public efficiency in the delivery of its services.
Efficiency has been described as the measurement of the relationship between input and output. Sherman (1988) defined efficiency as "the ability to produce the outputs or services with a minimum resource level required" (p.3). It refers to the extent to which the combination of inputs

is optimal for a given level of output (Lindsay, 1982). According to Johnes et al (2017), efficiency refers to doing the right thing. It is the accomplishment of a given task in an optimal manner. It also measures how well a task has been accomplished.

Ejiogu (1996) stated that efficiency produces a predetermined result with minimal expenditure on material and human resources. Adeogun (1999) saw educational efficiency as the ability of the educational institution to produce its graduates through minimising wastages in resource utilisation. In the context of education, efficient utilisation of resources is obtained when the outputs from education are produced at the least amount of resources (Johnes et al, 2017). According to Ipaye (2008), efficiency measures product output per unit in terms of available human and materials resources. However, some researchers believe the concept of efficiency is inappropriate in the context of the educational process (Romney et al., 1979; Hoos, 1975; Carter, 1972). This viewpoint is oblivious of the current situation in HEIs, where emphasis is more on ensuring that maximum benefit is derived from each amount spent on the provision of educational services. According to Merwin (1971), the issue is not about the appropriateness of measuring the productivity of educational institutions, but how to improve on the existing measurements.

An educational programme could be described as efficient to the extent that the students trained are able to acquire knowledge in the outcome measures in relation to the programme costs (Ipaye, 2008; Badmus, 1992). The resources available to an educational institution are utilised to provide general administrative costs, as well as teaching and learning expenditures. The mix in the utilisation of the resources determines, to a large extent, the degree to which the missions and objectives of an institution are met (Goldstein, 2005). Consequently, the internal efficiency of the medical institution affects the quality of service delivery by the institution. The efficiency of the system would, therefore, be realised if wastages and duplications of resources were significantly minimised, or completely eliminated (Adeogun, 1999). According to Ntim et al. (2015), the overall concept guiding the attainment of productivity and efficiency in financial management in the public sector is the issue of accountability and transparency. Using a modified version of Coy and Dixon's (2004) public accountability index, called public accountability and transparency index (PATI), to measure performance in 130 UK HEIs, it was found that a large degree of variability existed in the level of voluntary disclosures by universities and an overall low level of PATI with regards to the disclosure of teaching and research outcomes. The level of accountability and transparency found out was weak.

Using surveys administered to public and private sector family PACT clinicians as methodology, Bocanegra et al. (2012) found that funding has a direct relationship to improvement of the quality of service delivery. In the study carried out in California, U.S., the clinics that received the federal Title X funding in the state's family planning programme were able to implement more infrastructure enhancements, which enabled them provide quality service beyond their core medical services.

Generally, there is increasing pressure on higher education institutions to admit growing numbers of students (Altback, 2006). This mounting pressure necessitates increases in the quantum of funds required by the HEIs. Surprisingly, in most parts of Sub-Saharan Africa (SSA), Ssempebwa (2011) noted that the increasing demand for access to these institutions resulted in significant reductions in their funding. A variety of earlier scholarly studies corroborated similar findings of dwindling funding allocation in the wake of rising enrolments and rising costs of running academic programmes (Mamdani, 2007; Oyebade, 2007; Musaazi, 2006; Muzaki and Mugisa, 2006; Kwesiga and Ahikire, 2006; Zarummai et al., 2004). A number of different authors have identified the inability of matching enrolment with adequate financial resources as a major militating factor affecting the quality of education that such institutions provide (Adedeji et al., 2008; Babalola and Jaiyeoba, 2008; NCHE, 2004; Zarummai et al., 2004 and Kasozi, 2003).

Higher institutions, particularly in SSA and Nigeria, require appreciable increase in their level of funding, with government assistance coming from facilitating the conducive environment in terms of policy guidelines. Where the requisite funds are available, the scientific evaluation of the financial resources of the institutions becomes a critical factor in determining the efficiency of resources (input) put into the production process (teaching and learning) in order to maximise the outcomes (graduates). According to Ssempebwa (2011), using Juran's generalisation of Pareto's optimality theory, and based on multidimensional evaluation, the institutions' utilisation of resources might expose unexploited capacity to expand the institutions' enrolments, while also improving their adherence to relevant standards of quality assurance in a cost-effective manner.

2.3 Review of theoretical literature

The literature was reviewed under broad categorisations discussed as follows: -

2.3.1 Budgeting methods

The issue of the funding of tertiary education starts with understanding the budgeting methods adopted by an organisation. According to Best et al. (2005), budgeting techniques, and methods generally, must be comprehensively considered before the availability of funds could become relevant. Institutions are constantly engaged in discussions on identifying the appropriate budgeting tools to adopt that will best facilitate the attainment of institutional goals and objectives, within the constraint of limited resources available through government appropriations and collection of tuition (Zierdt, 2009). Anthony and Govindarajan (2007) classified the organisational controls involved in budgeting process at three levels:

- Strategic planning, relating to the use of information from the environment and information on internal services capabilities in determining the future strategy of the organisation.
- Management control systems, involving the implementation of strategy and the effective use of resources.
- Operational control, the authority to perform business functions over subordinates in the area of organising, designating objectives, assigning tasks and giving directions towards the attainment of the mission of the organisation.

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Generally, organisations tend to change these three indicators as more budgeting methods are developed and applied.

Budgeting methods adopted by organisations serve as instruments of communicating financial plans to all the relevant stakeholders. Where budget documents have been properly communicated, it becomes much easier to measure performance and institute remedial actions where necessary. Considering the larger scale of health and education sectors, Ensor et al. (2012), believed that allocation of national resources to regions based on need is a key policy issue in most health systems. Chen et al. (2002) discovered that more than half the population of residency programme students of a medical school did not know how much funding they received to cover the costs of their residency programmes. Educational institutions therefore, have the responsibility of ensuring that the budgets for the institutions are communicated to all the stakeholders for effective monitoring and compliance.

Budgeting methods and funding are the key elements of raising finances for provision of education to the populace (Chen, 2008; Kocher, 2007; Marti, 2006; Coleman and Letourneau, 2005; Chen et al., 2002). The choice of appropriate budgeting method influences the financial management strategies adopted by organisations. Lopez (2006) argued that the search for more flexibility in the financial management of public universities requires adjustments in budgeting strategies adopted by such institutions. Profit and non-profit outfits are faced with making a choice of the type of budgeting method to be adopted by their organisations. Scholars within the financial management sector have discussed extensively the types of budgeting methods available. Some of these budgeting methods, as highlighted by Zierdt (2009), are discussed below.

2.3.1.1 Incremental budgeting

An incremental budget is a financial document prepared using a previous period's budget or actual performance as a basis, with incremental amounts added for the new budget period.

This is the most commonly used and enduring method. It is called incremental budgeting because allowance is made for general inflation and price increases over the previous year's figures. According to Goldstein (2005), this budget tool "focuses on percentage adjustments (increments) to the existing base budget rather than on specific priorities" (p.159). This budgeting tool simply assumes that the priorities, goals and objectives of the departments and/or institutions have not changed significantly from the previous year's target and makes allowance for inflation (Linn, 2007; Lasher and Green, 2001). According to the Chartered Institute for Public Finance and Accounting (CIPFA, 2000), a major characteristic of the technique is that budget preparation involves negotiation and compromise between the users and management in arriving at the figures to be incorporated into the budgeting process. The method succeeds if both parties are willing to compromise to arrive at a workable figure. If consensus is not reached among the interested parties, the incremental process is aborted. CIPFA (2000) therefore reiterated that the use of incremental budgeting model requires a relatively stable form of representative arrangement.

2.3.1.2 Formula budgeting

Formula budgeting is a technique which makes use of quantitative data in the distribution of available resources (Goldstein, 2005). According to Lasher and Greene (2001), each formula manipulates certain institutional data, based on mathematical relationships between programme demand and costs to derive an estimated amount to support future programme operation. These formulas are based on historical data, projected trends, and negotiated parameters to assist the realisation of the desired levels of funding. Goldstein (op. cit) identified that formula could produce an unbiased distribution of financial resources based on the application of quantitative formula. A major drawback of formula budgeting is that it creates an incentive to retain activities that generate more funding to the organisation, even where it no longer advances the attainment of the missions, goals and objectives of the organisation as a whole.

2.3.1.3 Zero-base budgeting

Zero-base budgeting allows for the justification of each budget item that may be included in the budget. According to Linn (2007), "Zero-base budgeting (ZBB) is a system that, when used in its purest form, essentially has the organisation recreate its budget from scratch" (p.23). ZBB has been noted to be time-consuming in its preparation; this is considered a disadvantage. Lasher and Green (2001) observed that, "under ZBB, each budget unit evaluates its goals and objectives, justifies the need for various activities and their costs and benefits, develops decision packages for each activity at each level of output. A priority rank is established for each decision package at each hierarchical level" (p. 516). Ma (2006) worked on a case study which considered the implementation of ZBB in Hubei, China, and discovered that "ZBB will enable the Finance Department to make budgetary decisions in fiscal stress i.e. its own revenues are far from meeting expenditure responsibilities falling upon its shoulders". His study further revealed that political and economic constraints could impede full realisation of the benefits derived from the introduction of ZBB, especially in developing countries. First, in fiscal stress, the goal of achieving incremental budgeting and reallocating revenues among programmes would be difficult to attain. Also, legal challenges peculiar to China may not permit the same level of success achievable in Western countries to be derived from the introduction of ZBB systems in China.

However, Wei's (2007) study conducted in Taiwan, found that in general terms, the operating efficiency, or level of performance, of public and proprietary hospitals was lower after the implementation of the national budgeting system than before, while there was little or no change among private hospitals. Wei (op. cit) established that the implementation of National Health Insurance reduced most of the burden of the public on medical costs. The only type of hospitals whose efficiency and performance seemed not to be affected by the introduction of the National Health Budgeting System was the private hospitals, with the efficiencies or performances of all the other hospitals significantly decreasing. Private hospitals aim to make profits and those hospitals that fail to operate profitably are eliminated. In conclusion, Andrews and Turkewitz, (2005), submitted that the need for budgeting and financial management reform is more compelling across the entire world.

2.3.1.4 Responsibility-centred budgeting

This budgeting technique has been predominantly used by the private sector until recently, when it was embraced by public institutions as part of budget reform to improve efficiency and accountability. Zierdt (2009) observed that HEIs accord academic units the power to make changes within programmes and commensurate staffing requirements. Experience has shown that in most of the cases, universities do not hold these academic units financially accountable for their actions. The adoption of responsibility-centred budgeting allows the central administration to allow departments and units in the institution, academic authority and fiscal responsibility to run the budget (Linn 2007). This authority and responsibility relationship was succinctly reiterated by Lasher and Greene (2001) who argued that,

> *"under this budgeting approach, academic departments and support units are regarded as cost centres for the purpose of discharging fiscal responsibilities while they are also expected to contribute to the overall funding of the institution through their internally generated activities. This implies that the projected expenditures of each cost centre must be supported by sufficient revenues generated by that centre. In practical terms, an academic department or college, for example, has shared responsibilities of ensuring that the department's / unit's faculty and staff salaries, operating expenses, and a share of physical plant costs and other overhead expenditures must be covered by the department's / unit's income generated through tuition and fees, endowments, gifts, and grants and other sources of income. Some support units may also cover part of their budget by charging for their services (especially those providing easily monitored and measured services, such as physical plant and telecommunications). Nevertheless, under this budgeting approach, any revenue shortfalls in a particular unit are accompanied by a scaling back of expenditures in order that unit operations can fall within available income" (p. 521).*

2.3.1.5 Accrual budgeting

One of the tools of budgeting that an institution may adopt for its activities is accrual budgeting. Extensive studies have been carried out in Europe and America on the use of accrual budgeting method. According to Cortes (2006), countries such as New Zealand, Australia, the United Kingdom, Canada and the Netherlands have carried out reforms in their budgeting methods. The focus of budgeting from input to result-based budget ensures that the efficiency in fund utilisation is the primary focus of the budgeting system. The implementation of accrual accounting and budgeting had been linked to reforms in government accounting processes (Marti, 2006). It was found that in a context of excessive budget deficits and debt levels, countries are encouraged to increase budget disciplines and execute accounting reforms where accrual budgeting method is adopted.

According to Kovner and Lusk (2010), sustainability budgeting model emphasises survival as the key attribute in the resource–scarce environment that has characterised the entire world. The study, called Sustainability Budgeting Method (SBM), aims to improve on the Line Item Budgeting (LIB) model, whereby it incorporates the inherent variability of the resource inflows and outflows of the three necessary components underlying all budgeting models. This makes the model to be robust when compared with the LIB model.

2.3.1.6 Incentive-Based Budgeting System (IBBS)

One important strategy applied in the private sector on budgeting method is Incentive-Based Budgeting System (IBBS). IBBS endeavours to match revenues and costs on a unit-by-unit basis, thereby allowing institutions to benefit directly and immediately from their own revenue increases and cost savings. The goal is to grant each unit a degree of fiscal autonomy for deciding how revenues will be acquired and spent and how expenditures will be chosen and managed (Hearn et al., 2006). IBBS is a marked departure from the centralised, incremental budgeting methods prevalent in public institutions towards a programme-performance emphasis in which local academic decisions have direct financial implications on the unit's activities (Meisinger, 1994). Pursuing improved organisational flexibility, adaptability, and efficiency in the face of difficult fiscal conditions, many colleges and universities have begun to rethink their planning and management practices (Priest et al., 2002; Yudof, 2002; Lewis and Dundar, 1999). In this regard, tertiary institutions are increasingly adopting the same strategies applied in organisations. Hearn et al., (2006) conducted a research on the effectiveness of IBBS in the funding and internal management processes of colleges and universities in the US. The study established that the aim of IBBS is to integrate budgeting and management decision-making more fully at the level of individual cost centres within institutions. The move to IBBS reflects the higher-education community's interest in more decentralised management approaches. The study concluded that IBBS can indeed contribute to the institutional efficiency and productivity of tertiary institutions.

2.3.1.7 Programme budgeting

According to Goldstein (2005), a programme budget reveals information on the costs and benefits of an organisation's activities. It establishes goals and objectives to be pursued by the organisation and relates them to the organisation's activities. The process of operating programme budgeting requires determination of the resources and estimated benefits to be derived towards the realisation of the goals and objectives of the organisation. Programme budget contains projects costs and program output over a number of years so as to reveal a long-term view of the financial implications of those programmes. Programme budgeting tries to provide justification for how funds are spent. Kelly (2002), observed that programme budgeting encourages cost analysis for optimum results. The method is advantageous because it relates with institutional priorities and vision, even though a major drawback of the method, as noted by Goldstein (2005), is that costs may be arbitrarily allocated and this may not relate to a programme's activities. Another drawback is the determination of what is considered as appropriate outcomes and how these outcomes are measured.

2.3.1.8 Performance-based budgeting

Performance-based budgeting (PBB) and funding are often used interchangeably. PBB relates to macroeconomic allocations (Curristine, 2005; Joyce and Tompkins, 2002), while performance-based funding is concerned with the allocation of funding among various public service providers, such as universities and hospitals (Compagni and Tediosi, 2012; Herbst, 2007; Curristine, 2005; Leifner 2003; Geuna and Martin, 2003; Burke, 2002). Performance–based funding is commonly applied in the healthcare and higher education sectors.

This budgeting method ensures greater accountability of funds deployed by institutions (Linn, 2007). According to Alexander (2000), a*lthough most states in the U.S. have initiated numerous changes aimed at improving the quality of higher education, performance funding is the only budgeting reform to date that directly links financial incentives to achieve results in policy areas that states considered important* (p.421). PBB method is similar to responsibility accounting in which case, revenue and expenditure of key activities of an entity are matched to determine degree of efficiency of resources utilised. PBB method has assumed a dominant significance in the recent past. Proponents of this method argue that it makes it easier to evaluate public agency outputs and reward performance or impose sanctions where desired results are not obtained. Critics, on the other hand, claim that such methods are short-sighted and oblivious to the practical realities that many managers face in their daily activities. In fact, its implementation may result in unintended consequences that may turn out to impact negatively on service delivery (Rabovsky, 2012).

PBB is motivated by improvement in efficiency and decision making processes (Melkers and Willoughby, 2001). MacNab and Melese (2003) highlighted a major weakness of PBB, where "Public managers are penalised for identifying and implementing cost-saving techniques (in that) departments that realise cost savings through process improvement or managerial reforms may have their budgets cut in the following fiscal year and resources transferred to organisations that met or exceeded their funding levels" (p.78). Kong (2005), however, was able to subdue the emphasis from inputs to outcomes and results, whereby institutions are now assessed based on results achieved and cost-effectiveness. His research identified costing as the weakest area in the course of implementing a full-grown PBB system. The work established that the absence of a proper costing system will render performance-based management and budgeting system ineffective. MacNab and Melese (2003), identified investment in accounting and information systems as the crucial resource to be considered in budget process reform.

At the institutional level, internal resource allocation mechanisms are also changing. Many institutions in developed countries are advancing towards more decentralised budgeting mechanisms. This means that identifiable decentralised units have greater autonomy in the management of their budgets to achieve certain goals. The purpose is to combine the strengthening of intrinsic values of institutions with the introduction of some signals to make management units more concerned about changes in the market (Massy, 1996). This decentralisation is expected to enhance the quality of service delivery at educational institutions in the European countries where these models are being employed. The developing countries also have started to embrace the PBB method. PBB method was introduced by Democratic Republic of Congo (DRC) as part of a series of reforms to tackle a dearth of domestic resources needed for healthcare services. Introduction of performance-based financing in DRC assisted the reform of the public finance towards result based financing activities. Gargasson et al. (2014) identified dysfunctional budget processes and absence of transparency of public finance as major impediments towards the flow of funds earmarked in allocated resources to reach all the various health system levels in DRC.

Pursuing further the concept of decentralisation of budgeting methods, the US introduced Responsibility Centre Budgeting (RCB) into the university administration. Generally, RCB is an alternative organisational structure used by universities in executing fund allocation functions. Vonasek (2011) argued that the downturn in the value of endowment funds necessitated the adoption of alternative organisational structures and operating methodologies for productivity improvement and innovation.

2.3.1.9 Activity-based budgeting

Serritzlew (2006), in Denmark, noted that activity-based budgeting has become a common way of financing schools and hospitals. The study was conducted on the Danish Primary School System, and established results, rather than output, as the essence of public sector activity. Funding is therefore determined on the basis of output rather than outcome. Internationally, several countries are linking funding of higher education to expected outcomes. Management principles of economy, efficiency, and effectiveness are becoming measures of good governance in higher education as well as in business. Managing by outcomes or outputs rather than inputs has led to some performance-based and/or incentive funding models – rewarding actual rather than promised performance levels.

2.3.1.10 Mission-based budgeting

According to the Office of Programme Policy Analysis and Government Accountability (OPPAGA) Report (2008), the University of Florida's College of Medicine Mission-Based Budgeting, developed during the 1990s, enabled the institution to manage the college's resources more effectively.

According to the report,

> *"This approach provides a systematic way to link money and faculty effort to the college's three traditional missions of education, research, and clinical care. Decisions regarding departmental support by the Dean are made based on standard rates of funding for the activities assigned to the faculty in a department rather than on incremental budget allocations. Mission-Based Budgeting resolves a number of problems that are encountered in analysing university and college of medicine data. It has therefore become a national model for financial management of medical centres and is readily promoted by the Association of American Medical Colleges. The process also provides information that allows policy makers an opportunity to understand how colleges of medicine operate.*
>
> *University of Florida College of Medicine officials stated that Mission-Based Budgeting is based on the concept of linking instructional costs to the time budgeted for individual faculty to participate in specific teaching assignments. Faculty time is calculated at two hours of preparation time for each contact hour of classroom teaching (the standard established in the state's 12-hour law). Clinical work involving teaching and supervision of residents and MD students on clinical rotation (third and fourth year of the MD program) while treating patients is reported as 70% clinical and 30% instructional time. As a result, clinical teaching (teaching conducted while treating patients) is calculated at two hours per day. The time devoted to instruction is then used by the dean as the basis for distributing funds to the departments.*
>
> *Under mission-based budgeting, the reimbursement of state revenues to a University of Florida medical department for teaching is the same for all faculties, $82 per hour in fiscal year 2005-06, whether physician faculty or scientist and*

regardless of the actual salary of the faculty member. This fixed financial structure for state support facilitates the analysis of other revenues which make up the deficit between $82 per hour and actual faculty salaries. The university reports that the average cost per hour of faculty who taught was $88 for basic science faculty and $144 for clinical science (physician) faculty. As a result, 7% of basic science instruction and 43% of clinical instruction salary costs were supported by other sources than state funds and tuition. Thus, when faculty are assigned to teaching, non-teaching (non-state) sources of revenue must supplement the teaching revenue provided by the dean in order to maintain their actual hourly rate of pay. This gap is primarily filled by profits from faculty practice plans" (p.7).

Funding decisions were based on programme effectiveness and provided the congress with better information for allocating resources. The Department of Veterans Affairs (VA) began its reorganisation and reform in 1996 and this has continued to the present day. The Department of Veterans Affairs Medical Center (VAMC) provides a unique opportunity to compare alternative healthcare financing approaches within a comprehensive urban hospital healthcare complex.
The study emphasised the unique attributes that are applicable to the public mission in the US which may not be relevant to the rest of the world. Evidence has shown that the funding and financial structure of medical education in the US had evolved over the years.

It was reported that:

The financial structure for medical education in the United States began developing in the 1960s and was based largely on funding and programme expansion initiated by the federal government. These initiatives occurred in three major areas.

- *Medical research. Building on the success of federal investments in medical research during World War II (which led to advances such as penicillin and synthetic anti-malarial drugs), the federal government increased funding for university biomedical research from $2 billion in 1960 to $8 billion in 1990. Since this funding (in the form of grants) would pay up to 40% of the salary of medical researchers, medical schools quadrupled the size of their basic science faculty during this period.*
- *Medical education**.** During the 1960s, inaccurate population projections led to the anticipation that a shortage of physicians would occur by the end of the century. To address this problem, the federal government provided grants through the Health Professions Educational Assistance Act of 1963 to subsidise construction of medical school facilities and to provide scholarships to students pursuing medical degrees. This grant funding helped increase the number of accredited medical schools from 89 in 1965 to 141 accredited MD-granting institutions and 29 accredited DO-granting institutions in the United States of America.*
- *Patient care. While educational and research programs were growing, faculty practice plans emerged as the largest single source of revenue to medical schools. The creation of Medicare and Medicaid in the mid-1960s spurred the development of practice plans. These federal programs provided medical schools with new sources of revenue, which in turn led medical schools to organise practice plans*

to improve billing and collection for medical services by their faculty (Office of Programme Policy Analysis and Government Accountability, 2008, p.2).

- Public universities in the developing countries, in particular, Nigeria use the negotiated funding method whereby activity plans and budget proposals constitute the mechanisms considered to determine the level of funding to be released to the institutions (Oyo et al., 2008).

2.3.2 Theories of the budgeting process

This section considers the theories of resource allocation decisions that primarily focus on the processes from which budget portfolios emerge. There are generally three broad headings upon which the theories of budget process can be discussed. The first is the formal procedural view of the budgeting process. The second relates to models of organisational sciences and public administration while the third concerns the body of literature on the trade-off of budgetary items.

2.3.2.1 Formal procedural view of the budgeting process

The formal procedures underlying the budgeting process include taking into account the guiding documents that have been produced (such as poverty reduction strategy papers) to prioritise the issues of the upcoming budgeting period and further link it with the medium term and long-term framework (priorities) of the country. For many countries, the overaching policy guidance comes in the form of a medium-term expenditure framework (MTEF). The MTEF is a multi-year framework that allows a country to tie its current annual budget to a rolling budget that will be implemented over the coming year(s) while maintaining the policy orientation of the budget within the sectors. The objectives of doing these include obtaining greater macroeconomic balance; improved inter- and intra-sectoral resource allocation; greater budgetary predictability and more efficient use of public funds (Houerou and Taliercio, 2002).

The MTEF helps steer the budget-making process toward a more results-oriented approach with cross-ministerial coordination, and to a focus on longer-term needs. But, it has also been criticised as being incogruent with institutional capacities in place during its introduction, as being failed to foster national ownership, and having given adequate attention to problems with fundamental budgeting issues (Schiavo-Campo, 2009; Lawrence and Wayne, 2009). Nevertheless, the MTEF is a proper example of a framework that is intended to guide the formulation of budget strategies and objectives. There are myriads of reasons on why budget allocations do not follow the textbook budget process. McKie and van de Walle (2010) contrast constitutional, legal and formal bureacratic stipulations on how the budget process is supposed to work in various African countries with how it actually does work. There are institutional provisions on vertical accountability and horizontal accountability mechanisms in the budgetary process. However, these institutional provisions are plagued with legal, capacity and political constraints and these constraints further conspired to render the accountability mechanisms for budget processes ineffective or de facto absent, which, in turn, allows bureacrats and politicians to strongly diverge from formal procedures with little penalty.

2.3.2.2 Independent view of the budget process

There is another strand of the budget process known as the independent view. The independent view are body of work that, although clearly reject the notion of a textbook budget process in empirical reality, but also seems to reject the notion that there are systematic polito-economic or other influences on how public expenditures are apportioned across competing needs. There are separate models under the independent view. These are the garbage-can budgeting model; the budgetary model of incrementalism and the veto-players theory.

The garbage-can budgeting model comes from the organisational science literature. The model proposes that budget decisions are the random outcome of a large set of independent events. Under this model, budgets emerge from an organised hierarchy with four streams – various participants or actors; problems these actors perceive, solutions they identify, and actions they take in the form of initiatives (Cohen et al.,1972). According to this framework, the public resource allocation is essentially a simple random walk process in which public spending in one year is equal to the previous year's spending plus a randomly drawn (negative or positive) account. The theory implies, then, that given a problem, a set of policymakers with limited time and resources, and a choice among different policies, the result is an equal chance of any of the alternative expenditure policies being chosen.

Consequently, the budget choice that the policymakers select is not influenced in a systematic way by actors in or outside the formal budget system. In a way, the garbage-can budgeting model is the other extreme of the explanation of resource allocation decision making that point to the formal budget process. Consequently, the plausibility of either is rather limited. Although, the garbage-can theory has been extended and refined (Weissingger-Baylon, 1986; March & Olsen, 1976), studies comparing its applicability to alternative models find little support for the garbage-can theory (Reddick, 2003; 2002).

The budgetary model of incrementalism is said to be above systematic influences but free from unsatisfactory randomness. The model is proposed in the political science literature by Davis et al. (1966). The budgetary model of incrementalism portrays budget makers as backward looking and changes in budget allocation as incremental and, in its strictest form, increasing or decreasing by the same proportion each year. With the current budget allocation tightly tied to previous year's budget, the model leaves little room for actors to have an effect by lobbying for changes in budget allocation or policies. The incremental budget model has been applied to the budget-making process of various countries and organisations (Ostrom, 1977; Hoole, 1976; Covart et al., 1975; Edward & Sharkansky, 1975; Davis, 1971; Sharkansky & Turnbull, 1969). The logic and applicability of the incremental model has been challenged almost from the time it was first proposed, including through questions regarding the definition of what amount of budgetary change would be considered incremental, but more importantly through doubts about the assertion that neither policymakers' objectives nor politics and pressure groups feature in the equation (Andersen & Harbridge, 2010; Rubin, 1989; Bailey & O'Connor, 1975; Wanat, 1974; Natchez & Bupp, 1973). It should be noted that the garbage-can theory of budgeting seems to overcorrect for the naïve assumption of the neat formal budget process, and the incrementalist' understanding of budget processes implies a great deal of passivity on the part of politicians, bureacrats, interest groups and other actors.

The veto-player theory is another variant of the independent view of the budgetary process. The theory is an extension of the budgetary model of incrementalism as the theory provides understanding as to what conditions budgetary compositions are slow moving and under what circumstances they are more prone to greater shifts. Veto-players are actors and institutions that can effectively block budgets such as political parties within government, presidents and so on. Tsebellis & Change (2004) model and empirically tested (in the context of industrialised countries), the extent to which the budget compositions is able to change as a function of ideological diversity within government and between governments over time. Greater ideological distance of veto-players within government results in a more slowly changing budget (for example, when parties in parliament and/or parties controlling the different legislative and executive bodies are strongly heterogenous ideologically) because consensus for change in the allocation of resources across different sectors – whatever the direction of this change, is harder to achieve. In contrast, greater ideological distance between alternating governments spur budget composition change, since an incoming government with a strongly different political outlook from that of the preceding government is more likely to want to significantly change budget portfolios from what they were before.

2.3.2.3 Budgetary trade-off

The body of literature on budgetary trade-offs – predominantly embedded in the political science discipline – does not negate the existence of such trade-offs as do (directly or indirectly) the garbage-can and incremental budgeting theories, but neither does it take trade-offs as given. It does suggest that the explicit and conscious trading-off of different sectoral or pragmatic investments against each other is unusual (Domke et al, 1983). This is not to say that there is no budget constraints in contexts where no explicit trading-off occurs. Rather than the absence of trade-offs being a reflection of non-binding budget constraints, it is an outcome of features of the budget-making process. The literature on budget trade-offs to date has mainly focused on the guns versus butter decision of how countries should allocate their budgets between spending on defense; including the army, weaponry and associated departments, and spending on butter, which is interpreted variously as expenditures on social welfare programmes and social safety nets, on social sectors such as health or education, or on all non-defense expenditure.

2.3.2.4 Rational choice budgeting model

This model emerged out of the criticism of incremental resource allocation theories. The rational choice budget model is also from the political science literature but draws on key economic concepts. Thus, instead of policymakers and their budget decisions being perceived as random, or backward looking, they are instead forward looking, and decision makers are driven by rational expectations (Reddick, 2002). One conception of the budget allocation process prevalent in the economics literature borrows from economic theory on consumer demand and offers an economistic view of public resource allocation undertaken by a benevolent and autocratic social planner. The social planner allocating resources across competing sectors and needs is subject to the constraints imposed by a fixed overall budget. Other distinct branches have developed within the rational choice literature, including those that depart from the notion of an unencumbered policymaker. One such branch emerging from the public choice literature proposes that certain actors in the public sector are rational, budget maximising individuals and other (or the same) actors are vote-seeking.

2.3.3 Funding models for educational institutions

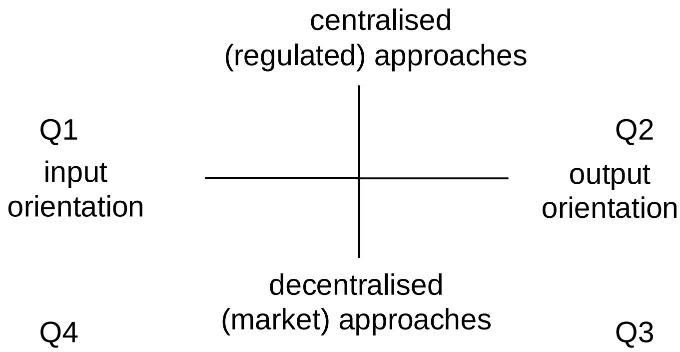
A review and extensive discussions of funding models relevant to the areas covered by this thesis was made. Funding of higher education has been a topical issue for a couple of decades (Nagy et al, 2013). As the complexity of higher education is expanding as a result of increasing heterogeneity of students' needs and entrance of many institutions, the role of government also changes. The autonomy of the higher institutions and the means of government's control over them also changes (Estermann and Pruvot, 2011; Jongbloed et al, 2010; Estermann and Nokkala, 2009).

Funding models were used as governance and management tools by institutions to maximise benefits of public management reforms. The literature contains a number of funding models that may be adopted by educational institutions to manage their finances. An educational institution could be classified as a public service, depending on the source of funding, whether privately funded or through the federation account. Educational Institutions must have clarity about how to fund their missions because this very important decision affects the delivery of their programmes to the various stakeholders.

> *Education funding models are typically used to distribute state funding among multiple public education entities (i.e. school districts, universities, community colleges) involved in delivering educational services* (OPPAGA Report, 2008 p. 5)

There are other variants of funding models that are applied by educational institutions. Input funding relates to situations where funds are released to institutions to cover costs such as staff emoluments, overhead costs or investments. Output funding, on the contrary, is the funding arrangement whereby institutional budgets are tied to specific teaching and research outcomes of the institution's activities. Output funding tends to encourage efficient behaviour by the managers. It is believed that those who received the funds will pay more attention to judicious utilisation of the resources made available to them. In the case of Nigeria, Saint et al. (2004) found that the funding framework in use did not serve the country's longer-term development interests but rather promoted rapid geographical spread of homogenous universities across the country. The findings led the World Bank (2010) to advise African countries to adopt PBB and funding allocation mechanisms in place of historical-based methods. The popular funding model being adopted by the higher education sector is a method that allows HEIs to measure performance through increased reliance on market-type coordination mechanisms, where funding is related to performance. This marketisation trend encourages higher institutions to compete for public and private funding for research, as well as the introduction (or increase) of tuition.

Graphically, the model may be captured succinctly as presented below:



The vertical axis depicts the degree of centralisation/decentralisation and the horizontal axis expresses the degree to which governments are paying for the results (outcomes) instead of the efforts (inputs). The quadrants – Q1, Q2, Q3 and Q4 – are used to classify funding arrangements.

Fig. 2.2: Trends in funding mechanisms (adapted from Jongbloed, 2009).

Broadly speaking, there are basically two major funding models; the activity-based (ABF) and the pay-for-performance (P4P).

2.3.3.1 The Activity-Based Funding (ABF) model

The ABF is the most commonly used funding model in acute care (Sutherland et al., 2012). The term ABF is used synonymously in the literature with such terms as volume-based funding, patient-based funding, service-based funding, case-mix funding and payment by result (PbR) (Duckett et al., 2013). In the case of a hospital, for example, ABF systems vary, but typically offer hospitals a fixed amount per bundle of care ordinarily delivered to clinically similar patients (based on diagnosis) (Palmer et al., 2014). In order to quantify each unit of care and its associated costs, hospitals rely on classification systems, the most common being diagnostic related groups (DRGs). Under ABF, hospitals are motivated to increase profits (or margins) by increasing efficiency, decreasing expenditures and maximising the difference between their unit costs and the equivalent ABF payment amount (Sutherland and Repin, 2014).

ABF represents an alternative to more traditional funding systems such as global funding, cost-based (fee-for-service, per case or per-diem) or cost-plus reimbursement systems (Sutherland, 2011). ABF systems have been implemented in various jurisdictions with the intent of achieving a variety of goals and policy objectives, the most common being to increase efficiency and enhance transparency (Ettelt et al., 2006), while decreasing costs (Cacace and Schmid, 2009; Schreyogg et al., 2006). Activity-based funding schemes could enhance the efficiency of the higher education sector. Noticeable drawbacks of activity-based schemes manifest if the institutions become more responsive to underlying student preferences and employers demand for skills, when unintentional side effects could arise. In most cases, output-based funding schemes may face the possibility that agents' efforts will be biased towards activities that increase measured parts of output and will turn away from unmeasured dimensions. When there are no tuition fees or when they are centrally fixed, universities can only affect the number of students by choosing the attributes of their services. Under simple quantitative schemes, based on enrolment or number of students passing the exam, this may lead institutions to shift educational resources towards marginal students and to lower standards. Regardless of this drawback of this funding method, it is still widely used as a yardstick for measuring efficiency of funds utilisation by educational institutions.

Overall, ABF has been criticised for its emphasis on volumes and reducing costs rather than the provision of high quality hospital care (Sutherland et. al, 2012).

2.3.3.2 Pay-for-Performance (P4P) model

P4P funding model differs from the ABF by focusing less on quantity and more on achieving outcomes based on "performance metrics" (Sutherland et al., 2012). P4P can be associated with quality and non-quality performance measures (e.g. cost measures). P4P ties financial incentives to quality and/or safety measures (Sutherland, 2011; Mehrotra et al., 2009). Sutherland et al. (2012) acknowledged that there is no generally accepted international definition of pay-for-performance. This explains the degree of heterogeneity seen in P4P programmes in terms of the types of incentives offered; the types of providers targeted and the quality measures (Sutherland, 2011; Van Herck et al., 2010). Quality measures tend to fall into two main categories: process and outcome (Sutherland, 2011; OECD, 2010a). *Process measures assess the medical treatment provided by physicians and other healthcare providers (e.g., timing of pre-surgery antibiotics administration). Outcome measures assess such things as morbidity, mortality, quality of life and patient satisfaction* (Cromwell et al., 2011).

Other variants of funding models in use in developed economies that have gained worldwide recognition are discussed in the subsequent sections.

2.3.3.3 Access-Equity-Cost sharing funding model

This funding model ensures the lowering of financial barriers to higher education while ensuring equity in the sharing of the funding burden by different stakeholders in the education sector based on ability to pay (Okebukola, 2014). The trend of rising cost of providing higher education per-student costs of instruction, the institutionally borne costs of research, the capital demands and operating costs of accommodating increased enrolments, and the expenses of student maintenance, necessitates that universities devise means and strategies to cover these costs to facilitate effective delivery of their mandates.

The resulting divergence in the trajectories of higher education costs and the total available public revenues tends towards increased higher educational austerity, especially in the developing countries (Johnstone, 2009). This financial austerity could be met through the application of a variety of solutions, especially to cover the cost aspect. In fact, every country and its government in trying to meet the long-term welfare of its citizens, develops policies that promote attainment of financial resources that will enable equity and accessibility to higher education.

2.3.3.4 Contextualised formula-funding model

Contextualised formula funding model is a method where funding to the university system is based on a formula which recognises the peculiar circumstances and state of physical development within the community where the university is sited. This is done with a view to encouraging courses in science and technology which have the potentials to accelerate economic development in a country. Okebukola (2014) proposed a formula, serving as a template for all public universities in Nigeria, aimed at revamping the gross underfunding that had bedevilled the educational system in the country. According to Okebukola, the funding requirements of public universities are determined through a set of formula which he proposed as follows:

1. Universities Total Funding Needs (UTFN) are calculated through a series of consultative processes with each public university using the formula given as follows:

$$UTFN = PNAS+(CC \times 0.02AUC \times FST \times RA \times GS)\ 0.02AUC + k$$

where:

- *PNAS = 10 year annualised cost of remediation from data collected through the 2012 Needs Assessment Survey on state of physical facilities and infrastructures; enrolment; vision and mission; and anticipated programme delivery for the next financial year.*
- *CC = carrying capacity of the university as approved by NUC.*
- *FST = Degree of focus on programmes on science and technology-based disciplines. This is scored on a scale of 10 (only science and technology to 0 = no science and technology programmes).*
- *RA = Research activity. This is scored on a scale of 10 (national and global research intensive to 0 = no nationally and globally-recognised research activity).*
- *GS = Generation Status (1 = first generation; 2 = second generation; 3 = third generation; 4 = fourth generation).*
- *K= constant of annual grant of ₦500 million to all public universities*

2. *Sum up total funding needs of universities (ΣUTFN) under a public proprietor-federal government.*
3. *Channel request for ΣUTFN to proprietor through NUC tying institutional accreditation to compliance with total release of ΣUTFN for three consecutive years.*
4. *NUC to make quarterly release of UTFN in advance to enable universities to plan.*
5. *Universities to support capital development with IGR, grants from TETFund, endowments, alumni support, donation of buildings from individuals and corporate organisations.*
6. *Personnel cost component of TFN of federal universities staff to be paid directly to staff through GFMIS. In other words, these components of funding need not be remitted through the universities to staff members as is currently the practice with federal universities.*
7. *Apply transparency, due process and budget disciplinary tools in the implementation mechanisms* (Okebukola, 2014, p. 18).

2.3.3.5 Performance-based funding model

Performance-based funding (PBF) model was developed to improve the quality of education by funding results (outcomes) attained by the universities rather than funding according to the size of an institution or standard budgeting procedures (NCSL, 2013; Harnisch, 2011). Historically, many institutions have received state funding based on the number of full-time equivalent students enrolled at the beginning of the academic session. This is called input-based funding model. The input-based funding model provides incentives for universities and medical colleges to enrol students and provide access for acquisition of higher education to a number of eligible students. It does not necessarily provide incentives to institutions to assist the students to successfully complete their university education.

The current trend supports a shift of the funding of education from an input-based to output-based funding model. For example, the Texas Higher Education Coordinating Board, in 2012, recommended output funding model for Texas institutions of higher education. This funding model ensures that institutions are funded only on their student enrollment counts, with their funding determined by enrollments and how well institutions help their students complete their programmes. This change will increase cost efficiency and successful student outcomes which will benefit both students and the taxpayer. According to Kaullychurn (2009), PBF of publicly-provided goods and services is an output-oriented system, as institutions such as medical schools are provided with better ways of improving efficiency and accountability, unlike input-based system. Kaullychurn (op. cit) adopted a pluralist methodology based on a literature review; a substantive assessment of five OECD countries (Australia, Denmark, Sweden, New Zealand and United Kingdom) where PBF models are in use in the tertiary education sector and qualitative interviewing. The results indicated some measure of support for performance-based systems among the respondents to promote the quality of tertiary education, enhance research capability and increase accountability for the use of public funds.

PBF is different from PBB. Whereas PBB utilises performance indicators to influence funding decisions, PBF relies on a formula which utilises performance indicators in deciding the actual funding allocations (Rabovsky, 2012; Dougherty and Hong, 2005). In specific terms, some portion of state allocation is awarded based on institutional outcomes. Thus, PBB is indirectly tied to funding, while PBF is directly tied to funding as “a system based on allocating a portion of a state’s higher education budget according to specific performance measures” (Miao, 2012, p.1). PBF is a system based on allocating a portion of a state’s higher education budget according to specific performance measures such as course completion, credit attainment and degree completion, instead of allocating funding based entirely on enrolment. It is a model that provides a full picture of how successfully institutions have used their state appropriations to support students throughout their university careers and to promote course and degree completion. PBF model promotes accountability, efficiency and effectiveness of the programmes and services provided by universities and medical schools.

Further, PBF structure incorporates enrolment and performance metrics as incentives for universities and medical schools to continue to make progress on these important objectives.

The model has been described as possessing these key attributes:

- Ensuring that enough money is apportioned for performance to create incentives sufficiently strong enough to change institutional behaviour.
- Integrating all metrics and provisions into the state higher education funding formula, making it more durable when states are faced with budget cuts.
- Using indicators that measure progress (course completion, momentum, credit attainment) and completion (degrees conferred, program completion), with emphasis on progress.
- Incorporating stop-loss provisions that prevent institutions from losing more than a certain level of funding each year.
- Subjecting the system to frequent evaluation and making adjustments where needed.

As higher education spending continues to decline, states face growing pressure to demonstrate that they are fully invested in the long-term success of their students. Going forward, it is imperative that the government continues to explore performance-based funding options, particularly in the context of a series of outcome-focused higher education reforms. As an alternative to incremental increases in enrolment-driven funding, a PBF model provides an opportunity for increased accountability for ensuring equality and meeting state needs (Friedel et al., 2013).

The challenges of PBF models revolve around focusing on performance measurement. The task of linking funding to the achievement of clear and measurable results requires investment in measurement systems. This could pose a serious challenge where there are slacks in monitoring and evaluation (M and E) mechanisms that may be introduced by the universities.

Also, there is the challenge of ensuring that reported data is accurate and reliable. The introduction of PBF models may have the possibility that the chosen indicators measure only a portion of the entire institutional picture, and that the potential exists for negative effects on institutional quality, access, equity, mission, or stability (Harnisch, 2011). Also, PBF models may cause an additional loss of funds, as well as disregard institution–specific factors, such as student populations (Cardona, 2013).

PBF rewards institutions that meet state goals, where outputs, rather than inputs, are used as measure of performance while also ensuring that the more goals that institutions meet, the more funding they receive (Blankenberger, 2011). The implication is that institutions must continually strive to be innovative and adapt to changes to accomplish their missions and objectives. The innovative skills embedded in the PBF model lead tertiary institutions to continually introduce funding models that facilitate seamless attainment of institutional missions and objectives. For instance, in Spain, the strategy for new funding models for Spanish universities, placed the university at the heart of the model change that Spain introduced to propel the country on sustainable knowledge-based economy (Moreno-Navarro, 2015).

2.3.3.6 Host-Proprietor-University-User funding model

This model, developed by Okebukola (2014), works by imploring all potential beneficiaries of the location of the university in contributing to funding the university. According to the author, the steps involved in determining the funding requirements include the following:

1. *Determine unit cost of university education for the financial year (UC)*
2. *Obtain maximum number of new students to be admitted from NUC*
3. *Add current to new student numbers to determine carrying capacity (CC) for the proposed budget year.*
4. *Calculate total funding need (TFN) as product UC and CC.*
5. *All local governments within the catchment of the university to contribute through legislation.*
6. *Proprietor (federal government) to contribute the largest share (at least 70%) as direct grants, scholarships or bursaries.*
7. *Allocate at least 10% of non-tuition Internally Generated Revenue (IGR) as university's share (US) of TFN.*
8. *Allocate balance [TFN-(PF+US)] as tuition for student component of cost sharing. Retain tuition for a fairly long time buffering with US.*

9. *Support capital development with IGR, grants from TETFund, endowments, alumni support, donation of buildings from individuals and corporate organisations.*
10. *Personnel cost component of TFN of federal universities staff to be paid directly to staff through GFMIS. In order words, these components of funding need not be remitted through the universities to staff members as is currently the practice with federal universities.*
11. *Apply transparency, due process and budget disciplinary tools in the implementation mechanisms (p.20).*

Like Okebukola, Jongbloed (2000) in writing about funding of higher education in developing countries pinpoints and distinguishes four different types of funding and elaborates succinctly on each of them. In his view, there are four different types of funding models and these are; Negotiated Funding, Input-based Funding, Output-based Funding and Student-based Funding. Jongbloed (op cit.) is highly convinced that all these four funding models emanate from funding policy objectives and from policy framework developed by the central educational authorities. What they intend to achieve acts as a guiding factor to the content of policy objectives and to the framework. Institutions implement these policy objectives and policy framework in a way that is most convenient to them because they experience state encroachment with spending decisions and their ability to raise surplus funds. These funding types are interwoven and each is dependent on the other. Basically, the categorisation of these funding models conforms to the components of funding enunciated by Jen (2005), who distinguishes three funding components as enrolment-based component; degree-based component; and research-based component. The enrolment component of funding conforms to the input-based funding while research and degree-based components are related to the output-based component.

2.3.3.7 Negotiated Funding

As far as negotiated-based funding is concerned, Jongbloed (2000, p.17) posits that “allocations are not based on objective criteria but on the allocations of the previous year”. The parties that are concerned with negotiated type of funding are representatives of institutions and the representatives of the government which is the Ministry or the Funding Council. Jongbloed (2004) likens input-based funding through higher education funding to negotiated funding which is done through the Ministry or Funding Council by carrying over what was not used in the previous year and based on this left over, the current budget is then determined.

Jongbloed (2004) views that since government funding is decided by politicians and the parliament, this is a move geared towards strategic and bureacratic governance of higher educational institutions, in deciding what amount of grant, budget or allowance to be given to each of these institutions. This government financing gives the government a regulatory hand in the internal affairs of these higher education institutions. The merit of this type of funding is that there is a one-to-one discussion by the representatives of the institution and that of the government. This can bring in trust and conviction. The representative of the institution can be able to persuade the government representative to submission. Since this type of budget is based on negotiation, the performance indicators of how the institution used the last budget will be reviewed. This also calls for transparency and accountability on the part of the institutions which has to target vital institutional projects which are visible and whose results are palpable. However, familiarity during negotiations would breed contempt, would erode institutional autonomy and could lead to squabbles.

2.3.3.8 Input-based funding

Jongbloed (2000) viewed input-based funding as determined by "measures of the cost of higher education". He identified these measures as staff salaries, material requirements, building maintenance cost, investment, etc. What is taken into consideration in the budgeting system is the human and material resources. The cost of the human resource category is calculated based on the number of students enrolled on each staff member acquired and on each imperative material or infrastructure obtained.

Jongbloed (2004) also juxtaposes this government strategic model of funding with the market-oriented model of funding which the government promotes and regulates in that, whether it is the enrolments, degree of programmes that are planned by the central administration or are planned by the institutions but approved by the central administration before it is implemented at the same institutions or whether these (enrolments, degrees or programmes) are decided by the clients in this case the students, private firms, research councils or foundations. Jongbloed (2000) insists that though it is market-driven, it is centrally controlled by the government. Jongbloed (2004) also presents a system which has to do with demand-driven input-based funding through clients. He proposed flexible vouchers to be disbursed by the providers to the Ministry of Education where the clients (students) can obtain and take to any institution of their choice as he earlier indicated in Jongbloed (2000).

He also insists that these institutions should be able to cash a voucher. In this light, the students will enrol in an outstanding institution in terms of quality of teachers, quality of programmes and will be demand-driven. He also prefers the government comes in to regulate this system. This funding type is advantageous in that the more an institution is providing quality education, the more finances it will attract through tuition fees from enrolled students. This type can be like a clarion call on education providers to sit up and to be conscientious of their duties. It will enable institutions to design attractive programmes that are marketable and have an economic impact to the society. The negative part of this funding type is that some institutions may disrespect the required student recruitment criteria since they need high enrolment for more finances.

2.3.3.9 Output-based financing

In elucidating output-based funding, Jongbloed (2000) believes that this form of payment can be tagged as "payment by results". In this light, it means that the amount of funding an institution attracts to itself, is determined by the number of graduates and postgraduates it produces and the amount of research it carries out. In a nutshell, academic publications, staff intellectuality and dedication to publish are much influential in determining the amount of finances its institution will carry. Hauptman (2005) is convinced that the peformance-based funding is rewarding institutions for actual work done and not promised performance. It posited that funding is linked to the quantity of outputs or the quality of outcomes rather than inputs. That it uses performance indicators that reflect public policy rather than institutional needs; that it helps in designing incentives for institutional improvements and not just maintain status quo.

Jongbloed (2004) projects "purpose-specific purchasing providers". In this case, the fund providers (usually, central government) go into an agreement with higher education institution on the specific number of graduates they will provide for specific skills in the needs of their (fund providers) labour market. With this done, the two parties are bound by the terms of the contract and each of them is expected to work in achieving the terms of the contract.

2.3.3.10 Student-based funding

Student-based funding can either be through loans or through an agreed sum that is paid privately by the students and their sponsors without any refund from the state or with subsidy from the state. Jongbloed (2000) also gives an explanation for student-based funding which he views that vouchers are disbursed directly to the students and not through institutions by the government or private sources. The student cashes this voucher in the institution of their choice. In this regard, he is convinced that most institutions will strive for better quality in a vein to attract potential students and by so doing, inter-institutional competition will enhance reputational and financial gains on some of the best institutions and motivate the weak institutions to aspire to emerge as the best institutions. Barr (2000) is of the opinion that governments should enhance a university loan scheme which will enhance access and quality. He believes that the students are from divergent backgrounds and the interest charges on these loans should not favour a certain class of students to the disfavour of others. He proposes that the interest rate levied on these loans should not be charged as exorbitant as that of banks but should be reduced in order for the students to be encouraged to take the loan so that the government could recover a great sum of the money disbursed for this purpose.

Mingat and Tan (1985) are for the notion that State subsidies which are always increasing yearly for Higher Education should be slashed and shifted to primary education. They are also in vote for privately sponsored higher education through the student loan scheme. They believe this will promote efficiency, success and tickle the consciences of the students to be hyper-serious and to go for study options which are relevant to the needs of the society. They believed that the private rates of return to the citizens which the State has given basic education to are invaluable as well as social rates of return to the State.

Arising from all these scenarios, the need to adequately fund educational institutions, especially medical schools, becomes more germane in any society to enable them to fulfil their mandate on teaching and learning, research and patient care. There are many demands that medical schools have to consider in the training of medical students. Employers of labour require a skilled workforce that possesses necessary information and technological know-how to position them to compete globally. New generations of students are articulating individual needs and emphasising the relevance of teaching to their current or future employment (Akintoye, 2008). Consequent upon the dwindling funding allocation to medical schools, in the light of competing needs of other sectors of the country, Akintoye (op. cit.) concluded that it is imperative for medical schools to devise other means of generating funds to meet the huge financial resources required to run medical schools effectively. Other sources of generating funds by medical schools, outside of government yearly subventions that he identified include:

- endowments
- foreign grants
- fees / levies

- international aids
- investments and internally generated revenues.

The relevance of education and appropriate funding cannot be over-emphasised. Education has been recognised as an instrument for achieving national development (Oguntoye and Alani, 1998). The proponents, while accepting that there is a strong link between the economy and the educational sector, also emphasised that there must exist, adequate skilled manpower that would facilitate the process of harnessing the infrastructural facilities of the country so as to bring about economic development and prosperity for the people. The missing link between quality education and national development is adequate funding of education. According to Oguntoye and Alani (op. cit), a country needs to invest adequately in its healthcare, education, agricultural sector, transportation facilities to remain competitive in the global landscape. Apart from tertiary education, which has been characterised by inadequate budgetary and funding provisions by the Federal Government, healthcare delivery in Nigeria too has suffered significant cuts in budgetary allocation since the wake of the economic crisis of the 1980's (Hashim, 2002).

The myriads of challenges facing the health sector were succinctly highlighted and discussed at the conference of chairmen and chief executives of tertiary hospitals, held in Abuja, Nigeria, it was noted that the dysfunctional organisation and inadequate funding of health services had a strong impact on the failure of health service delivery in Nigeria (Alli, 2003; Iya, 2003; Akinola, 2003). The health indicators in Nigeria, for instance, are poor, comprising of life expectancy – 53 years; infant mortality rate – 80 per 1000 births; maternal mortality rate – 8 per 1000; percentage of the population with access to health – 67%; the population with access to potable water – 43%. These statistics are far worse than those of some poorer countries. Multiplier effects of corruption over the years have also impacted negatively on the delivery of effective healthcare services. The need to broaden the financial resource base of tertiary education and healthcare services, as a way of reducing dependency on government funding, was further highlighted by the Minister of Health who argued that the neglect of healthcare services in Nigeria manifested in the fact that only curative services are focused upon. Ajayi (1992) opined that the country does not emphasise the enormous responsibilities of the tertiary tier for manpower development and research, around which the feasibility and success of the entire health policy revolve. There needs to be significant improvement on budgetary and actual releases of funds for the healthcare delivery services to complement the medical education training and practices obtained through medical schools.

Indeed, Arikewuyo (2010), whose study dwelt on funding and quality assurance in the educational systems in Nigeria, identified underfunding as a major factor threatening the quality of the educational system in the country. Other complementary factors that he identified as militating against delivery of qualitative educational services include:

- Inadequate infrastructure facilities
- Poor management of schools
- Industrial crises
- Poor remuneration of staff

Emphasis was placed on the fact that funding of education has not been given the necessary attention by the Nigerian government. On average, the Federal Government allocated less than 10% of its yearly budget to education. Jinadu et al., (2002) similarly identified inadequacy of human and material resources as a major deficiency militating against the effective functioning of community-based medical services, which is one of the core mandates of medical education in Nigeria.

Reed et al. (2007) carried out a study to determine the association between funding and the quality of published medical education research. A survey was designed which involved 210 medical education studies, published in 13 peer-reviewed journals. The outcome of the study revealed that the quality of published medical education research is associated with study funding. With regards to quality in education, Coombs (1968), using the definition propounded by International Institute for Educational Planning (IIEP), defined that quality could be assessed from the internal criteria of the system, such as the profile of student performance in a standard public examination. The second definition is based on the external criteria, which emphasises the fitness and relevance of an education to its environment. Ejieh (1990) argued that the quality of an educational system should be judged by its ability to enable the students to perform well in standard examinations and its relevance to the needs of the individual student, the community and society as a whole.

Ejieh (op cit.) believed that quality can be enhanced through employment of highly skilled and motivated teachers, provision of teaching materials and infrastructure, conducive learning environment as well as exposure of students to relevant educational programmes through prudential management of available educational resources, and through effective interaction between the school and the local community. Obanya (2002) argues that availability of adequate funds and financial resources is an important indicator of quality in education. The importance of funding to the attainment of qualitative education cannot be understated.

According to Arikewuyo (2010), it is difficult to talk of enhancing quality of education without considering funding. The UNESCO (2000) report on the state of education in Nigeria indicates that expenditure on education, when compared with overall annual budget, has been grossly inadequate. The report reveals that from 1987 to 1997, the average expenditure on education by the Federal Government of Nigeria was 5.1% of the annual budget and 1.1% of the Gross Domestic Product (GDP). These statistics fall short of the minimum recommended 26% of the annual budget on education by the same body. The huge gap in funding requires that urgent remedial actions be taken to ensure delivery of qualitative educational services.

Where the universities experience shortfalls in state funding for the execution of their core mandate, missions and survival as effective organisation, quick remedial actions in terms of raising additional funds to prevent disequilibrium in the system will be required (Wangenge-Ouma, 2010). This is in line with resource dependence theory (Pfeffer and Salancik, 1978), which states that organisations deprived of critical resources will seek to survive by adopting strategies to ensure a continuous flow of resources. For universities, this search usually entails the implementation of various income-generating strategies, including the introduction and raising of tuition, commercialisation and donations from alumni (Wangenge-Ouma, 2010).

Arikewuyo (2010), while reiterating the imperative of adequate financial resources of running educational institutions in Nigeria, also stated that the desired funds needed to be budgeted for, released and properly managed to assist in achieving the desired quality. In order to ensure the sustainable delivery of a functional educational system in Nigeria, there is the need for the federal institutions and medical schools to reduce its overdependence on the federal government for its funding and explore other enduring sources of financing education. Odusote (2013) identified these alternative sources of financing medical education and research in Nigeria as tuition, endowment funds, gifts and service' fees. Service fee is a major source of revenue for medical schools in the US and the proportion of total revenue derived from clinical services. Miller et al. (2012) reported that service' fees rose significantly from 6% as a portion of income realised in the 1960/1961 academic year to an average of 52% by the end of 2007/2008 academic year.

The dwindling funding accruing to HEIs and medical schools necessitated a closer collaboration between the medical schools and the teaching hospitals. In this regard, Aminu (2002) observed that the administrative relationship between the hospital and its medical school varies according to a wide variety of factors; such as tradition, history, finance, developments within the hospital and those in the wider society. Specifically, he espoused four recommendations that would engender better working relationship between both institutions:

1) The teaching hospital must, in spite of its teaching connections, be able to render care to patients at the current state of the art, and to do so with all the professionalism and compassion expected by patients and by their relatives.
2) The teaching hospital must make sufficient provisions in equipment, space and personnel for teaching at the predetermined level of training undergraduate, postgraduate and nurses, including all other health professionals.
3) The two institutions must each have a functioning financial plan to render their respective missions sustainable.
4) The institutions must support and not weaken each other.

The clinical service fee is made up of hospital payments and reimbursements for medical and supervisory services offered by the staff of the medical school to the hospitals. Odusote (2013) observed that the situation in Nigeria is different, as only the consultant staff benefits financially through the payment of honorarium for the clinical services offered to sister teaching hospitals. No payment is made to the medical school; the primary employer. This is a major loss of revenue to the medical school.

Research is one of the core mandates of a university and its medical school. According to Olayiwola (2010), university education serves as the main channel of knowledge production and continuous innovation, which provides the main character of the knowledge society. Hence, teaching, research and exchange/transfer of knowledge are the fundamental missions of universities. Again, federal government plays a dominant role in the funding of research activities of federal universities. Meanwhile, the level of funding is too small to have meaningful impact on the society. Universities and medical schools could access private research funds to augment government and internally generated resources. Using a set of probit and tobit panel data models on Italian universities, Muscio et al. (2013) noted that government funding to universities complements funding from research contracts and consulting, contributing to increasing universities' collaboration with industry and activating the knowledge transfer processes. The findings of this study support the existence of a Matthew effect-like (Merton, 1968) accumulation pattern. It also confirmed the findings of Arvanitis et al. (2008), who proved, in their study conducted in Switzerland, that institutions which had earlier collaborated with industry (that have attracted sizeable external funding in their budget) were more likely to be active participants in the knowledge transfer activities. At the same time, the creation of new channels of university–industry collaboration has gained strategic relevance to universities, primarily because of their potential as sources of external funding (Cohen et al., 1998). Recent studies highlighted empirical works justifying university-industry collaborations and business funding to universities (Gulbrandsen et al., 2011).

Perkmann and Walsh (2009) discovered the role that technology transfer had promoted patenting, licensing and spin-offs. Going further, the researchers reported university-industry collaboration which was more profound in improved research contracts and consultancy activities, characterised by better relational linkages which have the imbedded capacity to generate strong learning environment. According to OECD (2010b), European universities were primarily funded by the state. The review reported that, in most cases, the funding proportion lies between 60% and 90% of the total budget. During the last two decades, the shortcomings of the traditional input-oriented funding system, with respect to performance-based management systems of public administrations, have come to the fore, necessitating several European governments to implement numerous reforms of research of university systems (McNab and Melese, 2003).

The situation in many developed economies, such as Italy, USA, Japan, Germany, France, Canada, and the UK, means that government intervention has been reduced, and universities have embraced the action of market forces, which have become more and more important in allocating resources (Steil et al., 2002). Funding systems, and especially resource allocation mechanisms for public funds, were an essential element of reforms of university systems in several countries. Despite an international trend towards PBF, the approaches that have been implemented differ significantly across countries. According to the classification of university funding systems presented by Salmi and Hauptman (2006), Italy has a fundamentally traditional funding system similar to that of many other countries in Europe (Strehl et al., 2007).

> *The largest part of university budgets is based on 'negotiated budgets' and 'funding formulas' (based on size of staff or number of students enrolled), but universities also compete for research funding on the basis of peer-reviewed project proposals against a set of objectives. Like in many other European countries, other sources of university funding such as industry funding is becoming increasingly important for Italian universities' budgets (O.E.C.D., 2010 p.64).*

Arikewuyo (2010), referring to Donwa (2006), revealed that government support accounts for over 98% of research funding in Nigerian universities, whereas in developed countries, such as Germany, Belgium, Sweden and Korea, over 50% of research funding comes from the industry. Ibrahim (2007) argued that no country could achieve real indigenous and durable development without higher institutions and adequate research activities. Public services are duties carried out by public institutions, whether federal, state or local government. Such services could either be provided by the institutions directly or through agencies commissioned to do that on their behalf.

2.3.4 Theories of productivity and efficiency

The theories of productivity are hinged on the available models used in measuring productivity, sometimes at the micro-levels – with focus on a workman, a small section or of a department. Also, it could be at the macro-level where models are proposed for a plant or an organisation or a multi-unit corporation or industry. The earlier approach to productivity is related to the physical and technical aspects of the productive process. After the industrial revolution, mass-scale production changed the structure of jobs and the nature of work processes. The modern approach to productivity combines the classical and the neoclassical elements, which treats an organisation as a system of mutually dependent variables. The following major categorisation is possible on the basis of the approaches on which they have been constructed:

2.3.4.1 Production function models

This approach represents one of the earliest attempts to measure productivity. The model considers production as the major activity of an organisation and therefore infers that measurement of productivity is synonymous to measurement of productivity of the production function. Production function is perceived to be a function of several input factors.

Cobb-Douglas (Jean, 1957) function is the classic one and expresses the function as:

$$Q = aL^d K^t e^u \tag{1}$$

where;

Q = output; L = Labour; K = capital; U = random measurement error; a, d e and t are constants.

Ernst (1956) also proposed a model considering output to be a function of input as;

$$Output = F(X_1, X_2, X_3 \ldots X_n) \tag{2}$$

where; $X_1, X_2, X_3 \ldots X_n$ are the inputs.

2.3.4.2 Financial ratios measure

The financial ratios are used to assess the financial performance of a company. The use of financial ratios to set the productivity index of a firm can be discussed under three headings:

- Employee-related productivity measure
- Equipment-related productivity measure
- Cost and profit measure.

The first measure focuses on value-added per employee, labour-cost competitiveness and sales per employee; the second measure considers capital productivity and sales to fixed assets ratio; while the third measure focuses on cost of sales ratio, selling and administrative cost ratio and the profit to value-added ratio.

2.3.4.3 Production-based models

These differ from the concepts of “production function”. In the latter, the emphasis is to arrive at a mathematical expression which describes relationship among the several inputs comprising the production function. Under the approach of production-based models, production of goods/services is perceived as the only input. Productivity is considered as a ratio of output (goods manufactured or services rendered). Production-based models can be categorised into two variations depending upon the way the valuation of output is carried out.

(i) Output as value of production

(ii) Output as value of addition to models based on output as value of production

Ruist (1961) proposed measurement of output as:

$$\frac{Production\ of\ period}{Production\ of\ base\ period} \qquad (3)$$

Tsuyimura (n.d) proposed measurement of productivity as;

Physical productivity given as $Q/_L$ (4)

where; Q = Quantity produced; L = Labour

2.3.4.4 Product-oriented models

Bahiri and Martin (1970) advocated construction of the product productivity index; given by the total earnings of the product over the cost of producing the product. A similar productivity through product costing approach is suggested by Horngren (1965), who suggested two measures, rate of return on investment and transfer price. Smith (1973) proposed omni-factor model which considered output as a summation of all products in terms of their marginal costs.

2.3.4.5 Surrogate models

These selected models are difficult to define or are obtainable because of problems inherent in data collection and the productivity measurement, could be considered as:

$$P = \frac{ActualPay}{StandardPay} \qquad (5)$$

2.3.4.6 Economic utility models

Productivity measures under this model do not follow the conventional ratio concept of output to input and recommend the use of multi-ratios, with each ratio reflecting on a particular economic activity.

2.3.5 Theories of public expenditure

Education is generally considered as a public good because, in most cases, it meets the criteria of being non-excludable and cuts across every segment of the society (Eicher and Chevailler, 2002; Mankiw, 1998). The more common a good becomes, the more we tend to expect that it should be readily available (Bankston, 2011). Thus, while primary and secondary education focus on inculcating literacy and numeracy, higher education creates the needed manpower and technological skills to deliver productivity and growth within a society (Akintoye, 2008). McMahon (2004) argued that the potentials of realising substantial social and external benefits from education serve as justification for its public provision. Hence, compulsory education is funded from public treasury while higher education which combines public and private benefits is usually funded partially by government. Consequent upon the foregoing, that education is a public good, the review of existing theories on the funding of medical education can, in part, be explained by the theories of public expenditure. Also, the review of human development theories becomes necessary since education, at the tertiary level, is considered as a way of developing human resources for economic development.

2.3.5.1 Human capital theory

One major labour economics theory is human capital theory. Human capital is the stock of knowledge or characteristics that a worker acquires to enhance his productivity. Schultz (1961, 1960) applied human capital concept to education to examine the relationship between human capital and economic growth. Human capital theory provides a platform for the evaluation of the relevance of finance and funding mechanisms to education. Education could either be classified as a consumption good or investment good. It is a consumption good if the benefits derived increase the present satisfaction. Education is considered as an investment good where the individuals and the society are able to acquire the capacity to improve productivity through the acquisition of additional skills. According to Al-hajry (2002), expenditures incurred by persons that lead to an increase in productivity are regarded as investment. Knowledge and skills acquired through education have the potential to enhance the earning capacity and also improve the status of the beneficiary of higher education in the society. As a result of this, human capital theory postulates that the individual and the society benefit from investment in tertiary education.

There are two schools of thought on the classification of higher education and how it should be financed. There are those who believe that tertiary education is a public good and should be funded by the state (Adewuyi and Okemakinde, 2013; Adedeji and Bamidele, 2003; Curtin and Nelson, 1999; Fitzsimons, 1997; Peters and Marshall, 1996; Babalola, 1995; Peters et al, 1993). These scholars presented evidence to indicate that economic and health outcomes in developing countries will be significantly enhanced by increasing the allocation and proportion of the population that participate in tertiary education. They argued that a policy of limited funding of public education to primary school level, recommended to developing countries by World Bank and OECD countries, would have much the same probability of experiencing poverty and high mortality of the population as those with no education. They further submitted that this policy is an erroneous interpretation of human capital theory, focusing only on the declining marginal internal rates of return and public investments in successive levels of schooling, but ignoring the increasing marginal net present values of public investments in post-primary and tertiary education.

The other category believes that higher education provides elements of private benefits and should therefore be jointly financed by the government and the individuals.

According to Smith (1776),” *the wages of labour vary with the easiness and cheapness, or the difficulty and expense of learning the business. When any expensive machine is erected, the extraordinary work to be performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expense of much labour and time to any of those employments, which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work, which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace for him the whole expense of his education, with, at least, the ordinary profits of an equally valuable capital. It must do this, too, in a reasonable time, regard being had to the very uncertain duration of human life, in the same manner as to the more certain duration of the machine”* (p.203-204). Marshall (1890, 1920) clearly distinguished “personal” capital from “material” capital. He considered personal capital as being largely formed through investment by parents paying school fees and feeding expenses for the education of their children. The logic of tertiary education, as part of personal investments, was reinforced by Marshall (1961), who reasoned that education should be partly paid for by the individuals. He recommended that investment in education by individuals should be considered like any other investment, with a view to making a return in future. With education, the individual is presumably more productive and earns higher wages than would have been available without the educational investment (Balderston, 1997). These benefits would enable the individual to grow, change and benefit from exposure to higher education, and would also benefit society at large through the broader contributions of the educated person (Bowen, 1977).

The concept of human capital represents resources invested by an individual to improve personal productivity (Becker, 1964; Denison, 1962 and Schultz, 1961). In the past, it was easy for the government to fully provide the cost of higher education of the citizens because private demand for education was low (OECD, 1990). This is not the case in the present world as the demand for higher education has risen to such an alarming proportion that its financing has to be realistically apportioned between the government and individuals because of the public and private benefits involved. Researchers have developed the basis for quantitative methods for measurement of return to investment in education.

According to Blaug (1969), “*expenditure by individuals on improvement to health, education, job search, information retrieval, immigration and in-service training are viewed as investment rather than consumption, whether undertaken directly by themselves or undertaken by society on behalf of its members”* p88. Becker, (1962, 1964) had earlier conducted studies using rates of return to measure improvement in skills acquisition and efficiency on investment made by individuals on their education. Studies showed that there is justification for individuals to contribute towards the investment in education for the purpose of improving the future earning capacity of the individuals (Ahmed, 2015; Johnstone, 2007; Johnstone et al., 1998).

Investment in education is similar to other investments because all investments are made for the purpose of making a return on investment in the future. Capital concept is no longer restricted to tangible assets yielding tangible and intangible services. Intangible assets constitute part of capital formation. Further distinction is made on human resources as to whether the capital concept is restricted to investments to improve the human resource as a productive factor or not. Both input and output variables are present in investment in education, in a similar manner to other forms of investments. The input variable is the cost of all individual (private) and public (social) costs. Output is the skills and knowledge acquired through training and learning by the individuals and the society.

Education is generally considered as the greatest form of investment in human resources. According to Machlup (1982), “Education can, by elevating the learners’ intellect, improve their quality of life; but it may also improve the individuals’ skills and efficiency in producing useful things. Some economists see an important difference between the contribution that education may make to the flow of intangible satisfactions to the educated themselves (and their friends and contemporaries) and the contributions which the skilled and efficient workers will make by producing material goods in greater quantity or of better quality” (p.4).

Students and their parents invest in their education through payment of tuition fees, purchase of books and other learning materials, living expenses, etc. (Al-hajry 2002). The social rates represent the costs and benefits borne by society (Steel and Sausman, 1997). Higher education can be regarded to comprise elements of private and public investments. According to Al-hajry (op. cit), a financing arrangement of higher education that would be sustainable is a model where the cost of higher education to the individual is much higher than the cost to the public. The study carried out by Al-hajry views education as a form of economic investment under human capital theory with a view of higher returns (benefits) accruing to public and private good elements of the investment. The methodology used - cost-benefit and rates of return analysis - revealed that the bulk of the direct cost of tertiary education was borne by the government, while a lesser amount was contributed by the private parties. The resultant public rates of return on investment made by government were low when compared with the private rates of return on investment. Accordingly, the study recommended that deductions be made from the future salary earnings of the beneficiaries to defray part of the cost of higher education provided to the individual by the state, with a proviso that full recovery should be made within 25 years of employment.

In the same vein, it is important to note that a discussion on the theoretical handle of public expenditure has become difficult due to the changes in scope and the increasing composition of public expenditure coupled with the various operational aspects of public expenditure decision making (Sahni, 1972; Smith, 1961). The increasing urbanisation and the modern democratic political system remain strong factors for classifying public expenditure theories. Generally, however, there are three-fold divisions upon which the theoretical literature on public expenditure can be achieved. These are the normative theories, positive theories and the applied/empirical tests view of public expenditure.

2.3.5.2 Normative theories of public expenditure

The normative theories of public expenditure deals with the study of the appropriate levels and composition of public expenditure. It determines the norms of the operations for the satisfaction of social wants. Besides, it examines the effect and consequences of public expenditure and assesses the aims and objectives of public expenditure programmes. Hence, the normative aspect of public expenditure approach is also known as welfare approach. The areas of debates in this theory include the question of social choice; market failures and concept of 'public good'; normative solution for allocation and distribution of resources which is nothing but a pure theory of public expenditure. The concept of public good is reviewed here on the basis of Samuelson's (1954) contribution. People require public goods to lead the life in a civilised society. The service of public goods is provided to the people in such a way that they are consumed equally whether they pay or not and the principles of price mechanism cannot hold good in this context. These services are provided to the people by the government because of failures of the market. Market failure gives rise to various degrees of intervention for the government. The benefits of production of public goods are too costly to be divided into units to which prices can be assigned. Hence, it is difficult to exclude any one of the citizens from consuming these benefits if they refuse to pay for them.

2.3.5.2.1 Positive theories of public expenditure

The normative theory of public expenditure has not added much to the understanding of government behaviours in the real world. Hence, there is a need to shift attention from the problem relating to "what should be" to "what is?". In doing so, it is necessary to know how expenditure policies, in fact, be determined which reached to the positive theory of public expenditure. Bird

(1970) defined positive theory of public expenditure as that body of economic and political analysis which attempts to understand and explain the observed pattern and level of government expenditure and the changes in those expenditure over time. The positive theory of public expenditure deals with the formulation and empirical verification of relevant behavioural hypothesis. In this context, it is worth explaining the two prominent positive theories of public expenditure. These are the Wagner hypothesis, Peacock-Wiseman hypothesis; otherwise known as the Displacement Effect.

2.3.5.2.1.1 Adolph Wagner's law of increasing state activity

Wagner's (1893) law came into being in the late 19th century when the law of increasing state activity was developed, using empirical data to establish a relationship between state expenditure and government growth. He states that, as the industrialisation and economic activities develop, the functions of the government increase simultaneously. Wagner (op. cit.) further argued that during the industrialisation process, as the real income per capita of a nation increases, the share of public expenditures in total expenditures increases. The law cited that "The advent of modern industrial society will result in increasing political pressure for social progress and increased allowance for social consideration by industry". Wagner (1893) designed three focal bases, the economic, socio-political and technological advancement for the increase in state expenditure. Wagner (1893) stated that public spending is an endogenous factor, determined by the growth of national income. This implies that national income determines the level of public expenditure. Wagner's (1893) law tends to be a long-run phenomenon, as the longer the time-series, the better the economic interpretations and statistical inferences. Wagner's (1893) law infers that in progressive societies, the activities of the central and local governments increase on a regular basis; the increase in government activities is extensive and intensive. The governments undertake new functions in the interest of the society at large. The purpose of the government activities is to meet the economic needs of the citizens. A government's expansion and intensification of its activities leads to an increase in public expenditure.

Although not without some useful insights, the Wagner's (1893) law has suffered some considerable defects that are not even sufficient to undermine its usefulness and applicability to today's reality. Indeed, the theory still continues to play an important role in the study of public expenditure behaviours. According to Wagner's law, there is a functional relation between the growth of an economy and the government activities with the result that the government sector grows faster than the economy. In fact, the Wagner's law has been interpreted in terms of the concept of elasticity. This suggests greater than unity income elasticity for a number of public goods which can be interpreted to mean that the percentage change in the public expenditure is greater than percentage change in GNP or national income. The Wagner's law assumed that the state behaves as if it were an individual existing and making decision independently of the members of society (Bird, 1971).

In summary, Wagner (1893) states that a cause and effect relationship existed between the growth of economy and relative growth of public sector. According to the law, the principal determining force for the rise in public expenditure is the growth of real per capita income or in other words, increased public demand for new public services arising out of the growth of real per capita income. The main reasons for the increase in the size of public sector; as indicated by the percentage of public expenditure to gross national product, are social problems, expansion of traditional functions of the state, growth of population, urbanisation, rise in prices and national income.

A major criticism of this theory is its proposition of organic beliefs, where it is deemed that governments like to spend money, people do not like increasing taxation and the population votes for ever-increasing social services. This theory is defective in a developing economy such as Nigeria because government's resources to provide expansionist social services, such as tertiary education, are grossly limited. Nigeria is a monolithic economy and depends mainly on the sale of crude oil; a commodity that is exposed to the vagaries of the forces of demand and supply in the international market. The government of Nigeria faces a major challenge in the provision of social services as a result of the limited funds accruing to the federation account. The reality facing the nation implies that other sources of funding of tertiary education could be explored to address the inadequacy of the financing of tertiary education in preference to the federal government being the sole financier of public tertiary education.

2.3.5.2.1.2 Peacock and Wiseman's theory of public expenditure

Peacock and Wiseman's theory on public expenditure focused on England from 1890 – 1955. Unlike the proposition of Adolph Wagner, Peacock and Wiseman's theory asserts that large-scale disturbances, such as major wars, could propel public spending which will cause displacement effect, shifting public revenue and public expenditure to new levels. The government will be short of revenue and there will be an upward review of taxation to augment the revenue level to meet the people's expectation about public expenditure. Since government cannot ignore the demands for provision of social services by the people, there will be a new level of "tax tolerance". Individuals will now accept new taxation levels to provide required public revenue to provide the social services. These days, it is generally recognised that growth in public expenditure is a necessary phenomenon and thus the disturbance situations do not have significant impact any more.

Peacock and Wiseman (1967) provide a supply-side view to the theory of public expenditure. They stress the time-pattern of public spending trends and highlights the fact that the increase in public expenditure does not follow any smooth and continued trends; as depicted by Wagner (1893). Peacock and Wiseman (1967) highlights that increase in public expenditure over time has occurred in sets of step-like manner. In their own words, apart from the secular trend of public expenditure, there are other aspects of development of public expenditure such as the time pattern of public expenditure growth which seems to be equally significant. There are three underlying assumptions for the theory of public expenditure enunciated by Peacock and Wiseman (1967). The first is that decisions about public expenditure on different plan is political and are influenced through the ballot box or by whatever media citizens can bring pressure to bear on the government. The second is that political choices about the use of resources differ from choices made through the market system while the third is that citizens can have ideas about desirable public expenditure which are quite different from tolerable burdens.

In essence, the displacement hypothesis is founded upon a political theory of public expenditure determination where government likes to spend more money but citizens do not like to pay more taxes, and that governments need to pay some attention to the wishes of their citizens. Thus, opening up public expenditure to the influence of the ballot box. Peacock and Wiseman (1967) viewed the voter as an individual who enjoyed the benefits of public goods and sources but who disliked paying taxes. Thus, the government when deciding upon the expenditure side of its budget keeps a close watch on the voters' reactions to the implied taxation. They assumed that there is some tolerable level of taxation which acts as a constraint on government behaviours.
On the basis of the afore-stated assumptions, the Peacock and Wiseman (1967) theory can be explained under three concepts. These are the displacement effect, inspection effect and concentration effect. In explaining the displacement effect, Peacock and Wiseman (1967) explained that as the economy grows, tax revenue, at a constant tax rates, would rise. This would enable public expenditure to grow in line with the gross national product (GNP). In normal times, therefore, public expenditure would show a gradual upward trend, even though within the economy, there might be a divergence between what people regarded as being a desirable level of public expenditure and desirable level of taxation. During the period of upheaval, however, this

gradual upward trend in public expenditure would be disturbed. These periods would coincide with war, famine or some large-scale social disaster which would require a rapid increase in public expenditures. In order to finance the increase in public expenditures, the government would be forced to raise taxation levels.

This raising of taxation levels would, however, be regarded as acceptable to the electorate during the periods of crisis. It is this that Peacock and Wiseman (1967) referred to as the ‘displacement effect’. Public expenditure is displaced upwards and for the period of the crisis, private expenditure is displaced for public expenditures. The process represents an upward shift in the trend line of public expenditure. Here, displacement effect means a discontinuity in the growth pattern which produces expenditure peak during social disturbances. After the social disturbances are ended, the newly emerged levels of ‘tax tolerance’ make the society willing to support higher levels of public expenditure. Since the society realises that it is capable of carrying a heavier tax burden than the previous had thought possible to bear. War and other social disturbances frequently forced people and the government to find solutions of important problems which previously had been neglected and it is known as inspection effect. The concentration effect refers to the apparent tendency for the central government activities to become an increasing proportion of total public sector activities when society is experiencing economic growth.

2.3.5.3 The classical/keynesian approach of public expenditure

The classical economists believe that government intervention does more harm than good to an economy and that the private sector should run most of the economic activities. In his treatise: *The Wealth of Nations*, Smith (1776) advocated much on the “laissez-faire” economy, where the profit motive was to be the main cause of economic development. According to the classical dichotomy, an increase in the total amount of money leads to a proportionate increase in all money prices, with no change in the allocation of resources or the level of real GDP, which is known as money neutrality. The classical economists believe that the economy is perfect; that it is always at full employment level; that the wage rate and rate of interest is self-adjusting and, that the budget should always be balanced as savings is always equal to investment. Since they believe that the economy is always at its full employment level, their objective is certainly not growth.

The Keynesians, on the other hand, believe that government intervention exists to correct market failures. Keynes believed that economic depression needed government intervention as a short-term cure. Keynes (1936)’s *General Theory of Employment, Interest and Money* criticised the classical economists as puttting too much emphasis on the long run. According to Keynes, “we are all dead in the long run”.

It is along these threads that the literature on financing of higher education is categorised into three broad divisions. These are full private financing (privatisation), total state financing (tax funding) and shared financing between the state and private parties (students and parents). Privatisation of higher education originated from the concept of libertarianism, which espouses that the primary aim of institutions is individual liberty achieved through the mechanism of private markets (Barr, 2004a). According to Sanyal (1998), arguments in support of full privatisation of education could be predicated on three parameters; efficiency, quality and equity. Eicher and Chevailler (2002) also supported full privatisation of higher education, which they opined provides guaranteed equity participation. They argued that the acquired private benefits would bring about higher benefits by way of higher income and social status, greater efficiency in consumption, better health, increased political efficiency and greater access to and better understanding of culture, science and technology.

Total state financing is borne out of the socialist viewpoint that social justice and equality could best be achieved through egalitarianism that makes financing of higher education the responsibility of the state. Socialists believe that the state should provide necessary financing of education at all levels in a country (Barr, 2004a). Social justice has always been the dominant justification for full state financing of education. Nkrumah-Young, (2005), quoted Harrison, (1997) who identified externalities, social returns, equality of opportunity and equity as the basis for the state to assume full responsibility for the financing of higher education. Externalities imply that higher education benefits society at large because of knowledge transfer through research and development which leads to increased output.

Eicher and Chavailler (2002) supported the argument of the economists, who believe that education is a “pure public good”. Barr (2004b) on the other hand, canvassed against total state financing of higher education. The propositions that higher education should be financed by the state on humanitarian, moral, social and fiscal grounds were countered by Barr (2004a). The argument that higher education is a basic right that must be provided for free was dismissed by Barr, who argued that equity objective is not about education being free. Barr argued that the system should ensure that no bright citizen is denied access to higher education because he or she comes from a disadvantaged background. The moralist states that it is immoral to charge for education. This assertion was countered by the fact that education should not be made free for everyone, including the rich in the society. The social proposition states that private financing of higher education promotes elitism. Barr's (2004b) equity objective on the other hand is a system in which the ability of the brightest and best students to study at any ivory tower should not be hindered by the reason of his or her socioeconomic background. The fiscal argument posits that if the future taxes to be paid by graduates are higher than the current public expenditure, then there is justification for full state financing of higher education. Barr (2004b) argued further that tax funding (state funding) was unaffordable, inefficient and regressive. Full funding by the state is unaffordable due to resource constraints and the fact that higher education provides both private and social returns implies that its funding entirely by the state would be inefficient. Similarly, the reason that higher education was consumed mostly by the children of the rich and affluent in the society means that tax funding by the state could be regressive. Studies revealed that as demand for higher education increased, there was corresponding strain on economies and this weakened the argument for egalitarianism of higher education (Vawda, 2003; Gradstien, 2003). It had been argued that large scale public subsidies of tertiary education are inequitable and regressive to the extent that the students benefiting from subsidised university education come, disproportionately, from socially more advantaged background (Nerlove, 1975; 1972; and Schultz, 1972; Arrow, 1971; Friedman, 1962). Globalisation also has brought double-edged challenge to the funding of university education. The competitive advantage among nations has become more important (Castells, 1998) while the capacity and commitment of governments to fund tertiary education has diminished (Henry et al., 2001).

2.3.5.4 Baumol's law

Rather than work from the observed data, Baumol's law starts from an observation about the nature of the production technology in the public sector. The basic hypothesis is that the technology of the public sector is labour-intensive relative to that of the private sector. In addition, the type of production undertaken leaves little scope for increases in productivity and that makes it difficult to substitute capital for labour. Competitions on the labour market ensures that labour costs in the public sector are linked to those in the private sector. Although, there may be some frictions in transferring between the two, wage rates cannot be too far out of line. However, in the private sector, it is possible to substitute capital for labour when the relative cost of labour increases.

Furthermore, technological advances in the private sector lead to increases in productivity. These increases in productivity result in the return to labour rising. The latter claim is simply a consequence of optimal input use in the private sector resulting in the wage rate being equated to the marginal revenue product. Since the public sector cannot substitute capital for labour, the wage increases in the private sector feed through into cost increases in the public sector. Maintaining a constant level of public sector output must therefore result in public sector expenditure increasing. If public sector output/private sector output remain in the same proportion, public sector expenditure rises as a proportion of total expenditure. This is Baumol's law which asserts the increasing proportional size of the public sector.

There are a number of problems with this theory. It is entirely technological driven and does not consider aspects of supply and demand or political processes. There are also reasons for believing that substitution can take place in the public sector. For example, additional equipment can replace nurses and less-qualified staff can take on more mundane tasks. Major productivity improvements have also been witnessed in universities and hospitals. Finally, there is evidence of a steady decline in public sector wages relative to those in the private setor. This reflects lower-skilled labour being substituted for more skilled.

2.3.5.5 Rachet effect

Models of the Rachet effect develop the modelling of political interaction in a different direction. They assume that the preference of the government is to spend money. In contrast, it is assumed that the public do not want to pay taxes. Higher spending can only come from taxes, so by implication, the public partially resists this; they do get some benefit from the expenditure. The two competing objectives are moderated by the fact that governments desire re-election. This makes it necessary for it to take some account of the public's preferences. The equilibrium level of public sector expenditure is determined by the balance between these competing forces. In the absence of any exogenous changes or of changes in preferences, the level of expenditure will remain relatively constant.

Occasionally, though, economies go through periods of significant upheavals such as occurs during wartime. During these periods, normal economic activity is disrupted. Furthermore, the equilibrium between the government and the taxpayers become suspended. Rachet models argue that this permits the government to raise expenditure with the consent of the taxpayers on the understanding that this is necessary to meet the exceptional needs that have arisen. The final aspect of the argument is that the level of expenditure does not fall back to its original level after the period of upheaval. Several reasons can be advanced for this. Firstly, the taxpayers could become accustomed to the higher level of expenditure and perceive this as the norm. Secondly, debts may be incurred during the period of upheaval which have to be paid-off later. This requires the raising of finance. Thirdly, promises could be made by the government to the taxpayers during periods of upheaval which then have to be met. These can jointly be termed Rachet effects that sustain a higher level of spending.

Finally, there may also be an inspection effect after the upheaval, meaning that the taxpayers and government reconsider their positions and priorities. The discovery of previously unnoticed needs then provide further justification for higher public sector spending. The prediction of the Rachet effect model is that spending remains relatively constant unless disturbed by some significant external event. When these events occur, they lead to substantial increase in expenditure. The Rachet effect and inspection effects work together to ensure that expenditure remains at the higher level until the next upheaval.

2.4 Review of methodological literature

Generally, the empirical literature on measuring efficiency revealed that three basic techniques have been prominent in the literature. These are the Data Envelopment Analysis (DEA) model; the Stochastic Frontier Analysis (SFA) and the traditional method of Financial Ratio Analysis (FRA). While both the DEA and SFA are more sophisticated, the latter is a parametric measure and the former a non-parametric model. Generally, studies on efficiency have been dichotomised; those that employed a one-stage approach and a two-stage approach. The studies that considered a two-stage approach did not only obtain efficiency scores or ranks of a productive centre but also proceeded to ascertaining the determinants of this efficiency. Basically, studies centred on both sides of the divide have bordered around country-specific to cross-country and even regional analysis. This review of extant literature on the efficiency will rather focus on the technique of analysis rather than other features of differences among studies.

DEA consists of various analytical methods and techniques designed to evaluate the performance of organisations or decision-making units (DMUs) in terms of their use of multiple inputs to produce multiple outputs and outcomes (Zhu, 2009). Specifically, these techniques “measure the relative efficiency [of DMUs] where market prices are not available” (Zhu, 2009, p. 4). In measuring the relative efficiency of DMUs, DEA techniques yield a composite index of how well an organisation or its operations utilised resources (i.e., inputs) to produce outputs and outcomes (Zhu, 2009, 2014).

Both public and private institutions have discovered the relevance of DEA to measure the efficiency of service delivery since its introduction in 1978. DEA methods have been used to analyse the production (or technical) efficiency of private and public organisations with respect to achieving outputs and outcomes. In the public sector, researchers have used DEA to analyse the efficiency of educational institutions (Coates and Lamdin, 2002; Thanassoulis and Dunstan, 1994; Mancebon and Molinero, 2000; Thanassoulis, 1996a, 1996b).

As university administrators seek to improve resource usage, efficiency analysis has become an important concern in managing performance (Caroline et al., 2007; Fandel, 2007; Caballero et al., 2004; Avkiran, 2001; Chalos, 1997; Glass et al., 1995; Cohn et al., 1989). Previous studies have concentrated on how to allocate educational resource inputs more efficiently to improve output performance. The input indicators are generally units of measurement that represent the factors employed in service delivery. Generally, these inputs include human, financial and material resources (Martin, 2006). The CMUL saw the justification to seek to improve on efficiency in its daily activities as a key participant in the global educational community.

According to Samy (2003), schools impact the individuals and society as a whole; hence there is a need to formulate equitable education policies that would engender equity and equality in education. The United States of America has carried out series of reforms to ensure that education is accessible to every citizen (Caldwell and Roskam, 2002). The model of funding adopted in Canada, on the other hand, recognises the distinctions between need, demand, and utilisation as they affect the rationale for government involvement, models of the possible funding flows as they affect policy levels and implications of various approaches to payment. Issues of equity and equality also affect health services the same way it affects education.

Deber et al. (2008), in trying to address the research question of determining the best way to pay providers to deliver health services, came up with the fact that no single method may serve all purposes. Each approach has its own relative advantages and disadvantages (Robinson, 2001; Glaser, 1987). Since education and health both impact the training of medical doctors, the peculiar circumstances of the environment play significant roles in the appropriate policy direction of education adopted by the country.

Educational institutions require adequate funding to effectively carry out their functions. The choice of relevant funding model relies on a formula that would support the realisation of this objective. With the example of South Africa, Wangenge-Ouma (2010) found that funding formula had shifted from enrolment-driven calculations to a new policy that ensures equity and redress from the apartheid era method of allocating financial resources to the universities. Wangenge-Ouma's study revealed that the basic feature of the new funding framework (NFF) is that it links the award of grants by the government on higher education funding to national and institutional planning. The funding/planning mechanism engenders a goal-oriented approach in the distribution of government grants to individual institutions, in accordance with:

(a) The national planning and policy priorities
(b) The quantum of funds made available in the national higher education budget, and
(c) The approved plans of individual institutions (MOE, 2004).

Whereas the NFF is designed to lead South Africa's higher education in the direction of achieving specific policy goals, including transformation, there were unintended occurrences that had a tendency of threatening the attainment of these goals. For instance, the NFF is not driven by the actual costs of higher education budget. According to Steyn and de Villiers (2006), the instrumentality of responsibility accounting would have ensured that universities calculated the actual costs of training every student as a basis of determining the funding requirements and also established the amount of subsidies applied towards defraying the reasonable costs. Since this was not done, the NFF thus "serves as a division mechanism of a pre-determined total grant allocation" (Steyn and de Villiers, op cit.). The attendant consequences have been insufficient funding of the higher education sector (Wangenge-Ouma, 2010). As earlier mentioned, the funding framework is intended to lead public universities towards achieving particular transformation goals, while the unintended consequences of the framework on the behaviour of universities have the tendency of slowing down the attainment of the set goals. The above shortcomings notwithstanding, the NFF funding framework is generally consistent with some international accounts of the role which government funding can play in the implementation of national higher education policies (Merisotis and Gilleland, 2000; Ziderman and Albrecht, 1995).

Many research works have used the DEA technique to measure productivity and efficiency of several different types of decision making units (DMUs), such as hospitals, educational institutions, cities, courts and financial institutions (Tavares, 2002). In the production process, each DMU has a varying level of inputs and a varying level of outputs. DEA constructs a smooth curve based on the available data. The distribution of sample points is observed and a line is constructed enveloping them (Fried et al., 1993), hence the term "Data Envelopment Analysis (DEA)". From this line DEA shows which producers are more efficient and identifies the inefficiencies of other producers. Hence, Fried et al. (2002), suggest that DEA is an appropriate method of measuring the relative efficiency of multiple decision-making units by enveloping observed input-output elements as tightly as possible. Further, it is useful to estimate relative efficiency for the discussion of the relative importance of inputs and to observe the marginal contribution of each input (Fried et al., 2002). In parametric analysis, the single optimised regression is assumed to apply to each DMU and requires the imposition of a specific functional form relating the independent variables to the dependent variables (Fried et al., 1993). In contrast, DEA optimises the performance measure of each DMU and does not require any assumption about the functional form (Charnes et al., 1978). DEA constructs the efficient frontier from the sample data (Coelli et al., 1998).

It is particularly instructive that DEA models are not only found to be a relevant tool for measuring efficiency in public educational institutions, but have been used for the same purpose in hospitals. According to Simoes and Marques (2011), Portuguese citizens believe that health protection is a social and cultural right which must be open to universal access and with a tendency to be free. They believe procedures must be put in place that accord priorities to the health sector such that equity in access, and efficiency in financial, human and material resources utilisation is assured (Schaffhauser-Linzatti et al., 2009). Using the non-parametric technique of DEA and a double-bootstrap procedure in determining the influence of operational environment on efficiency, the study revealed the importance of congestion in efficiency measurement. A number of Portuguese hospitals (68 major Portuguese hospitals for the year 2005) were found to be congested and inefficient. Also, studies on measurement of efficiency of universities across Europe and America revealed that DEA technique facilitates seamless analysis of efficiency and inefficiency that may occur in the activities of institutions (Gralka et al, 2018; Worthington and Lee, 2008; Warning, 2007; Johnes and Johnes, 1993).

In similar vein, Avkiran (2001) looked into technical and scale efficiencies of universities. Leitner et al. (2007) extended further by their studies on Australian universities using multiple input and output variables. Ahn et al (1988) and Salemo (2002) did their studies on U.S. higher education. The findings from these research studies have assisted in analysing both efficiency and inefficiency embedded in services provided by universities. Tavares (2002), in an analysis of efficiency studies during the period from 1978 to 2001, reports more than 3000 DEA applications in various forms of organisations. His bibliography includes 1259 journal articles, 50 books and 171 dissertations, written by 2152 distinct authors. Most of these studies are based on the analysis of the efficiency of service-oriented organisations, including educational institutions like the College of Medicine, University of Lagos. The DEA model for constructing a production frontier and for the measurement of productivity and efficiency relative to the constructed formula, is an increasingly popular tool used in the non-parametric approach (Zhu, 2003). Generally, DEA evaluates the efficiency of a given firm, in a given industry, compared to the best performing firms in that industry (Coelli, 1996). Thus, it is a relative measurement technique. In efficiency analysis, most researchers generally use DEA to measure the efficiency in public sector organisations, non-profit making organisations and private sector organisations. Productivity indices for each firm are determined on the basis of the inputs and outputs of each firm. Such an index is called a DEA score. From these DEA scores, productivity and efficiency can be measured for a whole organisation or a unit within an organisation (Coelli, 1996). The evaluation unit is also referred to as a decision-making unit (DMU).

2.4.1 Theses and studies that adopted Data Envelopment Analysis (DEA) technique

The researcher has adopted the DEA technique for measurement of efficiency in this study to address one of the research questions. This study is similar to many studies that have been carried out, especially in universities and public institutions in different countries, to measure efficiency. The purpose of making this choice is to enable the researcher to compare and contrast the findings from this study to the results of previous studies using DEA to examine relative efficiency in the utilisation of scarce resources, within public and private sectors respectively. Results of these analysis have helped the managers of those organisations to identify areas of strengths and weaknesses and enabled them to take remedial actions. Performance indicators in the public sector have often been criticised for being inadequate and not suitable to analysing efficiency (Barrow and Wagstaff, 1989; Birch and Maynard, 1986). Areas of criticism include concentrating on input variables to the detriment of output variables, an ad hoc selection of indicators and an inability to distinguish inefficiency from environmental factors. In order to address this criticism, DEA technique becomes appropriate because it is capable of assisting in converting multiple inputs into multiple outputs, and the results highlight the efficiency levels.

DEA is a mathematical programming technique that produces a single aggregate measure for each DMU in terms of its utilisation of inputs to produce desired outputs (Kao and Hung, 2008). The relative efficiency of each DMU is expressed as the ratio of aggregated outputs to aggregated inputs. Conceptually, each DMU is allowed to select the weights which are most favorable in calculating its relative efficiency, as long as the same weights will not result in efficiency scores exceeding 1 for all DMUs. The efficiency calculations focus on the revealed best practice production frontier. This enables the inefficient DMUs to calculate the amount of inputs to be reduced and the amount of outputs to be increased in order to become efficient. This technique is a reliable and robust evaluation method (Montoneri et al., 2012). It has been widely applied in measuring the relative efficiency of different industries, especially for not-for-profit organisations (Charnes et al., 1978); medical industry (Valdmanis, 1990) and has also been used to assess the efficiency of HEIs (McMillan and Data, 1998). In order to obtain the highest efficiency score, it is possible that the DMU will assign a weight of zero to unfavorable factors. This implies that the associated factors are eliminated from evaluation (Seinford, 1996). A major disadvantage of DEA technique, as pointed out by Meng et al. (2008) and Meng (2006), suggests that the discrimination power of DEA models could be significantly decreased if too many input or output variables are used simultaneously. While there are dangers in using a simple quantitative approach, the advantages include the fact that the data required could be readily obtained at low cost and can be easily communicated to large audiences (Lindsay, 1982).

A host of studies examined technical and scale efficiency for public and private institutions. The study conducted by Ahn et al. (1988), sought to evaluate the efficiency of US higher education institutions using DEA model. Both technical and scale efficiency were computed for public and private doctoral-granting institutions, while taking cognisance of the presence of medical schools in 1984–1985. The data from the National Centre for Education Statistics (NCES) were used. Three cost-based input variables were introduced: 1) instructional expenditures; 2) physical investments; and 3) overhead expenditures. The output variables used include 1) FTE undergraduate; 2) graduate enrolments and 3) Federal research grants expenditures.

They found the public institutions without medical schools to be more technically efficient than their private counterparts (mean of 70% and 64% respectively). A further analysis between institutions with medical schools showed the same degree of dispersion between mean efficiency scores, though the nominal values were notably higher (mean = 84% and 77% respectively). However, they were only able to verify differences at α = .10 significance level when testing whether the mean scores differ for the two types of institutions. In the analysis of scale efficiencies, they estimated a mean efficiency score for universities without medical facilities of 65% and a mean score for universities with medical facilities of approximately 79%. The main objective of the study was to test hypotheses about public versus private sector behaviour; although no policy implications were offered. Also, the study only focused on a single year, whereas such a study would stand to benefit immensely from a multi-year analysis (Salerno, 2003).

Another study was conducted by Coelli (1996), who assessed the efficiency of Australian higher education, using 1994 data collected from the Australian Department of Employment, Education, Training and Youth Affairs (DEETYA). Coelli formulated three models of university performance for 36 universities: (1) to evaluate the university as a whole (2) to evaluate academic aspects, and (3) to look at university administration. The input and output variables used in the study are:

	(1) **University as a whole**	**(2)** **Academics aspect**	**(3)** **University administration**
Inputs	Total staff numbers Non-staff expenses	Academic staff numbers Other expenses	Administration staff Other administration expenses
Outputs	Student numbers Publications index	Student numbers Publications index	Student numbers Total staff numbers

For each model, a variable return to scale (VRS) DEA was conducted. A secondary analysis on the overall performance model disaggregated technical efficiency for the purpose of estimating scale efficiency. A sensitivity analysis was further done using modified input and output variables.

The study revealed a mean technical efficiency score for the university model of 92.5% and mean scale efficiency. It was found that the overwhelming majority of inefficient institutions (i.e., 21 out of 26) were operating at decreasing returns to scale (DRS). In the academics model, the mean technical and scale efficiency scores were 92.6% and 93.4% respectively. Nineteen scale inefficient institutions were shown to be at DRS and nine institutions are increasing returns to scale (IRS) (Salerno, 2003). In the third model, (i.e., university administration) the mean technical efficiency was shown to be lower significantly i.e. 87% and the mean scale efficiency of 94.4%; both being lower when compared to the other two models. He submitted that majority of Australian universities appeared to record high degree of technical and scale efficiency and some universities were inefficient in more than one model adopted in the study.

McMillan and Data (1998) also used DEA technique to estimate the efficiency of 45 Canadian universities between 1992 and 1993. The data was sourced from the Canadian Association of University Business Officers (CAUBO) and the Association of Universities and Colleges of Canada (AUCC). Models formulated were to examine cost efficiency using different combinations of the input and output specified in the study (Salerno, 2003). The input variables are faculty

expenditures, other expenditures and financial input. Output variables include undergraduate teaching, graduate teaching and research income.
The findings revealed varied efficiency score for broad groupings of the institutions into three categories – universities with medical schools; comprehensive universities without medical schools; and primarily undergraduate universities. They concluded that efficiency scores generally, are high, which may not be unconnected to the small sample size of the study population.

Avkiran (2001) investigated technical and scale efficiencies of Australian universities through DEA. Three models of university efficiency were developed in the study; these are overall performance, performance on delivery of educational services, and performance on fee-paying enrolments. All three models used FTE academic and non-academic staff as input variables.

The output variables used in each model are:

(1) Overall model	**(2) Educational services model**	**(3) Fee-paying enrolments model**
Undergraduate enrolment	Student retention rate (%)	Overseas fee-paying enrolments
Postgraduate enrolment	Student progress rate (%)	Non-overseas fee-paying
Research output	Graduate full-time employment rate (%)	Postgraduate enrolments

A variable returns to scale (VRS) DEA was conducted for each model. A secondary analysis was later done on the overall performance model that disaggregated technical efficiency so as to also estimate the scale efficiency (Salerno, 2003).

The findings of the study showed that, overall, Australian universities are technical and scale efficient. Also, the performance models adequately discriminate between efficient and inefficient universities; whilst also disclosing that the largest class of Australian universities with potential room for improvement, were in fee-paying enrolments category. The study also showed that a majority of Australian universities have been operating under a regime of decreasing returns to scale (DRS), while about one-third have been at a most productive scale size (MPSS), with a small number at increasing returns to scale (IRS).

A number of studies using DEA to evaluate efficiency were conducted in the United Kingdom. Athanassopoulos and Shale (1997) found, from their study, that universities that were cost

efficient recorded high output levels, but these did not necessarily equate to lower unit costs. Izadi et al. (2002) also looked at efficiency of UK higher education institutions. They argued that the inefficiency identified in the performance of higher education institutions is fairly modest and that it is not unlikely to achieve further efficiency gains by carrying out more benchmarking studies (Salerno, 2003).
The most comprehensive study carried out in UK to assess efficiency in higher education was carried out by Stevens (2001) who conducted a study to estimate efficiency and also potential inefficiencies in UK higher education. The study collected "*data from HESA and the Times Higher Education Supplement through which estimates for a number of quadratic SFE cost functions from 1995 to 1998 for 80 universities in England and Wales were obtained"* (Salerno, 2003 p. 39). Three models were formulated highlighting the inter-relationships of input and output variables. The dependent variables employed in the three models are total expenditures while the output variables used are research income, supplemented by one input price, which was the average staff cost in 1995.

In all the models, universities that produce a large number of high-flier students were found to be less efficient when the effect of teaching quality on costs is considered. On the other hand, changes in inefficiency were found to depend negatively on level of initial inefficiency. Institutions that had high level of inefficiency at origin (i.e. 1995) become more efficient over time. The dispersion of efficiency scores declined in every time period, suggesting that overall cost efficiency has become less variable among English and Welsh universities. The major policy implication reached by the study was that the introduction of tuition fees in 1997 served as a booster that motivated less efficient universities to become more efficient (Salerno, 2003).

Simoes and Marquies (2011) examined an earlier research by Grosskopf et al. (2001) which examined technical efficiency of 213 teaching hospitals in the US, using DEA methodology. The FGL approach was the technique used in determining how much of the congestion inefficiency was due to excess use of residents. It was discovered that 20% of inefficiency was due to the congestion effect. The input variables used were the physicians with staffing privileges, the medical residents/interns, the registered nurses, the licensed/vocational nurses, the other hospital personnel, and the number of licensed and staffed beds. The outputs obtained were the inpatient surgeries, the outpatient surgeries, the outpatient visits, the emergency room visits, and the total number of inpatients admitted to the hospital.

Robst (2001b) study was on institutional cost efficiency on 440 public colleges and universities in the US between 1991 and 1995. Using data from the NCES' Integrated Post-Secondary Education Data System (IPEDS) database, Robst estimated a series of four trans-log SFE cost functions. Different models were run based on different specifications of where inefficiencies were expected to emerge. The dependent variable was education and general expenditures. The output variables are 1) FTE undergraduate; 2) graduate enrolments and 3) research expenditures. Also included, a dummy variable for Carnegie Classification status, compensation (as an input price), and two measures of institutional revenue (tuition plus state appropriations) and the percentage of state appropriations to total institutional revenue.

The first model revealed a positive relationship between university revenues and inefficiency (= 0.1837). This was also true in the second model though he found that increases in both graduate enrolments (= 4.525) and research expenditures (= 0.5882) were positively related to cost efficiency. At the same time, inefficiency was shown to decline with increases in undergraduate enrolments (= -6.000) (Salerno, 2003 p. 34).

In the case of Salerno (2002), the study used DEA to assess the relative efficiency of higher education in the US in 1993, concerning 183 research and doctoral granting institutions. The data used came from the National Science Foundation (NSF), IPEDS, and the Institute for Scientific Information's citation indexes. Three different models were used. Institutions were grouped into two quality tiers (1 Tier 1 consisting of 68 universities and Tier 2 consisting of the remaining 115 universities). Separate technical efficiency analysis were conducted. Both models used the same input and output variables. The input variables include emoluments of FTEs on: 1) faculty members; 2) graduate teaching assistants; and 3) graduate research assistants. The output variables measured by FTE enrolments are 1) lower-level undergraduates; 2) upper-level undergraduates; 3) graduate students; and 4) no of publications (p. 6).

The technical efficiency analysis revealed mean efficiency scores of 93% for the high-quality tier and 86% for the low-quality tier. On the scale efficiency, the mean scores for each tier were 95% and 90.6% respectively. Both technical and scale efficiency scores showed differences between tiers to be significant. Further analysis of the scale efficiency measures showed that inefficient institutions were more likely to be operative at increasing returns to scale. However, when the presence of medical facilities were considered, institutions with medical facilities were found to be almost twice as likely to be considered technically efficient than those without medical facilities.

The main conclusion reached by the study is that input quality and competition positively influence productive efficiency and that public and private research universities should be analysed jointly in such situations.

Abbott and Doucouliagos (2003) did a study on the efficiency of Australian universities, using 1995 data collected from DEETYA. The research developed and presented findings for four DEA models. Two were conducted using all 36 institutions contained in the population size and two truncated samples were also analysed. Four input variables were specified: 1) FTE academics; 2) non-academic staff; 3) expenditures on all non-personnel emoluments input and 4) the value of non-current assets to approximate existing capital stock. Outputs variables were EFTS enrolments and research quantum. For each model, a VRS DEA was performed and estimates of scale efficiency calculated.

Based on the first model, a mean efficiency score of 94.6% was found and also a mean scale efficiency score of 96.7%. The second model reported a mean efficiency score of 96.7% which was slightly higher but the mean scale efficiency did not change. In the second set of DEA, based on output mix, the mean efficiency score for the low-ratio universities was 96.4% and 93% for the high-ratio institutions. The scale efficiency scores were similar to the first model at 96.9% and 94.6% respectively. The research suggested that overall efficiency level appears to be high among Australian universities. It was also concluded that there is a high degree of homogeneity in the system because DEA only provides relative efficiency scores; as a result, it may be the case that the entire system is under-performing (Salerno, 2003).

Valdmanis et al. (2004) used FGL approach in the DEA methodology to assess the capacity of 68 Thai public hospitals for the year 1999 in terms of how they were able to expand their services for the poor and the non-poor people. Congestion and capacity indices were estimated to measure poor/non-poor service trade-offs and capacity utilisation. The input variables used were beds, doctors, nurses, and other staff, and the allowance expenditures, drug expenditures, and other operating expenditures. The outputs were the outpatient visits for poor patients, the outpatient visits for non-poor patients, the inpatient cases adjusted with average diagnostic related group (DRG) weighting for poor patients, and inpatient cases adjusted with average DRG weighting for non-poor patients. It was discovered that the marginal product of poor and non-poor services were non-negative and that the financial incentives related to increased cost recovery from non-poor services did not affect the extension of services to the poor. This confirms that different patient types are considered as equals in practical terms.

Ferrier et al. (2005) also used FGL approach in the DEA methodology to examine whether indigent care provided by 128 hospitals in the State of Oklahoma contributed to output congestion. The study revealed that hospitals differ in terms of technical efficiency due to the indigent care being delivered and that congestion has an important influence on it.
The input variables were the staffed and licensed beds, the physicians, the registered nurses, and the other hospital personnel. The outputs used were the inpatient privately paid days, the inpatient Medicare days, the inpatient Medicaid days, the inpatient charity care days, the inpatient bad debt days, and the number of outpatient visits.

Using FGL approach, Ferrier et al. (2006) carried out another study based on output-based DEA methodology, to measure how uncompensated care affects hospitals' ability to provide the services for which they receive compensation. Beds, registered nurses, licensed practical nurses, residents, and other labour were the input variables considered, whereas inpatient surgeries, outpatient surgeries, emergency visits, non-emergency outpatient visits, adjusted inpatient days, and uncompensated care were the outputs of the study.
Based on a sample of 170 Pennsylvania hospitals, it was found out that, on average, hospitals could have produced 7% more output if they had all operated on the best-practice frontier and that uncompensated care reduced the production of other hospital outputs by 2%. The study also confirmed that congestion had a relevant role in hospital inefficiency.

Leitner et al. (2007)'s study explored the performance efficiency of natural and technical science departments at Austrian universities using DEA. The methodology of the research was the adoption of multiple input and output variables approach. To ensure delivery of reasonable results, suitable input and output variables have been determined in a previous step using correlation analysis and OLS regression. Input-oriented DEA models were run using teaching, research, and industrial cooperation outputs to show the departments' specialisation.

The major findings of the study are quite revealing. They include:

a) DEA exceeds traditional methods of analysing universities activities using simple ratio calculations. DEA determines the performance efficiency of university departments on the one hand, and shows the improvement potential for each evaluated unit separately on the other hand.

b) About half of all Austrian university departments in the natural and technical sciences perform efficiently. The DEA model also illustrated the existence of scale efficiencies and the relatively large heterogeneity of evaluated departments, both within and among universities, as well as among different fields of study.
c) In contrast to earlier studies revealing no (Gander, 1995) or linear relationships (Johnes and Johnes, 1993), between size and efficiency of department, this study found a cubic relationship between size and efficiency. Thus, small as well as large departments perform better than medium-sized Austrian university departments.
d) A high correlation exists between research and industrial cooperation specialisation-departments with intense research involvement which also engage strongly in industrial cooperation.
e) Departments with good research performance also achieved a good teaching performance. This finding validated the study by Bonaccorsi and Daraio (2002) which returned a similar result.

Clement et al. (2008) considered undesirable variables and congestion (according to the FGL approach) to investigate relationship between performance and quality of care in US hospitals. The input variables comprised the registered nurses, the licensed practical nurses, the other personnel, and the staffed beds. As outputs, the births, the outpatient surgeries, the emergency room visits, the outpatient visits, and the case mix adjusted admissions were utilised. The findings of the study suggested that congestion in hospitals is associated with poorer risk-adjusted quality outcomes that manifest through lower technical efficiency.

In the case of Valdmanis et al. (2008), the researchers used the FGL approach to analyse the congestion effects and assess the trade-offs between quality and efficiency in 1,377 urban US hospitals of 34 states in the year 2004. The input variables were the bassinets, the acute beds, the licensed and staffed “other” beds, the resident nurses, the licensed practical nurses, the medical residents, and the other personnel. Outputs were the Medicare case-mix index adjusted admissions, the surgeries, the outpatient visits, the births, and the other patient days.
The study discovered that inefficiency and quality congestion are associated with some hospital characteristics. Relevant inefficiencies were discovered (outputs could be increased by 26%) from which about 3% were attributed to quality congestion.

Tzeremes and Halkos (2010) conducted a study using DEA technique to determine the performance levels of 16 departments of a public-owned university. Multiple inputs that generated multiple outputs were applied. The results reveal the existence of misallocation of resources or/and inefficient application of departments' policy development.
The input variables were the number of academic staff, the number of auxiliary staff (teaching aide staff, technical and administrative staff), the number of students (undergraduates, postgraduates, doctorate students) and total income (governmental funding). The outputs that are produced by the university are teaching and research. The study illustrates how the recent developments in efficiency analysis and statistical inference can be applied when evaluating institutional performance issues.

Kempkes and Pohl (2010)'s study analysed the efficiency of 72 public German universities for the years 1998–2003, applying data envelopment and stochastic frontier analysis. The results of the DEA of German universities in the year 2003, as shown by the distribution of the efficiency scores, showed that large universities (e.g. University of Cologne, University of Munich) as well as small universities (e.g. TU Clausthal, University of Vechta) are operating on the efficient frontier. Hence, the size of a university is not necessarily associated with its efficiency.

The main finding of the study is that East German universities have performed better in total factor productivity change compared to those in West Germany. However, when considering mean efficiency scores over the sample period, West German universities appeared at the top end of relative efficiency outcomes.

Al-Shayea and Battal (2013) investigated the efficiency of eighteen faculties in Qassim University (FQU). The study aims to estimate and analyse the efficiency in (FQU) for the academic year 2011-2012. Using the number of students enrolled, the number of teachers and staff as inputs, and the total number of students with a bachelor's degree and a number of research as output, the output oriented model with variable return to scale to estimate efficiency score was adopted. The result showed that (10) FQU or 55.5% are efficient with average 0.88 in terms of variable return to scale efficiency. (5) FQU obtained average scale efficiency 0.68 and only (3) FQU got the optimum size.

Sacoto et al. (2015) examined the issue of handling outputs in DEA that occur at different stages in time. A set of data involving the evaluation of efficiencies of business schools, specifically the business school ENCSH (Escuela de Negocios, Ciencias Sociales y Humanidades) at ITESM (Instituto Tecnologico y de Estudios Superiores Monterrey) in Mexico were examined. The schools are viewed in terms of a set of quality measures (the inputs) and a set of accomplishments (the outputs), with the latter being internships and job placements. Based on efficiency measurement in settings where time-staged outputs are involved, it was demonstrated that the outputs occur at different times, with one of them influencing the other, which implies that one of the outputs plays a dual role (p. 1).

According to Sacoto et al. (2015), various frontier efficiency measurement techniques are available for use particularly within the education sector as well as different types of institutions. These include primary and secondary schools (Bessent et al., 1982), universities (Athanassopoulos and Shale, 1997) and university departments (Chang et al., 2012; Johnes and Yu, 2008; Kao and Hung, 2008; Beasley, 1995; Beasley, 1990). A review of the literature however, revealed that the primary frontier technique employed in evaluating the efficiency of education programmes has been DEA. A well known and earliest work in the area of education, arguably, was conducted by Bessent et al. (1982). Employing the Charnes et al.'s (1978) constant returns-to-scale DEA model, the study examined the productive efficiency of Houston's 241 school districts. This study was one of the first to point out some advantages of DEA over previously used techniques. In addition, Bessent et al. (1982) were the first to use standardised test scores as the measure of educational attainment, incorporated issues relating to local, state and federal funding, and recorded the quality of teaching inputs with teaching experience, training and qualifications.

In the case of Guajardo (2015), the study applied an output-oriented variable returns-to-scale (VRS) data envelopment analysis (DEA) technique to New York City (NYC) agencies to illustrate its usefulness in assessing and estimating organisational efficiency with respect to workforce diversity. Financial, personnel, and labor inputs of 38 agencies were analysed in relation to the level of workforce diversity achieved by each decision-making unit (DMU). The Simpson index of diversity ($D = 1 - \Sigma p2$) was used to measure the level of age, ethnic, and gender diversity in each agency. The findings suggest that the majority of the agencies have inefficient human resource (HR) recruiting and hiring processes (constant returns-to-scale [CRS] > 1.000 and $\Sigma\lambda > 1.000$). The findings also suggest that the inefficient agencies would exhibit decreasing returns-to-scale (DRS) if the level of inputs were to be increased.

Guajardo (2015) illustrated the use of an output-oriented Variable Returns-to-Scale (VRS) estimation model to assess the efficiency of New York City (NYC) agencies in achieving their current level of age, ethnic, and gender diversity. The selected output-oriented VRS model also assessed whether the level of outputs and outcomes would increase or decrease proportionally with a proportional increase in the level of inputs used by each agency. The study used financial, personnel, and labor data as inputs for each agency to conduct the efficiency analysis.

The findings of the study showed that the output-oriented VRS results of 22 agencies are efficient (VRS = 1.000); 5 are partly inefficient (VRS = 1.002 - 1.009) while 11 NYC agencies are inefficient (VRS > 1.010). These results indicate that these agencies achieved different levels of success with the use of their inputs as a result of having suboptimal recruitment processes. In addition, these agencies have a higher cost per hire in comparison with the efficient agencies. The least efficient agencies are Human Resources Administration (HRA), DSNY, and Probation (DOP) with VRS scores that equal or exceed 1.020 (VRS ≥ 1.020).

Another set of frontier efficiency measurement studies that deserves particular attention are the instances where educational outputs are jointly produced with (strictly) non-educational outcomes. This is the case with the small number of studies concerned with either universities or academic departments within universities.

Johnes and Johnes (1993) study of UK university economics departments and Beasley's (1995) study of UK physics and chemistry departments looked at teaching/research and research-only staff, and research grants as the inputs; outputs were measured in categories of published works and refereed journal articles. The Johnes and Johnes (1993, 1995) approach was similar in that no allowance is given for actual teaching outputs, while the Beasley (1995) study incorporates the number of undergraduates and postgraduates. In conventional DEA settings, Sacoto et al. (2015) confirmed that it is generally understood that members of the output set occur at the same point in time and where they do occur, there is generally no implied direct cause and effect relationship connecting one output to another. When some form of sequential or cause and effect relationship does exist, the question arises as to how to properly reflect this relationship in modeling efficiency. In furtherance of this scenario, DEA technique was employed using the case study of a large set of business schools in Mexico, with the primary aim of identifying relative efficiencies in an environment where dual role outputs are present. Inputs and outputs variables used in the analysis include:

Inputs	**Outputs**
Academic rating	% Students with internships
Admission rating	% Students who find jobs
Financial rating	% Students in top quartile of HS class

The data used for the sample of US universities were obtained from the book titled "The Best 373 Colleges" (Franek et al., 2011); the data of ITESM obtained from the university. All data were measured on the same 100-point scale making determination of multipliers relatively comparable. Also, the VRS model was applied, with the rating scale percentage nature of the data and output-oriented model chosen as a measure of efficiency. This implied that output enhancement (service delivery) was the focus of the study.

Using internships and jobs as outputs, and various quality measures as inputs, the study demonstrated that this problem setting gives rise to time-staged phenomenon. Specifically, the two outputs occur at different points in time, with one of them influencing the other; hence, one of them plays a dual role. In this study, the conventional DEA model was modified to obtain the model that was applied by the study, which provided the incorporation of assurance region constraints in the time-staged setting.

2.5 Review of empirical literature

The review of empirical literature on the relevance of budgeting and funding on public medical education would be considered in three sub-sections, such as evidence from developed economies, evidence from emerging and developing economies and evidence from Nigeria.

2.5.1 Evidence from developed economies

Shaheed et al. (2010) investigated the impact of tuition increases on medical student demographics, indebtedness and financial stress in Quebec Canada. Using a national survey of medical students in Quebec compared with students in other parts of Canada as the methodology, the study found that higher tuition was the factor most strongly associated with increased anticipated debt at the time of medical graduation. Although the available data does not conclusively demonstrate that increased tuition poses a barrier to access for students from lower-income families and other under-represented groups, it has been shown that lower tuition results in the public subsidy of all students, including those with very affluent families (Lee, 1984). There is therefore strong support for introduction of tuition fees for higher education in Quebec, Canada.

Also, in Germany, the study by Kempkes and Pohl (2010) saw the justification for the introduction of tuition fees in public universities in the wake of dwindling federal allocation of financial resources by the government to the universities, especially when the universities are faced with rising costs and high demand for admissions by students. Arising from this reality facing the German university system, the researchers supported the public and academic discussion that more private funding was needed in the German university landscape to support the smooth running of the educational system. According to them, many federal universities are introducing tuition fees in public universities as an option to improve the financial situation of the universities. Regardless of privatisation or tuition fees, information about university efficiency performances is essential in times of scarce public resources. The focus of this study was to examine how efficient German public universities were using funds at their disposal.

Using data envelopment and stochastic frontier analysis, and focusing on 72 public German universities for the years 1998 – 2003 to investigate efficiency level in funds utilisation, the study discovered that total factor productivity had been increasing more rapidly in East German universities. However, when looking at mean efficiency scores over the sample period, West German universities appeared at the top end of relative efficiency outcomes.

In the U.S., Kallison and Cohen (2009) found that America's previous compact for higher education needed to be changed to the compact for higher education. The old method ensured that public funding of higher education was based on the premise that higher education produced the educated workforce who generated employment and research outputs needed for the economy to grow and bolster development and national security. The old method in other words, supports government subsidy of higher education. A major drawback on the old method was the fact that not all citizens were able to participate equally in higher education. Their study on the compact method of funding recognised that higher education retains both characteristics of public and private goods. This was borne out of the government's broad support for increased federal and state funding for public universities, state regulation of tuition at public institutions, and more need-based financial aid for low-income students. An educated person is able to attract increased individual lifetime earnings. In reality, since there had been reduced state funding as a percentage of institutional costs, many governing authorities of tertiary institutions and some state legislatures have increased tuition while some states in America have pursued tuition deregulation (Davis, 2006). It was reported by the authors that any additional public funding should attract increased accountability and improvement in performance to the citizens whose taxes have been utilised to fund the public higher education system.

More recently, the environment in which US universities operate has changed. According to Just and Huffman (2009), there has been a slowing of federal research funding growth and a decline for real research funds for health programmes such as Medicare. At the same time, state governments have reduced real per capita subsidies to public institutions of higher education (Ehrenberg, 2006; Lyall and Sell, 2006). Since funding from government has taken a downward trend, institutions such as medical schools required to take steps to ensure that limited funds at its disposal are judiciously utilised in order to maintain quality delivery of service. As a result of this, there is a growing demand for public utilities to increase the efficiency in the utilisation of resources they manage (Martin, 2003). According to Boussofiane et al. (1991), a combination of performance indicators is needed to measure the outputs of public or private organisations apart from profitability which seems to be the dominant consideration, in the private sector. The concept of DEA technique enables organisations to aggregate performance indicators in order to obtain an overall performance measure through the comparison of a group of decision units. Using the DEA in the assessment of the performance of the Zaragoza University's departments in Spain, the performance of each department was determined, highlighting areas of strength and weaknesses as variables towards the overall performance of the institution. Performance evaluation recognises that a single indicator may not be sufficient for effective performance management, especially for the performance evaluation of research institutions, which often have multi-dimensional research activities. It is now the usual practice to set or select a set of performance indicators in the performance evaluations of research institutions.

For evaluation of DMUs with multiple-inputs and multiple-outputs in public sector, DEA is now one of the most widely accepted methods to measure the relative efficiency or productivity of research institutions. However, the discrimination power of DEA models will be much decreased if too many inputs or outputs are used. It is a dilemma if the decision makers (DMs) wish to select comprehensive indicators to present a relatively holistic evaluation using DEA. Be that as it may, it is possible to develop DEA models that utilise hierarchical structures of input-output data so that they are able to handle very large numbers of inputs and outputs. The study conducted by Avkiran (2001) on Australian Universities brought out succinctly the relevance of DEA model in measuring efficiency within the educational sector. This study developed three models to measure efficiency: overall performance, performance on delivery of educational services, and performance on fee-paying enrolments. The findings, based on 1995 data, showed that the university sector was performing well on technical and scale efficiency but there was room for improving performance on fee-paying enrolments. There were also small slacks in input utilisation. DEA helps in identifying the reference sets for inefficient institutions and objectively determines productivity improvements. As such, it can be an important benchmarking tool for educational administrators and assist in more efficiency allocation of scarce resources. In the absence of market mechanisms to price educational outputs, which renders traditional production or cost functions inappropriate, the study admonished universities to seek alternative efficiency analysis methods such as DEA, to measure efficiency in their production processes. The absence of market prices for university factors and outputs makes the evaluation particularly complex and leads to the development of alternative performance measures (Johnes and Johnes, 1993). DEA technique provides a veritable tool to perform this function.

Since the Bologna Declaration, improving the efficiency and transparency of the systems of higher education has become one of the principal challenges for all European countries. Increased scrutiny has forced public entities to increase the efficiency with which they use the resources they manage. Governmental units have greater autonomy because of decentralisation processes that have taken place in a number of different countries. These reforms form part of the process of implementing new public management (NPM) principles (Hodges and Mellet, 2002), which promote the use of new management techniques capable of evaluating performance and that provide tools that can contribute to improvements in decision-making processes in the public sphere. Thus, accountability, efficiency and value for money are issues on the higher education policy agenda in most OECD countries. The process of convergence initiated after the Bologna Declaration (1999) has meant that European higher education systems particularly are involved in these trends. The creation of the European Higher Education Area (EHEA) by 2010 is intended to contribute to increasing the employability, mobility, transparency and comparability in these systems (Mora, 2003), but at the same time it is expected to emphasise competition between the institutions in providing a quality service with a higher degree of efficiency that enables them to enrol new students. In consequence, improving the quality of European higher education systems is a key issue on which the creation of the EHEA is based. According to the Commission of the European Communities (2003), there are three directions in which efforts aimed at improving quality in higher education should go:

1. Ensuring that European universities have sufficient and sustainable resources and use them efficiently
2. Consolidating excellence in teaching and in research
3. Opening up universities to a greater extent to the outside and increasing their international attractiveness

Higher education institutions are also interested in establishing their own internal evaluation mechanisms to monitor the accomplishment of their objectives. Self-evaluation plays an essential role in strategies implemented to measure performance and improve quality in higher education institutions (Thune, 1998). It provides critical information about the performance of the units that make up the institution and so enables the making of decisions aimed at improving the efficiency and quality of the processes. Empirical analysis of the performance of universities typically takes the form of estimating cost functions with the focus on economies of size and scope or on the analysis of efficiency, using DEA or frontier functions (Abbott and Doucouliagos, 2003).

Efficiency and funding of public universities are critical variables considered by this study. Education managers have a responsibility to ensure judicious utilisation of available scarce financial and human resources, while the proprietors of the educational institutions relate performance to funding extended to the universities. In a study conducted on Bulgarian universities, Tochkov et al. (2012) estimated technical and cost efficiency for various groups of Bulgarian universities, correlates performance with funding levels, and investigates the factors that influence efficiency and the amount of government subsidy. The study further estimated the relative efficiency of public and private institutions of higher education in Bulgaria using a number of quantitative and qualitative indicators from a set of data. A non-parametric methodology was used to estimate the extent to which colleges and universities minimise their input costs in the process of obtaining a given level of educational outputs. The efficiency levels obtained were ranked relative to a benchmark composed of the best performing institutions. Also examined was the correlation between the estimated efficiency levels and the corresponding amount of government subsidies to test whether the system of public funding of Bulgarian universities rewards efficiency. The hypothesis formulated was that this is not the case given the fact that subsidies are based mostly on student enrolment rather than on performance. Also considered is the determinant of efficiency and the government subsidy using regression analysis which the study used to formulate policy recommendations aimed at reforming the system of public funding for tertiary education in Bulgaria.

The findings of the study indicate that private institutions exhibit significantly higher efficiency than public schools, which is most likely related to their teaching performance. Public universities were found to perform better in the area of research even though they exhibited staggering amount of inefficiency in this aspect. Overall efficiency levels are lower when the cost of inputs is taken into consideration. Another finding of the study indicates that efficient universities focus on fewer fields of study, offer a large number of degrees in natural sciences, medicine and engineering, and claim a larger share of the market for higher education. Also revealed was that a better performance in terms of cost minimisation and output maximisation fails to attract larger amounts of public funds to public universities who have been found to be inefficient in their funds utilisation. These findings suggest that public funding for tertiary education in Bulgaria is in dire need of reforms that would create incentives for universities to manage their resources efficiently.

There is the belief that an investment in tertiary-level education is a crucial factor for employment, competitiveness, growth and social cohesion (Asplund et al., 2008). Accordingly, European countries employ a mixture of public expenditure and private funding schemes. The collaboration between public and private sectors create incentives for students to enroll and for private entities to contribute to the national effort by European countries to finance educational investments (Asplund et al., op cit.). The training of doctors implies that they render their services in health sector where they practice their profession. In this regard, Young and Coffman (1998) examined the financial apparatus for graduate medical education (GME) and identified seven policy objectives which have stood as an important barrier to producing a physician workforce that is appropriately sized, balanced and skilled. These are revenue incentives that promote expanded resident production; base the GME subsidy on actual costs and distribute it more uniformly; focus reductions on specialty residency positions; provide GME payments for training provided in ambulatory, community, and managed care sites; decouple medicare GME reimbursement from payments to health maintenance organisations for patient care; require health insurers to contribute to GME; and ensure that reductions in the GME subsidy do not reduce access to care for low-income persons.

The study on graduate medical education in the U.S advocated that the resources utilised to train excess residency programs students could in fact be redirected to other areas of need to the society. The U.S government reimburses all expenses incurred on GME and this has encouraged an unbridled production of physicians. Connolly et al. (2011) also found out that publicly funded health treatment in Denmark provided economic benefits to government over the life time of the citizen concerned through the projected discounted net tax revenue accruable to the state over a defined period. This is a corollary to the situation we have in developing countries, including Nigeria, where there is gross underfunding allocation to health education with severe consequences to the economic and social well-being of the citizenry. Also, the Department for education and skills, in its Higher Education Funding – International Comparisons paper, published in 2003, which was later reinforced by Docampo (2007) and Jones-Esan (2007), highlighted the challenges of having a successful and modernised higher education system in the 21st century. The report critically examined the funding of higher education, tuition and student support schemes available in thirteen OECD (Organisation for Economic Co-operation and Development) member countries and highlighted varied international practice and experience in funding the diverse international higher education systems and in providing support to learners. The thirteen countries are: Australia, Canada, Denmark, France, Germany, the Republic of Ireland, Italy, Japan, Netherlands, New Zealand, Spain, Sweden, and the United States of America.

The study of Adam (2020) found that there is lack of orientation for performance-based funding for universities across the globe than ordinarily envisaged. It was recommended that institutions of higher learning must embark on a structural change or paradigm shift to performance-based funding. It was in the same vein that Broome et al (2017) argued that non-tuition funding model should be the new paradigm shift to cater for financial needs of nursing programs at the Duke University and, by extension, all other schools of nursing. It is instructive to note that this is also a case study approach. The authors suggested that there should be a complete shift away as well as diversification from the traditional tuition-based funding approaches that are mostly adopted by public and private institutions of learning. The recommended funding method will afford these institutions additional revenue to meeting their pressing needs. The justifications for the diversification of the revenue base of these schools of higher learning was succinctly put by Ehrenberg (2020) who established that tuition cannot continue to increase beyond the price levels in America as this would suggest that it would outgrow the reach of the under-represented populace.

In the extreme, the study of Wolszczak-Derlacz (2017) indicated that government funding are detrimental to the efficiency of higher educational institutions in Europe. However, the author was not able to obtain robust result from the America schools of higher learning. The study conducted by Woolliscroft (2020) obtained findings that lend credence to the potency of government financing on the growth and sustainability of medical institutions but not without lending support to the role of internal intervention in reducing negative effects on education. Apart from the traditional learning environment, the electronic learning framework has been suggested by the study of Barteit et. al. (2020). However, the authors opined that the lack of electronic architecture and infrastructure has put paid to its potential benefits in solving myriads of problems confronting quality medical education. Although, more robust and rigorous investigations have been suggested, the authors conducted a meta-analysis that supports the evidence for the potency of electronic learning intervention to improving medical education.

Heinig et al (2016) considered public investment in medical research in US as an evolving social contract that serves as a public good. The study showed that public medical investment entrusts so much responsibilities on public medical institutions and research centres to serve the purpose of the populace; who are ultimately the funder of research, research training and infrastructure. De Pillis and De Pillis (2001) developed a mathematical model to explore the long-term effects of university budget cuts. With series of simulations analysis, the study acknowledged that the full impact of budget modifications came with variable lags.

According to Usher and Cervenan (2005), Global Higher Education Rankings – Affordability and Accessibility in Comparative Perspectives, revealed that tuition is becoming the international rule and not the exception towards adequate funding of higher education in the world at large. Introduction of school fees has not impacted negatively on access to higher education, as it was reported in Canada. In fact, in Australia, participation in higher education has increased across all social groups since higher, differential fees were introduced. Stokes and Wright (2008) conducted their study in Australia to research whether students were actually paying more for their education. It was discovered that the movement away from “free education”, and the introduction of the Higher Education Contribution Scheme (HECS), saw a reduction in the proportion of higher education funding provided by the Commonwealth Government and a shift to a greater contribution by students.

Nonetheless, Russell (2008) argued for the establishment of dedicated funding as an alternative for funding of higher education in the U.S. This was in order to protect the education sector from the vagaries of unpredictability in the level of appropriation to higher education from the state budget and also make education affordable to poor and middle class citizens. He posited that reasonable percentages of state tax revenues are earmarked for higher education. Also gaming revenues and revenue from state trust land are all earmarked to be pooled into a buffer to fund higher education in the United States of America. It was observed that marketplace changes are undermining traditional subsidies for the support of clinical education. Government and employers exhibited a strong desire to control health care costs. Harrington and Califf (2010) examined industry-sponsored education for medical education. The authors reasoned strongly that industry support for medical education is needed to ensure that those who use the products have adequate knowledge to use them appropriately. They stated that the participation of the industry is part of the knowledge based industry/economy and, in fact, the industry would be at substantial risk if it failed to support the education of the citizenry by contributing towards medical education.

The Health Care and Education Reconciliation Act of 2010, in the U.S., among others, revealed that the 2008 economic downturn and cuts in federal funding further challenged American higher education institutions. According to the report, the health of a higher education institution is tied directly to its ability to acquire resources. Students generally assume a role as customers of the institution (Brochado, 2009), paying to attend and owing an expectation of quality educational opportunity. Those students later graduate, so representing the institution's product by demonstrating the quality and relevance of the institution as they operate in the professional arena (Air War College, 2010).

Funding of clinical education is considered from two perspectives: education and health. Since training of medical students cuts across the medical school (education) and the teaching hospital (health), both sectors are considered to ensure that students' training is adequate and competitive. A classical case to draw up the comparison between education and health is to take a look at what happens in Italy and Spain, for instance, considering the environment in Italy and Spain, there are considerable similarities between both countries in terms of historical development, economic structure and institutional arrangements on health care facilities. Decentralisation, which the constitutions of both countries grant to the regions or autonomous communities (ACs), accords them the right to collect and distribute tax revenues (Rico and Costa-Font, 2005; Donatini et al., 2001). The constitutions of both countries, as well as major pieces of legislation, grant substantial powers to the regions, but at the same time clearly identify national rights, including that of access to healthcare. In both countries devolution of powers to regions is associated with measures to ensure that citizens are granted the same rights across regional jurisdictions. In this respect, the Italian and the Spanish healthcare systems are very similar, because although they are managed at the regional level, they are subject to national rules concerning coverage and, to a large extent, financing. These two countries, on the other hand, are characterised by substantial differences with regard to the public expenditure on health care.

In Italy and Spain, the issue of how to define health benefit baskets (i.e. the overall set of healthcare goods and services guaranteed to citizens under public coverage) is deeply intertwined with the history of the two national healthcare systems and their reforms over the past few decades. In Italy, the central government has the role of ensuring and monitoring adequate funding for the provision of the essential levels of care (LEA), whereas regions are held accountable for the organisation of healthcare facilities and the provision of services. Healthcare system financing is mainly based on regional and central taxes.

Since 2003, Spain has implemented a number of reforms in its public health policy and the provision of care to its citizens. Under the reform policy, the central government provides competencies on the basic principles and as well as coordination of health strategies and drug policies. The inter-territorial council of the NHS (an advisory body comprising of representatives of central and regional governments) ensures the smooth running of the health system. The health care systems of the ACs are funded through two main sources; namely, tax-related sources and appropriations from the general state budgets. This mixture of financing ensures equity and regular availability of funding to keep the health care systems running effectively.

One of the main differences between the benefit baskets in the two countries concerns the definition of services and goods provided in the hospital setting. Traditionally, these services have never been defined explicitly in the Italian NHS. Rather, the implicit assumption has been that all interventions (including medical technologies) considered to be appropriate at the hospital level would be covered by the public system. In the Spanish health basket, conversely, the services and medical technologies to be provided in hospital settings are, in most cases, defined in an explicit manner.

Italy and Spain have two very different systems for funding hospitals, and thus differ substantially in the way the costs of in-patient medical technologies are covered. In Italy, all goods and services delivered by public or private accredited hospitals since 1995 have been mainly funded on a per-case basis, as classified according to US Medicare DRGs (France et al., 2005). The DRG tariffs are intended to cover all hospital operating costs, including administrative costs and overheads, but excluding most capital costs.

Although Spain was one of the first European countries to introduce DRGs as a system of classification for hospital output, DRGs are not used in the reimbursement of public providers. Instead, hospitals in Spain are funded primarily through a global budget (Sanchez-Martinez et al. 2006). Before the devolution of competencies to the ACs, hospital budget allocation was based on a contractual relationship between the financing body at the national level (INSALUD) and healthcare providers. After 2002, the responsibility for hospital budget allocation was transferred to the ACs. Hospital funding in the public sector is now generally carried out prospectively by negotiating a contract programme between the hospital and the regional authority/third-party payer. The contract annually sets out the objectives to be achieved by the hospital (type, volume, and quality of services) and defines a budget for achieving these goals. Capital investment in the public sector is generally funded from global budgets and is monitored by the respective regional funding authority (Duran et al., 2006). Even though the system was initially designed to separate functions between purchasers and providers and to introduce contractual parameters into the relationship between these two parties, global budgets have continued to burden mainly on the basis of historical patterns, therefore maintaining de facto the retrospective nature of the funding mechanism (Sanchez-Martinez et al., 2006). Given their decentralised character, Italy and Spain have been facing a common challenge in the recent years: to maintain the financial sustainability of their national healthcare systems while ensuring equitable access to care throughout the jurisdictions. The Italian school system is predominantly a centralised public system financed by the government through taxation (Checchi et al., 1999; Cappellaro et al., 2009). Both sectors require reforms to promote sustainability of funding mechanisms to provide medical education to the populace.

A related study conducted by Tammi (2009) tried to find out if the higher education policy and research policy in Finland combines certain deregulative and service-based financing measures. Some of the variables considered include:

(i) Extending more autonomy to universities
(ii) Increasing the role of competitive financing
(iii) Emphasising the financing of specific services rather than general operative functions.

The empirical analysis revealed that the intended outcome of categorising Finnish universities to various groupings was achieved, with the unintended consequence of the impoverishment of the research performance in terms of scientific publishing also obtained. Mc Carthy (2012) did a comparative study across some European Union (EU) countries and found that those countries received most of the EU's structural funds, with substantial part of it allocated to research. Annually, the EU allocated around £7 billion, through the structural funds, for member states' own use on research. These funds cover infrastructure, academic employment and direct research grants. The funds earmarked by the EU are largely to support public health in member states. Public health research encompasses research at health system and organisational levels, including health care, health promotion and health surveillance. Allocation of funds within the structured funds was negotiated by each country with the European Commission's Directorate for Regions. Funds could be allocated for university and science buildings, studentships and other training, and formal research calls. The educational sector could benefit substantially from the funds window made available by the European Union (EU) on public health research.

In summary, the funding of education and health sectors flows from various sources across countries of developed economies to improve the quality of service delivery in general. The dominant pattern of funding is mainly the central government providing funds for capital investment for the educational and health facilities and the recurrent costs are funded by individuals and the private sector including insurance support facilities. This arrangement ensures that the flow of service delivery at both sectors is not truncated, thereby ensuring sustainability of services.

2.5.2 Evidence from emerging and developing economies

Generally, it has been argued that funding of higher education has not been accorded adequate attention. Studies carried out by scholars have revealed the lack of appropriate level of funding by government to support education. According to Banya and Elu (2001), the national governments of developing countries almost single-handedly finance education and this has led to a dearth of empirical research on higher education financing, except to the extent of identifying what proportion of the national budget is allocated to higher education. Earlier studies carried out by Johnstone et al. (1998), Zidermann and Albrecht (1995), reaffirmed similar findings. African leaders saw their systems of formal education, especially from the early 1960s, when significant African countries got independence from their colonial masters, as the principal means of achieving economic and social development of the continent (Coleman, 1965). Banya and Elu (1997) concluded that, indeed, economic transformation of the continent was to follow from attainment of university education. According to Banya and Elu (op. cit), the main source of funding from early independence till present is central government grants. World Bank Report

(2000), on higher education in developing countries, identified most public universities as highly dependent on government for their financial resources. The report further revealed that tuition is seldom charged at the undergraduate level. Where fees are paid, it is usually negligible and may, in most cases, bypass the university and go directly into the central government treasury. This template plays a major role in support of Nigeria's policy of no tuition fees payment at the undergraduate level of all federal government owned universities and medical schools.

Balderston (1997) advocated the implementation of a market based tuition policy that enables the school to cover the full cost of its instructional and research programmes. Studies have been carried out to highlight the budgeting and financing mechanisms of tertiary and medical education. Countries aspire to adopt funding models that best serve their educational needs in terms of effectiveness and efficiency. Alshamy (2011) did a comparative study of funding mechanisms and quality assurance systems in higher education in Egypt and the UK. The aim of the study was to identify any justification for carrying out reform in the funding mechanism of higher education institutions in Egypt. Using questionnaire and interviews, the study found out that Egyptian higher education institutions were inefficient in terms of funding, whereas the UK institutions were reasonably efficient. Respondents believed that efficiency in Egypt is negatively affected because of line-item funding as well as inadequate funding, lack of flexibility and transparency, lack of proper up-to-date equipment and no incentives for efficiency gains (Al Shamy, 2011). On external efficiency, both students and employers noted the poor quality and inefficiency of education (World Bank, 2002). Another major finding of the study was the fact that free education for all students was a dis-incentive to rapid students' progress as most students could not have the burning desire to complete their degrees on time because they had no financial commitment towards the financing of their education (Bevc and Ursi, 2008). The block grant awarded to universities in the UK is seen to enhance efficiency because it affords the universities an opportunity to display a reasonable degree of stability, flexibility and autonomy in the allocation and prioritisation of their resources (Johnstone et al., 1998). On equity, whereas the majority of interviewees in Egypt could not decide whether the system is fair or not in terms of funding, in the UK, the majority saw the system as reasonably fair. The main findings show that different forms of funding and quality assurance systems differ in their consequence for the autonomy, accountability, efficiency and equity of universities. Consequently, the study submitted that changes to funding and quality assurance systems in Egypt was suggested for a reform and further developed to address issues of governance and culture (Al Shamy, 2011).

In South Africa, Wangenge-Ouma (2010) found that funding formula had shifted from enrolment-driven calculations to a new policy that ensures equity and redress from the apartheid era method of allocating financial resources to the universities. The study argued that the basic feature of the new funding framework (NFF) is that it links the awarding of government higher education grants to national and institutional planning. This funding/planning link makes the new framework essentially a goal-oriented mechanism for the distribution of government grants to individual institutions, in accordance with the National planning and policy priorities; the quantum of funds made available in the national higher education budget, and the approved plans of individual institutions (MOE 2004, p. 483).

Whereas the NFF is designed to restructure South Africa's higher education towards rapid transformation, the reality suggested that the attainment of these goals could be impaired; actual cost of higher education budget was not applied in the new funding framework (Wangenge-Ouma, 2010). In the same vein, Steyn and de Villiers (2006) argued that responsibility accounting should be applied to enable universities calculate the actual costs of training each student and also establish the amount of subsidies applied towards defraying the reasonable costs. The absence of this, according to Wangenge-Ouma (op. cit), meant that the NFF merely plays the role of distributing a pre-determined total grant allocation. The attendant consequences, according to Wangenge-Ouma, had been insufficient funding of the higher education sector. Although the funding framework is intended to steer public universities towards achieving particular transformation goals, the unintended consequences of the framework on the behaviour of universities could be to slow down the attainment of these lofty goals (Wangenge-Ouma 2010, p.484).

The above criticisms notwithstanding, the NFF aligns generally with some international accounts that emphasise the relationship of government funding with the implementation of national higher education policies (Merisotis and Gilleland, 2000; Ziderman and Albrecht, 1995). South Africa, unlike many other African countries, adopts a well established cost-sharing method in higher education financing. The introduction of tuition and regular increases have largely been a response to declining public funding of higher education (Wangenge-Ouma, 2010). Although there is a general consensus that high private costs of higher education are likely to impact negatively on higher education access and persistence by especially low income students (Vossensteyn, 2007; Vossensteyn and De Jong, 2006), nonetheless, tuition is a critical source of revenue for Higher Education Institutions (HEIs) and a likely determinant of demand for higher education (Wangenge-Ouma, 2010).

Whereas the introduction of tuition fees has been justified as a good source of generating revenue by the universities, access to education for low income students has also been said to be threatened by the introduction of tuition fees (Vossensteyn, 2007; Vossensteyn and De Jong, 2006). Tuition is a major source of raising revenue by Higher Education Institutions (HEIs) and as such could actually determine to what extent the demand for education could be met by each HEI (Wangenge-Ouma, 2010). Education and health are the critical sectors in the training of medical doctors. According to Omer (2005), the dwindling funds allocated to healthcare in Africa contributed in no small measure to the rising costs of obtaining health services, which was brought about by the huge cost of qualified personnel and the new technologies continuously being developed and deployed by the hospitals. Nambiar et al. (2007) also agreed that extremely limited material and human resources and low government spending on health, constitute a major impediment for health care planners in developing countries. The study by Torabipour et al. (2014) on efficiency measurement of Iranian hospitals, using DEA technique, showed that despite improvement in the productivity trend of hospitals, and with the average productivity of hospitals not improved, the findings of the study could be used as a warning in order to make better use of existing resources of the hospitals covered.

On the other hand, Gordon (1962) investigated the financing of undergraduate medical education. This study revealed that subventions were released by the Treasury through the Department of Education. The Universities of Cape Town, Witwatersrand, Pretoria and Stellenbosch received their subventions, which were based upon a formula that applies to all the university faculties, whereby budgetary support for operating costs was determined, amongst others, by the number of students enrolled and the number of departments in the faculties. A special subsidy is applied in the case of the faculty of medicine of the University of Natal whereby the treasury, through the Department of Education, meets the entire operating costs of the medical school. All universities in the Republic receive treasury grants on a proportional basis for their capital expenditure and those grants are supplemented from other sources, such as endowment and gifts. For many years since the early period, many governments have been trying to come up with the ideal ways of funding public higher education. The quest for improved methods of funding arises mainly from societal changes and emerging development paradigms. Wangenge-Ouma (2008) argued that the higher education funding policy shifts cannot be separated from situations in other countries due to globalisation. Governments and medical institutions realise that the terrain of service delivery is similar due to the effect of globalisation. It is argued that these policy shifts have been triggered by the changing relationship among the university, the state and society, in the context of globalisation (Maasen and Cloete, 2002). The particular aspect of globalisation impacting upon higher education is the rise of neo-liberalism as the main economic model of the twenty-first century (Wangenge-Ouma, 2008; Scholte, 2000; Friedman, 1999; Castells, 1996; Fukuyama, 1992). Castells (1998) concluded that higher education is now deemed more important than ever for the competitive advantage of nations. The paradox, however, is that the commitment and capacity of governments to fund it have weakened considerably (Henry et al., 2001).

Sekwat (2003) argued that the desire to contain skyrocketing healthcare costs largely triggered the initiative for reform, while the shrinking public resources and increased demand for healthcare services drove the healthcare financing reform agenda in developing countries. The study concluded that Sub-Saharan Africa's healthcare financing reform policies broadly involve identifying alternative arrangements in paying for, allocating, organising, and managing health resources. The challenge facing higher education on the other hand, has necessitated the adoption of pro-active strategies to confront those challenges. Asian higher education scholars generally hold the view that holistic financial management structure and governance of higher education alone should be reformed, rather than reducing the expenditure which would undo the gains in higher education of the last decades in the Asian continent (Mok 2008, 2006; Lee 2004; Tilak 2004). At the advent of the world economic crisis in 2008, higher education systems in eastern Asia were already less dependent on government and more attuned to economic climate changes and challenges and are adept at raising funds adequate for running academic activities under difficult situations (Postiglione, 2011). Also, the effect of the global and regional financial crisis brought about different responses by the governments of the countries affected by that crisis. This is evident in Indonesia, where there was a shift in the share of education resources away from higher education to basic education (Postiglione, 2011; Purwade, 2001). Also, China, Thailand, Malaysia and the Philippines have faced a similar fate (Postiglione, 2011; Varghese, 2001; Ablett and Slengesol, 2001; Lee and Rhee, 1999). In order to address the challenges for the 21st century, the Chinese government initiated a number of reforms in the higher education system. A group of universities, called Project 211 universities, were allocated additional funding to strengthen their research capabilities to facilitate the transformation of Chinese educational standards to world-class quality. A study conducted by Yaisawarng and Ng (2014) using DEA technique, revealed that the reform initiated by the Chinese government achieved the intended result. Empirical findings showed that the Project 211 universities performed better than the non-Project 211 group, which had limited access to facilities and funding. The DEA highlights that managerial inefficiency was the key attribute of low overall productive efficiency. Using a questionnaire administered on individuals spread across 46 medical schools, Shi-Hao et al. (2011) found out that the financial support from the school to research units was the main source of medical education research units in China. Meng et al. (2008) adopted two-level approaches in evaluation of 15 research institutes also in China. Whereas the standard DEA models are sensitive to indicator set changes, it was shown that the removal of a highly correlated output (or input) can greatly change the evaluation result (Dyson et al., 2001).

The significance of reform in higher education brings out the quality of education that would make the graduates of developing countries competitive in the global space. This position was reiterated by Collings and Rhoads (2008), who posited that the first challenge faced in developing nations, is raising adequate funds for expanding the size, scope, and quality for their universities. The researchers argued that overcoming this challenge is critical to enable nations to build forms of human capacity suitable for competing in a global knowledge-based economy. The second major challenge is that financial constraints also limit the ability of universities in the developing world to contribute forms of research-based knowledge suitable for advancing a nation's role in the global economy. Overcoming this challenge requires developing nations to address a variety of complex issues, including brain drain, the inadequacy of scientific facilities and laboratories, and limited knowledge-based cultures upon which to advance science and technology (Collings and Rhods, 2008; Peters and Besley, 2006).

The emerging economies are shifting focus from secondary to primary care, on understanding the population dynamics of diseases along with the patient perspective and an emphasis on both cure and care (Nair and Webster, 2010). The researchers highlighted that reforms are being undertaken in the Latin American countries of Chile, Argentina, Brazil, Mexico and Peru. Colombia too aims to strengthen its primary health care system to achieve social transformation and equity in health care delivery. Countries in East and South East Asia, such as India, China and Thailand are also undergoing transformations in health care in order to meet the needs of rural and underserved populations. The study completed a review of published literature on recent updates on medical and nursing education. The review was undertaken using the qualitative synthesis approach based on the critical review done and came up with a number of findings. Of particular importance is the outcome on initiatives to ensure the quality of education, which noted that the

Institute for International Medical Education has taken up the process of developing global minimum essential requirements (GMERs) to standardise the quality of doctors around the world. The GMERs primary focus is the outcome rather than the process.

Gadelha (2006) also emphasised Brazil's health-industrial complex for health development. He went further, stating that individual countries need to invest in the national healthcare industry and Research and Development (R&D) capacity in order to develop their health systems. Brazil's presence in Africa, particularly in Portuguese speaking countries, is significant. The country supports projects on individual training, training institutions, AIDS and malaria programmes and also strengthens the pharmaceutical industry. African students training in health-related subjects, such as medicine, public health and epidemiology are supported in their training by Brazil's Ministry of Education (Russo et al., 2013). The number of doctors in a community has always remained an important determinant of health status in the form of human capital (Nasreen et al., 2012; Murthy, 2007; Nixon and Ulmann, 2006; Robst, 2001a, and Robst and Graham, 1997). This position confirms that the literacy rate is the main contributor in health status (Anyanwu and Erhijakpor, 2009; Murthy, 2007). The position is not too far from that of Malaysia, where Chua and Chean (2012) discovered that one of the challenges to overcome to attain universal coverage and equitable health system in the country is to develop effective structuring of health care financing.

According to Knowles and Owen (2008) and Jones et al. (2007), life expectancy in countries such as Pakistan, India and Bangladesh have direct relationship with improvement in the quality of their formal institutions. In a study conducted in India by Sood (2008), it was affirmed that since the early 1990s, curricula reform in medical education has attempted to make it more responsive towards societal needs. Only a very small proportion of medical schools, however, are adopting innovative curricula approaches and not enough allocation is paid to the training and assessment of skills of medical students. Naik (2015) found that training in medical research has been largely neglected in the curriculum, especially at the undergraduate level in India. This deficiency has impacted negatively on the ability of doctors in accessing research funds available for conducting researches in the country. According to Sood (op. cit), there has been a tremendous growth in private sector medical schools as compared to public sector institutions. The increase in this growth was partly traceable to budgeting constraints in the public sector. The private sector growth was witnessed in metropolitan cities where the citizens have resolved to make a paradigm shift from altruism to pragmatism by willingly agreeing to pay for medical education.

Keck and Reed (2012) observed that Cuba, over the past decades, has developed strategies that have resulted in consistent improvement in the population's health status that produces impressive health indicators in the country. Cooper et al. (2006) argued that in virtually every critical area of public health and medicine facing poor countries, Cuba had achieved undeniable success in creating a high quality primary care network and a unique public health system, educating a skilled work force, sustaining a local biomedical research infrastructure, controlling infectious diseases, achieving a decline in non-communicable diseases, and meeting the emergency health needs of less developed countries. Cuba also gives higher priority to tertiary care facilities and research. Medical school curricula were redesigned; residency training programs were revised as well. The Government of Cuba provided free tuition as financial incentives to its citizens. Cuba recognised that healthcare and education are the two important elements of improved living standards of the citizenry (Kirk, 2011). The tremendous social pressure in Israel to improve medical education in order to uphold quality of health service delivery; could also not be ignored (Reis et al., 2009; Grant and Gale, 1989).

The implication of all of these is that greater attention is being given to medical education across the emerging and developing economies; whilst also improving health services facilities of many of the countries within this region.

2.5.3 Evidence from Nigeria

There has been a rapid increase in demand for university education, with medical education constituting a significant aspect of this demand. According to Okojie (2014), the objective of government in this regard is to provide adequate access to university education to those who desire it and have the requisite qualifications for admission. The challenge of government and education managers, however, is to raise the necessary financial resources to support the huge demand for university education in Nigeria. The inability of both the government and the higher education institutions to realise funding expectations has heightened concerns about the quality of university education in Nigeria. According to Imhabekhai and Tonwe (2001), government provides more than 80 per cent of the capital and recurrent expenditures of federal public universities in Nigeria; whereas the reverse is the case in most developed countries where tuition fees are charged and it is the most reliable source of raising funds by the public universities.

Constitutionally, the National Assembly makes appropriation to all sectors of the economy, including education. The Federal Government, through the NUC, disburses funds to federal universities. The block grants were differentiated into capital and recurrent; with the recurrent component distributed using FTE and historical/incremental funding method to the universities as the case may be. The challenge faced by the stakeholders in the education sector in Nigeria is predominantly based around inadequate funding by the higher educational institutions. Federal government funds the public universities and all other sectors of the economy based on projected earnings accruing to the federation account. Due to the paucity of funds available in the federation account, federal universities and the medical schools are allocated fractions of their funding requirements, with the funds allocated not covering their requirements for teaching and learning. Despite this gap in financing, federal universities are not allowed to charge tuition fees at undergraduate level to augment the funds available to run the system.

It has been argued that health and education are the two most important prerequisites for human capital development of a country (Obansa and Orimisan, 2013; Kirk, 2011). According to Arikewuyo (2010), however, neither sector has been accorded the appropriate attention in Nigeria. Nigeria, with a total of 170 approved universities as at 2019, (43 federal universities, 48 state universities and 79 private universities) still grapples with the challenge of finding the necessary resources to support the huge massification of university education (Okojie, 2014). Similarly, the Nigerian health system is also comatose, with hospitals having few drugs, inadequate and substandard technology and a lack of infrastructural support (FMoH, 2004). Adeniyi (2013) also posited that the quality of medical care in hospitals in Nigeria is directly related to the quality of the fellows and consultants who practice in those hospitals. This further strengthened the earlier proposition by Ajayi (1992), who believed that the acquisition of basic knowledge and skills promoted the acquisition of professional self-development as the bedrock of good training for medical personnel. The training of doctors, at both undergraduate level as well as postgraduate medical education, is central to the attainment of quality in healthcare delivery in Nigeria. The major challenge facing educational development in Nigeria, however, is lack of adequate finance (Adewuyi and Okemakinde, 2013). In order to ensure that quality of education is maintained, there has been various studies which suggested that funding is a major factor and may not be the sole responsibility of the government. Adeniyi and Taiwo (2011) conducted a study of education cost-sharing in Nigeria, and posited that the federal government's inability to single-handedly fund publicly-owned tertiary institutions makes the adoption of cost sharing method imperative. According to Johnstone (2007), and another study by Sanyal and Martins (2006), cost-sharing in education is made among government, parents, students and institutional donors/organisations. The government's contribution is made through taxes; the parent’s contribution by paying the tuition fees and other expenses; students contribute by accessing education loans repayable after graduation; while the institutional donors share in the cost of providing education through endowment and scholarships awarded to deserving students. The alternative source(s) of funding, such as charging tuition at the undergraduate level which had been prohibited, were suggested to be considered to alleviate the pressure of over reliance on annual budgetary allocation, TETFUND intervention funds and other ad-hoc fund releases, to a more enduring system where parents and students contribute towards the delivery of effective medical education in Nigeria.

In contrast, Postiglione (2011) conducted a study across developing countries in Southeast Asia and identified that the governments of South East Asian countries provided subsidies and loans to alleviate some of the hardships faced by the poor and vulnerable in the population. Evidence supports that students pursuing higher education pay tuition as part of their cost sharing to augment funds from the government, which mostly are grossly inadequate. The funding requirements for running medical education could be enhanced through the introduction of tuition fees in public medical schools in Nigeria. Some scholars on the other hand, have argued for a significant reduction in the user fees paid by undergraduate students in Nigeria. According to Akinyemi et al. (2012), whose study revealed that household demand for university education was inelastic, the regressive effect of users’ fees, charged by the institutions are mitigated through the introduction of scholarships and students’ loans, with emphasis on the low- and middle-income households. To buttress the argument for institutions to be allowed some amount of tuition, a study was conducted by Askin (2007) in the United States which assessed the funding patterns of community colleges between local and state governments. It was discovered that the funding accruing to community colleges from local sources dwindled from its 1918 level of 94% to only about 20% by the year 2000. On the other hand, the percentage of revenue from tuition was discovered to have tripled since 1918. It was discovered that the institutions were able to make up for the shortfall in funding requirements for the running of the community schools, from revenues derived from tuition and other internally sourced revenue, and this enabled the institutions to run their activities optimally.

The medical schools of federal institutions in Nigeria run similar training programmes for their students and, consequently, are bedevilled by similar funding challenges. The curricula of medical schools contain both basic sciences and clinical education. The medical students receive their basic education in the medical school where they are introduced to the basic sciences’ courses and allied subjects. They receive their clinical training at a teaching hospital attached to the medical school, under the close supervision of a consultant who is a lecturer at the medical school. The medical doctors and other health professionals, who are saddled with the responsibilities of providing healthcare services to the entire citizenry, ultimately are trained both at the medical schools and teaching hospitals respectively. The situation of teaching and learning at these teaching hospitals are, therefore, necessarily of concern to medical school administrators because of the central role the teaching hospitals occupy in the overall training of medical doctors and allied professionals in health sector. The public medical schools in Nigeria face a host of problems which affect the provision of medical training and conducive learning environment.

According to Ibrahim (2007), the major problems facing most of the medical schools in Nigeria include:

- Curriculum overload.
- Curriculum atrophy, with no iterative process built upon evaluation.
- Absence of staff training programmes.
- No departments of medical education and absence of leadership.
- Lack of awareness of global changes in medical education, with little or no opportunity to travel and learn.
- Inertia and reluctance to accept changes by those who find themselves in leadership position in Nigerian medical schools.
- Finance not allocated to the acquisition and development of modern teaching resources, like clinical skills centres.
- No national quality control body. Once a medical school is accredited, it produces graduates on internal standards, despite the minimum standards established by the Medical Council.
- The quality of graduates is not of same standard across the country.
- A poor national social infrastructure. Electricity supply has remained extremely poor and unreliable for most of the country, including universities and hospitals. Power generation in 2007 averaged 2500 – 3000 megawatts (MW), against a demand of 20,000MW. The power generation in 2016 is below 2500MW for a population of over 170 million people. Hospitals and medical schools had to rely on diesel powered generators, with attendant costs and shortened lifespan of equipment, that had to be switched on and off on a daily basis.

In Nigeria, the federal government introduced a number of reforms to address the deteriorating healthcare delivery in the country. In order to arrest the dwindling funding of all the sectors of the economy, including the health sector, minimal fees were introduced in the health sector to ensure that the citizenry could continue to enjoy uninterrupted provision of adequate, regular and high quality services (Aregbeyen, 2001). The same concession needs to be extended to the educational sector since all federal tertiary institutions, including medical colleges, are not allowed to charge tuition on undergraduate programmes (Okojie, 2014).

Adeniyi and Taiwo (2011), while agreeing that one of the main challenges facing higher education in Nigeria is low level of funding, also observed that the admissions of students into higher educational institutions have significantly outstripped the available facilities provided by the proprietors. This has hampered the educational delivery, monitoring, inspection and other quality assurance activities in federal tertiary institutions including CMUL. Empirical data showed that the Federal Government allocation to the education sector generally has fallen short of the minimum of 26% of the national budget as prescribed by the UNESCO (Table 2.1). There are no signs of progressive increase in the funding injected into the university system even though there is an astronomical rise in the student population and increased cost of maintenance of ageing equipment, inflation rate and rising overhead costs (Tunde and Issa, 2013; Hartnett, 2000; Oguntoye, 2000). According to Omigbodun (2010), while the ultimate goal of medical education is to improve the health delivery services to the citizenry in general, the quality of health care must be assured at all times. The researcher further argued that the quality of practice is generally a function of the quality of education received by the practitioners. Thus, to ensure that quality is obtained, it is germane that improvement in medical education needed to be assured. It has also been argued by various scholars that an important component of quality of education is the availability of functional and well equipped library (Tunde and Issa, 2013; Kachoka and Hoskins, 2009).

The corollary to government funding of tertiary education was justified by Marcucci and Johnstone (2007) who argued that there is a worldwide trend of decreased government support for higher education and increased costs to students and families in the form of tuition. Marcucci and Johnstone believed that given the paucity of funds facing most governments and the competing public needs for social services, such as health care, primary education, housing and the environment, an increase in higher education enrolment will have to attract increased investment costs by parents and students. The challenge, therefore, is to design efficient and effective student aid programmes that can offset any discouraging impact that tuition has on the participation of low-income students.

In order for tertiary education in Nigeria to be competitive nationally and internationally, there is a very strong justification for all stakeholders to contribute towards adequate funding of the institutions. Otite (1992) drew the attention of the academic community to the fact that the crisis in Nigeria's educational sector was historical – inadequate university funding, lack of respect for university autonomy and poor conditions of service of the workers within the university community. These have tended to jeopardise the basic objectives of excellence in teaching, research and service, which is the hallmark of a university system, including the medical schools as constituent part. Onyeonoru (2004) similarly identified a decline in funding and facilities, amongst others, as contributory factors to the decay in the university system on the social, infrastructural, institutional, and intellectual levels. The challenge facing education managers is how to boost not only the funding for education, but also to maximise the utilisation of available resources in the effective discharge of teaching and research activities.

2.5.4 Gap in literature

From the discussions and evidence found from the review of the literature, there has been extensive work done by scholars on budgeting and funding models of tertiary institutions. However, limited studies were carried out on the funding of medical education in developing countries, particularly in Nigeria. The latest studies on funding of medical education in Nigeria, to the best of the knowledge of the researcher, were carried out by Ibrahim (2007) and Akintoye (2008). These studies need to be brought up to date to the current period which is one of the primary objectives of this study.

The incremental funding model is used for funding public tertiary educational institutions in Nigeria. This activity-linked funding model adopted by the federal government of Nigeria focuses more on funding salaries and allowances plus a small margin for general overhead costs. Funding for teaching and research components are met through a contractual funding window provided by TETFUND and similar irregular bulk releases through other government agencies, such as the National Universities Commission (NUC) and Federal Ministry of Education.

The funding of medical education in the developed countries involves governments and the private sector, which contributes through research grants, donations and endowments. Parents and students invest in education through cost recovery mechanisms involving payment of tuition and user fees. Government, on its part, funds the institutions by providing the infrastructures and maintaining and upgrading the facilities to meet the challenges of running the institutions. Government also encourages students to contribute towards their education by advancing loans which are repayable after graduation. Bursary grants are extended to deserving students. Conversely, the main source of funding of education in Africa is the central government grants. The World Bank report (2000) identified most public universities as highly dependent on government subventions to carry out their activities. Unfortunately, however, the declining revenue accruing to the central governments as a result of the global economic recessions has affected the flow of revenue available to the tertiary institutions. This development, in turn, has led to a situation whereby most universities have been constrained to devise other means of generating income, sometimes at the expense of focusing on their core mandate of teaching, research and community service. Docampo (2007) argued strongly that tertiary education must be paid off at least in part by the students because tertiary education which they enjoy also retains the private benefit, apart from being a public good.

The review of the literature also revealed that pay-for-performance (P4P) funding model considers quality and non-quality performance measures and has found relevance in tertiary institutions, including medical schools.

The review of theoretical literature revealed that negotiated funding model, human capital theory, Adolph Wagner's law of increasing state activity theory, Peacock and Wiseman theory of public expenditure as well as the Classical/Keynesian theory of public expenditure, were the major framework used for empirical investigations in the funding of education generally. The negotiated funding model forms the basis upon which this thesis was conducted. The other theories mentioned above fail to address the interrelatedness of budgeting and funding as they influence the outcome variables of medical education comprising teaching, research and service. The Resilience and Youth Development Module (RYDM) model provides a relevant tool that succinctly links all the input variables through the processes to generate the outcomes, which is the production of medical doctors and other allied professionals. This forms the basis for the investigation of the second objective for this study. Consequently, the model facilitates analysis for funds utilisation that engenders effective teaching and learning activities of public medical education in Nigeria.

Also, studies abound that either use DEA technique or questionnaires on funding of tertiary education and not both techniques combined. This study used both DEA and questionnaires simultaneously in order to capture the human element inherent in budgeting and funding for which the DEA technique cannot adequately address. Also, the DEA technique is more scientific and covers non-average or non-mean relationships among budgeting, funding and teaching and learning which constitute core services provided by public medical schools in Nigeria. This shows that both techniques are complementary and produce a more far-reaching effect than a single technique would have revealed.

This study, therefore, attempts to fill the gap by bringing the literature up to date in terms of the methodology adopted. Also, most studies that have examined the efficiency of budget and funding of medical education only ended up with the use of efficiency model such as Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA) or financial ratios. This study, however, extends the frontier of empirical literature by employing the use of multivariate model anchored on the extended negotiated funding framework. This is basically for impact analysis and also to account for the role that the institutional factors would have on medical education in Nigeria.

2.5.5. General Summary of Literature

This study seeks to examine the role of budgeting and institutional factors on funding of public medical education in Nigeria. As a result, there is preponderance of theories on budgeting, budgeting process, funding, public expenditure and productivity as well as efficiency that were reviewed in the study. Also, the empirical literature was discussed under various sub-sections of developed, developing as well as emerging economies and specifically for Nigeria. More so, the methodological literature sufficiently considered studies that adopted the Data envelopment analysis (DEA); which is the dominant technique used in investigating efficiency. From the foregoing summary of empirical and theoretical literature and going by the expansive literature in the study, it is evident that very few studies have been conducted in the case of Nigeria. The latest studies on funding of medical education in Nigeria, to the best of the knowledge of the researcher, were carried out by Ibrahim (2007) and Akintoye (2008). There is need to gather recent evidence to update the literature in this regard.

Nevertheless, most of the instruments of analysis used in those studies were exclusively primary or secondary data. The studies that focused on secondary analysis predominantly used the Data

Envelopment Analysis (DEA) in investigating efficiency of medical institutions while the use of questionnaire has been prominent for primary analysis. This study however, did not just use an integrated analysis of both primary and secondary data for the analysis, but also included a multivariate analysis of cause and effect relationship. It is important to emphasise that the Autoregressive distributed lag (ARDL) model was used to investigate the multivariate model. The use of the ARDL methodology is justified on two major grounds. First, the ARDL model is appropriate in investigating the dynamic paths of medical education funding in Nigeria. The effect of funding cannot be ascertained immediately as it comes with lags. Statistically too, it lends credence to the mix of stationary and non-stationary series as usually evident in financial modelling.

Importantly, no empirical investigation can be carried out without an appropriate theoretical framework. As reviewed, there are numerous models as well as theories of fundings. For this study, however, the negotiated funding model was adopted for too many obvious reasons. In the Nigerian educational settings, it is expected that funding of medical education is negotiated between the representatives of the government and the management of the institutions. Therefore, the negotiated funding model is considered desirable among the various theories reviewed in the study.

Table 2.1a: Summary of Theoretical Literature – Theories of Budgeting

S/N	Theories	Proponents/Adherents	Assumptions	Predictions	Boundary conditions/ Limitations
1.	Incremental Budgeting	Goldstein (2005)	It assumes priorities, goals and objectives of the institutions have not changed significantly	It made allowance for general inflation and price increases over the previous year's figures	It fails if no negotiations and compromises are made between users and management.
2.	Formula Budgeting	Lasher and Greene (2001); Goldstein (2005)	It relies on historical data, projected trends and negotiated parameters	Application of formula produce an unbiased distribution of financial resources	It creates an incentive to retain fund-generating activities even when not needed
3.	Zero-based Budgeting	Linn (2007); Lasher and Greene (2001)	Priority ranking are to be established for all decision package in hierarchical order	It justifies the inclusion of each budgetary item.	It is time-consuming, energy sapping and create fiscal stress
4.	Responsibility-centered Budgeting	Zierdt (2009); Linn (2007); Lasher and Greene (2001)	It opines that all functional units in the institutions are to be accorded cost centre statuses.	It accords responsibility centres, like the academic units, financially accountable	Problems arise where responsibility centres are not accorded cost centres statuses.
5.	Accrual Budgeting	Kovner and Lusk (2010), Cortes (2006)	It presumes that there is a need for reforms.	It suggests a result-based budgeting system to promote efficiency	It is not always embraced as it comes with drastic changes
6.	Incentive-based Budgeting	Meisinger (1994); Yudof, (2002)	There is a premonition that every cost incurred would generate revenue in every unit	It matches revenues to its corresponding cost on a unit-by-unit basis	It is sometimes not true to link cost to revenue in every functional units

7.	Programme Budgeting	Kelly (2002); Goldstein (2005)	Budgeting serves as a means to achieving the objectives of the organisations.	It links the objectives of the firms to its resources	Costs may be arbitrarily allocated to activities
8.	Performance-based Budgetng	Curristine, 2005; Joyce and Tompkins (2002)	It assumes proper costing system in place	Allocation of funds among various public service providers	It is often taken to be short-sighted and sometimes impractical
9.	Activity-based Budgeting	Serritzlew (2006)	The basis of funding is results and not output	Results, rather than outputs, is the essence of public sector efficiency	Its application has not been widely tested.
10.	Mission-based Budgeting	Report (2008)	It assumes every mission can be quantitatively operationalised	It is to manage the college's resources more effectively	The mission of the institutions is not sometimes quantitatively operationalised

Table 2.1b: Summary of Theoretical Literature – Theories of Budgeting Process

S/N	Theories	Proponents / Adherents	Assumptions	Predictions	Boundary conditions/ Limitations
1.	Formal Procedural View	Houerou and Taliercio (2002)	It is predicated on guiding documents that has been systematically designed	It prioritizes upcoming budgeting period to medium and long-term goals of a country	It has been criticised for being incongruent with institutional capacities in place
2.	Independent View	Chen et. al., (1972); Davis et. al., (1996); Ostrom (1977); Tsebellis and Change (2004)	There is equal chance of any alternative expenditure policy bein chosen	Public resource allocation follows a (satisfactory) random walk process	It has little applications
3.	Budgetary Trade-Off	Domke et. al., (1983)	There are mutivarious requests to be met at every fiscal period	It suggests trade off among competing needs	The trade-off could be bias
4.	Rational Choice Budgeting	Reddick (2002)	It is predicated on rational expectation	It adopts a forward-looking approach to budgeting	Reality checks suggest that budgetary process cannot always be rational

Table 2.1c: Summary of Funding Models for Educational Institutions

S/N	Theories	Proponents/Adherents	Assumptions	Predictions	Boundary conditions/ Limitations
1.	Activity-based funding (ABF)	Sutherland et. al., (2012); Duckett et. al., (2013); Palmer et. al., (2014)	It is based on marginal analysis of cost and benefits	To quantify each unit of care and its associated costs.	There could be bias towards efficiency-inspired activities
2.	Pay-for-Performance Model	Sutherland et. al., (2012); Van Herck et. al., (2010)	It presumes that quantity measures are insufficient	It ties financial incentives to quality and non-quality measures	The metric of measurements are not usually the same
3.	Access-Equity-Cost Sharing Funding	Okebukola (2014); Johnatone (2009)	It indicates there is rising costs of providing higher education per student costs of instruction	Financial resources are allocated based on the ability to pay	It does not focus on efficiency of resources
4.	Contextualised Formula-funding	Okebukola (2014)	It presumes a scientific approach to allocation of funds	It recognizes peculiar circumstances and state of physical development	It is formula-based nd could sometimes be complicated in application
5.	Performance-based funding	NCSL (2013); Harnish (2011)	Funding ensures that institutions are funded only on their student enrollment counts	It provides funding based on results and outcomes	It is an output-based approach and could be bias against already established institutions
6.	Host-Proprietor-University-User	Okebukola (2014); Jongbloed (2000)	It presumes that all stakeholders contribute to the success of the institution	It is a stakeholder approach to funding	It could amount to undue wastage and misallocation of funds

7.	Negotiated funding	Jongbloed (2000; 2004)	Previous years allocations are used as the benchmark	Allocations are made collectively with compromises	Bureacracy and delays
8.	Input-based funding	Jongbloed (2000; 2004)	Amounts to provide are determined by costs incurred	Fundings are determined by measures of costs incurred	It is centrally controlled by the government; even though appears market-driven
9.	Output-based financing	Hauptman (2005); Jongbloed (2000; 2004)	The quantity of outcomes should be measurable	Funds are based on purpose-specific purchase	The funding model fails when outccomes are not quantifiable
10	Student-based funding	Jongbloed (2000; 2004)	No state subsidies are provided	Private funds provided by the students or their sponsors; without repayment is employed	With poor economic condition, private financing are impracticable

Tablel 2.1d: Theories of Productivity and Efficiency

S/N	Theories	Proponents/Adherents	Assumptions	Predictions	Boundary conditions/ Limitations
1.	Production Function Models	Jean (1957); Ernst (1956)	Production is considered as the major activity of the organisation	Production is perceived as a function of several input factors	There is no role assigned to technology and knowledge as input factors
2.	Financial ratio measure				
3.	Production-based Models				
4.	Product-Oriented Models	Bahiri and Martin (1970); Horngren (1965); Smith (1973)	It focused on the product	Productivity is given as the ratio of total earnings over cost of production	Many variants of the measures have been provided; making it look subjective
5.	Surrogate Models				
6.	Economic Utility Models				

Tablel 2.1e: Theories of Public Expenditure

S/N	Theories	Proponents/Adherents	Assumptions	Predictions	Boundary conditions/ Limitations
1.	Human Capital Theory	Schultz (1961); Al-hajry (2002);	Education is a form of human capital taken as a consumption or investment	Human capital is the stock of knowledge that a worker acquires to enhance his productivity	It does not consider the relevance of the education
2.	Normative Theories	Samuelson (1954)	It assumes that there is hierarchical levels in public expenditure	It considers the appropriate levels and composition of public expenditure	Issues of market failure and question of social choice have been debated
3.	Positive Theories	Bird (1970)		It seeks empirical verification of relevant items in public expenditure.	

2.6 Data on funding of education in Nigeria

Government budgets of education, over the 25-year period covered by this study, reveal a significant trend of underfunding of this important sector of the national economy. Details of budget allocations to education and health sectors are provided below:

Table 2.2: Data on Federal Government expenditure (Total)

Expenditure on Education (Total and Proportion of Total)
Expenditure on Health (Total and Proportion of Total)

YEAR	TOTAL BUDGET (N' Millon)	Education (N' Million)	%	Health (N' Million)	%
1991/1992	45,638.80	1,470.55	3.22	727.80	1.59
1992/1993	94,880.60	5,279.19	5.56	2,354.50	2.48
1993/1994	113,351.00	8,132.56	7.17	2,982.79	2.63
1994/1995	108,802.35	8,564.57	7.87	2,707.34	2.49
1995/1996	126,060.55	10,621.28	8.43	3,172.21	2.52
1996/1997	141,527.40	13,174.85	9.31	3,457.41	2.44
1997/1998	168,330.65	14,221.52	8.45	4,316.69	2.56
1998/1999	313,880.10	28,600.07	9.11	10,690.52	3.41
1999/2000	455,631.20	50,783.65	11.15	15,928.43	3.50
2000/2001	520,450.00	48,919.62	9.40	19,870.18	3.82
2001/2002	638,050.00	60,206.75	9.44	32,571.85	5.10
2002/2003	840,534.00	72,643.40	8.64	36,937.96	4.39
2003/2004	946,461.75	68,486.90	7.24	33,315.95	3.52
2004/2005	1,000,854.75	82,406.30	8.23	41,705.10	4.17
2005/2006	1,218,049.60	111,008.30	9.11	58,791.50	4.83
2006/2007	1,200,816.10	133,450.09	11.11	69,389.55	5.78
2007/2008	1,587,974.50	150,727.88	9.49	84,724.11	5.34
2008/2009	2,122,666.75	150,567.05	7.09	94,210.96	4.44
2009/2010	2,618,675.01	153,963.59	5.88	94,661.26	3.61
2010/2011	3,211,945.92	253,304.23	7.89	165,461.71	5.15
2011/2012	4,648,849.157	342,727.782	7.37	224,512.037	4.83
2012/2013	4,987,220.426	432,760.714	8.68	279,819.554	5.61
2013/2014	4,695,190.000	373,532.095	7.96	214,946.652	4.58
2014/2015	4,493,363.957	392,363.785	8.73	237,075.743	5.28
2015/2016	6,060,677.358	367,734.727	6.07	221,412.548	3.65

Sources: Federal Republic of Nigeria official gazette and the various states' official gazettes.

From Table 2.1, the trend of national budgets' allocations to education hovered between 3.22% and 11.15% with an average allocation of 8.19% over the 25-year study period. In the same vein, the allocation to health sector, where the medical students have their clinical exposure, averaged 3.69% during the same study period. The percentage allocation to education falls short of the 26% minimum ratio prescribed by UNESCO. The inflation rate in Nigeria has not been stable but has been on the rise. In a situation of static allocation in the face of rising inflation, it is implied that the expenditure in real terms has been declining. This obviously has, implications for allocation to a sub-sector such as medical education as shown in the next sections relating to CMUL. Perhaps, the dwindling allocation to public medical education may not be peculiar to Nigeria. According to Dugas et al (2018), publicly funded higher education in the United States witnessed decreased per pupil funding allotment to state colleges and universities and this had put public university administrators under increasing pressure to decrease costs, increase revenues, and run the institutions more efficiently.

2.7 Evolution of medical education in Nigeria

The evolution of medical education in Nigeria covers the history of medical education, a review of the existing institutional frameworks for medical education, an overview and sources of funding of medical education. These are considered in greater detail in the following sections:

2.7.1 History of medical education in Nigeria

By 1890, a few Nigerian families sent their children to study medicine abroad. The Scottish medical schools were, for a long time, the favourites abroad but these were later followed by those of Durham, London and Dublin. Other medical schools in England, the United States of America, Canada and the continent of Europe came into the students' field of choice relatively recently. Nearly all medical students who studied abroad were privately sponsored. It was obvious that the medical manpower needs of the country could never be met by the resultant trickling output of half-a-dozen to a dozen doctors graduating yearly. Around 1928 to 1930, the colonial government started a medical school in Nigeria with the object of training medical assistants (Olujuwon, 2002). The students admitted to the school possessed the necessary academic qualifications to be admitted to a university in the United Kingdom or elsewhere abroad, but they did not have the money to pay for medical education abroad.

Grants from the government were made available for them to study at the Yaba Medical School, the first medical school in Nigeria. There were said to be (at least) two drawbacks to the medical education given at Yaba. It lacked the sophistication of a medical education received overseas and the qualification awarded was recognised for the practice of medicine only within Nigeria. These were serious drawbacks from the graduates' point of view because they were regarded as 'sub-doctors' compared with doctors who qualified overseas and were consequently rewarded with lower salaries.

The psychological impact of the Yaba Medical School on the country was more subtle, and although not so readily appreciated at the time, it proved far more damaging later. It led to an attitude among the people which regarded a medical qualification obtained locally as something second-rate, something good enough for a colonial people but which would not be accepted by the 'ruling powers' in their own country. For the graduates of Yaba, the means to escape from the resulting opprobrium and slight were simple. As soon as they had earned enough money to do so, they went to medical schools in the United Kingdom. Such was their professional ability that they obtained a 'proper' medical qualification in the minimum time permissible. For the country, the next step taken in medical education was the founding of the University College in Ibadan. So strong, however, was the psychological impression created by the Yaba Medical School that it delayed the establishment of a fully-fledged medical faculty in Ibadan by many years. Public opinion insisted that never again would the people of Nigeria allow a second-rate institution to be foisted upon them.

Nothing short of an attachment by 'special relationship' to the University of London would be acceptable. This meant that although University College Ibadan was founded in 1948, it was not until ten years later that the full medical course could be completed there. Until 1958, students had to go to the United Kingdom to do the clinical part of the course, and they received their medical degrees from the University of London. It was hoped that the University College, Ibadan, would be autonomous in 1963. Even then it had been proposed that Ibadan students graduating during the years 1963 to 1967, inclusive, should continue to be awarded University of London degrees. In 1962, a new beginning was made with the establishment of the University of Lagos with its School of Medicine, in as much as, from its inception, the medical school has had full powers to award its own degrees. Today, there are as many medical schools as there are public tertiary institutions of learning in Nigeria.

2.7.2 Review of existing institutional frameworks for medical education in Nigeria

Ferreira (1993) identified institutions charged with the regulation of medical ethics and profession in Nigeria as; the Medical and Dental Council of Nigeria (MDCN); Medical Schools; The Nigerian Medical Association (NMA); The National Council of Nigerian Nurses and Midwives; The National Association of Nigerian Nurses and Midwives; School of Nursing; Pharmaceutical Society of Nigeria; National Pharmaceutical Council. These institutions are charged with the following major functions:

a. Preparing and reviewing, from time to time, a code of conduct for medical practitioners considered desirable for the profession by the council.
b. Determining the standards of knowledge and skills of practising doctors and allied professionals.
c. Maintaining a register of persons to practise medicine.

In his comments on the functioning and problems of these institutions in ensuring adherence to the ethics of the profession, Ferreira (1993) lamented that the National Universities Commission (NUC) gives approval to Universities to establish medical schools without the knowledge of the MDCN. Hence, proper guidelines in respect of standards are not laid down from the beginning. Even when they are properly set up, it is difficult to ensure that minimum standards are maintained in these institutions. The NMA is considered as a quasi-voluntary association of doctors, with its own disciplinary committee, but which plays a very minimal role in ethics or professionalism in medicine. Generally, it appeared there was a universal lack of institutional cohesion and co-ordination to regulate ethics in the medical profession. In this regard, he offered the following suggestions on how to help these institutions to effectively contribute towards tackling the problem of unethical conduct among medical practitioners:

a. The Medical Education Committee of the MDCN should monitor the development of the doctor even after his full registration.
b. Each practising doctor should attend a minimum of one continuing medical education programme, in subjects such as ethics in medical practice, every two years and this should be a condition for yearly re-registration of doctors.

c. Arising from the fact that some doctors are known to have graduated from medical schools and were not registered afterwards and yet practise, placement for house jobs should be done through the MDCN.
d. Colleges of Medicine should incorporate ethics and medical jurisprudence into their curricula.
e. Bodies like NMA, AGMP and the Guild of Medical Doctors (GMD) should serve as alert agents or watchdogs to enhance the image of the profession.
f. An independent body should be set up to monitor medical practice due to the fact that state ministries of health and public medical institutions have failed to carry out their responsibilities, leading to the present declining standards in the medical profession (Adekunle, 1993).

In the same vein, Adekunle (op. cit) identified a lack of teaching of medical ethics in medical schools as the cause of falling standards of ethics in medicine. He recommended the introduction of a course in the medical curriculum of medical schools to be taught either at block postings or in the major clinical departments where students are in contact with patients. He also suggested the introduction of continuing medical education programmes in medical ethics by specialist associations and postgraduate colleges, even as he urged the NMA to draw up a national code of ethics for medical practitioners.

2.7.3 Overview of medical education in Nigeria

The University College Hospital, Ibadan (UCH) is the premier medical school in Nigeria and was established in 1948 following the report of the Elliot Commission on higher education. The medical school started in the 1940's with a small number of students who had to complete their clinical training in the United Kingdom (UK) because there were no appropriate structures in place to train the newly admitted students. With time, the faculty was developed to provide full medical training locally. The British Government, during the colonial administration, helped to establish the UCH. In 1960, the Ashby Commission on Higher Education in Nigeria recommended the establishment of more training institutions, including medical schools. The report stated that the University of Lagos would have a medical school and utilise existing medical institutions for training in clinical medicine. In June 1961, in collaboration with the Federal Government, and at its request, the United Nations Educational, Scientific and Cultural Organisation set up the UNESCO Advisory Commission for the establishment of the University of Lagos. One of the terms of reference of the Commission was to prepare detailed recommendations in regard to the organisation, administration and financing of the university, as well as the range and organisation of the discipline and research programmes required. The report was accepted by the Federal Government and immediate steps were taken to found the Lagos University Teaching Hospital. The Act establishing the Lagos University Teaching Hospital became law in 1961 and provided that a “Teaching Hospital”, to be known as the Lagos University Teaching Hospital, for the purposes of providing such facilities for the training of medical students as are usually provided by teaching hospitals of internationally high repute.

A bill for an Act to establish a University of Lagos was laid before the Federal Parliament in March 1962. This bill provided for the establishment of a medical school which should be an autonomous unit of the University and was passed into law on 13th April, 1962. The Act established that “the medical school in Lagos shall for all purposes be an autonomous unit of the University” (College of Medicine of the University of Lagos Prospectus 1983 – 85, p. 7). In October 1962, the first batch of 28 students was admitted into the institution. Infrastructure support and equipment was adequate and students’ numbers were small at that time. In March 1967, the Federal Government of Nigeria, through a Decree (No. 3, 1967), reconstituted the University of Lagos and established within it a body corporate called the College of Medicine of the University of Lagos, which became an integral part of the university. With this new law, the University of Lagos Medical School was re-designated “College of Medicine of the University of Lagos”.

The mission of the College of Medicine of the University of Lagos is to be a world class institution for the pursuit of excellence in knowledge, through learning and research, character and service to humanity. The mission is to be achieved through the provision of innovative teaching, translational research and service that impacts the health needs of Nigerians, in particular, and the world, in general (College of Medicine of the University of Lagos Prospectus, 2009-2010). The attainment of these goals is achievable through the development of curricula which are run at undergraduate and postgraduate levels.

Strong agitation has been made over the past decades to improve the medical education process through scholarly teaching and education research (Whitcomb, 2002). Consequently, during the post-independence era, more medical colleges were established and adequate funding was budgeted and made available to these institutions to cover fully their capital and recurrent costs to enhance the quality of teaching and research. The College of Medicine of the University of Lagos was one of the three medical schools that were established in Nigeria after independence.

The College of Medicine, being an integral part of the University of Lagos, occupies a central position within the overall organogram structure of the university with its distinct teaching and non-teaching units.

The distinct position of the CMUL in the hierarchy of medical training in Nigeria is depicted below:

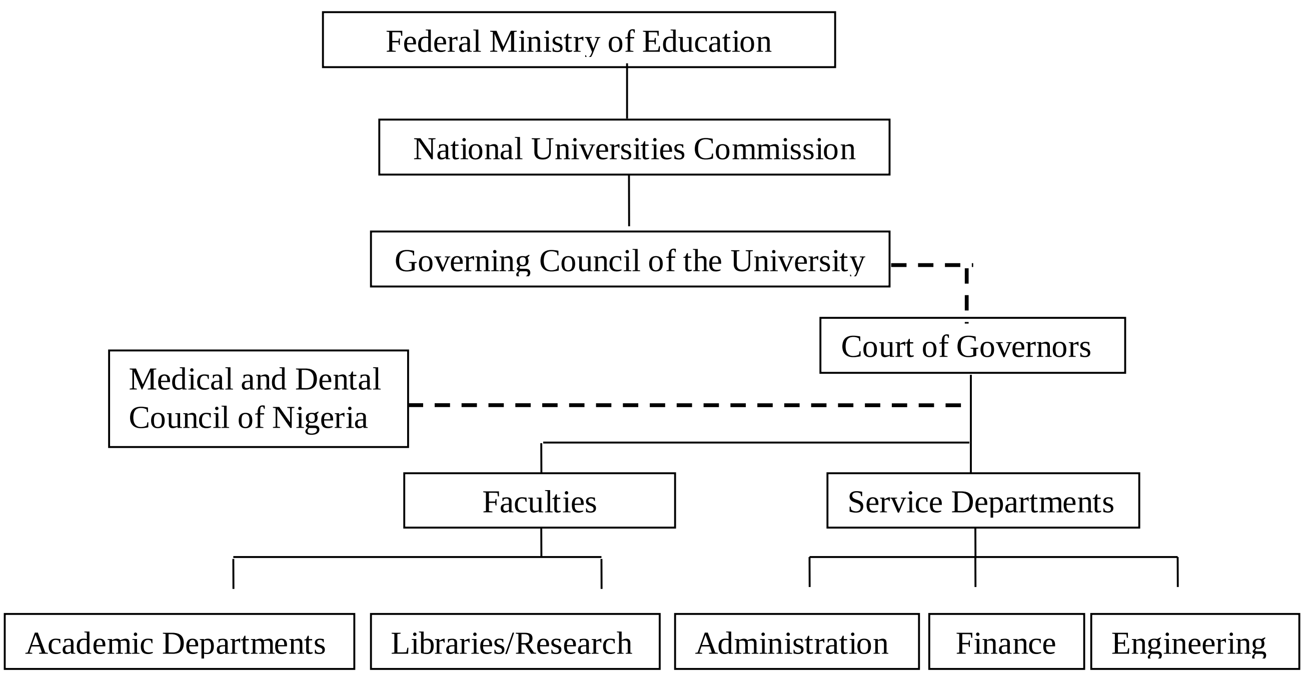


Fig. 2.3: Organisational structure of CMUL

Medical School teaches subjects such as, biochemistry, physiology, anatomy and pharmacology. At the completion of the taught programmes at the undergraduate level, the doctor can only legally practise as a medical officer upon certification by the Medical and Dental Council of Nigeria (MDCN), which is the authority vested with the power for regulating the production of doctors and ensuring good medical practice in Nigeria. The

National Universities Commission (NUC) is the other regulatory body, created in 1962 and reconstituted as a statutory body in 1974.

According to Saint et al. (2004),

> "the NUC was originally intended to function as a modest university grants commission, advising government on policy issues, defining norms for quality assurance, channeling block grants from government to the universities, and ensuring the balanced and coordinated development of the system. By the end of the military era in 1998, it had become a large and unwieldy organisation that was involved in all spheres of university endeavour. It managed micro-level institutional finances through a series of predetermined-expenditure guidelines and constant expenditure monitoring. It was involved in the selection of institutional leaders and members of governing councils. Its approval was required for all new university course offerings and for the physical development plans for each campus. It participated in the negotiation of staff salaries with the various academic unions" pp 3.

However, the current scenario has led to a restructuring of the activities of the NUC to make it more focused in its role of providing general guidelines to Nigerian universities on curricula and maintenance of quality of courses delivered across all licenced universities in the country.

The NUC is the body charged with the coordination of university development and operation in the country and whose main objectives are to ensure the orderly development of university education in Nigeria, to maintain its high standard and to ensure its adequate funding. According to Okojie (2007), the NUC improves the quality of university education in the country through the following activities:

- Accreditation of courses
- Approval of courses and programmes
- Maintenance of minimum academic standards
- Monitoring of universities
- Giving guidelines for setting up of universities
- Monitoring of private universities
- Prevention of the establishment of illegal campuses
- Implementing appropriate sanctions

However, the overall control of each university is vested in the Governing Council with a Pro-Chancellor at the helm of affairs. The Council takes charge of goal setting, policy formulation, financial control and administration, staff development, general discipline and liaison activities with the government. The Vice-Chancellor sees to the day-to-day running of the University, implementing the decisions of the Council. The Chancellor is the ceremonial head of each university, with the Vice-Chancellor as the head, which regulates the academic activities of the university while the Registrar serves as the Secretary to the Governing Council and Senate.

However, with the establishment of more medical schools by both the federal and state governments, which goes with the need to provide additional infrastructures, such as teaching/learning tools; capacity development for the medical school; energy for generation of electricity for learning and medical researches; funding has become grossly inadequate to support the training of an increasing population for both undergraduate and postgraduate medical students. The focus of this study is the federally owned public medical schools. These medical institutions belong to the same proprietor – the Federal Government of Nigeria – and operate the same funding model (normative and contractual funding model). Though budgets to run these medical schools are submitted to the federal government for consideration, the fund releases remained inadequate year after year. While the number of higher education institutions continues to increase and the resources appear to be reducing, governments adopt more selective resource allocation policies and begin to see themselves as buying services rather than subsidising higher education (Chiang, 2004). The neglect of adequate funding provision cuts across federal tertiary institutions in Nigeria and it is particularly predominant with medical educational institutions. The funding mechanisms for these federally owned public medical schools in Nigeria have become precarious as a result of dwindling resources accruing to them from the depleting allocation through federation account. A study conducted by Hartnett (2000) stated that between 1990 and 1997, the real value of government allocation for higher education declined by 27%, even as enrolment grew by 79%.

The observable trend over the years has been deterioration in fund allocation as a result of increasing demand by prospective students, who desire to study at CMUL in preference to other medical schools in the country.

2.7.4 Sources of funding of medical education in Nigeria

The financing of medical education globally is guided by the following factors:

1) That the production of doctors who provide healthcare services to the populace is a public good that is worthy of public support.
2) That training doctors is a private (individual) good that specifically benefits certain individuals (the doctor and his family) and groups (his employers).
3) That medicine is a public trust and society expects the profession to produce the next generation of doctors.

In recognition that the production of doctors is a public good, many governments establish medical schools and fund them (Odusote, 2013).

At the moment, there are four major sources of financing of university education in Nigeria:

A. Subventions and grants from federal and state governments, which constitute almost 90% of the available revenue to the institutions.

B. Internally Generated Revenue (IGR). The National Universities Commission (NUC) prescribes that federal universities must generate at least 10% of their total yearly funds internally (Odebiyi and Aina, 1997).

C. Tertiary Education Trust Fund

   The Tertiary Education Trust Fund (TETFund) prescribes that 2% of assesible profits of limited liability companies registered in Nigeria be paid as an educational tax which shall be disbursed according to the ratio of 50:40:10 to higher, primary and secondary education respectively. The share of higher education is further allocated to the universities, polytechnics, and colleges of education according to the ratio of 2:1:1 respectively.

D. Students' contributions

   Students' contributions towards living expenses on campuses have been insignificant in Nigeria. In fact, this has been less than 1% of the total operating costs of tertiary institutions in the country. Past governments, including the present one, have not allowed institutions to charge realistic amounts for fear of attracting negative reactions from the citizens, who believe that cost of education should entirely be borne by the Nigerian state.

E. Other sources: Other sources of raising finances include endowments, fees/levies, gifts and grants from foreign donors in form of research grants, etc.

A study, conducted by Akinwande (2013), showed paltry details of fees paid by undergraduate students in federal universities in Nigeria, which appeared inadequate to support students' training and academic activities. Details of fees paid in all federal universities at the undergraduate levels include: examination NGN 200 (US$ 3.7); registration NGN 150 (US$ 2.77); students' handbook for new students NGN 200 (US$ 3.7); accommodation (excluding food) NGN 90 (US$ 1.66); hostel maintenance NGN 200 (US$ 3.7); sports NGN 150 (US$ 2.77); and acceptance fees for new students NGN 300 (US$ 5.55). Other fees charged include caution fees NGN 100 (US$ 1.85) for science students and NGN 150 (US$ 2.77) for arts students; student union fees NGN 60 (US$ 1.11); medical registration NGN 100 (US$ 1.85); identity card NGN 400 (US$ 7.40); departmental registration NGN 50 (US$ 0.92) for parent department and other departments NGN 25 (US$ 0.46); and library fees NGN 50 (US$ 0.92). Students are also required to pay NGN 300 (US$ 5.55) for management information system; NGN 200 (US$ 3.70) for examination results verification for new students; and late registration NGN 1000 (US$ 18.51). Evidence available from developed and developing economies showed that students do not only pay tuition as part of cost sharing towards their education, the tuition paid is constantly reviewed by the university management to reflect current realities.

Jones-Esan (2007) reported the review of higher education funding by 13 OECD countries and highlighted that:

- Payment of tuition is becoming the international rule and not the exception.
- Canada charges tuition and, in fact, the fees are on the rise. Australia varies school fees payable based on level of income. China sets fees according to market conditions taking into account both costs and demand.
- In America, fees at public and private institutions are rising by an average of 14.1% from 2002 – 2003 to 2003 – 2004 at public institutions. Overall, the split is between public universities – which charge around $5000 - $15000 per annum, depending on location, type and length of course; and private universities, where fees can be as high as $30,000 per annum. In England, fee in universities is £6000 per annum.
- In Nigeria, there were wide protests that the N90 (i.e. $0.60) hostel fee charged since 1985 should not be increased. Federal Government has also failed to release to the universities exactly what it costs to provide this service for each student.

In Nigeria, in 2014, the need to seek reforms of educational funding led to the hosting of a national summit on education, organised by all staff unions in the Nigerian university system, where scholars lamented the poor infrastructure and inadequate funding situation of tertiary institutions in the Nigerian university system. As part of the recommendations coming out from the summit, a number of funding models were suggested for creatively funding higher education in Nigeria. The proposed models for the sustainable funding of the Nigerian university system have three base elements; government's minimum fund allotment; availability of revenue to government to meet the allotment; capacity for creative internal generation of revenue by the managers of the universities and the determination of cost unit for grant disbursement. The models proposed include: Access-Equity-Cost sharing model; Contextualised Formula-Funding Model; Performance-Based Funding Model; the Host-Proprietor-University-User-Funding Model and Pay-for-Performance Funding Model.

The current trend of funding for tertiary education is on the basis of output rather than input. Internationally, several countries are linking the funding of higher education to expected outcomes. The management principles of economy, efficiency, and effectiveness are becoming measures of good governance in higher education as well as in business. Managing by outcomes or outputs rather than inputs has led to some performance-based and/or incentive funding models – rewarding actual rather than promised performance levels.

In Nigeria, the funding of tertiary and public medical education requires a shift from the input based to output based method in order to address the perennial shortfall being experienced by the institutions in the discharge of their duties of teaching and learning.

Chapter three Research methodology

3.1 Introduction

The research methodology is a comprehensive concept which discusses the methodological approach of conducting a study. The research methodology adopted is an important aspect of conducting a logical and reliable study (Ardalan, 2003). It encapsulates the main objectives of a study and the methods of addressing research questions. The research methodology chapter of this thesis also covers the overall research design, process of fieldwork and analytical frame for data collection. The sources of data; the rationale for data collection and method for analysis are clearly explained.

This is an evaluative study carried out at the College of Medicine of the University of Lagos (CMUL). College of Medicine is the medical school of University of Lagos, a federally-owned tertiary institution in Nigeria. The medical school has the same funding model as any other federally-owned medical school in Nigeria. Therefore, the case study of CMUL may reflect the funding pattern of each of federally-owned medical schools in Nigeria.

3.2 Re-statement of research objectives

The broad objective of this study is to examine the role of budgeting and institutional factors on funding of public medical education in Nigeria, using College of Medicine of the University of Lagos as a case study.

Following from the statement of research problem, the specific research objectives are designed to:

i. ascertain the trends in budgeting and funding structure of public medical education in Nigeria.
ii. examine the efficiency of budgeting and fund utilisation on public medical education in Nigeria.
iii. investigate the impact of funding requirements on public medical education in Nigeria.
iv. assess the significance of institutional factors on budgeting and funding of public medical education in Nigeria.

3.3 Research hypotheses

Drawing from the statement of research problem and in order to answer the research questions and address the research objectives earlier stated, the following research hypotheses were formulated:

Hypothesis One

H_0 Efficient utilisation of budgeting and funding does not have significant effect on public medical education in Nigeria.

H_1 Efficient utilisation of budgeting and funding has significant effect on public medical education in Nigeria.

Hypothesis Two

H_0 Budgeting and funding requirements have not significantly impacted on public medical education in Nigeria.

H_1 Budgeting and funding requirements have significantly impacted on public medical education in Nigeria.

Hypothesis Three

H_0 Institutional factors do not significantly influence budgeting and funding of public medical education in Nigeria.

H_1 Institutional factors significantly influence budgeting and funding of public medical education in Nigeria.

3.3.1 Research design

The research design enables the identification of the appropriate alternative to provide acceptable answers to the research questions. Saunders et al. (2009), Hakim (1987, 2000) identified experiment, survey, case study, action research, ethnographical, archival research and grounded theory as various strategies for carrying out research. Graham (2000) drawing from Wass and Wells (1994) and Easterby-Smith et al. (1999) identified the same methods, including case studies, as research methods that could be applied. Robson (2002) argued that research design embraces the selection of research strategies, research choices and time horizons that could lead to finding appropriate answers to the research questions. Easterby-Smith et al. (op. cit), quoted by Njiru (2002), argued that since time and resources are limited when carrying out a study, it is important for researchers to make choices which would provide the focus of their research clearly. In the context of a research project, design means the overall configuration of the research; the kind of evidence to be gathered, the source of data collection and how they are interpreted to satisfy the research objectives. It has been argued that where there exists a well-developed and tested theory to be applied on a research topic, a deductive approach is more suitable in such a situation. Deductive approach concerns the application of theory capable of being measured quantitatively. Deductive models of research as well as application of quantitative methods are generally applied because they allow for the collection of factual data. Collins and Hussey (2003), quoted by Saunders et al. (2009) contended that deduction is the dominant research approach which allows researchers to present the basis of explanation, allows the anticipation of phenomena, predicts their occurrence and therefore, permit them to be controlled. Deduction explains relationships between variables and enables concepts to be investigated to produce results that could be measured quantitatively.

This thesis is an integration of both qualitative and quantitative approaches. This is due to the nature of the research questions and objectives designed. A case study of the CMUL is adopted to evaluate the role of budgeting and institutional factors on funding of public medical education in Nigeria. According to Theodorson and Theodorson (1969), cited by Punch (1998), a case study is "a method of studying social phenomena through the thorough analysis of an individual case. The case may be a person, a group, an episode, a process, a community, a society, or any other unit of social life". Remenyi et al. (1998) averred that a case study provides a rich and in-depth study because it establishes relationships of the items being studied. All data relevant to the case are gathered, and all available data are organised in terms of the case. The case study method gives a unitary character to the data being studied by inter-relating a variety of facts to a single case. It also provides an opportunity for the intensive analysis of many specific details often overlooked by other methods. Case studies have been widely used in Sub-Saharan Africa (SSA) to investigate cases of pricing methods, performance evaluation in non-profit government institutions among others (Njiru, 2002; Kumar, 1999). Case studies were also embraced in earlier studies (Remenyi et al., 1998 and Yin, 1994; Broome et al (2017). It has further been argued that the type of research questions being investigated could better be addressed through the adoption of a survey within a case study. This study saw the justification for the use of the case study approach and has obtained data for 25 years to enable the collection of data to be as representative as possible and free from bias. Significantly, the case study approach is contemporary. The subject matter of this research is also contemporary in nature. It concerns phenomena relevant today as they were in the recent past. Moreover, a case study can be used as a follow up to a survey by questionnaire to further reinforce the findings from the survey. Following the argument by Yin (1994), the research questions under investigation in this research could be easily corroborated with the use of a questionnaire within a case study so as to give an holistic and robust result. The study used a questionnaire within the framework of a case study research, to collect and analyse the primary data. The evidence from the perception of the key stakeholders is complemented with secondary data collected from archival information from the medical school i. e. CMUL.

3.3.2 The research pyramid

This section is designed to graphically present the ''research ladder'' in Figure 3.1, showing the various rungs of the ''ladder'' used in ascending to the top to achieve the objective of the study. The aim of presenting this ''research pyramid'' is to provide an overview of the assumptions, methods and methodology that guided the study. Also, the pyramid serves as a guide to allow the researcher to remain focused throughout the course of the research.

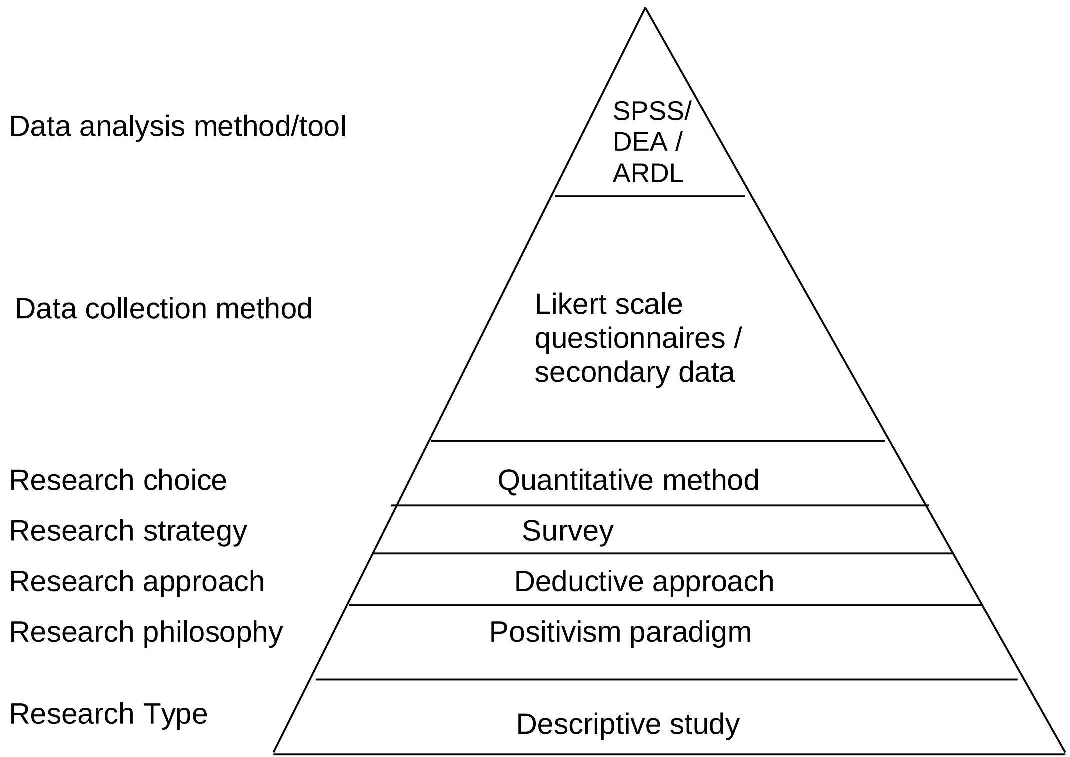


Fig. 3.1: The research pyramid

3.3.2.1 Research Type

Descriptive study is the use of summary statistics including the mean/average, standard deviation, variances and kurotosis to quantitatively describe the relationship between two or more variables of interests.

3.3.2.2 Research Philosophy

Research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders et al., 2009). Philosophy encompasses the researcher's beliefs and cultural background that impact on the research strategy adopted to carry out the study. A study could be conducted in the light of different philosophies (Sharifabadi, 2012).

3.3.2.3 Research Approach

The deductive approach involves the development of a theory subjected to a rigorous test and hypothesis as well as the design of research strategy to test the hypothesis. Deductive approach is generally adopted in positivism studies.

3.3.2.4 Research Strategy

The research strategy is an overall plan adopted in carrying out a research. It encompasses the entire research process such as planning, execution and monitoring. The four major types of research strategy are case study, qualitative interviews, quantitative survey and action-oriented.

3.3.2.5 Research Choice

Quantitative studies adopt objective measurements and statistical, mathematical and numerical analysis of data collected. Data is collected through questionnaires, interviews and secondary data, such as records from books of companies and institutions. Quantitative research refers to gathering numerical data and generalising the result across groups of people to explain a phenomenon.

3.3.2.6 Data Collection Method

The primary data for this study are collected through the use of structured questionnaire. The questions are structured on a five-point likert scale form of strongly disagree, disagree, undecided, agree and strongly agree.

3.3.2.7 Data analysis method/tool

The DEA and ARDL techniques were the primary instruments used to analyse the secondary data of CMUL for measurement of efficiency in funds utilisation. The DEA remains the dominant technique in examining the efficiency and was consequently adopted in evaluating the funding in the College of Medicine of the University of Lagos (CMUL). The Autoregressive Distributed Lag (ARDL) model was used to investigate cause and effect relationship between budgeting and institutional factors as it affects funding of CMUL.

3.3.3 Research philosophy

Research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders et al., 2009). Philosophy encompasses the researcher's beliefs and cultural background that impact on the research strategy adopted to carry out the study. A study could be conducted in the light of different philosophies (Sharifabadi, 2012). Guba and Lincoln (1994) argued that the choice of research method becomes secondary only after the determination of which paradigm is applicable to the research. Saunders et al.

(2009) also agreed to the importance of addressing the underlying research philosophy behind a study before undertaking the research but went further to develop what is generally referred to as the research "onion" to underscore the various layers of the paradigm to be considered before the choice of the research method is made. The "research onion", an invention by Saunders et al. (2009), provides an overview of the layers of philosophical approaches, strategies, methods, time horizons, techniques and procedures of carrying out a research. The choice of research philosophy depicts the basic assumptions about the way the researcher views the world. Saunders et al. (op. cit) identified four (4) classes of philosophical stance that guide researchers' thoughts, namely: Pragmatism, Interpretivism, Realism and Positivism. The research philosophy of this study is positivism.

3.3.3.1 Positivism

A positivist is a researcher who collects and analyses data considered as "facts" for the purpose of conducting a research. In positivism, reality is represented by data that can be identified and countable such as physical objects, numbers and figures. According to Saunders et al. (op. cit.), these objects have separate existence distinct from that of the researcher and hence, could be argued to be less open to bias and therefore, considered more objective.

The philosophical stance of positivism entails working with an observable social reality. The final result of such research can be law-like generalisations (Remenyi et al., 1998). The research is conducted based upon observation of phenomenal to generate production of credible data. Existing theory is used to develop hypotheses tested and confirmed. Positivism connotes the possible and desirable study of social behaviour, just as scientists study behaviour in the natural world and obtain specific and empirical results. Positivists use scientific method and language to investigate and write about human experience. Studies of the causes of behaviour can be done and the effects could be empirically observed.

The positivism philosophy approach to this study enables an in-depth analysis of variables of budgeting and funding for CMUL to be empirically collected over a period and scientifically analysed to establish the relationships and effects on teaching, research and learning. The ontology of the study is objectivism. Accordingly, likert-scale questionnaires were administered to obtain the perceptions of key stakeholders of the institution on the role that funding plays on public medical education, using CMUL as a case study.

3.3.3.2 Objectivism

Objectivism, as an element of research philosophy, has a reality that separates the person from the office he occupies. The formal structure remains largely unchanged regardless of who occupies the office at any point in time. In other words, it implies that social entities exist in reality, external to social actors (Saunders et al., 2009).

The ontology of this study is objectivism. DEA technique, ARDL and likert-scale questionnaire produced standardised results and could be replicated in similar environments. The questionnaire was administered to key stakeholders within the medical education subsector to obtain their perceptions on the availability and impact of funding on public medical education. The DEA and ARDL techniques were the primary instruments used to analyse the secondary data of CMUL for measurement of efficiency in funds utilisation.

3.3.3.3 Deductive

The deductive approach involves the development of a theory subjected to a rigorous test and hypothesis as well as the design of research strategy to test the hypothesis. Deductive approach is generally adopted in positivism studies. This study is predicated on negotiated funding model. Robson (2002) identified five steps involved in deductive research.
These are:

a. Formulation of hypothesis. This is a testable proposition on the relationship between two or more variables from the theory
b. Expressing the hypothesis in operational terms; how the variables could be measured
c. Testing the operational hypothesis, this involves collection of quantitative data to carry out the test
d. Examining the outcome of the enquiry to either confirm or reject the proposition
e. If necessary, modifying the theory in the light of the findings.

The use of likert-scale questionnaire in this study, coupled with the collection of 25-years data from CMUL on relevant variables to the study, provided a platform that elicited responses from the respondents quantitatively and statistically processed. The results are capable of generalisation and could be replicated in similar environments.

3.3.3.4 Quantitative

Quantitative studies adopt objective measurements and statistical, mathematical and numerical analysis of data collected. Data is collected through questionnaires, interviews and secondary data, such as records from books of companies and institutions. Quantitative research refers to gathering numerical data and generalising the result across groups of people to explain a phenomenon.

The purpose of conducting a quantitative research is to determine the relationship between an independent variable and a dependent variable within a stated population. Quantitative research designs are either descriptive (subjects measured once) or experimental (subjects measured before and after a treatment). A descriptive study establishes only associations between variables, while an experimental study establishes causality. This study is descriptive.

The overall aim of a quantitative research is to classify features, count them and construct statistical models to explain the observed results.

3.4 Theoretical framework and models specifications

This study is anchored on the negotiated funding model. The model fits the peculiarity of funding public education in developing economies such as Nigeria. As far as negotiated-based funding is concerned, Jongbloed (2000, p.17) posits that "allocations are not based on objective criteria but on the allocations of the previous year". The parties that are concerned with negotiated type of funding are representatives of institutions and the representatives of the government which is the Ministry (of Education) or the Funding Council (NUC). Jongbloed (2004) likens input-based funding through higher education funding to negotiated funding which is done through the Ministry or Funding Council by carrying over what was not used in the previous year and based on this left over, the current budget is then determined.

Jongbloed (2004) views that since government funding of public tertiary institutions such as CMUL is decided by politicians and the parliament, this is a move geared towards strategic and bureacratic governance of higher education institutions, in deciding what amount of grant, budget or allowance to be given to each of these institutions. This government financing gives the government a regulatory hand in the internal affairs of these higher education institutions. In fact, Konings (2004) also notes that "all promotions and appointments to administrative posts are politically motivated and that loyalty appears to be more important in a university career than intellectual merit". This system of administration is that which Gornitzka and Massen (2000) describe as the rational planning and control model where the state believes it is the ultimate decision maker. This has a devastating impact on the teaching, learning and research processes because when professional technocrats are not appointed to the areas they master, it will have a repercussion on these processes and on the graduates they produce (Leinyuy, 2012). From the foregoing, it becomes evident that the functional model to examine the impact of budgeting and funding on public medical education in Nigeria would be related as such:

$$fund = f(budget, gov\_gdp, grad, postgrad, politrisk, sch\_fees, other\_internal) \ldots(1)$$

where;

fund: is the yearly fund allocation;

budget: is annual budget to public education;

gov_gdp: is government expenditure ratio of GDP which is an indicator for the size of government intervention,

grad: is the number of undergraduate students graduated on yearly basis, and

postgrad: is the number of postgraduate students graduated on yearly basis.

politrisk: is the political risk factors; indicating the extent to which institutional factors would affect budget allocation to medical education

sch_fees: is the school fee and it is an internal source of finance

other_internal: is the other source of internal funds to the CMUL

Stemming from equation (1), the empirical model to carry out this investigation can be specified as;

$$fund = \beta_o + \beta_1 budget + \beta_2 gov\_gdp + \beta_3 grad + \beta_4 postgrad + \beta_5 politrisk + \beta_6 sch\_fees + \beta_7 other\_internal + \varepsilon$$

……………………………………………………………………………………………….(2)

While the variables are as earlier defined,

$\beta_i, i = 0,1,2,3,4,5,6,7$ are the parameters for fund allocation, budget, size of government intervention, number of undergraduate and postgraduate students graduated and political risk factors, school fees and other internal sources of finance respectively;

ε is the error term that captures other imperceptible variables affecting funding of medical education in Nigeria.

3.5 Analytical procedure

Data collation and analysis is a key component of every research where the investigator provides insight and privy information about the sample collected and its reliability as a good representation of the study population. This requirement was duly undertaken in this study.

The analytical procedure for this study encapsulates three major stages. The first is to state the various tests of analysis that would indicate the appropriate technique(s) of analysis for the study. The second is to estimate the model(s) specified based on the appropriate techniques indicated by the various tests. Lastly, the third stage is to conduct robustness tests and diagnostic checks for the reliability of estimates obtained in the second stage.

This study entails both primary and secondary analysis. The tests of analysis for the primary data comprise both the Cronbach Alpha test for the reliability of research instrument and in order to ensure validity, extensive literature review and expert suggestions were relied upon. For the secondary data, on the other hand, the use of both unit-root tests and granger causality tests serve as the tests of analysis. Consequent upon these, the framework for the Autoregressive Distributed Lag (ARDL) technique and the framework for the Data Envelopment Analysis (DEA) for the secondary analysis were specified. As a robustness check, the use of structured questionnaire (FMEEQ) was also employed to analyse the perceptions and human elements inherent in budgeting and fund utilisation at the College of Medicine of the University of Lagos (CMUL), Nigeria.

3.5.1 Tests of Analysis for Secondary Data

3.5.1.1 Unit-Root tests

Although, it is unnecessary that the order of integration of the underlying regressors for ARDL bound test be ascertained prior to testing the existence of a level of relationship between two variables (Pesaran et al., 2001), Bahmani-Oskooee and Nasir (2004) posited that the first step in any cointegration technique is to determine the degree of integration of each variable in the model. In view of this, the Dickey-Fuller (DF) test is used to determine if a variable is stationary. To overcome the problem of autocorrelation in the basic DF test, the test can be augmented by adding various lagged dependent variables.

This would produce the following test:

$$\Delta y_t = (\rho - 1)y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta y_{t-i} + u_t \quad \text{...(3)}$$

The correct value for *m* (number of lags) can be determined by reference to a commonly produced information criterion such as the Akaike criteria or Schwarz-Bayesian criteria; the aim being to maximize the amount of information. As with the DF test, the Augmented Dickey-Fuller (ADF) test can also include a drift (constant) and time trend. Common criticisms of these tests include sensitivity to the way the test is conducted (size of test), such that the wrong version of the ADF test is used. The power of the test may depend on:

- The span of the data, rather than the sample size. (This is particularly important for financial data)
- If ρ is almost equal to 1, but not exactly, the test may give the wrong result.
- These tests assume a single unit root I(1), but there may be more than one present I(2).
- If the time series contains a structural break, the test may produce the wrong result.

Of particular interest to this research is the Augmented Dickey-Fuller (ADF) test that has been developed to test univariate time series for the presence of unit roots or non-stationarity. The extended maintained regression used in the ADF test can be expressed in its most general form as:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad \text{...(4)}$$

where; μ is the drift term, t denotes the time trend, and p is the largest lag length used. In order to analyse the deterministic trends, modified versions of the likelihood ratio tests suggested by Dickey and Fuller (1981) was used. The study followed the testing sequence suggested by Patterson (2000), which suggests the following maintained regressions, test statistics, and hypotheses:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \text{...(5)}$$

$\hat{\tau}_\beta, H_0 : \gamma = 0, H_a : \gamma < 0; \phi_3, H_0 : \gamma = 0, \beta = 0, H_a : \gamma \neq 0,$ and/or $\beta \neq 0$

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \omega_t \text{..(6)}$$

$\hat{\tau}_\mu, H_0 : \gamma = 0, H_a : \gamma < 0; \phi_1, H_0 : \mu = 0, \gamma = 0, \beta = 0, H_a : \mu \neq 0,$ and/or $\gamma \neq 0$

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \text{..(7)}$$

$\tau, H_0 : \gamma = 0, H_a : \gamma < 0$

3.5.1.2 Granger causality framework

As against the practice in previous empirical works; where blanket conclusion is reached as to the assertion that the link between public funding and public medical education is from the former to the latter, this study is a clear departure as it seeks to investigate the true direction of linkage between the two concepts before estimations are made. Based on the null hypothesis that the parameters at all lags of X_t are equal to 0 and therefore that X_t does NOT Granger cause Y_t; Granger causality tests whether lagged values of one variable predict changes in another, or whether one variable in the system explains the time path of the other variables. Hence, a variable x is said to Granger cause another variable y $(x \rightarrow y)$, if past values of x can predict present values of y. Granger (1988) posits two cardinal principles; namely the cause precedes the effect and the causal series contains special information about the series being caused that is not available in the other available series.

Similarly, there is an instantaneous causality from x to $y (x \Rightarrow y)$ if present and past values of x predict present value of y. If causality is in one direction e.g. from x to *y*, we have uni-directional causality while if x Granger causes y and y Granger causes x, we have bi-directional or feedback causality $(y \Leftrightarrow x)$. There are two commonly used causality tests; one due to Granger (1969) and the other due to Sims (1972). The former is however more widely used in applied econometrics, partly because of its simplicity and also because it is less costly in terms of degrees of freedom (Charemza and Deadman, 1997).

The test for Granger causality is performed by estimating equations of the following form:

$$\Delta funding_t + \alpha_o + \sum_{i=1}^{m} \beta_{1,i} \Delta funding_{t-i} + \sum_{i=0}^{m} \delta_{2,i} \Delta Z_{t-i} + \gamma ECM_{t-1} + \mu_t \text{..............................(8)}$$

$$\Delta Z_t = \alpha_o + \sum_{i=1}^{m} \beta_{1,i} \Delta Z_{t-i} + \sum_{i=0}^{m} \delta_{2,i} \Delta funding_{t-i} + \gamma ECM_{t-1} + \varepsilon_t \text{.............................(9)}$$

where;

ε_t and μ_t are white noise disturbance terms (normally and independently distributed), 2 are the number of lags necessary to induce white noise in the residuals, and ECM_{t-1} is the error correction term from the long-run relationship.

$funding_t$ is said to Granger cause Z_t; being the control variable, if one or more $\alpha_{2,i}$ (i=1,…m) and δ are statistically different from zero. Similarly, y_t is said to Granger cause x_t if one or more $\beta_{2,i}$ (i=1,…m) and γ are statistically different from zero. A feedback or bi-directional causality is said to exist if at least $\alpha_{2,i}$ and $\beta_{2,i}$ (i=1,…m) or δ and γ are statistically different from zero. If, on the other hand, $\alpha_{2,0}$ or $\beta_{2,0}$ are statistically significant, then, an instantaneous causality exists between $funding_t$ and Z_t. To test for causality, we use either the significance of the t-statistics of the lagged error correction term or the significance of F-statistics of the sum of lags on each right hand side variable.

The Granger Causality test might be very sensitive to the selected number of lags in the analysis. One should be careful to choose the reasonable lag lengths. For example, when analysing monthly data, the reasonable lags can range from 1 to 12 or 24, etc.; for the quarterly data, the reasonable lag terms can range from 1 to 4, 8, 12, etc., and for the annual data, the reasonable lag terms should be lower. In order to control for the loss of degree of freedom, the data-point for this study is quarterly-spliced annual time series data upon which the lag selection criteria would be employed to adequately capture the optimum lag length.

3.5.2 Techniques of analysis

The procedures of analysis for this study hinge on two techniques. The first technique concerns the second objective; which is to examine the efficiency of budget and fund utilisation on public medical education in Nigeria while the second technique is to address the third objective about the impact analysis of funding requirements and proceed to account for the role that institutional factors play in the process. The study employs a non-parametric method to measure efficiency while parametric method through the specification of multivariate model; as indicated in equation (2), was employed for the impact analysis and institutional factors respectively. The use of non-parametric method of Data Envelopment Analysis (DEA) is to address the second objective while the parametric method of Autoregressive Distributed Lag (ARDL) method is to address both the third and fourth research objectives.

The choice of the ARDL method is highly instructive. First, the method is able to capture short period of analysis, as it is the case for this study. Also, the method is able to address the data stationarity condition inherent in a time-series study such as in this study. This implies that the stationarity of the variables at different order of integration does not affect the estimates obtained. This is because the mix of **I**(0) and **I**(1) can be combined for estimations. Lastly, it captures a dynamic interaction of a model as the relationship between funding and explanatory variables specified in this model cannot be expected to follow a static dimension. In summary, the choice of an ARDL model rather than a static one is motivated by the need to reflect all the dynamic responses in the dependent variable (that is, on funding) brought about by changes in its own lags and the contemporaneous and lagged values of the other explanatory variables. Starting by directly estimating a static long-run equation – such as the Engle-Granger Cointegration – may fail to capture any immediate, short-run, and long-run responses in the system, thus, generating imprecise coefficient estimates (Johnston and Dinardo, 2009; Charemza and Deadman, 1997; Banerjee et. al., 1993). Estimating the model in this manner yields valid t-statistics even when some of the right-hand variables are endogenous (Enders, 1995).

Following Johnston and Dinardo (2009), the general ARDL (p,q) can be represented in the following form:

$$A(L)y_t = \alpha + \beta(L)X \qquad (10)$$

where;

$$A(L) = 1 - \alpha_1 L - \alpha_2 L^2 - ... - \alpha_p L^p \qquad (11)$$

$$B(L) = \beta_0 + \beta_1 L + \beta_2 L^2 + ... + \beta_p L^p \qquad (12)$$

p, q are lag lengths; $A(L)$ and $B(L)$ are polynomial lag operators. L is the lag operator such that $L^p y_t = y_{t-1}$; ε_t are white residuals.

Consequent upon the foregoing general specifications of the ARDL model, the methodological model for this study can be rightly specified as;

$$funding = \beta_o + \beta_1 funding_{t-1} + \sum_{t=1}^{n} \delta_t Z_{t-1} + \varepsilon \qquad (13)$$

where; $funding_{t-1}$ is the lag of the dependent variable which serves as the autoregressive component of the ARDL model. It is also incorporated as an independent variable as the dynamic component of the model. $\sum_{t=1}^{n} \delta_t Z_{t-1}$ is the distributed lag component which seeks to capture the current and previous lag effects of the explanatory variables? Z_{t-1} is the collection of control variables which include budget ($budget$), government involvement in the economy (gov_gdp), the number of undergraduate ($undergrad$) and postgraduate students ($postgrad$) graduated, the school fees (sch_fees) and other internally generated revenue ($other\_internal$) and the political risk factors ($politrisk$).

The methodological model for this study becomes;

$$\begin{aligned} fund = \beta_o + \beta_1 funding_{t-1} + \delta_1 \sum_{t=1}^{N} budget_{t-1} + \delta_2 \sum_{t=1}^{N} gov\_gdp_{t-1} + \delta_3 \sum_{t=1}^{N} undergrad_{t-1} + \\ \delta_4 \sum_{t=1}^{N} postgrad_{t-1} + \delta_5 \sum_{t=1}^{N} politrisk_{t-1} + \delta_6 \sum_{t=1}^{N} sch\_fees_{t-1} + \delta_7 \sum_{t=1}^{N} other\_internal_{t-1} + \varepsilon \end{aligned} \qquad (14)$$

Equation (14) is the full-fledge ARDL model to examine the impact of budget and funding on public medical education in Nigeria. The model is to estimate the bound-testing long-run equilibrium condition for the study. As decision criteria for the existence of long-run equilibrium condition is the use of bound-test. The bound test comprises both the upper and lower bound. If the value of the F-statistics is greater than the upper bound, there exists a long-run equilibrium but no long-run exists if lesser than the lower bound. The decision for the existence of a long-run equilibrium condition would remain inconclusive if the F-statistics ratio lies between the lower and upper bound critical values.

3.5.2.1 Statistical significance for ARDL bound test

The bound testing approach is based on F-statistics under the null hypothesis of no cointegration among the examined variables regardless of whether they are purely I(0) or I(1). Pesaran et al (2001) computed two sets of critical values for the given level of the significance.

Table 3.1: Bound tests for cointegration analysis

Critical Values	**Lower Bound Values**	**Upper Bound Values**
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52

Source: Pesaran et al., (2001) – Table CI(iii),

Case III: Unrestricted intercept and no trend

As detailed above, one set assumes that all the variables are I(0) referred to as lower bound and other set assumes that they are all I(1) referred to as upper bound. If the computed F-statistics exceeds the upper critical bound value; the H_0 is rejected which implies that there exists co integration between funding and public medical education in Nigeria. If the F-statistics falls into the bounds, the test becomes inconclusive but if the F-statistics lies below the lower critical bounds values, it means no cointegration. In case cointegration was found, the study would proceed with the estimation of the long-run impact analysis and the short-run dynamics of the model.

In order to capture the short-run situation, ARDL-ECM estimation is also conducted. The methodological framework for this short-run dynamics is given thus;

$$\Delta funding_t + \alpha_o + \sum_{i=1}^{m} \beta_{1,i} \Delta funding_{t-i} + \sum_{i=0}^{m} \delta_{2,i} \Delta Z_{t-i} + \gamma ECM_{t-1} + \mu_t \cdots\cdots\cdots\cdots\cdots\cdots (15)$$

where; μ_t is white noise disturbance terms (normally and independently distributed), 2 are the number of lags necessary to induce white noise in the residuals, and ECM_{t-1} is the error correction term from the long-run relationship. The short-run dynamics relates to how funding recovers to stability level when it is affected by economic shocks.

3.5.3 Data Envelopment Analysis (DEA)

In order to examine the second research objective about the efficiency of budget and fund utilisation on teaching and learning in public medical education in Nigeria, the Data Envelopment Analysis was employed. In analysing relative efficiency of any organisation or firm, there are two basic approaches; parametric and non-parametric. The parametric method estimates parameters of the truncated regression while the non-parametric method does not. Examples of the parametric method are stochastic frontier approach (SFA) also called econometric frontier approach, thick frontier approach (TFA) and distribution-free approach (DFA). On the other hand, examples of non-parametric approach are data envelopment analysis (DEA), malmquist index, tornquist index and distance functions. Basically, the efficiency of a production unit can be measured by means of parametric and non-parametric techniques. In parametric studies, SFA is often used and in the non-parametric studies DEA is often used (Iparaguirre and Ma, 2015). Parametric methods are not likely to be successful in the measurement of efficiency if few data points are available due to limited degrees of freedom (Coelli et al., 2005; Jerome, 2004). Besides, the major weakness of parametric or econometric approach is the imposition of an explicit functional form for the technology, and for the distribution of inefficiency terms (Seinford and Thrall, 1990).

The use of financial ratios by researchers to measure efficiency, especially of business organisations is fraught with deficiencies. Comparing the ratios of different business organisations is not appropriate unless the organisations are almost identical in terms of product mix, size, market conditions, and other characteristics that may affect their costs (Oke, 2012; Chen, 2001). A major disadvantage of using financial ratios as performance evaluation index is its reliance on benchmark ratios; as these benchmarks could be arbitrary (subjective) and mislead analysts (Yeh, 1996). Further, Sherman and Gold (1985) noted that financial ratios do not record the long term performance and it aggregates many aspects of performance such as operations, marketing and financing. Thus, DEA is the most appropriate non-parametric technique to be used in this study for the measurement of efficiency as enunciated in research objective two. DEA allows for multiple dependent variables and does not require any assumptions concerning the functional form, but it assumes that any departure from the efficiency frontier is a measure of inefficiency.

Five types of efficiency have been identified in the context of social care services provisions, such as the medical education at the CMUL: horizontal target efficiency, vertical target efficiency, input-mix efficiency, output-mix efficiency and the technical efficiency (Iparaguirre and Ma, 2015). Of these five types, technical and input-mix or cost efficiency are the two most popular procedures. The input-mix or cost efficiency approach focuses on the minimisation of the cost of producing a given level of quality of life. In itself, such an exercise would have merit primarily for managerial purposes and also for value-for-money considerations, in so far as it helps determine the output levels that minimise the cost of providing the services. When measuring efficiency in the public sector, aspects related to differences in social preferences regarding the utilisation of resources, introduce complications that make cost minimisation a less appropriate objective than in the private sector context. In this regard, Gasparrini and Pinto (1998) contended that only technical efficiency is immune to the problematic specification of social preferences when it comes to measuring efficiency in public services. Pestieau and Tulkens (1993) and Pestieau (2009) also recommend focusing on technical rather than allocative efficiency when measuring performance in the public sector, such as in the CMUL. Moreover, within the "production of welfare" theoretical framework, the focus is on the outcome(s), the objectives of the policy endeavours rather than the output, which reflects the different activities carried out and services provided to achieve these objectives. Consequently, the relative efficiency must be measured in relation to those objectives and not against activity-based indicators. Therefore, efficiency should be considered akin to the pursuit of stated objectives and the correct approach, then, output maximisation should be looked into (Iparaguirre and Ma, 2015).

In the literature, the DEA is a method for measuring efficiency of decision-making units (DMUs) using linear programming techniques to envelop observed input-output vectors as tightly as possible (Boussofiane et al., 1991). While there are dangers in using a simple quantitative approach, there are also substantial advantages which include the fact that the data required could be readily obtained at low cost and can be easily communicated to a wide-ranging audience (Lindsay, 1982; Toombs, 1973). DEA allows multiple inputs-outputs to be considered at the same time without any assumption on data distribution. In each case, efficiency is measured in terms of a proportional change in inputs or outputs. DEA model can be subdivided into input-oriented model, which minimises inputs while satisfying at least the given output levels, and output-oriented model, which maximises outputs without requiring more of any of the observed input values. In the application of the input and output measures during the bootstrap process, it is suggested that, when the former is taken as the orientation of the model, the model results in profit efficiency, whilst if the latter (output) is taken then productive efficiency is the result as the orientation of the DEA. The DEA is a linear programming method for assessing the efficiency and productivity of units called DMUs in DEA. From the foregoing and according to Lee (2009), the framework for the DEA depends on its orientations, such as the input-oriented DEA model or output-oriented DEA model, in tandem with the duality theorem of primal-dual (Table 3.2).

DEA models can be input-oriented or output-oriented. According to Iparaguierre and Ma (2015), the objective of input-oriented models is to minimise the amount of inputs to produce the given levels of output. On the other hand, the objective of output-oriented models is to maximise outputs at a given level of inputs (Cooper et al. 2007). Various studies in literature have adopted DEA model to measure efficiency. Some of these studies are discussed in more details in the body of this thesis (section 2.4.1).

Table 3.2: DEA Framework

Orientation	Primal	Dual
Input-Oriented DEA Model	$Max: z = uy_j - (u_j)$ $s.t.$ $vx_j = 1$ $-vX + uY - (u_j e) \leq 0$ $v \geq 0, u \geq 0; (u_j)$	$Min: \theta$ $s.t.$ $\theta x_j - X\lambda \geq 0$ $Y\lambda \geq y_j$ $(e\lambda = 1)$ $\lambda \geq 0$
Output-Oriented DEA Model	$M\ \text{in}: z = vx_j - (v_j)$ $s.t.$ $uy_j = 1$ $vX - uY(v_j e)^* \geq 0$ $v \geq 0, u \geq 0; (v_j)$	$Min: \eta$ $s.t.$ $x_j - X\lambda \geq 0$ $\eta y_j - Y\lambda \leq 0$ $(e\lambda = 1)^*$ $\lambda \geq 0$

Source: Lee (2009). Note: ***X***, ***Y*** are input, output matrix; u, v are row vectors; $\lambda = (\lambda_1, ..., \lambda_n)^T$ is the non-negativity vector; θ, η are real variables while * is the additional constraint in BCC model.

According to Sacoto et al. (2015), output-oriented VRS model best captures the efficiency measurement of a business school; the focus of the study carried out in Mexico. A baseline efficiency ratio was conducted in this study, using other inputs that were further examined as an extended model to account for the effect of budgeting and funding. As such, a comparative analysis of the efficiency ratios obtained through the baseline and extended models was conducted. For this study, the output-oriented DEA model was adopted, which seeks to investigate the productive efficiency of service delivery of public institutions, such as the CMUL, as against the use of the input-oriented DEA model that centres on profit efficiency obtainable in private sectors. The use of the variables of this study is further justified as similar variables were extensively used in various studies that have adopted DEA technique to measure efficiency (Section 2.4.1).

Unlike the DEA set-up obtained in some statistical packages, like STATA, a plug-in set-up of SOLVER to Microsoft Excel was used making it amenable to undertake a single DMU at a given time. Generally, the various input variables into the medical education at the CMUL include amount allocated, indicated as the budget; salaries; amount expended on goods and services; internally generated revenue (IGR); student fees; and other general expenditures (including personnel costs, administrative expenses, expenses on attendance at learned conferences, teaching and research expenses). The various components of funding include the amount received as grants, such as subvention, development and specific grants. The outputs include the number of students graduated both for the undergraduate and postgraduate levels. It is upon these variables that the baseline and extended models were conducted, with the former being the inclusion of all other inputs except budgeting (amount allocated) and funding (amount received and various grants received); the major component of the latter.

As a complement to the use of the DEA method, the second objective would further be interrogated through the use of questionnaire. The primary data aspects of the second objective become imperative as it is necessary to study the human element of efficiency for which the Data Envelopment technique alone cannot fully capture. The use of various statistical tools such as chi-square and T-test became essential. This is needed for the analysis of the responses elicited from the targeted respondents upon which structured questionnaire (FMEEQ) was administered. The T-test basically tested for the equality of means and variances of funding and medical education in Nigeria. Levene's test is used to test if there were equal variances between samples; hence its relevance in this study. In this regard, a collection of questions that are directly related to the second objective were identified from the structured questionnaire (FMEEQ) upon which responses were elicited from the targeted respondents.

3.5.3.1 Justification for conceptual framework on DEA model

The conceptual framework was developed based on the Resilience and Youth Development Module (RYDM) model. The RYDM model is a component of the California Healthy Kids Survey. It emphasises that it is as important to assess the strengths, competencies, and positive social and health attitudes and behaviours of youth as it is to identify their risks and problem behaviours. The model has been applied to developmental studies of individuals, schools, community development, learning organisations, and evaluation research, amongst others.

The RYDM model finds relevance to medical institutions in respect of interrelationships of key variables that impact the realisation of producing well trained medical doctors and allied medical professionals. The interrelationship of variables embedded in the RYDM model is similar to the workings of the DEA technique. DEA is a measure of relative efficiency among DMUs, taking a particular unit as a reference in relation to others. The technique is particularly relevant for measurement of efficiency in the private and public sectors. It is a robust means of incorporating multiple input and output variables in the process of determining their interrelationships towards achieving the set objectives. It is instructive to emphasise that this study's main focus is on the assumption that funding is invested on the provision of teaching equipment and other relevant expenditures that directly promote teaching and learning in medical education. It is expected that a significant improvement brought about by efficiency in fund utilisation would impact the quality of medical education provided by CMUL.

The RYDM model explains how input variables are processed to achieve expected outcomes. In the case of CMUL, the components of input variables, processes and expected outcomes are tested in the methodology of this study using statistical tools to establish the efficiency of resources utilised to provide medical education. The inter-relationship is schematically given in Figure 3.2 as follows:

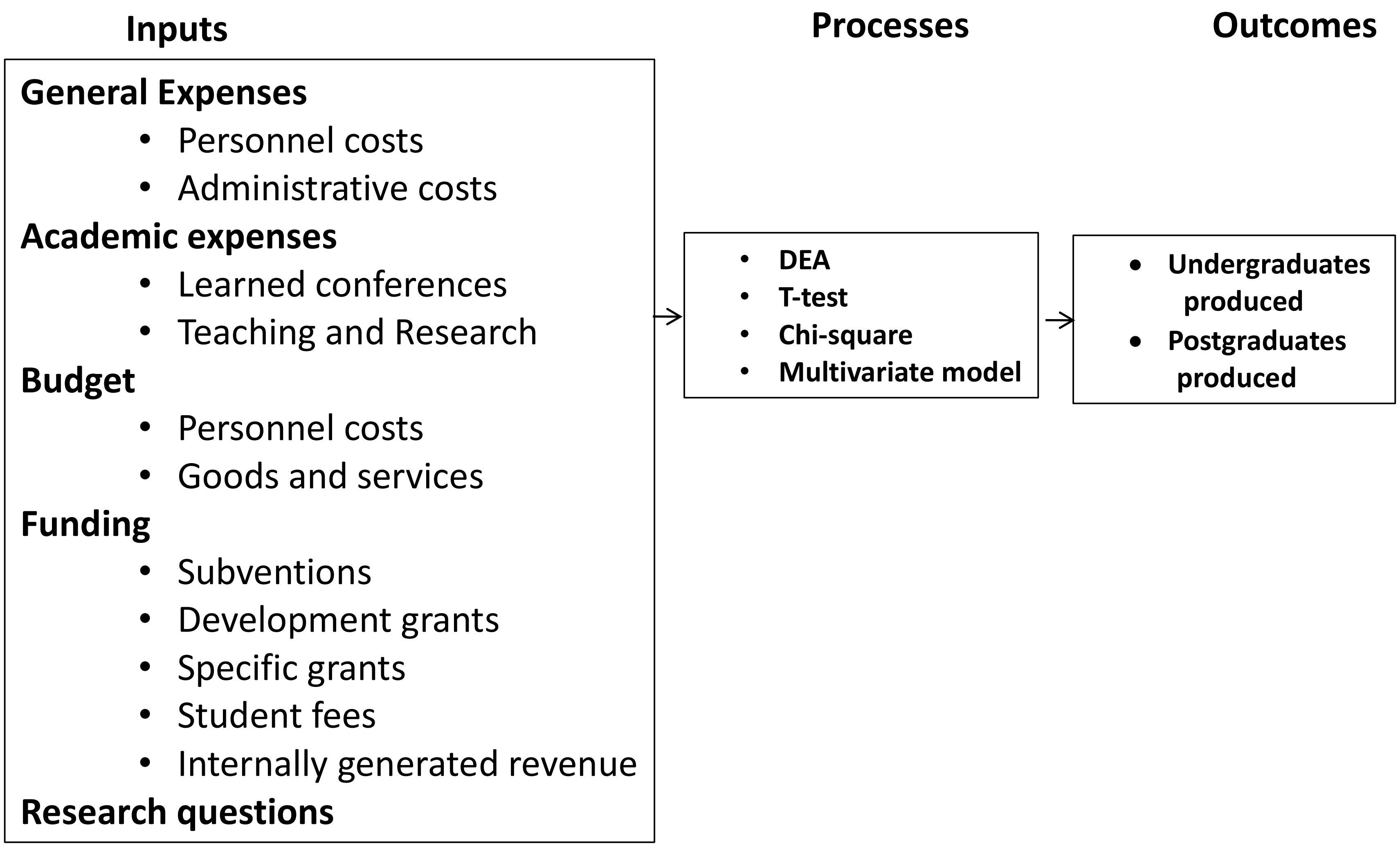


Fig. 3.2: Methodological framework of using the DEA technique

Source: Adapted from the RYDM conceptual framework

3.5.4 Robustness checks and Diagnostic tests

3.5.4.1 Robustness checks

In addition to the secondary data, primary data was collected through questionnaire; subjected to reliability test, as explained in the validity and reliability section. In the use of structured questionnaire as robustness check for this study, it is required that this section of the study details the research design that would make the administration of the structured questionnaire appropriate.

In this vein, the research design enables the identification of the appropriate alternative to provide acceptable answers to the research questions. Saunders et al. (2009), Hakim (2000, 1987) identified experiment, survey, case study, action research, ethnographical, archival research and grounded theory as various strategies for carrying out research. Graham (2000) drawing from Wass and Wells (1994) and Easterby-Smith et al. (1999) identified the same methods, including case studies, as research methods that could be applied. Robson (2002) argued that research design embraces the selection of research strategies, research choices and time horizons that could lead to finding appropriate answers to the research questions. Easterby-Smith et al. (op. cit), quoted by Njiru (2002), argued that since time and resources are limited when carrying out a study, it is important for researchers to make choices which would provide the focus of their research clearly. In the context of a research project, design means the overall configuration of the research; the kind of evidence to be gathered, the source of data collection and how they are interpreted to satisfy the research objectives.

This thesis has been investigated through the use of quantitative analysis. To further complement the findings, however, the use of structured questionnaire was employed to investigate the human element components of budgeting and funding that secondary analysis cannot quantify. A case study of the CMUL was adopted to evaluate the role that funding plays in the delivery of core services of public medical schools such as teaching, research and learning. Importantly for this robustness analysis, the research instrument used was validated through the use of Cronbach Alpha and the extant literature as well as expert opinions which was relied upon to further support the findings contained in the secondary data analysis. Consequent upon these, the use of descriptive statistics like frequencies and percentages coupled with chi-square test as significance test were applied as the techniques of analysis. Basically, this study is well justified as the use of a 25-year data; spanning the period 1991 – 2016, was employed for investigation.

3.5.4.1.1 Study population and sample selection

The study population comprises the teaching faculty - lecturers, consultants and technical staff. Also, included are senior administrative staff, accountants and finance officers as well as students of CMUL. The students are considered as key customers of the services rendered by the medical school. There is a necessity to link the needs of the customers (students) with service functions and constantly improve on quality of services rendered in the educational environment (Franklin, 2016; Stukalina, 2010; Barlow-Hills et al., 2009 and Ace-Morgan et al., 2003). The Provost and Deans, heads of academic department and unit as well as engineers directly in charge of equipment and laboratories used for teaching of medical students also form integral parts of the focal group for this study. This thesis adopted the quantitative method for data analysis. The use of quantitative data requires sampling to determine the population for the study. Sample size determination when the estimated population size is more than 10,000 (i.e. N = 10,237) which include academic staff, technologists, senior non-teaching staff and students (undergraduate and postgraduate), is expressed as follows:

$$n = \frac{Z^2pq}{d^2}$$

where: Z = standard normal deviation = 1.96

p = proportion of the attribute of interest in the reference population = 0.5

q = 1 – p = 1 – 0.5 = 0.5

d = precision of the estimate = 0.05

$$n = [(1.96)^2 \times (0.5)(0.5)] \div (0.05)^2$$

$$= (3.84 \times 0.25) \div 0.0025$$

$$= 0.96 \div 0.0025 = 384$$

With an addition of 10% non-response rate = 38.4

The estimated sample size: 384 + 38.4 = 422.4 ≈ 423

A probability sampling technique known as simple random sampling was employed for this study. This is a sampling technique in which every element in the population is randomly selected by balloting or the use of the table of random numbers.

The respondents for the questionnaire comprised the under-listed distribution pattern.

Category	Number	%
Academic	127	30
Senior (non-teaching)	148	35
Technologists	42	10
Students	106	25
	423	100

3.5.4.1.2 Data collection instrument

Following Sharifabadi (2012); Ipaye (2008); Sunkar (2005) and Al-hajry (2002), this thesis adopted the likert-scale questionnaire as the method for the collection of primary data. The use of the likert-scale questionnaire and longitudinal survey were employed in data collection by the above referenced studies. Alshamy (2011) on the other hand, adopted the qualitative approach to analyse secondary data in establishing a relationship between funding and quality assurance in the Egyptian university system. The methodology of this thesis differs from that of Sharifabadi (2012) whose thesis focused on the Iranian university system, using questionnaire and secondary data obtained from the records of the institution being studied. The use of a likert-scale questionnaire gives room for wider options to be made by the relevant stakeholders, who are the respondents to the questionnaire, for the purpose of obtaining useful information.

It has been argued that one of the problems that may arise in a survey-based research, through the adoption of a questionnaire, is the risk that it might be completed by inappropriate recipients, which could adversely affect the results of the research (Smith, 2005). This potential risk has been mitigated by stratifying the entire CMUL into key units / departments considered in the study, rather than considering the entire college as a unit. It is believed that the lecturers and consultants, financial managers, administrators and students who constitute the stakeholders in medical education were involved in this research to further strengthen the reliability and validity of the findings as well as the conclusions.

The questionnaire for this study was drafted based on the guidelines in the document "Quality Improvement in Basic Medical Education", produced in 2012 by the World Federation for Medical Education (WFME), as well as the adapted instrument used by Sharifabadi (2012) on a similar study. The guidelines on assessment of objectives and evaluation contained in these two documents formed the basis of the questionnaire titled, "Funding of Medical Education Evaluation

Questionnaire (FMEEQ)" developed in this study to elicit responses from lecturers and consultants, finance officers, administrators and students. Broad categories in the questionnaire include mission and outcomes of medical education, curriculum, assessment of students, staff training and development, physical facilities, medical research and educational budgets and resource allocation.

The questionnaire is divided into two main sections, A and B:

Section A:
This provides the background information on the biographic data of the respondents. Every item is assigned numerical values for coding and analysis purposes.

Section B
This section provides information on the assessment of the quality of medical education. The questionnaire focused on the various indicators of quality and efficiency measurements for the attainment of the institutional objectives. It contains a 58-item five-point likert-scale questionnaire with responses ranging from strongly disagree to strongly agree.

The questionnaire covered the following seven areas:

- Mission and outcomes of medical education (4)
- Curriculum (10)
- Assessment of students (4)
- Staff training and development (6)
- Physical facilities (9)
- Medical research (5)
- Educational budget and resource allocation (15)

3.5.5 Reliability and Validity

Studies using questionnaire require the tests on reliability and validity to be conducted prior to its adoption as a means of carrying out research functions.

3.5.5.1 Reliability test

Warwick and Linninger (1975) pointed out that there are two basic goals in questionnaire design. The first is to obtain information relevant to the purposes of the survey and, second, collect this information with maximal reliability and validity. As a result, this section scientifically investigated the reliability and validity of the research instrument. Reliability is the degree to which an assessment tool produces stable and consistent results. This implies that the instrument must produce the same result whenever used, given similar conditions. Carmines and Zeller (1979) asserted that reliability is the tendency towards consistency found in repeated measurements. To this end, reliability testing was used to test the reliability of the primary data collected from respondents. In order to test the reliability of the measuring instrument, Cronbach alpha (Cronbach, 1951) was used to measure the internal consistency of the measuring instrument. Cronbach's alpha is the most commonly used measure of reliability (i.e., internal consistency). It was originally derived by Kuder and Richardson (1937) for dichotomously scored data (0 or 1) and later generalised by Cronbach (1951) to account for any scoring method.

Cronbach's basic equation for alpha goes thus:

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum Vi}{Vtest}\right) \qquad (2)$$

where: n= number of questions; V_i = variance of scores on each question;

V_{test} = total variance of overall scores (not %'s) on the entire test. Alpha works as:

$$Vi = p_i * (1 - p_i)$$

where: p_i is the percentage of success and $(1 - p_i)$ is the percentage of failure. The formula can be derived from the standard definition of variance, but V_i varies from 0 to 0.25.

Table 3.3: Cronbach's alpha formula

p_i	$(1-p_i)$	Vi
0	1.00	0
0.25	0.75	0.1875
0.5	0.5	0.25

Since V_{test} is the most important part of alpha and if V_{test} is large, it can be seen that alpha will be large also. Large V_{test} leads to small ratio $\frac{\sum Vi}{Vtest}$ and subtracting this small ratio from 1 leads to high alpha. High alpha, caused by high variance is good; this means there exists a widespread of scores or distribution but if the test has a low variance, the scores for the distribution are close together and as such, not useful for analysis. This is likened to the case of perfect multicollinearity in secondary estimation's test.

Cronbach's alpha generally increases when the correlations between the items increase. For this reason, the coefficient is also called the internal consistency or the internal consistency reliability of the test. For this study, Cronbach's alpha value of 0.988 was obtained for the Funding of Medical Education Evaluation Questionnaire (FMEEQ) (Table 3.4). According to Hair et al. (2003) and Pallant (2004), alpha scores greater than 0.75 are acceptable for social sciences study. The score obtained for this study suggests that the items in the questionnaire possessed high internal consistency that makes the instrument reliable.

Table 3.4 Cronbach's alpha method for reliability test for FMEEQ

Reliability Statistics

Cronbach's alpha	Cronbach's alpha based on standardised items	Number of items
0.988	0.75	22

3.5.5.2 Validity test

Validity is often defined as the extent to which an instrument measures what it purports to measure (Punch, 1998). Validity is arguably the most important criterion for the quality of a test. Validity requires that an instrument is reliable, but an instrument can be reliable without being valid. When the validity of a test or instrument is conceived, validity is not a property of the test itself. Instead, validity is the extent to which the interpretations of the results of a test are warranted, which depends on the test's intended use (measurement of the underlying construct). Hypothetical constructs cannot be measured directly and can only be inferred from observations of specified behaviours or phenomena thought to be indicators of the presence of the construct. Measurement of a construct requires that the conceptual definition be translated into an operational definition. An operational definition of a construct links the conceptual or theoretical definition to more concrete indicators that have numbers applied to signify the “amount” of the construct. The ability to operationally define and quantify a construct is the core of measurement for which the validity test is justified.

World Bank as an institution constitutes a team of experts from various fields of discipline such as business, economics, ecological and psychological among others. To ascertain the validity of the questions structured in this research instrument, an attempt was made to align this set of questions with the requirements of service delivery, as enunciated by the body of experts in this field.

To ensure the validity of data instruments, the under-listed steps were carried out:

a. An exhaustive literature review was undertaken to underscore the process of using questionnaire in a study (Saunders et al., 2009).
b. The instrument was subject to expert review and suggestions by my supervisors and lecturers of accounting and finance departments in the University of Lagos. In this process, relevant research questions that would facilitate the attainment of research objectives were incorporated in the questionnaire.

The questions are considered value-free, objective, clear and explicit enough to elicit the required responses from the targeted audience.

3.5.6 Diagnostic Tests

As a form of robustness, the use of structured questionnaire (FMEEQ) is also employed to examine human factor element inherent in budget and fund utilisation of public medical education in Nigeria. In order to guarantee the reliability and validity of the estimates employed for interpretations and analysis in this study, it becomes imperative that some diagnostic tests be conducted for robustness of these estimates. Essentially, four of these tests stand out. These are the Ramsey RESET test (x^2_{RESET}) which is to check for functional misspecification form of the model while the Jarque Bera test (x^2_{NORMAL}) is meant to test that the residual value is normally distributed. More so, the Breusch-Godfrey LM test (x^2_{SERIAL}) is meant to test the serial correlation of the residuals while the ARCH (x^2_{ARCH}) examines whether there is evidence of autoregressive conditional heteroscedasticity or not.

3.5.7 Primary Analysis

The data from the questionnaires are checked for correctness and accuracy through validity and reliability testing and are then entered into the statistical package for social sciences (SPSS). After data entry into the appropriate statistical application software, a statistical analysis was carried out in line with the study objectives. Above all, the findings obtained from the analysis are discussed with respect to the literature to show the similarities or differences between the current study and existing knowledge in the literature. Descriptive and inferential statistics were used for the analysis of the data collected. Descriptively, data were analysed using frequencies, percentages, averages, variances, ranges, and mean item score for in-depth insight of data collected from the participants. Also, data were displayed in tables, charts, and graphs for visual interpretation, while inferential statistics was used for hypothesis testing. With respect to the primary data, the demographic data in the questionnaires were analysed descriptively, using frequencies and percentages and displayed in frequency tables. The non-demographic data in the questionnaires were analysed using mean-item-score to ascertain the respondents' scores for each variable.

3.6 Ethics and confidentiality

When respondents were asked to complete the questionnaires, they were assured that the information given to the researcher would not be disclosed to a third party. The respondents' identities have been concealed by coding their responses to maintain anonymity and confidentiality.

Chapter four Presentation of findings

4.1 Introduction

This chapter focuses on the estimation of the empirical model; the analysis of responses from the administered questionnaire and the results of the multivariate analysis conducted in the study. Generally, the empirical analysis of the Data Envelopment Analysis (DEA) model centres around three dimensions; beginning with the use of baseline model; where the analysis ascertained how effective the College of Medicine of the University of Lagos (CMUL) had been able to deliver its services by relating some basic (fixed) input variables, such as salaries and wages, academic and general expenses to generate a level of efficiency in service delivery (i.e. teaching and learning), as an output component. Thereafter, the variables of budget and funding were incorporated to ascertain their effect on the service delivery capability of the institution. This informs the extended model. Further, the study determined the extent to which budget and funding could be increased and/or reduced in order to reach an optimal efficiency level in service delivery. This is the third dimension known as the sensitivity and scenario analysis.

For robustness of investigation, the researcher employed the responses elicited from FMEEQ administered likert-scale questionnaire to complement the findings from analysis of the secondary data obtained from the records of the CMUL. This becomes imperative for many reasons, given that the use of responses arising from the perceptions of key stakeholders allow the study to capture some inherent information that revolve around medical services, such as the human components of service delivery. Secondly, it facilitates a holistic approach to analysis as this ensures that all stakeholders to medical education, as well as the services delivered by the medical school, were properly consulted for a far-reaching policy recommendation. Finally, it enables all the stakeholders to genuinely address the problems inherent in budgeting and funding structure of public medical education in Nigeria. This is to ensure that efficiency of funds utilisation becomes a key aspect of fund availability to tertiary institutions and medical schools in Nigeria (Section 2.6 refers).

Research Question One: Are there structural changes in the trends of budgeting and funding of public medical education in Nigeria?

To address this research question, a collection of trend analysis on amounts allocated, amounted received, number of students graduated at the undergraduate and postgraduate levels, the amount of school fees and other internally generated revenue of the College of Medicine of the University of Lagos (CMUL) were highlighted.

4.2 Trends of budgeting and funding of public medical education at the CMUL

In CMUL, it was observed that the student population had grown from 236 in the 1991/92 academic year, to an intake of 977 in the 2015/16 academic session; an increase of 313.98% with an attrition rate of about 10% (i.e., 97 students within the reporting period). O'Neill et al. (2011) had cautioned that in tax-funded medical education, dropout constitutes a direct economic loss to society and a reduction in the stream of medical doctors entering the general workforce, which may compromise both the healthcare and welfare of a society. The funding level of the CMUL had remained almost static in relative terms, as the total revenue generated, inclusive of subvention, was largely utilised in paying staff salaries and emoluments and other overhead costs, leaving a paltry amount for teaching and learning costs.

Arising from the increased demand for admission into the CMUL, there has been an astronomical rise in the admissions given to students, which overstretched the facilities available in relation to the quantum of fund accruing to the school from the government subventions and the internally generated revenue. This lends credence to the assertion in Johnstone (2003) that increased pressure from rising enrolments is part of financial problems faced by higher institutions. Government and university authorities perhaps must realise that there are great benefits derivable from appropriate funding of medical education. The availability of large corporate investments (funds) in socially responsible activities (e.g. medical education) can enhance efficiency and lead to further access to critical resources, such as finance and skilled human resources (Ntim and Soobaroyen, 2013; Branco and Rodrigues, 2006 and Pfeffer and Salancik, 1978). The dearth of funds available makes it extremely difficult to maintain and upgrade the equipment and facilities at the CMUL to train the students. Although Table 4.1 shows an increase in the absolute total amount realised by CMUL during the period under review, the aggregate fund is grossly inadequate in relative terms because of inflationary trends which have negatively affected the value in real terms. Consequently, infrastructures and consumables have been inadequate, and where some equipment are available, they have become obsolete and decayed and are not suitable for the effective teaching and training of medical students that could compete in the global space. This unfortunate scenario has compelled higher educational institutions to seek alternative sources of raising additional revenue in order to discharge their duties effectively. This contrasts sharply with the situation in developed economies. According to Lopez (2006), in his study conducted in Spain, the relationship between public universities and government, in terms of funding, had produced a favourable enabling environment whereby both parties contribute adequately towards raising finance needed to run public universities. In Nigeria, the National Universities Commission (NUC) prescribes that federal universities and medical schools should generate a minimum of 10% of the total income as internally generated revenue in any academic year.

Table 4.1 indicates the trend in the funding requests, allocations and disbursements over the period of 25 years (i.e., 1991/1992 – 2015/2016).

Table 4.1**:** CMUL funding requests (1991/1992 – 2015/2016)

Period	Amount requested by CMUL (₦)	Amount allocated in budget ₦	Amount received by CMUL ₦	Amount allocated (%)	Amount received (%)
1991/1992-1995/1996	75,258,808.00	68,147,356.80	85,723,418.20	92.10	114
1996/1997-2000/2001	381,380,301.60	252,146,950.20	305,940,387.20	75.54	80.2
2001/2002-2005/2006	1,469,447,521.00	1,008,447,521.00	656,164,539.20	71.90	44.7
2006/2007-2010/2011	3,954,485,298.00	2,286,639,823.20	1,558,850,993.00	66.78	39.4
2011/2012-2015/2016	4,110,522,742.00	1,717,364,495.00	2,262,784,607.00	41.78	55.05

Note: Where receipts exceed allocation, supplementary grants were made to the medical school i.e. (CMUL).

The estimates tabulated in Table 4.1 show that the amounts allocated and received by CMUL has continually increased at decreasing rates since the 1991/1992 session. It was at 92.1% at the beginning and by 2011/2012 - 2015/2016 academic session, it has decreased by 41.78% from its previous interval periods of 2006/2007 – 2010/2011 academic session. Similarly, for the actual amount received, there had been an increase at decreasing rates since the 1991/1992 academic session. Beginning at a 114% increase in the 1991/1992 – 1995/1996 interval period to 55.05% in the 2011/2012 – 2015/2016 period. This is only a nominal reduction as a real reduction in the allocation, given the changing price levels in the economy, would suggest a worse scenario of falling amount of allocation to the institution. This is demonstrated graphically as shown in Figure 4.1. However, the amount requested, which aptly indicates the amount needed to properly run the institution, has continued to soar from the 1991/1992 academic session (Figure 4.1). The amount requested increased from ₦22,308,224.00 in 1991/1992 academic session to ₦4,781,285,392 in 2015/2016 academic session. This is about 21,332% increase in the amount requested to run the affairs of the medical institution.

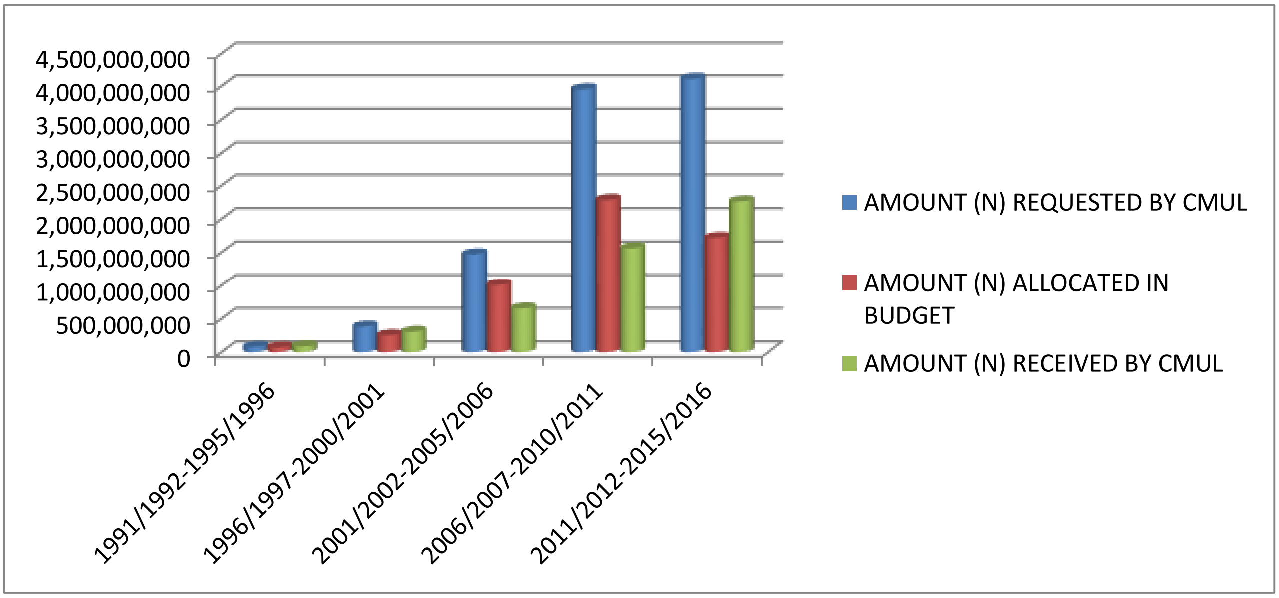


Fig. 4.1: Chart of CMUL funding requests

Between 1991/1992 – 2000/2001, it is obvious that the amount received surpassed the amount allocated or budgeted for. The implication is that, for a decade, there had been extra-budgetary spending as well as funding of the CMUL to the tune of 114% of the amount requested (Table 4.1). This means that the budgetary process may not have been effective or government funding might have been haphazard; thereby hindering proper planning by the medical school. However, it is further evident that for other periods of five-year intervals, covering the 2001/2002 – 2015/2016 sessions, there had been a consistent shortfall in the amount allocated as compared to the amount received. While both amounts increased at a decreasing rate, the latter nosedived as it increased at a decreasing rate during the period 1991/1992 – 2010/2011. This suggests that the amount received reduced to 80.2%, 44.7% and 39.4% respectively over the period (Figure 4.2). For the period 2011/2012 – 2015/2016, both the allocated and received amounts increased appreciably. In fact, both amounts were at an all-time high during this interval period. However, both figures fell short of the amount requested; which is the actual sum needed to run the affairs of the college effectively.

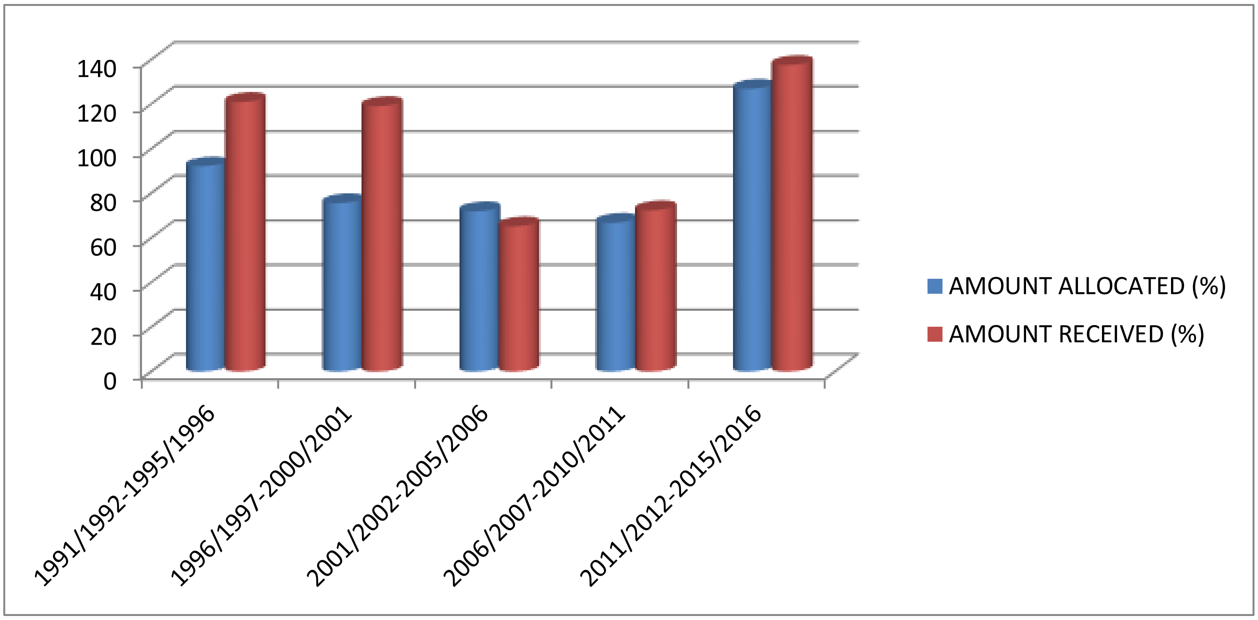


Fig. 4.2: Chart of CMUL amount allocated and funding received

This could portend grave consequences for a strong internal control system and budgetary mechanism but it could also show that this could be a decade of expansive medical infrastructure and development towards the discharge of adequate medical education in the institution.

Moreso, Fig. 4.3 indicates the proportion of amount received to amount allocated. It is evident that the former hovers around 50 percent for all periods except the academic session 2001/2002 – 2005/2006 with 55 percent allocation.

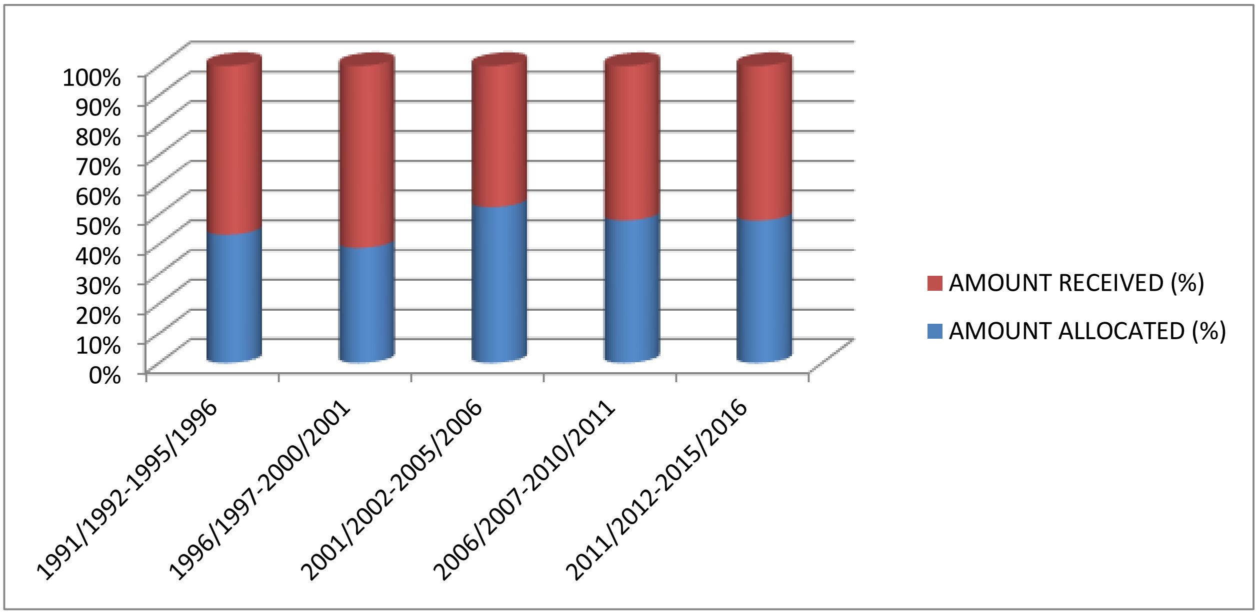


Fig. 4.3 Percentages of amount allocated and amount received in CMUL

In furtherance of this trend, it is also evident that the proportion of amount allocated and amount received for the period under consideration also provides some insights into how the medical institution embarked on extra-budgetary spending during the study period (Figure 4.4). Specifically, the academic periods1991/1992 – 1995/1996 and 1996/1997 – 2000/2001 are indicative of the amount received having a higher proportion than the amount allocated. However, the periods 2001/2002 – 2005/2006 and 2006/2007 – 2011/2012 suggest that the amounts allocated are marginally higher than the amount received. This implies that there is extra-budgetary spending for the former periods, covering ten (10) academic sessions, while for the latter periods it indicates a shortfall in funding. The scenario revealed in Table 4.1 could further be presented graphically to incorporate amount requested; amount allocated in budget; and amount received by CMUL, in order to display a vivid evidence of budgeting and funding variables in the books of CMUL.

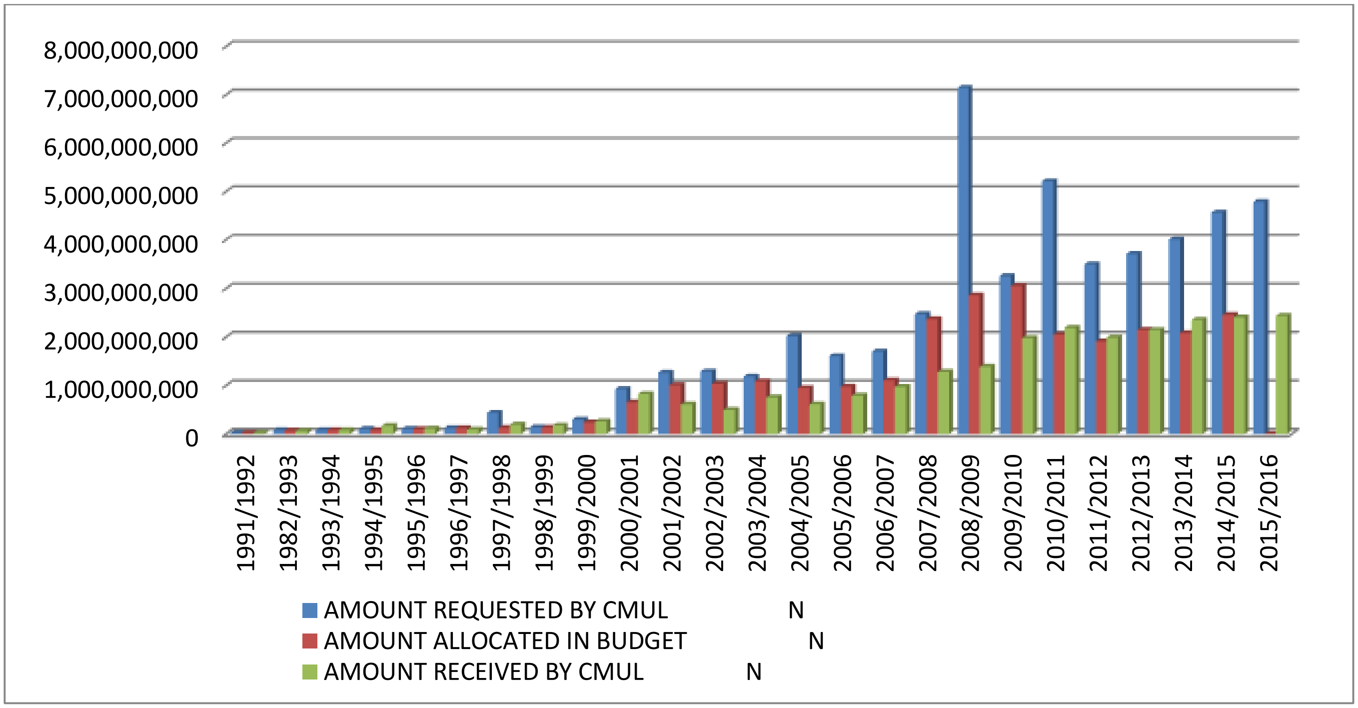


Fig. 4.4: Trends of budgeting and funding for the CMUL (1991-2016)

However, the trend depicted in figure 4.4 indicates that for virtually all the sessions, the amount requested has always been far more than the amount allocated in the approved budget by the proprietor. This implies that a case of amount received more than that allocated could not be attributed to poor internal control mechanism but a pressing need for adequate funding of the insitution. Therefore, the management of CMUL could be reasonably excused from running a defective system; rather the government appears not to have devoted adequate attention to funding of public medical institutions in Nigeria, using CMUL as a case study.

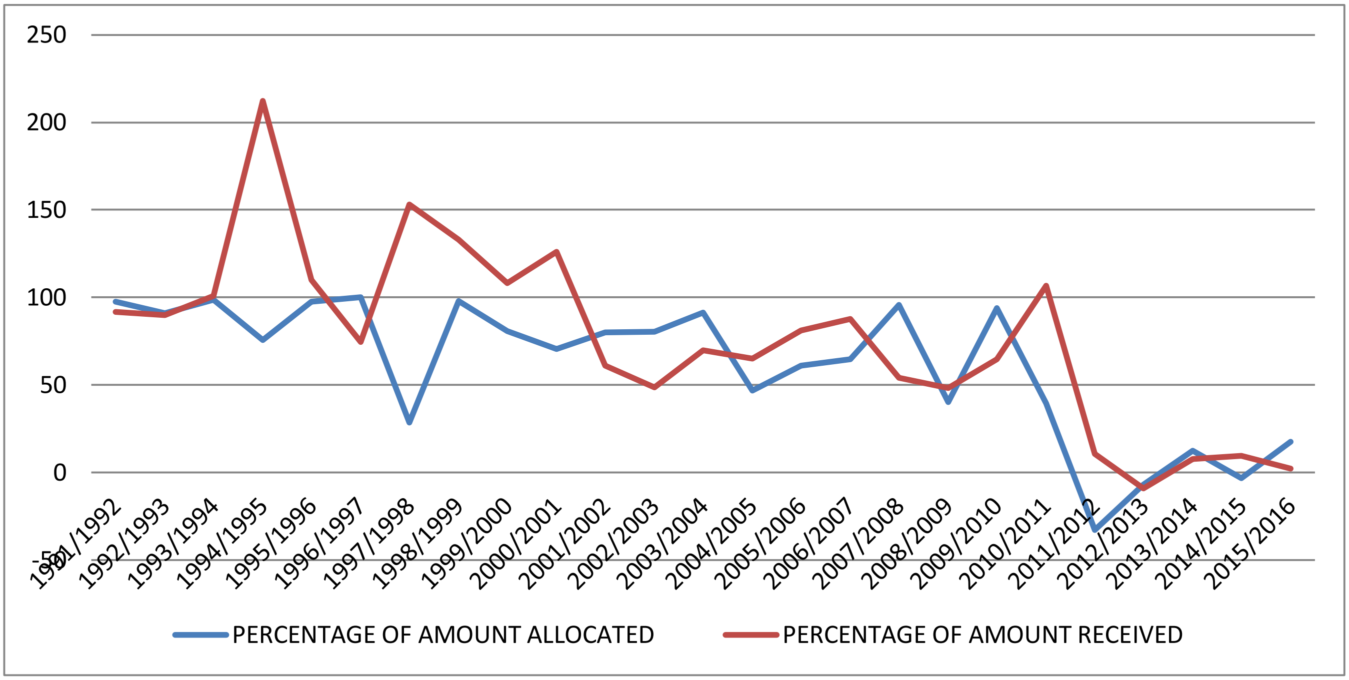


Fig. 4.5: Percentages of budgeting and funding for the CMUL (1991-2016)

Figure 4.5 further reinforces the disparity between amount allocated and amount received. There are five periods such as 1991/1992, 1992/1993 and 1993/1994, 2012/2013, 2013/2014 and 2014/2015 where the two amounts tally. On the whole, the trend shows that periods in which the amount received exceeded the amount allocated are relatively more, accounting for the excess of the former over the latter on the average. This further lends credence to the extra-budgetary spending of the medical institution in Nigeria. This submission is more evident in figure 4.6.

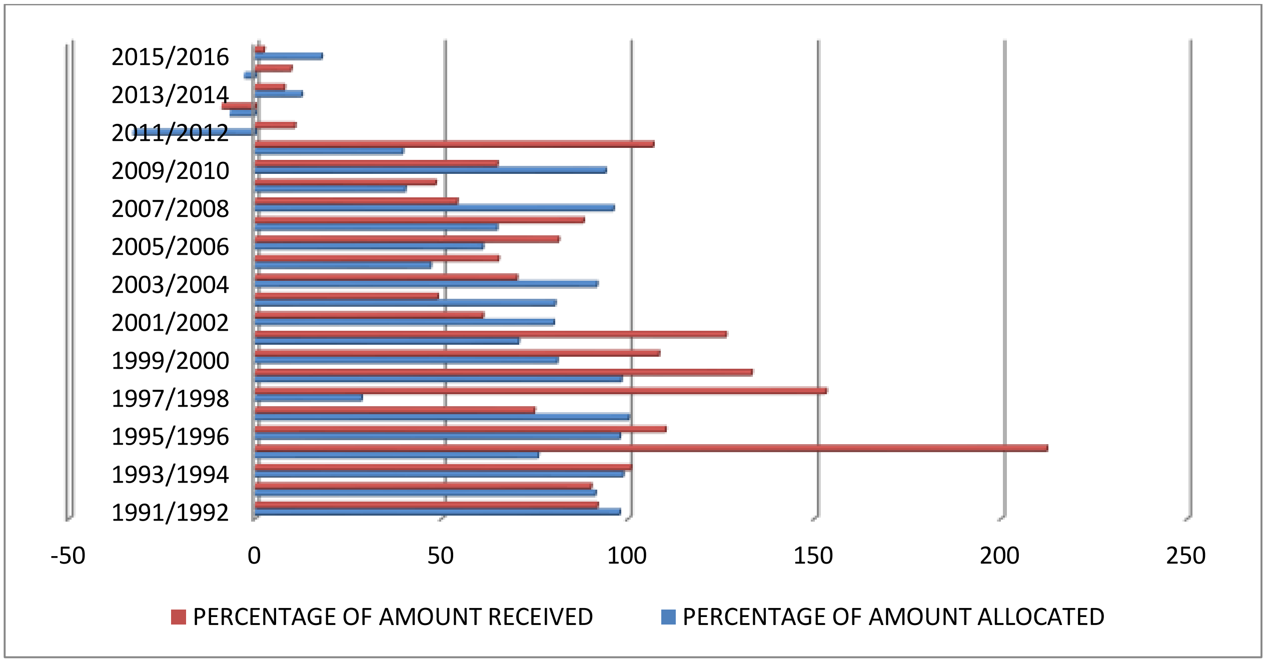


Fig. 4.6: Percentages of amounts received and allocated at intervals at the CMUL

The disparity between amount received and amount allocated highlighted the haphazard nature of funding of medical education by the Federal Government. As the figure 4.6 indicated, funding released by government exceeded the figures allocated in the approved budget of the institution and this anomaly readily brought about extra budgetary spending.

A clear distinction must be made that the total funding released by the federal government to CMUL covers all the activities of the institution in any academic session. Federal government reserves the allocative right which it constantly prescribes to the universities and medical institutions on how the total funds released must be disbursed. This leads to the lopsidedness in the allocation that always exists between core and non-core activities of CMUL. The medical institution is therefore precluded from unilaterally varying the allocation as the bulk of the fund is meant to pay staff salaries and other administrative expenditures.

As highlighted in Table 4.2, the bulk of fund were utilised in payment of staff salaries. The amount spent on teaching, learning and research is a fraction of the allocated figures for goods and services over the period of the study.

Table 4.2: CMUL budget allocation between core and non-core activities for 1991/1992 – 2015/2016

Period	Salaries (%)	Goods & Services (%)	Total (%)
1991/1992-1995/1996	71.87786159	28.12213841	100
1996/1997-2000/2001	77.96620568	22.03379432	100
2001/2002-2005/2006	82.23672559	17.76327441	100
2006/2007-2010/2011	78.12829418	21.87170582	100
2011/2012-2015/2016	87.816	12.184	100

Source: Approved budgets of the CMUL

It is obvious from the above scenario, that a federally-owned public medical school, such as CMUL, could not afford to refurbish most of its ageing and dilapidated infrastructure because there is massive paucity of funds to carry out the infrastructural renewal. The domestic budget prepared by the College is predicated on the budget allocation figure given by the federal government. The bulk of this figure is earmarked for salaries and other emoluments. The amount set aside for general overhead was largely consumed by running costs, leaving a small amount for teaching and research expenses. A summary of the budgets for the relevant years is presented in the succeeding figures and tabular trends.

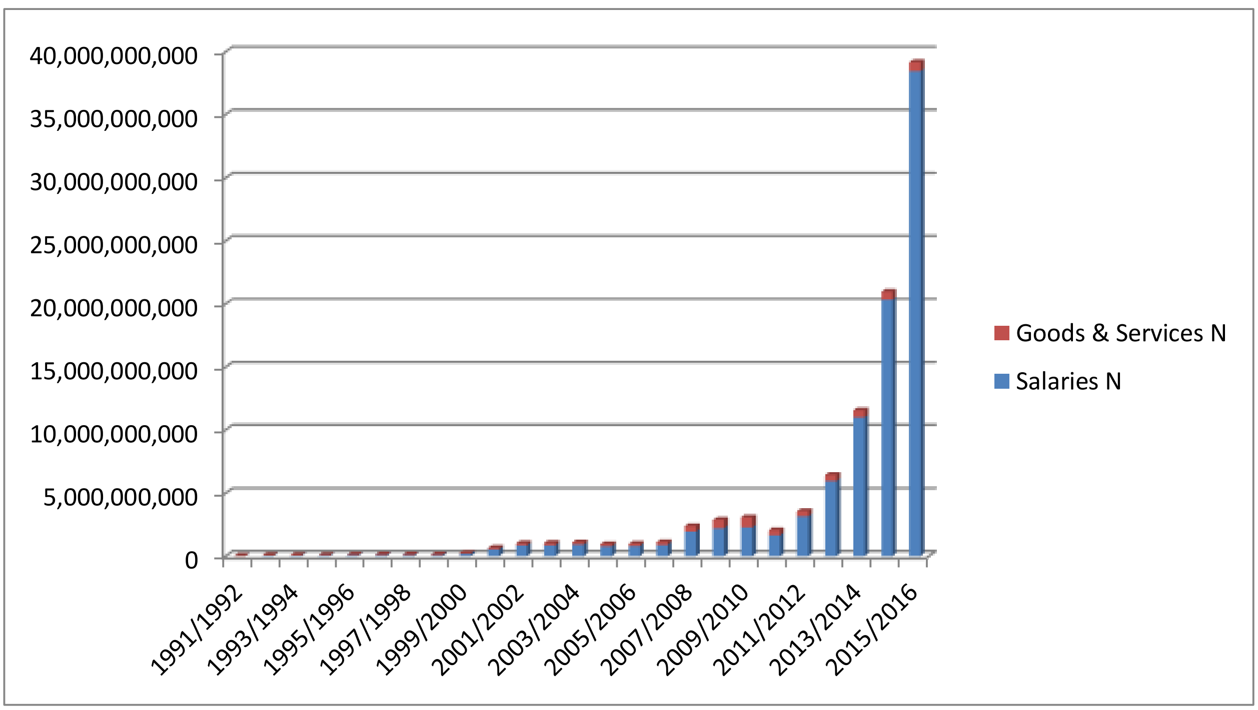


Fig. 4.7: Components of funds received by the CMUL

As stated earlier, the released funds do not fully cover the estimates made by the medical school. In fact, the major components of the released funds are meant for staff salaries and allowances and are expected to be kept in a separate, dedicated bank account, upon which there should not be any virement. There are minimal allocations for teaching equipment, consumables and reagents and staff training that are expected to be made for the purpose of bringing about the desired quality expected of medical students produced by the CMUL.

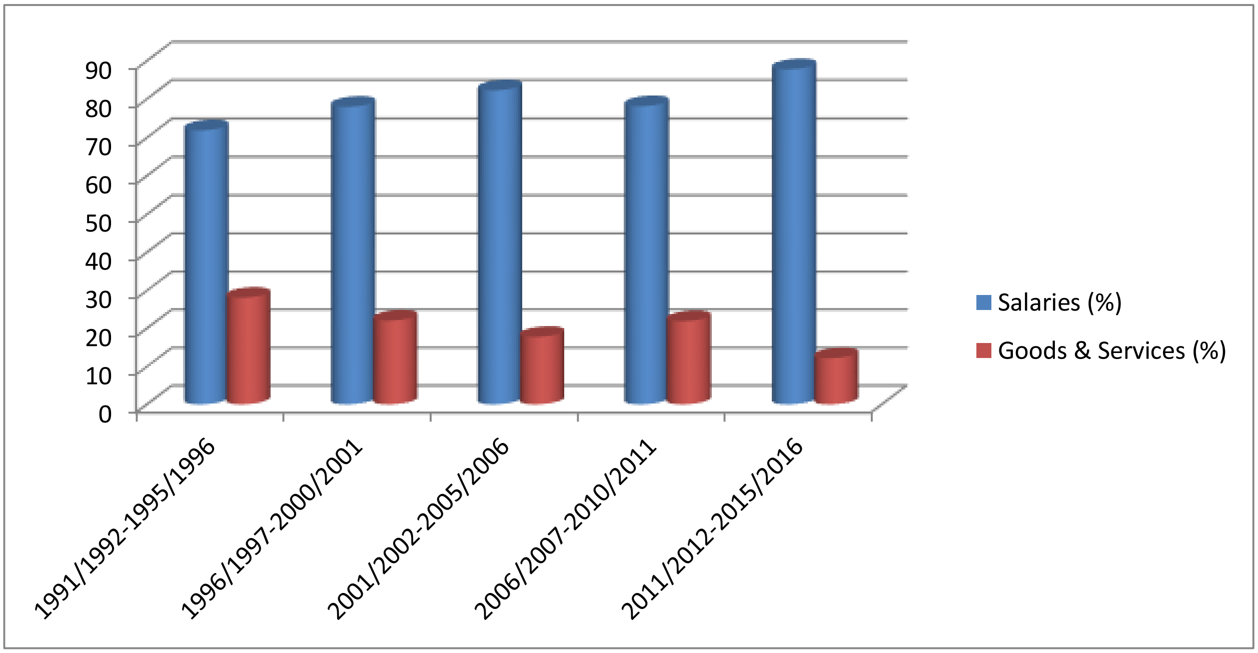


Fig. 4.8: Components of amount received to fund medical institution (CMUL)

CMUL receives its funding from these major sources:

- Subvention grants
- Development grants
- Specific grants
- Students fees
- Internally generated revenue

Percentage contribution of amounts realised under these headings during the reporting period are as follows:

Table 4.3: Details of actual monies received by CMUL within the last 25 years

Period	Subvention Grants (%)	Development Grants (%)	Specific Grants (%)	Students Fees (%)	Internally Generated Revenue (%)
1991/1992-1995/1996	66.94526994	22.53625873	5.48757763	0.449629768	4.58126394
1996/1997-2000/2001	79.39231480	9.68082274	7.064633665	0.666492528	3.195736263
2001/2002-2005/2006	93.25357654	0	0	2.259610792	4.486812667
2006/2007-2010/2011	92.69013776	0	0.234744215	3.411011192	3.664106828
2011/2012-2015/2016	90.25848809	0	1.090304126	3.235904727	5.415303054

Source: Audited financial statements of CMUL

Table 4.3 shows the various areas under which the CMUL received its funds. Generally, subvention grants from the federal government have remained consistently on the increase, beginning with 66.95% in the 1991/1992-1995/1996 sessions and going up to 92.69% in the 2006-2010/2011 sessions. This is diametrically opposed to the trend evident in the development grant which started at 22.5% and ended at 0.0%. Similarly, the specific grants have the same trend, as it only increased marginally from 5.49% in the 1991/1992 - 1994/1995 session to 7.06% in the succeeding interval periods, which further declined in the period following this. The internally generated revenue of the institution has hovered around 4% for decades. This shows the lack of innovation and creativity on the part of the institution and the near absolute reliance on the government as the major financier of the institution through subventions.

The bulk of the income, as detailed in Table 4.3 is from government sources. Ironically, it is becoming increasingly obvious that the government alone cannot fund education, generally, and indeed, medical education in particular. Therefore, the institution needs to be empowered to generate a significant proportion of its income locally to adequately fund its growing operations. Students' intake, coupled with maintenance of decaying infrastructures, need urgent attention by all the stakeholders in the educational sector. The scenario on ground is that the federal government is the dominant party responsible for funding public medical education in Nigeria, including CMUL. Total income realised is broken down into constituent parts to highlight the make-up of the government's contributions towards the funding of the medical school. Though CMUL was able to attract some research grants both locally and internationally, this laudable initiative unfortunately, has not impacted significantly on the funding position of the institution.

The funding contributed by the federal government has accounted for between 90% and 97% of the total income of the CMUL. Due to the dwindling revenue accruing to the national treasury, funding from government has not adequately covered the total requests made by the CMUL over the years. The CMUL has a mission to produce world class medical doctors and other health professionals, and as such, could not afford to be inadequately funded in its quest to realise its mission and objectives. In the circumstance, government policy may have to be reviewed to allow institutions to introduce realistic tuitions at both undergraduate and postgraduate levels to shore up the low base of funds at public medical schools. Income generated by CMUL on school fees was grossly below 5% over the 25-years period covered by the study. There is a yearning gap that could be explored if there was an enabling environment to support the initiative. The local income from internally generated revenue can also be substantially improved upon by the management of the medical school.

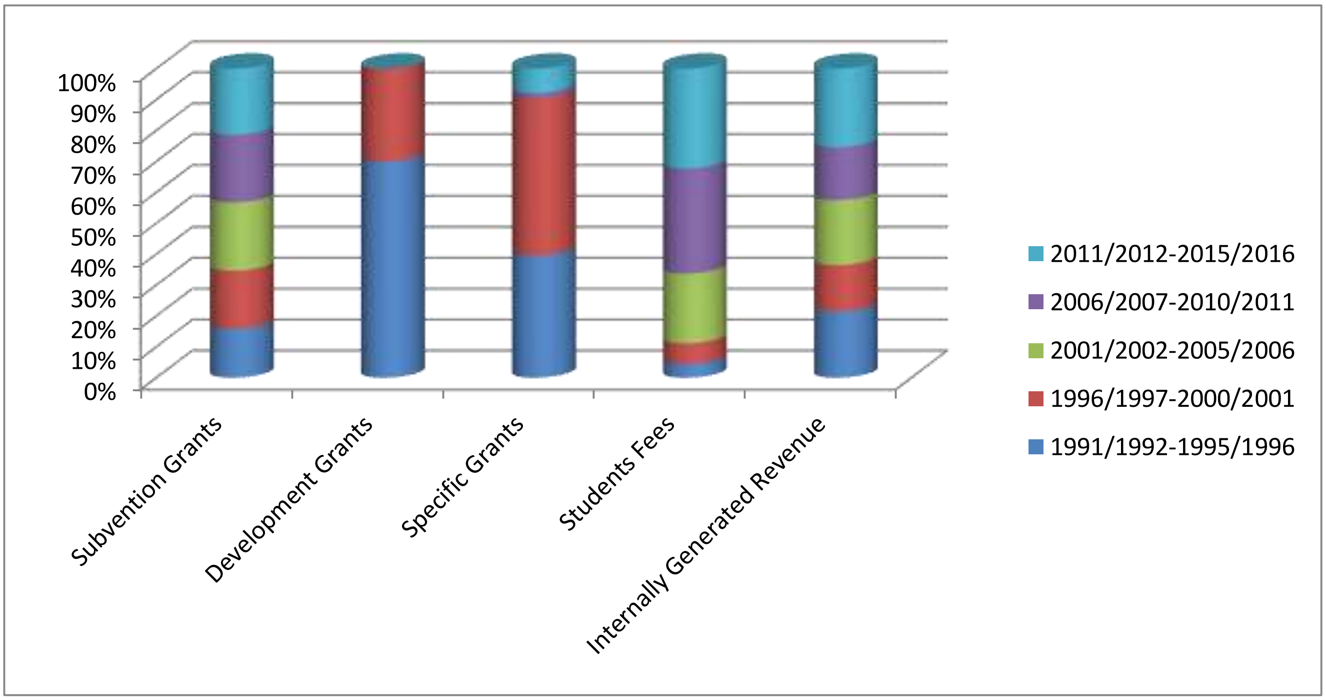


Fig. 4.9: Funding trend of medical education at the CMUL

Evidences abound showing that payment of tuition fees by students is becoming the norm rather than exception in other parts of the world. Tertiary institutions in the emerging and developed economies do not only charge realistic tuition fees both at undergraduate and postgraduate levels of university education, but constantly review the rates of tuition fees payable by students to ensure that the amount charged could reasonably cover costs of providing qualitative educational services by the institutions (Jones-Esan, 2007). The federal government of Nigeria may have to seriously consider this emerging trend as a source of attracting huge funds to run medical schools such as CMUL, as well as the federal university system in general. More so, public medical institutions should take giant strides towards innovations and inventions in order to improve on their internally generated revenue capacities. Efforts in this regard have started yielding positive results in CMUL; especially in the period 2011/2012 – 2015/2016 where the IGR generated was above the recommended rate of 10% threshold prescribed by the National Universities Commission (NUC).

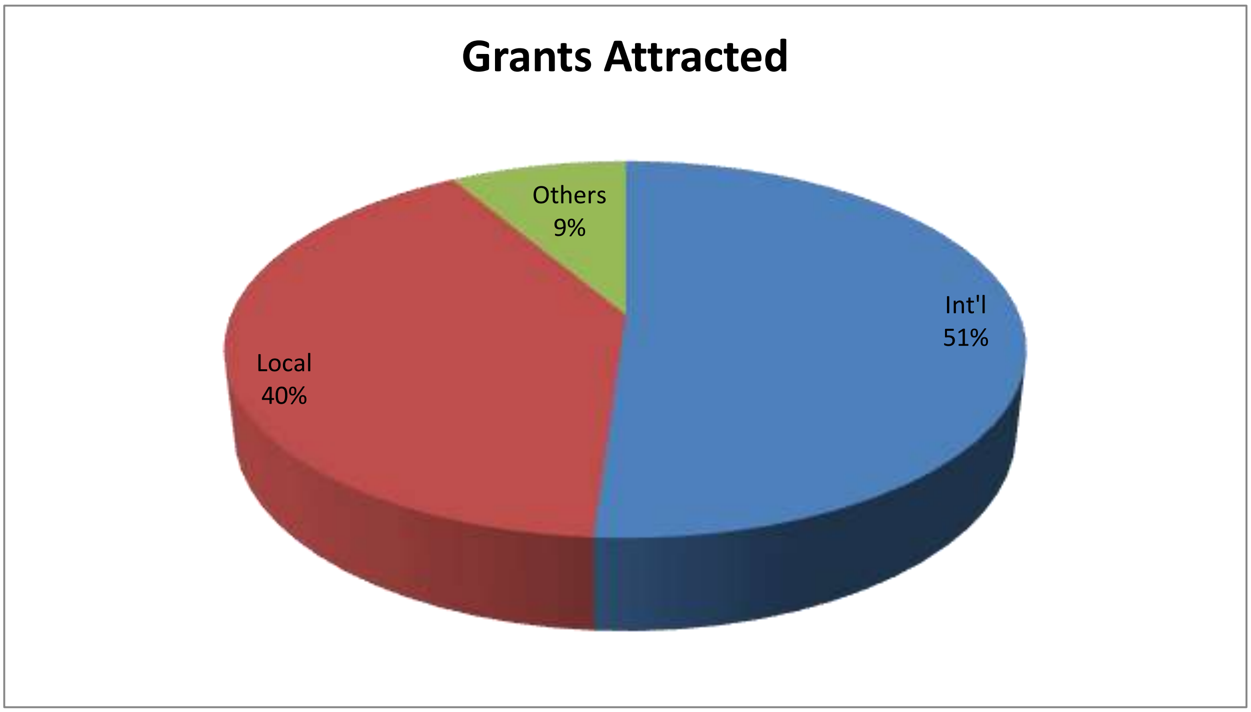


Fig. 4.10: Percentages of amount attracted as grants for medical education at the CMUL (2008-2011)

Of the grants attracted by the institution, between 2008 and 2011, 51% has been sourced internationally, 40% locally and barely 9% from other sources. The implication of this trend is that the institution relies largely on foreign donors for its grants. The majority of these grants come from the European Union and the United States agencies, among others. This portends a grave consequence for the sustainability of the inflow to the institution, since reliance on foreign donors can no longer be guaranteed due to the dwindling global savings and the incorrigible effect of the global financial and economic crises.

The clinical training of medical students at CMUL takes place at LUTH; the teaching hospital serving as twin institution to the medical school and sited within the same community (i. e. Idi-Araba, Lagos).

The teaching hospital, just like the CMUL, also relies heavily on government subvention with little proportion of its revenue generated through patients' fees and other IGR (Fig. 4.11). Consequently, the ability of raising adequate financial resources needed for procurement of equipment and consumables is significantly curtailed. The dearth of funding therefore cuts across both institutions (CMUL and LUTH) and this poses a serious challenge for teaching and learning in public medical education in Nigeria.

The funding pattern of LUTH is depicted as follows:

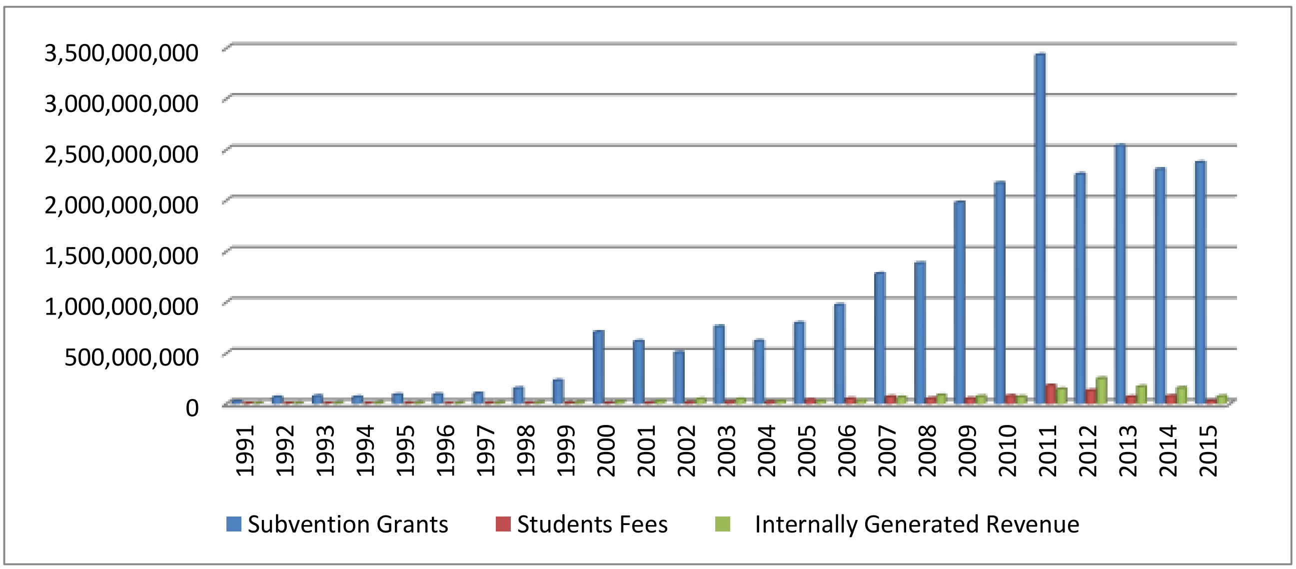


Fig. 4.11: Funding for clinical training of medical students at the Lagos University Teaching Hospital (LUTH).

In the case of CMUL, the distribution pattern of the funds generated is largely tilted in favour of salaries and general overhead expenditure, as opposed to teaching and learning costs.

Table 4.4: Disbursement pattern of the financial resources that accrued to CMUL

Year	Personnel Costs (%)	Administrative Expenses (%)	Learned Conferences Attendance (%)	Teaching & Research Expenses (%)	Total (%)
1991/1992 - 1995/1996	69.93	26.32	0	3.75	100
1996/1997 - 2000/2001	73.72	24.30	0.13	1.85	100
2001/2002 - 2005/2006	90.73	8.53	0.20	0.54	100
2006/2007 - 2010/2011	90.98	8.36	0.35	0.30	100
2011/2012 - 2015/2016	87.82	11.36	0.40	0.42	100

Source: Audited financial statements of the CMUL

The amount disbursed for the operations of the CMUL indicates that the amount devoted to payment of personnel costs, such as wages and salaries, largely accounts for about 90% in recent times, with more than 20% increase from 69.93% in the 1991/1992-1995/1996 periods. Ironically, the amount devoted to teaching and research expenses has continued on a downward swing, while the amount devoted to learned conferences has remained negligibly insignificant, at less than 0.5% of the amount received in the periods under review. This allocation, in absolute term, is grossly inadequate to execute the core activities of the institution.

Diagrammatically, the scenario is as shown below:

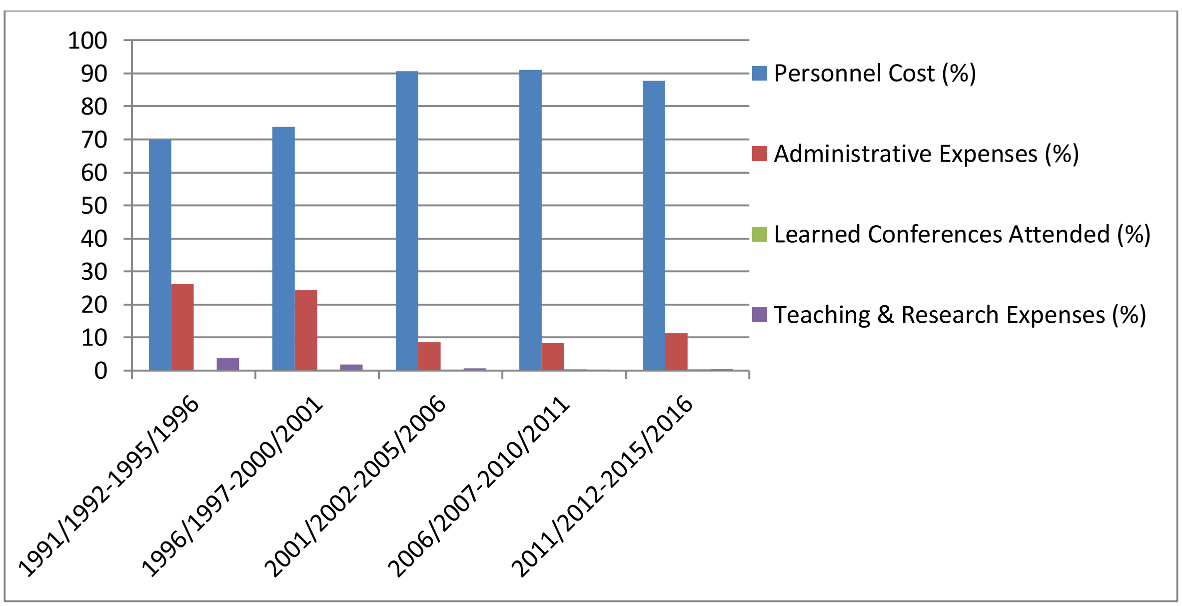


Fig. 4.12: Disbursement of received allocation for expenses at the CMUL

In conclusion, the various trends that have been revealed from the secondary data of CMUL indicated that there had been significant structural changes in the trends of budgeting and funding of medical education in Nigeria. This was evident in the data of this case study which covered 1991/1992 to 2015/2016 academic sessions that addressed the research question one.

Having addressed the research question one, other research questions are addressed through formulation of hypotheses.

4.3 Re-statement of hypotheses

The relevant research hypotheses for this study are hereby restated as:

Hypothesis One

H_0 Efficient utilisation of budgeting and funding does not have significant effect on public medical education in Nigeria.

H_1 Efficient utilisation of budgeting and funding has significant effect on public medical education in Nigeria.

Hypothesis Two

H_0 Budgeting and funding requirements have not significantly impacted on public medical education in Nigeria.

H_1 Budgeting and funding requirements have significantly impacted on public medical education in Nigeria.

Hypothesis Three

H_0 Institutional factors do not significantly influence budgeting and fund utilisation of public medical education in Nigeria.

H_1 Institutional factors do significantly influence budgeting and fund utilisation of public medical education in Nigeria.

Research Question Two:

How efficient has budgeting and funding been utilised on public medical education in Nigeria?

In order to address this second research question, it becomes imperative to estimate the Data Envelopement Analysis (DEA) for the College of Medicine of the University of Lagos (CMUL). The DEA is an input-output analysis which is predicated on the conceptual framework of the RYDM model. More so, the estimation of the DEA model to answer this research question is to also test for hypothesis one re-stated above.

4.4 Models Estimations

4.4.1 Estimations of efficiency scores for the CMUL

This section begins with a baseline model, which classified the expenditure distribution of CMUL over a 25-years period into two broad categories of general and academic expenses. The personnel costs and administrative expenses made up the former (general expenses) while learned conferences expenditure; teaching and research expenses constituted the latter (academic expenses). In line with the DEA framework, the general and academic expenses were the input variables while the numbers of undergraduate and postgraduate students graduated during the academic sessions of 1991/1992 to 2015/2016 were the output variables. Depending on the input variable(s) of interest, either an input-oriented or output-oriented DEA could be considered. The efficiency scores of the input-output relationship were obtained and the percentage change in the expenditure distributions and percentage change in students who graduated during the period under review were examined. This allows for the elimination of possible scale effect, especially as the expenditures were in volume, higher than those of the graduated students in undergraduate and postgraduate categories.

In effect, the intention of obtaining the efficiency scores of expenses as input variable and the number of students who graduated was to ascertain how budgeting impacted teaching and learning at the CMUL. It should be noted that expenses incurred had earlier been budgeted for. The analysis of the amounts allocated (budgeted) and expended showed that both were not significantly different (Section 4.2). In other words, “budget” and “expenses” connote the same meaning in this study. Further analysis using DEA was conducted directly on the amount allocated rather than on the expenses, using the students’ graduation figures as output to establish the robustness of the results.

As a follow-up and for robustness, the baseline model was extended to incorporate funding as another input variable. This is to ascertain the possible efficient allocation of funds generated to obtain a desirable output of students graduated. Generally, the total funding is often decomposed into students' school fees, the internally generated revenue (IGR), subventions and grants (such as development and specific grants). This sub-heading summarised the effect of funding on public medical education at the CMUL. Altogether, this systematic analysis facilitated far-reaching conclusions and generalisations on whether or not budgeting and funding significantly impacted public medical education in Nigeria.

Again, the study proceeded to undertake series of sensitivity and scenario analysis to ascertain the level that these input variables needed to attain to ensure the efficiency of service delivery at the CMUL. It is interesting to note that the same weight of one was assumed for each period. This is predicated on the premise that the CMUL holds each year as important as any other year in achieving its predetermined goals of service delivery in public medical education in the country. While the efficiency score obtained from the DEA estimations was a single composite figure, also extracted were some salient parts of the reported results. These were then attached to the Microsoft Excel output on these efficiency scores and sensitivity, as well as scenario analysis, as adjoining appendices for transparency in the estimation processes.

4.4.2 Estimations of DEA model

In estimating data envelopment analysis models on efficiency level of a production unit, there are two prominent methods available in the empirical literature. These are the Microsoft Excel SOLVER ADD-IN menu and the STATA command. This study settled for the former due to its merit over the latter. First, the Microsoft SOLVER ADD-IN menu is a user-friendly and an interactive plug-in which is allowed to feature within the basic Microsoft Excel environment. This is unlike the STATA command, which is command-driven and highly sensitive to syntax errors. The SOLVER ADD-IN allows for the introduction of many dynamics and scenario analysis to be examined in working towards the efficiency level of a production unit; such as in the case of CMUL.

For the STATA command, this "luxury" is not available; at least, not without some rigidities. Second, the results obtained with the SOLVER ADD-IN of the Microsoft Excel are usually more detailed as it highlights the various binding and non-binding constraints. A binding constraint is a limitation in resource in which there is a marginal cost to be incurred or a shadow price to pay in a bid to obtaining extra one unit of the scarce resource. On the other hand, a non-binding constraint is a redundant or superfluous constraint in resource engaged in the production process. For this kind of resource, which is not absolutely limited, there is no shadow price that the organisation will have to pay to obtain one additional unit of it. The marginal cost of such a resource is zero (i.e. non-binding constraint). More so, additional information, such as the allowable decrease and/or allowable increase permissible before efficiency could be obtained, is part of the information that has made the Microsoft SOLVER ADD-IN preferred to the STATA command of estimating the efficiency score. It is instructive to note that ascertaining the allowable increase or decrease is part of the comparative statistics that provides valuable information as to the extent of the expenditure on medical education. Additionally, it provides information on how much that budgeting and funding will have to decrease or is expected to increase before efficiency of medical education at the CMUL could be achieved.

In the estimation of the DEA models for this study, a scientific procedure was adopted that began with the baseline model and proceeded at measuring, in successive order, the marginal effects of budget and funding, both respectively and collectively. The inclusion of the budget and funding into the baseline model, where the general and academic expenses served as the input variables and the number of undergraduate and postgraduate students who graduated during the academic sessions of 1991/1992 through 2015/2016 was considered as the output variables, served as the extension of the baseline model. It is instructive to note that the estimations of DEA through the Microsoft Excel ADD-IN go through a series of iteration process to attain a convergence before a result could be reported. If no convergence was found, no result would be reported, which implies that the DEA framework is structurally incoherent and could not be estimated. Attaining a level for convergence is important as it is the only way to, not only report the efficiency scores, but also to proceed towards obtaining the sensitivity analysis and the limits of the model. It is only through a convergence result that all constraints can be satisfied and all boundary conditions can be considered towards the optimality as well as the estimations of the efficiency level of the productive unit, which in this case is the CMUL.

In obtaining the aggregate efficiency scores for each of these models, the use of weight attached to the respective academic session considered for this study was employed. A weight of 0.04 was attached to each academic session since the period of investigation spanned 25 years and efficiency level was expected to be of cumulative effects. This study attached equal weight to each academic session to lend credence to the fact that none of these years was taken to be superior to the other and that efficiency in each year depended on the level of efficiency attained in the previous year(s). The weight of 0.04 to the respective academic year in the baseline model was also the same for the extended models with which budget and funding variables were included. The dimension for the use of 0.04 weight for the extended models was informed by the fact that budget and funding at the CMUL had been on an incremental basis (Section 4.2). This is unlike the case of zero-base budget, where each academic session is expected to be independent of the other and efficiency level in medical education of each session is not cumulative in nature but isolated from one another. In zero-base budget, yearly expenditure vote are to be justified irrespective of what transpired on the item in the previous years.

Table 4.5: Efficiency score: 1991/1992 to 2015/2016

		Extended models								
(1)	**(2)**	**(3)**			**(4)**			**(5)**		
Academic session	**Baseline Model**	**Baseline + budget model**			**Baseline + funding model**			**Baseline + budget + funding model**		
		Result	**Rank**	**Remark**	**Result**	**Rank**	**Remark**	**Result**	**Rank**	**Remark**
1991/1992		19.51	4	Y	3.484	2	Y	0.985	2	X
1992/1993	-1987.77	17.13	7	Y	3.016	5	Y	0.962	3	X
1993/1994	12.77	-0.54	18	Z	0.642	15	X	0.940	4	X
1994/1995	498.61	-0.98	19	Z	0.249	18	X	0.931	5	X
1995/1996	1	18.19	5	Y	3.120	4	Y	0.898	6	X
1996/1997	1	16.04	8	Y	2.881	6	Y	0.887	8	X
1997/1998	1	20.92	3	Y	3.174	3	Y	0.892	7	X
1998/1999	1	17.46	6	Y	2.881	7	Y	0.837	10	X
1999/2000	1	15.32	9	Y	2.475	9	Y	0.839	9	X
2000/2001	1	15.16	10	Y	0.357	17	X	0.661	13	X
2001/2002	1	13.81	12	Y	1.331	13	Y	0.610	14	X
2002/2003	1	4.49	15	Y	1.188	14	Y	0.662	12	X
2003/2004	1	0.48	16	X	-0.206	20	Z	0.561	16	X
2004/2005	1	-14.19	22	Z	-2.116	22	Z	0.605	15	X
2005/2006	1	13.97	11	Y	1.709	11	Y	0.514	17	X
2006/2007	1	5.94	14	Y	0.368	16	Y	0.431	18	X
2007/2008	1	0.31	17	X	-0.003	19	Z	0.211	19	X
2008/2009	1	-6.23	20	Z	-1.20	21	Z	0.111	20	X
2009/2010	1	-17.00	23	Z	-5.27	25	Z	-0.048	21	Z
2010/2011	1	-8.99	21	Z	-4.10	23	Z	-0.229	22	Z
2011/2012	1	-34.30	25	Z	-5.18	24	Z	-6.207	25	Z
2012/2013	1	-21.20	24	Z	2.83	8	Y	-5.616	24	Z
2013/2014	1	8.89	13	Y	1.370	12	Y	0.784	11	X
2014/2015	1	25.12	2	Y	2.430	10	Y	-0.361	23	Z
2015/2016	1	31.84	1	Y	6.11	1	Y	10.572	1	Y
Aggregate	8.88E-09	7.38E-05			1.61E-05			3.62E-06		

Remark: X = decreasing return to scale Y = increasing return to scale Z = inefficiency

4.4.3 Presentation of results using DEA technique

As highlighted in section 3.6, DEA is a non-parametric approach for measuring relative efficiency of any organisation or firm. In the case of CMUL, data covering 25 years, from 1991/1992 to 2015/2016 academic sessions, were used in the study.

In Table 4.5:

- Column (1) represents each time-series year of investigation;
- Column (2) presents the details of baseline results model for each of the years
- Column (3) depicts individual year's results for baseline and budget variables
- Column (4) presents the results for baseline and funding
- Column (5) is the combined results on baseline, budget and funding

Efficiency is measured in aggregate value, between the range of 0 and 1. The closer the score is to 1, the better the efficiency level. A negative efficiency score is termed inefficiency; efficiency score of 1 is constant return to scale; efficiency score ranging between 0 and 1 is relative and decreasing return to scale while a score greater than 1 is increasing return to scale.

4.4.3.1 Efficiency of budgeting and fund utilisation in CMUL

The results obtained from the baseline model suggests that there is high degree of inefficiency with efficiency score of 8.88E-09 when the medical institution employed the use of both general and academic expenses as input variables to generate output of graduating a number of undergraduate and postgraduate students. Expectedly, the efficiency score ranges between zero and one, the more it tends towards one the more efficient and the more it tends towards zero, the less efficient the medical institution had been. There appeared to be huge improvement in the efficiency score to 7.38E-05 when the model is extended by including the effect of budget and to 1.61E-05 when funding was used to extend the baseline model. But, the inclusion of budget and funding as extension of the baseline model is relatively better (with efficiency score of 3.62E-06) as compared to that of the budget-extended model but not as good when compared to that of the funding-extended model. The implication here is that better efficiency can be achieved with more funding available at the disposal of the institution to effectively discharge its avowed mandate of producing the required medical capacity for the nation. This has more effect than the fiduciary requirements of preparing yearly budget which is just a prospective income and expenditure required for this purpose.

4.4.4 Sensitivity analysis

Sensitivity analysis, otherwise known as scenario analysis, is where the study investigated the effect of parameter changes on the efficiency objective of the CMUL. In this section, the possible increment or reduction that will maintain the envisaged level of efficiency or to what extent will possible adjustments in the input factor(s) reduce or improve the level of efficiency in service delivery of medical education at CMUL, were examined.

The results of the sensitivity analysis carried out on the data used for this study are presented as follows:

Table 4.6: Table of Sensitivity Analysis: 1991/1992 to 2015/2016

Table 4.6a : Sensitivity outcome for baseline model (Appendix C)

Variable	Shadow price	Allowable increase	Allowable decrease
General expenses	0	1.00E+30	1.00E+30
Academic expenses	0	1.00E+30	1.00E+30
Undergraduate graduated	0	1.00E+30	1.00E+30
Postgraduate graduated	0	1.00E+30	1.00E+30
Efficiency score	0	3.00	1.00E+30

4.4.4.1 Discussion of sensitivity analysis on baseline model

Arising from the sensitivity analysis, the results show that equal proportion of allowable increase and allowable decrease are required to obtain efficiency; considering that budget and funding have not been incorporated. The implication here is that if efficiency is to be pursued without budget and funding, the College of Medicine of the University of Lagos cannot be misled by the effect of money illusion and that only real addition(s) from any of these variables could guarantee efficiency of medical education in the institution (Section 4.2, Table 4.4 and Fig. 4.12). All the input (general and academic expenses) and output (undergraduate and postgraduate graduated) variables had shadow prices that are approximated to zero at the optimum (when allowable increases or decreases had been effected). This suggests that to obtain one additional unit of this expense (general expenses) would be counterproductive as well as detrimental to the institution's objective of efficiency in the teaching and learning of the medical institution. For academic expenses, undergraduate and postgraduate graduated with zero shadow prices, these combined would amount to the institution bearing no additional cost if put to optimal use. It is evident that the amount of allowable increases and decreases are the same. This is highly instructive as it suggests that only a uniform decrease and increase is allowed to facilitate the attainment of efficient service delivery at the CMUL (Table 4.6a).

Table 4.6b: Sensitivity outcome for baseline + budget model (Appendix F)

Variable	Lagrange multiplier
General expenses	0
Academic expenses	0
Budget	1.312E-06
Undergraduate graduated	0
Postgraduate graduated	0

4.4.4.2 Discussion of sensitivity analysis on extended model - baseline + budget

The sensitivity analysis indicates that the Lagrange multiplier is approximately zero for all the input and output variables; except for budget which is non-zero. This implies that the marginal utility of money for all the variables is zero, except for budget. The implication is that an infinitesimally small amount of additional benefit would be derived from an additional ₦1 obtained from budgeting. This is an indication that budgeting still matters for the efficient teaching and learning of medical education in Nigeria. The additional money spent on budget is relatively more beneficial with 1.312E-06. This lends credence to the fact that budget plays a relatively significant role in the funding requirements of teaching and learning of CMUL (Table 4.6b; Appendix F).

Table 4.6c: Sensitivity outcome for baseline + funding model (Appendix J)

Variable	Lagrange multiplier
General expenses	0
Academic expenses	0
Funding	0
Undergraduate graduated	0
Postgraduate graduated	0

4.4.4.3 Discussion of sensitivity analysis on extended model - baseline + funding

This section dwells on the sensitivity analysis of the extended model which had to do with the infusion of funding into the baseline model. As evident in the result presented in Table 4.6c, the marginal utility of money as denoted by the Lagrange multiplier were zero for the general expenses, academic expenses, funding, undergraduate and postgraduate students graduated. This implies that efficiency from additional benefits on general and academic expenses and efficiency obtained through additional student graduated either at the undergraduate or postgraduate levels were not value-adding. For efficiency to be attained, it implies a comprehensive and holistic effort is required throughout the sectional units and components of medical education in the institution.

Table 4.6d: Sensitivity outcome for baseline+budget+funding model (Appendix N)

Variable	Lagrange multiplier
General expenses	0
Academic expenses	0
Budget + Funding	0
Undergraduate graduated	0
Postgraduate graduated	0

4.4.4.4 Discussion of sensitivity analysis on extended model - baseline + budget + funding

This section dwells on the sensitivity analysis of the overall extended model which had to do with the infusion of budget and funding into the baseline model. As evident in the result presented in Table 4.6d, the marginal utility of money as denoted by the Lagrange multiplier were zero for all the input and output variables considered, viz. general expenses, academic expenses, budget, funding, undergraduate and postgraduate students graduated.

It was observed from Table 4.6d that despite the respective addition of budget and funding to the baseline model there was no improvement in efficiency of teaching and learning, at least relatively. The combined effects performed better from the baseline. This manifested as the sensitivity as well as scenario analysis suggest that the Lagrange multiplier; which is the marginal utility of money is absolutely zero (Table 4.6d); as against approximate zero (Tables 4.6b & 4.6c) for all the constraints. As the marginal utility of money is absolutely zero, the implication is that the benefit derived from additional budget or funding would not contribute meaningfully to effective teaching and learning of medical education. It is imperative to emphasise that this suggests the need for efficient utilisation of the budget and funds chanelled towards the improvement of medical education in the country. One way this can be done is to ensure that a large proportion of the fund is expended on academic activities as against allocating higher proportion to general expenses. Secondly, necessary institutional frameworks should be put in place towards ensuring that necessary budgetary and funding provisions are available. This brings to the fore the fact that only effective budgeting and fund utilisation are required to obtain optimum efficiency in teaching and learning of public medical education such as the CMUL. These findings are in tandem with the studies of Just and Huffman (2009) which supports that limited funds should be judiciously utilised in order to attain efficiency and promote the culture of quality service delivery in institutions of higher learning.

Further attempts were made in the study to remove the scale effects by obtaining the percentages of these input and output variables but it was discovered that no convergence could be reached for optimality. Admittedly, the results obtained for the effectiveness of teaching and learning of medical education at the CMUL, were quite revealing. The various results obtained revealed different scenarios where funding had affected the expected outcome variables of the CMUL; thereby addressing one of the objectives of the study. In order to recognise the perception of key stakeholders involved in this analysis, and for the sake of complementarities of results, the use of questionnaire was also explored in the study.

As a robustness check for the estimates obtained from the DEA model, a structured questionnaire was administered in order to elicit responses from the targeted respondents. This becomes imperative in that the human elements aspects of funding public medical education cannot be evaluated in a quantitative form. As a result, this study proceeded to conducting primary analysis to further strengthen the results obtained in Research Question Two.

4.5 Primary data analysis

The data contained in this section were generated from the stakeholders of the CMUL. These stakeholders served as the targeted respondents. A total of 423 respondents made up of the academia, non-teaching staff (senior cadre), technologists and students (undergraduate and postgraduate) were selected randomly and questionnaires administered on them. Before the commencement of the analysis, tests of measurement tool (questionnaire) were performed to validate it as the proper data collection tool. Questionnaire tests, as used in this research, were used to evaluate enquiry of the items contained within, and so obtained the validity and reliability level. The questionnaire validity test was done through exhaustive literature review, corroborated by expert opinions on the application of questionnaire as a data collection instrument. Cronbanch-alpha (Cr) method was used to test for reliability. The Cr value is 0.988 (Table 3.5). This is larger than the benchmark value of 0.75, hence, the questionnaires were considered reliable.

Table 4.7: Analysis of administered questionnaires

Questionnaires administered	Questionnaires returned	Questionnaires usable	Questionnaires not usable
423	406	401	5

Source: Research field survey, 2017

Table 4.7 shows that a total of 423 questionnaires were distributed, 406 returned, out of which 401 were usable (completed), yielding a response rate of 94.8%. This response rate was considered large enough and sufficient for statistical reliability and generality (Stevens, 2002; Tabachnick and Fidell, 1996). This high response rate undoubtedly improved the validity and reliability of the questionnaires since the greater the response rate, the more accurate its estimate parameters in the population sampled (Pallant, 2002). Hence, no further attempt was made to increase the sample size.

To guarantee the utmost precision of this work, the use of Scientific Package for Social Sciences (SPSS) software was employed. This research effort is devoid of any manual analysis prone to mechanical manipulations and shortcomings. This section is divided into three parts. The first part contains personal information about the distribution of the respondents; the second part revolves around the research questions; while the third and final part hinges on the research hypotheses for acceptance or rejection at a given level of significance.

4.5.1 Personal data of respondents

The personal information of the respondents summarised some cogent statistics on the distribution of job/academic status, position, course of study, student level of study and the work duration of the respondents who are non-students. As shown in Table 4.8, the distribution of the respondents is not skewed to any class of respondent, but normally distributed. The lecturers and students accounted for 31.9% and 26.4% of the total respondents, respectively. This further lends credence to the reliability of the administered questionnaire as it shows that main stakeholders in service delivery components of medical education were adequately considered in the study. The technologists who play a complementary role in the laboratory and practical training of medical students also accounted for 9.5% of the total respondents. The finance officers and administrators are in charge of budget and funding proceeds; so their involvement in this study was able to provide relevant information beyond what figures and statistics could ordinarily reveal. They both accounted for 28.7% of the respondents. Other respondents and stakeholders considered to be important were also considered.

TABLE 4.8: Job/academic status of respondents

STATUS	**Frequency**	**Percentages**
Lecturer/Consultant	128	31.9
Technologist	38	9.5
Finance officer	59	14.7
Administrator	56	14.0
Student	106	26.4
Others	14	3.5
TOTAL	**401**	**100.0**

Source: Research field survey, 2017.

The positions occupied by the respondents indicate their capacity to give good judgment on the true state of budget and funding at the CMUL, since 72.3% of these respondents (Table 4.9) were at the managerial and senior staff cadre. This suggests that their views on budgeting and funding would have reflected their understanding of the conventions and expectations of this important aspect of medical training in Nigeria.

TABLE 4.9: Position of respondents

Position	**Frequency**	**Percentages**
Managerial	28	7.0
Senior Staff	262	65.3
Student	106	26.4
Others	5	1.3
Total	**401**	**100.0**

Source: Research field survey, 2017.

In tandem with the discussion in Table 4.9, the responses in Table 4.10 suggest that most of the respondents who were of the managerial and senior staff cadre had a minimum of ten years working experience and accounted for 62.7% of the total respondents. The remaining 37.3% of the respondents had less than ten years of experience. The importance of this information is that these respondents understood the socio-cultural components of medical education as delivered at the CMUL. The institutional framework, human factors, social impediments and the various cultural biases that hindered the service delivery of medical education, which the figures and statistics could not reveal, were reflected in the elicited responses.

Table 4.10: Work duration of non-student respondents

Duration	Frequency	Percentages
0-5 years	58	19.7
6-10 years	52	17.6
11-15 years	49	16.6
16-20 years	42	14.2
21 years and above	94	31.9
Total	**295**	**100.0**

Source: Research field survey, 2017

On the students' distribution of the analysis, the questionnaires were administered to students directly and indirectly affected by the delivery of medical education. 77.4% of the targeted respondents who were students of Medicine and Dentistry were directly affected while others, belonging to the Basic Medical Sciences (22.6% of the total respondents), were indirectly affected by the service delivery of medical education. This distribution reinforced the objectivity and consistency of distribution of the questionnaire, which ultimately impacted on the reliability of the findings.

TABLE 4.11: Students' course of study

Course	Frequency	Percentages
MBBS and BDS	82	77.4
Others	24	22.6
Total	**106**	**100.0**

Source: Research field survey, 2017.

Interestingly, these student respondents were on the verge of completing their medical education. As such, the responses elicited from them were expected to reflect the true picture of the education capital of CMUL which is the medical school of the University of Lagos. This is because they had acquired the needed skills and attained certain level of education sufficient to judge the status of medical education content of the university (Table 4.12).

TABLE 4.12: Level of student respondents

Level	Frequency	Percentages
500 Level	63	59.4
600 Level	43	40.6
Total	**106**	**100.0**

Source: Research field survey, 2017.

4.5.2 Descriptive analysis

The main objective of this study is to examine the role of budgeting and institutional factors on funding of public medical education in Nigeria, using College of Medicine of the University of Lagos as a case study. To accomplish this objective, three research hypotheses were formulated, with the answers provided assisting in achieving the objective. Prior to this, it was deemed necessary to also employ the tools of descriptive statistics, in the form of frequencies and percentages to validate the results obtained in addressing one of the research objectives i.e. Research Question Two. The responses complemented the results obtained from the DEA. Questions raised in the questionnaire were two-fold. The responses obtained were statistically analysed and are as presented below:

Question 1: What implication does current funding model in College of Medicine of the University of Lagos have on its service delivery?

Table 4.13: Current funding model and its implications on service delivery

	Strongly Agree (SA)	Agree (A)	Undecided (U)	Disagree (D)	Strongly Disagree (SD)	TOTAL
I am familiar with the funding model adopted by CMUL	47 (15.9%)	65 (22.0%)	79 (26.8%)	68 (23.1%	36 (12.2%)	295 (100%)
There are inefficiencies in the normative and contractual funding model in use at CMUL	36 (12.2%)	52 (17.6%)	130 (44.1%)	47 (15.9%)	30 (10.2%)	295 (100%)
Improved funding would require a review of the existing model	67 (22.7%)	99 (33.6%)	77 (26.1%)	28 (9.5%)	24 (8.1%)	295 (100%)

Source: Research field survey, 2017.

Given that the funding model adopted at the CMUL is the normative and contractual funding model, discerning from Table 4.13, only about 37.9% of the respondents agree that they were familiar with the funding model adopted by CMUL, while 35.3% disagree and 26.8% were undecided. This shows that a fair percentage of the respondents were aware of the funding model in operation at the CMUL; although this appeared latent. As expected, a majority of the respondents (44.1%) could not ascertain whether there were inefficiencies in the normative and contractual funding model in use at the CMUL, while 29.8% believed inefficiencies were found, with only 26.1% responding otherwise. As such, a majority of the respondents, 56.3%, affirmed that for there to be improvement in the funding of medical education, there is a need for a review of the existing model, 17.6% disagreed, with 26.1% of the respondents undecided. Putting these together, it could be inferred that the existing funding model did not impact meaningfully on service delivery at the CMUL, thus, the introduction of a new funding model which could bring about an improvement in funds availability is required. This is the concern addressed in Table 4.14.

TABLE 4.14: Recommended model of funding at CMUL

Funding model	**Frequency**	**Percentage**
Access-Equity model	66	22.4
Contextualised model	96	32.5
Performance-based model	47	15.9
Host-Proprietor-University model	33	11.2
Pay-for-Performance (P4P) model	55	18.6
TOTAL	**295**	**100.0**

Source: Research field survey, 2017.

The response on the funding model adopted at the CMUL was targeted at the employees of the institution, which comprised of the teaching staff, technologists, finance officers and administrators. These were the respondents expected to understand the operational dynamics of the institution; including the workings of budget and funding. The responses appeared to be well-distributed among the respondents but, significantly, most of them (32.5%) believed that the funding model was contextualised; with 11.2% of the respondents accounting for the funding model of the Host-Proprietor-University type. Of the access-equity funding model, only 22.4% of the respondents alluded to Access-Equity; closely followed by those of Pay-for-Performance and Performance-based models with 18.6% and 15.9% of the respondents, respectively, who consented to them. As such, the questionnaire, in meeting one of its objectives, concluded that the recommended funding model for the funding of medical education at the CMUL should be the contextualised.

Question 2: What are the effects of budgeting and funding on teaching and learning at the CMUL?

Table 4.15: Effects of budgeting and funding structure on medical education at CMUL

	Strongly Agree (SA)	**Agree (A)**	**Undecided (U)**	**Disagree (D)**	**Strongly Disagree (SD)**	**TOTAL**
The medical school operates a dedicated budget specifically for curriculum activities	53 *(13.2%)*	94 *(23.4%)*	146 *(36.4%)*	62 *(15.5%)*	46 *(11.5%)*	401 *(100%)*
The medical school allocates the dedicated resources to meet the educational needs	53 *(13.2%)*	89 *(22.2%)*	129 *(32.2%)*	79 *(19.7%)*	51 *(12.7%)*	401 *(100%)*
Funding has been adequate to meet the needs of CMUL	49 *(12.2%)*	42 *(10.5%)*	72 *(18.0%)*	136 *(33.9%)*	102 *(25.4%)*	401 *(100%)*

Source: Research field survey, 2017

To answer question 2 above, three major sub-questions are relevant; as depicted in Table 4.15. The responses elicited from the targeted respondents show that barely 27% disagreed that the dedicated budget being operated by the CMUL is directed towards curriculum activities. Some 36.6% of the respondents supported the positive interaction between budget and curriculum activities, while 36.4% remained undecided. Based on this survey, the budget being operated by the CMUL is likely to impact significantly on curriculum development. This submission is reinforced by the responses elicited on the question that the medical school allocated the dedicated resources to meet the educational needs of the institution, with 32.4% of the respondents disagreeing, 35.4% agreeing and 32.2% undecided. More so, 59.3% of the respondents disagreed that funding had been adequate at meeting the needs of CMUL, while 22.7% agreed and 18.0% of the respondents were undecided. On the whole, this information shows that the budget and funding structure is likely to impact more meaningfully on medical education at the CMUL.

Table 4.16: Effects of funding on expected outcomes at CMUL

	Strongly Agree (SA)	**Agree (A)**	**Undecided (U)**	**Disagree (D)**	**Strongly Disagree (SD)**	**TOTAL**
Funding has been adequate to meet the needs of CMUL	49 (12.2%)	42 (10.5%)	72 (18.0%)	136 (33.9%)	102 (25.4%)	401 (100%)

Source: Research field survey, 2017

Interestingly, the responses detailed in Table 4.16 show that most of the respondents, 59.3%, disagree that funding had been adequate to meet the needs of the CMUL, while 22.7% of them agree, and 18% were undecided. The implication of these responses is that funding did not positively affect the expected output and service delivery of the institution. While these responses have been revealing, a robust conclusion could not be reached with the use of only frequency and percentage analysis of responses without performing formal tests through testing of stated hypotheses. This concern is addressed in the next section of the analysis, involving significant testing of these identified questions aimed at the second research objective.

4.5.3 Significance testing and interpretation of findings

This section analysed the responses elicited through the structured questionnaire. All the research questions from which the research hypotheses were drawn have been analysed and tested using the Data Envelopment Analysis (DEA) and the multivariate regression analysis forthwith. In this section, however, the responses elicited from the structured questionnaire were tested through the use of analytical tool of chi-square test statistics. In tandem with one of these responses, the T-test statistical tool was also employed to test the significance of improved funding on teaching and learning of medical education at the CMUL.

Table 4.17: Chi-Square Table -The medical school allocates the resources dedicated for curriculum equitably to meet the educational needs (equit_educ_needs).

	Observed N	Expected N	Residual
Strongly Agreed	53	80.2	-27.2
Agreed	89	80.2	8.8
Undecided	129	80.2	48.8
Disagreed	79	80.2	-1.2
Strongly Disagreed	51	80.2	-29.2
Total	401		

Source: Research field survey, 2017.

On the basis of equally likelihood probability, the expected frequency of 80.2 is ascribed to each of the response scale of Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD). The observed frequencies show that departures from the expected exist. It is not expected that a residual (departure) of 48.8 would exist for those undecided, 29.2 for those strongly disagreed and 27.2 for those that strongly agreed. Of all, only those that disagreed were close to expectation, with only a negligible -1.2 residual closely followed by those that agreed, by a departure (or residual) of 8.8.

Table 4.18: Chi-Square Test Statistics - The medical school allocates the resources dedicated for curriculum equitably to meet the educational needs (equit_educ_needs)

	equit_educ_needs
Chi-Square(a)	50.534
Df	4
Asymp. Sig.	.000

Putting these together, the chi-square statistical value for the null hypothesis of an equal observed and expected frequencies were obtained and tabulated in Table 4.18. The chi-square test statistics shows the rejection of this hypothesis with asymptotically significant probability value of 0.000. This suggests that the observed frequencies are significantly different from their expected counterparts. This implies that the medical school did not allocate the resources dedicated for curriculum equitably to meet the educational needs. The rejection of this hypothesis indicates that the medical school did not allocate the resources dedicated for curriculum to equitably meet the teaching and learning needs of the medical institution. As such, adequate institutional frameworks and appropriate budgetary allocation should be practiced in order to obtain the best outcomes for the medical institution.

Also, the use of the chi-square test was employed to investigate if the medical school operates a dedicated budget specifically for curriculum activities (i.e. learning). The chi-square test was done with the null hypothesis that budgeting structure has no significant effect on learning at the CMUL. The deviation from the expectation was substantial for those undecided, with 65.8 residual, followed by the respondents that strongly disagree with -34.2 residual while those that strongly agree have a deviation from expectation to the tune of -27.2 residual. The one that appeared least deviated was the responses of those that agree with 13.8 residual, followed by those that disagree with -18.2 residual (Table 4.19).

Table 4.19: Chi-Square Table – The medical school operates a dedicated budget specifically for curriculum activities (ded_budgt_curr)

	Observed N	Expected N	Residual
Strongly Agreed	53	80.2	-27.2
Agreed	94	80.2	13.8
Undecided	146	80.2	65.8
Disagreed	62	80.2	-18.2
Strongly Disagreed	46	80.2	-34.2
Total	401		

Source: Research field survey, 2017

As evidence, the chi-square test-statistics of 84.3 significantly rejects the null hypothesis that the medical school did operate a dedicated budget specifically for curriculum activities (Table 4.20). As such, it could be inferred from this statistic that budgeting structure would have a significant effect on learning in the CMUL. This finding further reinforced the results obtained from the first elicited responses analysed above that budgeting would significantly impact on teaching and learning of medical education if budgetary allocation and institutional frameworks were put in place.

Table 4.20: Chi-Square Test Statistics - The medical school operates a dedicated budget specifically for curriculum activities (ded_budgt_curr)

	ded_budgt_curr
Chi-Square(a)	84.299
Df	4
Asymp. Sig.	.000

Furthermore, the significance testing between funding and teaching in medical education in Nigeria is essential. In this significance testing, the study examined if funding had been adequate to meet the needs of CMUL (Table 4.21).

Table 4.21: Chi-Square Table - Funding has been adequate to meet the needs of CMUL (adeq_fundg).

	Observed N	Expected N	Residual
Strongly Agreed	49	80.2	-31.2
Agreed	42	80.2	-38.2
Undecided	72	80.2	-8.2
Disagreed	136	80.2	55.8
Strongly Disagreed	102	80.2	21.8
Total	401		

Source: Research field survey, 2017.

Interestingly, these responses suggest significant proportions of the deviations between the observed and the expected responses were skewed more to those that disagree that funding had not been adequate to meeting the needs of CMUL. While 80.2 was expected on an equally likelihood probability, the responses obtained suggest that most respondents were more than the expected number, while those who were either supposed to agree or strongly agree fell short of the expected number of 80.2 responses. The negative skewness on the part of those who were to either agree or strongly agree, coupled with the positive skewness on the part of those who were either supposed to disagree or strongly disagree, produced chi-square test statistics presented in Table 4.22.

Table 4.22: Chi-Square Test Statistics - Funding has been adequate to meet the needs of CMUL (adeq_fundg)

	adeq_fundg
Chi-Square(a)	75.920
Df	4
Asymp. Sig.	.000

The chi-square test statistics of 75.92 show a significant difference between the expected and observed frequencies with an asymptotic significant probability value of 0.000. The implication is that funding has not been adequate to meeting the needs of CMUL. This is due to the fact that the null hypothesis that funding has been adequate to meet the needs of the CMUL has been rejected at the 5 percent level of significance.

Similarly, the significance testing between funding and learning in medical education in Nigeria is also of importance. To test this hypothesis, the study asked if scholarship schemes were available for award to deserving students of CMUL (Table 4.23).

Table 4.23: Chi-Square Table - Scholarships schemes are available for award to deserving students (avail_schlar_schem).

	Observed N	**Expected N**	**Residual**
Strongly Agreed	83	80.2	2.8
Agreed	129	80.2	48.8
Undecided	65	80.2	-15.2
Disagreed	79	80.2	-1.2
Strongly Disagreed	45	80.2	-35.2
Total	**401**		

Source: Research field survey, 2017.

On the question of whether the scholarship schemes were available for award to deserving students of the college, -36.4 deviations of the observed from the expected was noticed from the respondents that disagree and strongly disagree with such submission. Deviation as indicated by the residual of the observed from the expected frequencies of those that agree and strongly agree is about 51.6 residual, while those indifferent recorded -15.2 residual. To ascertain these deviations from the observed and expected responses, the chi-square test statistics was conducted to provide a better indicator for significance testing (Table 4.24).

Table 4.24: Chi-Square Test Statistics - Scholarships schemes are available for award to deserving students (avail_schlar_schem)

	avail_schlar_schem
Chi-Square(a)	48.140
Df	4
Asymp. Sig.	.000

The chi-square test statistics of 48.14 has asymptotic probability value of 0.000. This significance suggests a rejection of the hypothesis that scholarship schemes were available for award to deserving students of CMUL. By implication, it could be inferred that funding structure would have a significant effect on learning in the CMUL, if available. To evaluate the first four hypotheses, a T-test was conducted to compare significance tests between budgeting and funding in ascertaining which matter more to teaching and learning of medical education at the CMUL.

Finally, the significant relationship between improved funding and service delivery in medical education in Nigeria is also investigated. In this significance testing, the researcher took cognisance of group statistics and independent sample T-test responses elicited from the respondents. This was done by considering some service delivery variables, such as teaching and medical education generally as independent variables against funding as a dependent variable.

Table 4.25: Independent Samples T-test

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
equit_educ_needs	Equal variances assumed	15.440	.000	-25.878	120	.000	-2.21707	.08567	-2.38670	-2.04744
	Equal variances not assumed			-25.288	98.306	.000	-2.21707	.08767	-2.39104	-2.04309
ded_budgt_curr	Equal variances assumed	66.833	.000	-27.193	120	.000	-1.78569	.06567	-1.91571	-1.65568
	Equal variances not assumed			-30.370	103.232	.000	-1.78569	.05880	-1.90230	-1.66909
adeq_fundg:	Equal variances assumed	296.717	.000	-41.202	120	.000	-2.69014	.06529	-2.81941	-2.56087
	Equal variances not assumed			-48.671	70.000	.000	-2.69014	.05527	-2.80038	-2.57991

As shown in Table 4.25, the Levene's test for equality of variances indicates that the equality of variances assumed can be rejected at the 5% level of significance for the responses of all the variables of interest. Meanwhile, the responses from the variable that funding has been adequate to meeting the needs of CMUL, have the highest variance; the highest deviation from the expected. This is closely followed by the responses that the medical school operates a dedicated budget specifically for curriculum activities, but least varied from the expected was the responses that medical school allocates resources dedicated to curriculum equitably to meet the educational needs. The implication is that funding has been the least significant as well as relevant to the service delivery of medical education in CMUL at the moment, while the budget and budgeting structure are lesser and less relevant, respectively, in meeting the service delivery of CMUL. In conclusion, the large variance under funding suggests that the variations from expected can be significantly reduced in order to make funding an important component of efficient service delivery of medical education in Nigeria. Putting it differently, this would imply that more funding would be required for efficient service delivery of medical education. This would be robust to the extent that the deviation of funding moves closer to the expected.

Also, the T-test for the Equality of Means, under the assumptions of equal and unequal variances, reinforced the findings that funding is considered less equal to expectation in impacting on teaching and learning at the CMUL, while budget and budgeting structure followed in successive order. This is evident with the T-statistics values of -41.2 and -48.7 under equal and unequal variances for funding and -27.2 and -30.4 for the simultaneous impact expectations of budgeting and -25.9 and -25.3 for budgeting structure, respectively.

Research Question Three: To what extent has more funding requirements been suggested for public medical education in Nigeria.

In order to address this research question, it is required that an impact analysis of how budget and funding affect public medical education in Nigeria is conducted. To begin with, data stationarity tests are conducted to provide the direction for the appropriateness of techniques adopted.

4.6 Estimations of multivariate models

4.6.1 Unit-root estimations

As argued by Bahmani-Oskooee and Nasir (2009), the first step in any cointegration technique is to determine the degree of integration of each variable in the model. As such, the researcher subjected the variables included in the model to stationarity test so as to ascertain the time-series characteristics of the data and also concomitantly provide evidence for the use of Autoregressive Distributed Lag (ARDL) technique of analysis. As posited by Pesaran et al., (2001), ARDL is more suitable for variables at different order of integration while the Engle-Granger Cointegration technique is suitable for series with same or uniform integration order.

The result for the stationarity test is given by the unit root ADF test below.

Table 4.26: Unit-Root using Augmented Dickey Fuller (ADF) test

Variables	**Augmented Dickey Fuller (ADF) Series**		**H_o: I(1)**
	At Levels	**At Order 1**	**Order of Integration**
$funding$	-0.4182	-4.6198*	I(1)
$\log(budget)$	-1.3667	-4.5404*	I(1)
$\log(sch\_fees)$	-1.1771	-5.9218*	I(1)
$\log(other\_internal)$	-1.3392	-5.0542*	I(1)
$undergrad$	-0.3854	-8.4211*	I(1)
$postgrad$	-3.3197**	-	I(0)
$politrisk$	-2.4293	-6.5865*	I(1)
gov_gdp	-1.1158	-7.7337*	I(1)

Mackinnon critical values: at levels: 1%: -3.738; 5%: -2.9919; 10%: -2.6355
at order 1: 1%: -3.753; 5%: -2.9980; 10%: -2.6390

Note: *, **, *** denote significance at 1%, 5% and 10% levels respectively

Evidence from Table 4.26 shows that the test of stationarity is mixed among the variables to be included in the model. While one variable (*postgrad*) is without unit-root; that is, stationary at levels – I(0), the remaining seven variables are integrated at an order one, I(1), before they could become stationary. Both measures of fund utilisation (funding) and budget have to be integrated at order one before they could be stationary. Also, the number of undergraduates graduated, (proxied as *undergrad*) alongside the extent of government involvement (proxied as *gov_gdp*) with internal sources of funding such as school fees (proxied as *sch_fees*) and other internally generated revenue (proxied as *other_internal*) and the degree of political risk (proxied as *politrisk*) were also integrated at order one; I(1), before they could become stationary.

It is only the data for the number of postgraduate students graduated that could be employed for analysis without resulting in any spurious regression. The fact that those series differenced at an integration of higher order, I(1), would be used under the same modeling framework with non-unit-root series, I(0), lend credence to the use of the Autoregressive Distributed Lag (ARDL) model. As posited by Pesaran, the Engle-Granger Cointegration is found suitable for series of the same integration order while the ARDL model can be used to obtain the long-run equilibrium condition of variables irrespective of the differences in the order of integration.

4.6.2 Granger causality estimates

Having justified the use of Autoregressive Distributed Lag (ARDL) through the time series characteristics obtained about the variables to be included in the model, the use of Augmented Dickey Fuller (ADF) unit-root test is then employed in the research to ascertain which of these variables Granger-causes the other. In other words, the research establishes from which of the variables do impact analysis emanate. The study adopted the Granger (1969) due to its simplicity and also because it is less costly in terms of degrees of freedom (Charemza and Deadman, 1997). In doing this also, the study observes two lag periods as the maximum lag length adequate for the study; as informed by the optimum lag length chosen (Table 4.27).

Table 4.27: Granger causality results

Null hypotheses	**Lag period of 2**	
	F-statistics ratio	**Probability values**
Budget does not Granger cause Funding	0.7228	0.4990
Funding does not Granger cause Budget	26.584*	0.000004
Gov_gdp does not Granger cause Funding	10.133*	0.0011
Funding does not Granger cause gov_gdp	1.445	0.2618
Sch_fees does not Granger cause Funding	0.4384	0.6518
Funding does not Granger cause Sch_fees	9.7528*	0.0014
Other_internal does not Granger cause Funding	1.7335	0.2049
Funding does not Granger cause Other_internal	21.0503*	0.00002
Undergrad does not Granger cause Funding	0.2289	0.7981
Funding does not Granger cause Undergrad	6.9181*	0.0074
Postgrad does not Granger cause Funding	0.5178	0.6096
Funding does not Granger cause Postgrad	2.6752	0.113
Politrisk does not Granger cause Funding	1.5211	0.2468
Funding does not Granger cause Politrisk	0.1316	0.8776

Source: E-views output

The granger causality test tabulated in Table 4.27 is highly instructive. The null hypothesis that funding does not granger cause budget is rejected; even at the 1% level of significance with F-statistics ratio of 26.584 and a negligible probability value of 0.000004. However, the reversed null hypothesis that budget does not granger cause funding cannot be rejected even at the 10 percent level as it has F-statistics ratio of 0.7228 and probability value of 0.4990. The implication from the foregoing is that government expenditure on medical education is not exegenously determined as the amount of fund available to government usually determines how much to be budgeted on medical education. This suggests that, irrespective of the various stipulations such as the UNESCO requirement of 26% of national budget on education, the government follows the negotiated funding model in determining how much to release to public tertiary institutions and their medical schools, such as CMUL. This contrasts sharply with the findings obtained in the study of Adam (2020). One of the recommendations provided in the study was that institutions of higher learning must embark on a structural change or paradigm shift to performance-based funding.

Besides, the degree of involvement of government in academic institutions; including medical schools usually determines the amount of funding made available for their smooth running. The null hypothesis that gov_gdp, an indicator for government involvement does not granger cause funding is rejected at the 1 percent level with F-statistics ratio 10.133 and probability value of 0.0011. The reversed null hypothesis cannot be rejected even at the 10% level. Perhaps, this could be an insight into the political factors that play out during the funding exercise. Otherwise, it could imply that institutions whose management seek to be independent are not likely to be favoured for fund allocation as against those institutions that allow government free interference into their activities. Also, the need for funding necessitates the amount to be charged as school fees for undergraduate and postgraduate students. The null hypothesis that funding does not granger cause school fees is rejected with highly significant probability value of 0.0014 and F-statistics ratio of 9.7528. This indicates that if medical institutions are not provided enough funds, there is bound to be increment in school fees. This could lead to increase in student unrest as this increment is bound to be met with reactions from the students by disturbing campus peace through protests and even sometimes vandalisation of school property. More so, the amount of other funding sources necessitated by the funding requirements of the institution. This is theoretically plausible as the institutions would be spurred to becoming creative in exploiting its resources to the fullest. This will create relative financial autonomy for the institution.

Nevertheless, the availability of fund also determines the number of undergraduate students graduated. The null hypothesis that funding does not granger cause undergraduate is rejected at the 1% level with highly significant probability value of 0.0074 and F-statistics ratio of 6.9181. However, the same cannot be said of the number of postgraduate students graduated. This is highly intuitive as it suggests that the perception of medical education in Nigeria is considered the role of government; only at the level of first degree. This indicates that institutional resources diverted to medical education at the postgraduate level should be withdrawn so as to make that of the undergraduate level more efficient. In terms of political risk, it is evident that the funding requirement is not affected by political factors. The implication here is that the political affairs is not allowed to meddle with medical education in Nigeria. This is highly commendable and suggests that the medical institution, in particular and the academic institution in general are still in tune with credibility and devoid of political bickering from the political class and political office holders.

4.6.3 ARDL long-run equilibrium estimates

The F-statistics ratio of 4.49 indicates that long-run equilibrium condition exists among the variables included in the specified model; particularly funding and budget of medical education. The implication is that long-run convergence exists for the specified funding model. This is so in that the critical values for the upper bound, I (1), at the 10%, 5% and 2.5% levels with 3.35, 3.79 and 4.18 values respectively are all lesser than the F-statistics ratio of 4.49 (Table 4.28). This suggests that the decision criteria for equilibrium condition are met (Pesaran et al, 2001).

Table 4.28: Funding and budget on public medical education in Nigeria

Computed F-statistics		4.49***	
Bound Testing Critical Values		I(0)	I(1)
	10%	2.26	3.35
	5%	2.62	3.79
	2.5%	2.96	4.18
	1%	3.41	4.68

Source: Pesaran et al, (2001) ***denotes rejecting the null hypothesis of no cointegration at 2.5% level.

4.6.4 Estimates of ARDL long-run impact analysis

As tabulated in Table 4.29, only budget (denoted as $D(\log(budget))$, school fees (denoted as $D(\log(sch\_fees))$ and other internally generated revenue (denoted as $D(\log(other\_internal))$ significantly impact on the funding of medical education at the CMUL. While both school fees and internally generated revenue are negatively related, budget is positively related. This suggests that an increase in budgetary allocation increases the funding towards teaching and learning at the CMUL. On the other hand, increased school fees and other internally generated revenue reduce funding from government expenditure devoted to medical education in the country. This is plausible as the government has long indicated that no charges should be made on public education in the country at undergraduate level and any opportunity to charge and increase school fees would suggest autonomy to public academic institutions to freely charge fees considered appropriate for its day-to-day running of medical education by the institutions.

Table 4.29: Estimates for ARDL long-run impact

Long-run impact estimates			
Variable	**Coefficient**	**T-Stat**	**Prob.**
c	0.1255	2.7006	0.027
$D(\log(budget))$	1.8372	3.3426	0.010
$D(\log(sch\_fees))$	-0.717	-2.764	0.025
$D(\log(other\_internal))$	-0.7005	-2.642	0.030
$D(\log(undergrad))$	0.0929	0.8332	0.429
$D(\log(postgrad))$	-0.3448	-1.944	0.088
$D(\log(politrisk))$	-0.1478	-0.256	0.804
$D(\log(gov\_gdp))$	-0.1942	-0.822	0.435

Source: E-views output. Note: dependent variable is funding

In the same vein, the number of postgraduate students graduated (denoted as $D(\log(postgrad))$, the level of political risk (denoted as $D(\log(politrisk))$ in the country and the depth as well as the degree of government involvement (denoted as $D(\log(gov\_gdp))$ are all negatively related to funding of medical education at the CMUL; albeit insignificantly. This also shows that increases in these variables negatively affect funding towards medical education in the country. These are theoretical plausibilities as it is expected that political risk endangers funding opportunities and government's involvement would not assist in nurturing innovative ideas and inventions towards better funding ideas.

4.6.5 Short-run dynamics of budget and funding of public medical education in Nigeria

Estimates from the short-run dynamics further reinforce those obtained under the long-run but with some contrasting results.

The error correction term (ect) is properly signed with -0.966 and highly significant at 0.008 probability value. The implication is that the recovery of funding to the CMUL when affected by economic shock is almost at .97 percent. This suggests that it will take barely a year for the funding to CMUL to return to equilibrium once affected by economic shock. The current level of budget on funding has 2.246 coefficient and 0.028 probability value. This shows that budget positively and significantly impacts on funding of the CMUL. The amount of school fees and other internally generated revenue has a negative short run impact on funding with -0.946 and -1.169 coefficients and 0.041 and 0.033 probability values respectively. This shows that the higher the amount of school fees and other IGR, the lower the funding to CMUL in the short run period (Table 4.30). The fact that the school fees cannot continually be on the increase because it is expected, in accordance with extant legal provisions, that medical education is made tuition-free in Nigeria. Hence, the government must consider all other sources of internally generated revenue apart from tuition in financing medical education at all public higher institutions in the country. As submitted in the study by Broome et al (2017), non-tuition fee is the new normal for funding of medical institutions. However, it contradicts the findings obtained in the studies of Shaheed et. al. (2010), Kempes and Pohl (2010) and Wooliscroft (2020) that opined that the potency of government financing on the growth of sustainability of medical institutions but not without lending support to internal interventions in reducing the negative effects.

In tandem with the long run estimates, the number of undergraduates and postgraduates graduated together with political risk and level of government effectiveness do not impact on funding of CMUL. The only exception is that of the current level of government effectiveness and three-period lagged political risk with 0.036 and 0.043 probability values respectively.

However, the three-period political risk impacts negatively with -2.598 coefficient while the current level of government effectiveness impacts positively with 0.226 coefficient on funding. This suggests that previous years' political risk negatively affect funding while current level of government effectiveness positively affects funding of CMUL respectively. The implication is that it takes time for political risks to endanger the level of public financing of medical education in the country.

Table 4.30: Estimates for ARDL-ECM short-run dynamics

Short-run impact estimates			
Variable	**Coefficient**	**T-Stat**	**Prob.**
c	0.1242	1.815	0.144
$ect(-1)$	-0.966	-4.908	0.008
$D(\log(budget))$	2.246	3.377	0.028
$D(\log(budget(-1)))$	0.384	1.545	0.197
$D(\log(sch\_fees))$	-0.942	-2.968	0.041
$D(\log(sch\_fees(-1)))$	-0.323	-2.889	0.045
$D(\log(other\_igr))$	-1.169	-3.211	0.033
$D(\log(undergrad))$	0.0003	0.541	0.617
$D(\log(postgrad))$	-0.0007	-0.540	0.618
$D(\log(politrisk))$	1.514	1.961	0.121
$D(\log(politrisk(-2)))$	-1.335	-1.272	0.272
$D(\log(politrisk(-3)))$	-2.598	2.922	0.043
$D(\log(gov\_gdp))$	0.226	3.117	0.036
$D(log(gov\_gdp(-1)))$	-0.133	-1.758	0.154
R^2	0.95		
$Adj.R^2$	0.80		
DW_Ratio	1.67		
$F-Ratio$	6.345		
$\Pr ob.(F-Ratio)$	0.044		

Source: E-views output. Note: dependent variable is funding

The fitness as well as the appropriateness of the model is confirmed through the Durbin-Watson (DW) statistics and the Fisher ratio (F-ratio); both at the 5 percent level of significance. The DW ratio suggests that there is no first-order serial correlation in the specified model while the F-ratio implies that the model does not suffer from specification error. The adjusted coefficient of determination indicates that the important variables that could explain the movement in the funding of medical education at the CMUL are included in the model.

Research Question 4: What roles do institutional factors play on budgeting and funding of public medical education in Nigeria

Although the role of institution has been explained within the estimated models but as a stand-alone objective, it still requires careful discussion. As such, extracts from the estimated models were detailed in Table 4.31 below in order to properly document the roles played by institutional factors on budgeting and funding towards public medical education in Nigeria. Essentially, the extracts from the granger causality test (Panel 1), the ARDL long-run estimates (Panel 2) and the short-run impact estimates (Panel 3) were considered crucial for this purpose.

Table 4.31: Estimates to account for roles of institution

Panel 1: Granger causality test (Extract from Table 4.27)			
Politrisk does not Granger cause Funding		1.5211	0.2468
Funding does not Granger cause Politrisk		0.1316	0.8776
Panel 2: ARDL Long-run Impact (Extract from Table 4.29)			
Variable	**Coefficient**	**T-Stat**	**Prob.**
$D(\log(politrisk))$	-0.1478	-0.256	0.804
Panel 3: Short-run Impact Estimates (Extract from Table 4.30)			
Variable	**Coefficient**	**T-Stat**	**Prob.**
$D(\log(politrisk))$	1.514	1.961	0.121
$D(\log(politrisk(-2)))$	-1.335	-1.272	0.272
$D(\log(politrisk(-3)))$	-2.598	2.922	0.043

Source: Extracts from estimates. Note: dependent variable for the estimated models in Panel 2 and 3 is funding

The extract from the granger causality test suggests that the null hypothesis that political risk does not granger cause funding cannot be rejected at the 5% level of significance. The reverse causality hypothesis that funding does not granger cause political risk cannot also be rejected at the 5% level of significance. By implication, it is evident that funding of public medical education in Nigeria has not been affected by institutional as well as political factors. This conclusion is further re-inforced by both the long-run and short-run impact analysis. The estimates from the long-run impact suggest that political risk negatively impacts on funding of medical education in Nigeria; albeit insignificantly with 0.256 T-statistic value and 0.804 probability value. Also, the estimates of the short-run impact analysis suggest that only three (3) years lag effects of political risk have impact on the funding of medical education in Nigeria at the 5% significance level. The conclusion therefore, is that political risk does not have a significant impact on funding of medical education in Nigeria in the long-run situation and that its impact in the short-run situation only becomes significant after a 3-year duration.

4.6.6 Diagnostic tests and robustness checks

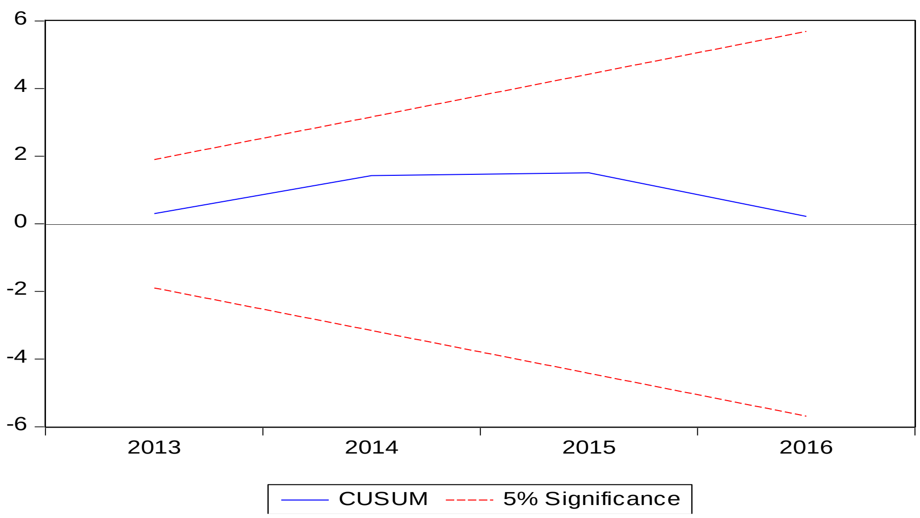
In terms of diagnostics, the null hypotheses for these tests are that there is absence of autoregressive conditional heteroscedasticity – for the ARCH test; the residuals are serially uncorrelated – for the Breusch-Godfrey test; the model does not suffer from functional specification bias – for the Ramsey RESET test and that the residual is normally distributed – for the Jarcque-Bera test.

Table 4.32: Diagnostic Results

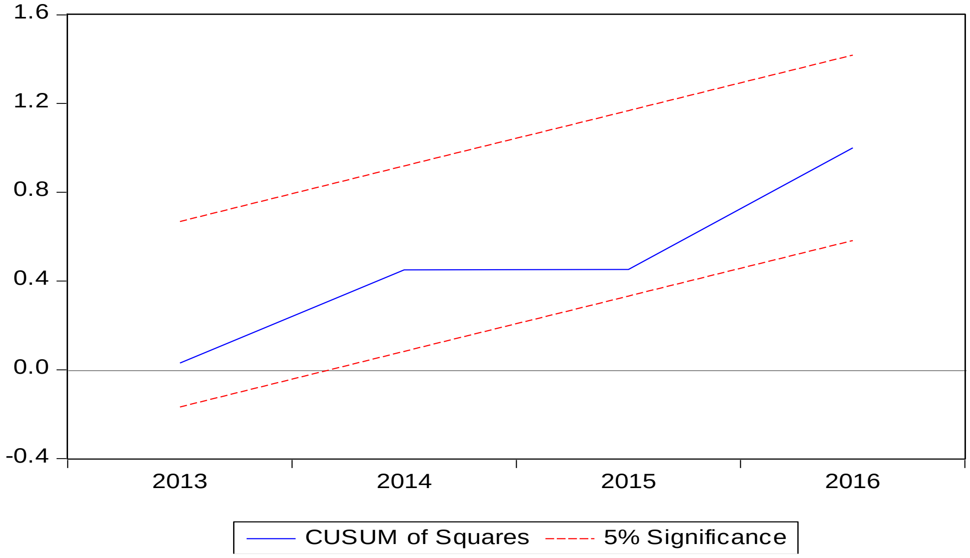
S/N	Test Statistics	Model1:Market-based Measure	Model 2: Legal/Policy Index
1	χ^2_{ARCH}	0.0478 (0.973)	1.3484 (0.502)
2	χ^2_{SERIAL}	3.1127 (0.079)	2.1718 (0.153)
3	χ^2_{RESET}	0.1139 (0.386)	2.7514 (0.115)
4	χ^2_{NORMAL}	0.0943 (0.750)	1.7713 (0.412)

Source: E-views output. Note: Figures in parentheses are the probabilities of significance

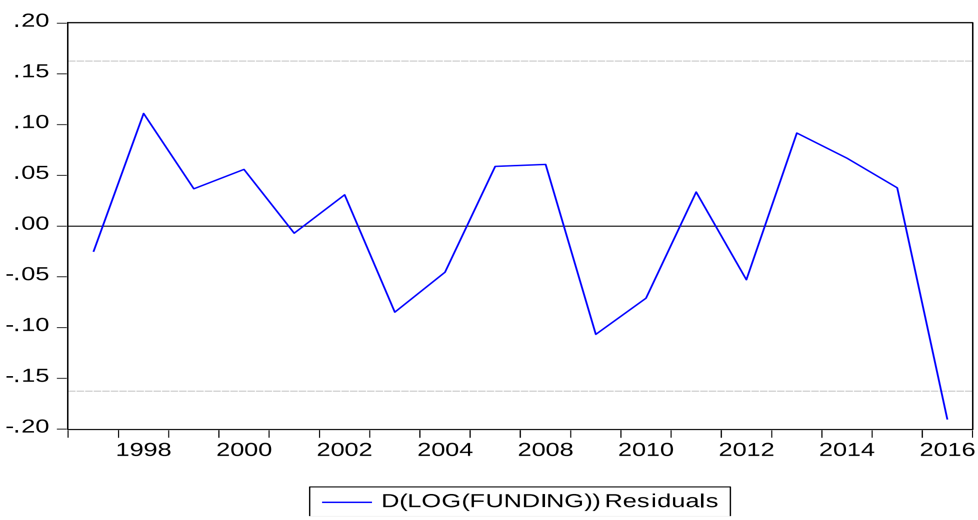
In line with these null hypotheses, these estimates suggest that they should all be accepted at least at the 5% significance level since the probability values for these tests are all above 0.05.



The diagnostic tests confirm the overall goodness of fit of the model and further reinforces the stability tests depicted in the CUSUM and CUSUM squared graphs coupled with the residual graph below. As indicated, the model is stable with a 5% confidence interval and, hence, reinforces the reliability of the estimates obtained from the models specified.



The stability of the residual suggests that there is no problem of second order correlation and the explanatory variables were truly independent and that no correlation between these variables and the white noise error term. The correlation between the explanatory variable and the white noise error term could be as a result of simultaneity, omission of important explanatory variable or/and measurement error. On the whole, this residual graph depicts that the model does not suffer from either of specification and/or measurement errors.



Chapter five Discussion of findings

5.1 Introduction

The discussion of findings for this study largely hinges on two anchors. The first is to consider the efficiency of funds utilisation in teaching and learning in public medical institutions in Nigeria. The second focuses on the impact of budgeting and funding on public medical education in Nigeria. Also, the role of institution as well as political factors will be fully discussed in tandem with estimates obtained in the previous sections. For developing economy such as Nigeria, the role played by institutional factors in the financial performance of institutions cannot be over-emphasised. Institutional and political risk factors have been considered as important factors affecting all spheres of business and economic activities in developing economies. This is so in that economic choices cannot be completely divorced from political affiliations of the stakeholders. While an extensive literature exists about the significant role of sound institutional frameworks, its impact on public medical education has not been well researched. The medical education and, by extension, academic institutions of learning, is only an integral part of the Nigerian society. Efforts were made to assess the impact of political risks on medical education in Nigeria just like how the same effect is measured on business and other economic activities in the larger society. Evidence obtained from this study only ascribed importance to political risks after a three-year period. This suggests that the damaging effects of political risks on medical education in Nigeria cannot be considered negligible. Rather, its effects are felt after a 3-year lag.

Moreover, the long-run and short-run impact analysis through the use of the ARDL Bound-Testing approach and the ARDL-ECM re-parameterised model respectively suggest that the school fees and other internally generated revenues impact significantly negatively to funding of medical education on the long-run in Nigeria. These estimates are strongly instructive in that it suggests that increase in school fees becomes the substitute for public funding of medical education in Nigeria. If the government allows introduction and increase in school fees, this will further worsen the level of literacy in the country and will affect the general welfare and the future income streams of the citizenry. This is because government is still the largest employer of labour in Nigeria with a very low income level. This is further precipitated by the high level of unemployment in the country. However, budget is the only variable that positively significantly affects funding of medical education in Nigeria on the long-run. This suggests that the funding of medical education is largely borne by the government through its annual budget. These conclusions conform to the estimates obtained for the short-run situation too. The only exception is that government intervention has a short-run positive impact on funding of medical education. This largely agrees with the position that government intervention creates distortions to the natural working of the economy. This is more evident as government intervention leads to a negative impact on the funding of medical education in Nigeria in the long-run situation. A clear import of these estimates is that as much as government funding of medical education in Nigeria is desirable, its wholesale interventions in the operationalisation of medical education in Nigeria is detrimental to its long-run success and effectiveness.

Besides, this chapter also discusses the findings of this study in relation to related researches with respect to the efficiency of funds utilisation on teaching and learning in medical institutions. The literature on the budgeting and funding for educational purposes has been populated with divergent opinions. Although, education is generally accepted to be a merit good, the main concern has been how to identify at what level the state should be involved in its funding. Arguments have been canvassed for full government participation in funding of medical and tertiary education; partial funding and no funding as in the case of private tertiary institutions. The popular opinion has been dichotomised. There are scholars who posited that the budgeting and funding for educational purposes should be left entirely in the hands of government, since education is a public good, non-excludable and non-rivalry. The other category argued that government's involvement should only be limited to the extent to which individuals will attain literacy. This is considered as the Universal Basic Education (UBE) level, and consequently, education at the higher level should be an economic decision to be made by individuals.

The proponents of education funding by government are of the opinion that education is a consumption service, while the adherents of non-funding of education at the tertiary level opine that education is an investment. The incontrovertible submission from both ends of the divide is that funding of education improves the literacy level of the populace and engenders a sound and progressive environment. Arising from the foregoing, budgeting and funding for education remain aspects of the cardinal objectives of every government of developing economies, including Nigeria. The motive is to improve the literacy level and bridge the widening gap between the rich and the poor, as education is generally regarded as a major tool that provides equal opportunities to all citizens to contribute towards the GDP regardless of their socioeconomic background.

Predicated on the foregoing, successive governments have seen the need to pay attention to funding education but have been handicapped by economic realities and the continued pressure on budgetary allocations exacerbated by political exigencies. While the debate on whether education is a consumption or an investment good still rages, funding of medical education has been identified as one area that should not be allowed to decline, irrespective of the availability or otherwise of funding from government perspective. The reasons are quite apparent, given that the proper teaching of medical education has a multiplier effect of correcting social and economic challenges facing the country. Proper funding of medical education produces sound medical personnel, which facilitates reduction in social problems like diseases and illnesses; which in turn bring about increase in life expectancy of the citizens. This creates additional working years which improve the productive base of the economy and the general welfare of the people through citizens' contributions. Hence, the need for adequate budgeting and funding of medical education cannot be overemphasised. This thesis examined the need for budgeting and funding in the efficient service delivery of medical education in Nigeria. Historically, budgeting and funding for medical education is imperative, but to what extent that will guarantee the efficient delivery of quality services of medical education is an issue that remains the main empirical question to be addressed in this study.

To accomplish this task, sufficient conceptual clarifications were provided on the major terminologies, such as budgeting, funding, productivity and efficiency, with various literature reviews on the two concepts provided. In this light, various models of budgeting and funding were reviewed, such as the incremental budgeting, zero-base budgeting, responsibility-centred budgeting, accrual budgeting, incentive-based budgeting, performance-based budgeting and programme-based budgeting. Also, funding models such as the activity-based, access-equity-cost-sharing, contextualised formula and the pay-for-performance models were highlighted.

5.2 Findings

The budgeting method used by all federal universities and medical schools in Nigeria, including CMUL, is normative/incremental budgeting method. Federal Government also makes irregular interventions to the universities and medical schools, especially on provision of academic buildings and equipment infrastructure through contractual funding model. Incremental budgeting and funding models assume budget provisions of previous years were adequate to execute the activities of the current year and merely add a marginal percentage increase to cover for inflation. This assumption is flawed in major respects, mainly due to steep increases in the number of students admitted yearly into the medical schools and the need to adequately provide for their training needs in terms of teaching consumables, laboratory equipment, hostel accommodation and lecture theatres. The budgeting and funding methods in use in CMUL have not been adequate in providing the needed financial resources for the services rendered. Various budgeting methods have been developed by scholars, which provide remarkable improvements to incremental budgeting method. Zero-base budgeting method, for instance, considers each budget unit in terms of costs and benefits before it is incorporated in the annual budget document. Priority rank is then allocated to budget item (Lasher and Green, 2001). Responsibility-centred budgeting method also, has been embraced by educational institutions as academic units are granted academic authority and fiscal responsibility (Linn, 2007). Academic units and support units were allowed to measure their level of contributions of funding through tuition fees, endowments, gifts and grants. Any revenue shortfall will bring about a scaling back of expenditures to ensure a production of a balanced budget (Lasher and Green, 2001).

A review of theoretical literature on public expenditure was also undertaken in the study. This included Wagner's, Wiseman-Peacock, Classical, Keynesian, human capital theory and negotiated funding model respectively. The theories of productivity and efficiency reviewed were the production function, production-based, product-oriented, economic utility, financial ratios and surrogate models. The review of empirical literature was discussed tripartite, entailing empirical literature in developed economies, developing as well as emerging economies and country-specific review with particular reference to the Nigerian economy, where the various sources of funding available to the university system were also discussed.

In addition, empirical evidences from previous literature which were reviewed in the previous sub-sections of this study, can generally be grouped into three strands as stated below:

1. The first group relates to those that posited that education is both public and private good and, as such, its funding should be based on cost-sharing as well as public subsidy basis (Adeniyi and Taiwo, 2011; Shaheed et al., 2010; Kallison and Cohen, 2009; Johnstone, 2007; Jones-Esan, 2007; Sanyal and Martins, 2006; Young and Coffman, 1998).
2. The second category supports education being classified as purely a public good and should then be fully funded by the government (Postglione, 2011).
3. The third strand opines that the shrinking finances of the government should necessitate granting financial autonomy to medical institutions in terms of raising adequate financial resources for proper conduct of their academic programmes (McCarthy, 2012; Harrington and Califf, 2010; Just and Huffman, 2009; Tammi, 2009; Bevc and Ursi, 2008; Rusell, 2008; Usher and Cervenan, 2005).

Despite this evidence-mix, it is clear that the trend in developing as well as emerging and the country-specific studies of Nigeria, holds the popular view that the government should largely finance medical education (Banya and Elu, 2001; Johnstone et al., 1998; Ziderman and Albrecht, 1995). The popular view of studies from the developed economies is that of cost-sharing or public subsidy form, since the submission is that higher education produces social capital and yields private benefits to the individuals (Bevc and Ursi, 2008).

Students at federal universities and medical schools in Nigeria do not pay tuition fees at undergraduate levels but are only permitted to pay minimal obligatory charges. Education is generally considered as the greatest form of investment in human resources. It elevates the learners' intellect, improves their quality of life as well as individuals' skills and efficiency in the production process (Machlup, 1982). Provision of qualitative education requires massive funding. According to Usher and Cervenan (2005), payment of tuition fees by students has been found in Canada not to have debarred students from having access to higher education. In Australia, Stokes and Wright (2008) found out that participation in higher education across all social groups increased when contributory scheme of funding education was introduced. This implies that institutions could in fact charge appropriate fees that would promote the delivery of their educational services to the students. Over the years, the federal government of Nigeria has been unable to meet the budget requirements of tertiary institutions and their medical schools in full on a yearly basis and this trend constitutes a major challenge faced by these institutions. Arguably, the shortfall in fund generation by the federal universities and medical schools could be partially covered through reasonable participation in funding by all the stakeholders in the education sector.

Students and their parents invest in their education through payment of tuition fees, purchase of books and other learning materials, and living expenses, among others. According to Steel and Sausman (1997), the social rates represent the costs and benefits borne by the society. Akinwande (2013) shows the paltry details of fees paid by undergraduate students in federal universities in Nigeria, which appeared to be grossly inadequate to support students' training in the absence of adequate government funding. Earlier studies by Adaralegbe (1990) and Adesina (1990) cited by Bello (2014) buttressed the fact that parents and students must pay for education so that government policy on free tuition does not amount to an empty promise. It was further argued that other countries that run free education programmes usually provide opportunities for students to raise funds, either directly or indirectly, towards financing their education. This could be in form of bursary grants or students' loans payable after graduation and subsequent employment.

Findings from studies in the developed world show that undergraduate students do not only pay tuition as part of cost sharing towards their education, but the university authorities constantly monitor and review the tuition paid by students to ensure that the fees collected are adequate to provide qualitative training and service delivery (Kallison and Cohen, 2009; Jones-Esan, 2007). In CMUL, the total income generated by the medical school on tuition on yearly basis was below 5% of total income over the 25-years period covered by the study. Obviously, there is room for improvement to at least increase the quantum of funds generated through tuition fees to about 20% of total income. The NUC prescribes a minimum of 10% of total revenue as IGR that must be met by every tertiary institution. The amount generated as IGR by CMUL falls short of this recommended figure. According to Jones-Esan (2007), payment of tuition fees is becoming the international rule rather than an exception. Bevc and Ursi (2008) also found out that free education was a dis-incentive to rapid student progression because the policy of free tuition unintentionally brings about inertia on the part of some students in facing their studies diligently and completing same as scheduled. The study further supported the introduction of tuition fees because it serves as incentive for rapid student progress, as payment of tuition is a financial commitment towards timely completion of a students' education.

Also, the most comprehensive study conducted in the UK by Stevens (2001), revealed important conclusions; the study recommended the introduction of tuition fees and also analysed levels of efficiency in the universities covered by the study. Thus, institutions do not only need to attract adequate funding but must also ensure judicious utilisation of the scarce resources in order to accomplish their missions and objectives.

The funding mechanisms of medical institutions and their parent universities need to align with evidence gathered both within and outside Africa. Consequently, medical schools owned by federal government in Nigeria clearly saw the justification to clamour for improved funding through introduction of tuition fees at undergraduate level of tertiary education. In Oman, Al-hajry (2002) found that the financing arrangement of higher education, where the public cost of higher education is much higher than the cost to the individual who does not incur any direct cost, was no longer sustainable. Using human capital theory, which views education as a form of economic investment with motivation of higher returns (benefits), it was discovered that most of the direct costs in public higher education were fully subsidised by the government and the estimates of public rates of return to investment were low in comparison to the private rates that will accrue to the students upon graduation. This finding shows that individuals were enjoying greater benefits at the expense of the larger society. Consequently, the study recommended the introduction of appropriate funding mechanisms that would enable the society to recover the cost of tertiary education by deducting from the individual's income after graduation and during the first 20 years of employment.

Similarly, Alshamy (2011) did a comparative study between Egypt and England on funding mechanisms and quality assurance of Egyptian universities. Using questionnaire and interview instruments, Egyptian universities were found to be inefficient in terms of funding. Respondents believed that efficiency in Egyptian universities is negatively affected because of line-item budgeting as well as inadequate funding, lack of flexibility and transparency, lack of proper up-to-date equipment and no incentives for efficiency gain. Samy (2003), on the other hand, found out that schools impact the individuals and the society as a whole. In this regard, the study recommended a need to formulate a policy that will engender equity and equality in access to education by the citizens. The major challenge in Nigeria's tertiary education terrain has been paucity of funds which has greatly affected efficient service delivery of medical education. This led to the hosting of a summit on education in Nigeria that recommended the adoption of a funding model for higher education which promotes rapid improvement in the financial resources available to medical institutions.

On methodological ground, there are three prominent methods for measuring efficiency levels:

- Stochastic Frontier Analysis (SFA)
- Financial Ratio Analysis (FRA)
- Data Envelopment Analysis (DEA)

Prominently, the DEA has remained the most applied method in assessing the efficiency level of medical education for some subtle reasons. It is more robust and data capping than the two other methods because the DEA sufficiently incorporates all the available data to measure the efficiency scores of productive units; such as medical education at the CMUL. While the DEA and SFA are more sophisticated, the latter is a parametric measure and the former a non-parametric model. Generally, studies on efficiency have been dichotomised into two: those that employed a one-stage approach and those that employed a two-stage approach. The studies that considered a two-stage approach did not only obtain efficiency scores or ranks of a productive centre but also proceeded to ascertain the determinants of this efficiency. Basically, studies centred on both sides of the divide have bordered around country-specific to cross-country and even regional analysis. The review of extant literature on the efficiency focused on the technique of analysis rather than other features of differences among studies.

The studies that have adopted the DEA method have been numerous. Beginning with the pioneer studies of Charnes et al. (1978), other empirical studies that have adopted the DEA methods include Ahn et al. (1988); Coelli (1996); McMillan and Data (1998); Stevens (2001); Robst (2001b); Avkiran (2001); Grosskopf et al. (2001); Salerno (2002); Abott and Coucouliagos (2003), Valdmanis et al. (2004); Ferrier et al. (2005); Ferrier et al. (2006); Leitner et al. (2007); Clement et al. (2008); Valdmanis et al. (2008); Tzeremes and Halkos (2010); Kempkes and Pohl (2010); and recently, Al-Shayea and Battal (2013); Guajardo (2015) and Sacoto et al. (2015) have also contributed to the methodological literature. Given these rich empirical studies on the DEA method of efficiency delivery of medical education, this study has covered the gaps in existing studies in two major ways.

1. It is the first study in this area that has considered the use of questionnaires to complement the DEA technique; having employed the use of trend analysis to provide some background intuitions into the dimensions of budgeting and funding of medical education.
2. This thesis brings the study on financing of medical education up-to-date in Nigeria.

Most studies that were carried out in Nigeria were, to the best of knowledge of the researcher, done on the financing of tertiary education in general. The most recent studies, specifically on medical education, were Ibrahim (2007) and Akintoye (2008). This thesis therefore, provides a valuable information tool to guide policy formulators as well as other relevant stakeholders in the financing of medical education in Nigeria. The overview of medical education funding in Nigeria provides some striking results. This study found that the amount of money received towards financing medical education at the CMUL was persistently less than the amount requested and allocated in the budget, in most cases. Also, the amount set aside for general overheads were largely consumed by running costs, leaving small amounts for teaching and research expenses. In fact, the major components of the funds were often expended on staff salaries and allowances. There were minimal allocations for teaching equipment, consumables and reagents as well as staff training, which should have constituted the major area of emphasis in order to have the desired impact on the quality of medical students and doctors produced.

Specifically, the Internally Generated Revenue (IGR) of the institution hovered around 4% for decades but improved appreciably in the academic periods 2011/2012 – 2015/2016. This shows; until recently, the lack of innovation and invention on the part of the institution and the near absolute reliance on the government as the major financier of the institution through subventions. The bulk of the income accruing to the institution comes from government sources. It is becoming increasingly obvious that the government alone cannot fund tertiary education in general, and medical education in particular. The federal institutions need to be empowered to generate a significant proportion of their income locally to adequately fund their growing operations. The pattern of funding established in developed countries tilts towards institutions being given the latitude to charge tuition fees at public universities to carry out their functions effectively. In Germany, for instance, the study by Kempkes and Pohl (2010) saw the justification for the introduction of tuition fees in public universities in the wake of dwindling federal allocation of financial resources by the government to the universities, especially when the universities are faced with rising costs and high demand for admissions by students. Conversely, in the US, Kallison and Cohen (2009)'s study supported increased federal and state funding for public universities, state regulation of tuition at public institutions and more need-based financial aid for low-income (indigent) students.

The need for improved funding for tertiary education in general and medical education in particular, places responsibility on the education managers to ensure prudent utilisation of available financial resources in carrying out the functions of teaching and learning. Using DEA technique, Yaisawarng and Ng (2014) did a study in China on a group of public universities called Project 211 universities, based on the release of additional funding from the central government and discovered that institutions which got improved funding performed better than the non-Project 211 group that did not get additional funding. Kempkes and Pohl (op. cit) also used DEA and stochastic frontier to analyse efficiency level in fund utilisation of 72 public German universities and found that total factor productivity was increasing more rapidly in East German universities than their West German counterparts. According to Frolich and Strom (2008), several countries have experienced a large increase in enrolments in higher education in the last decades. Following the transition of higher education to “mass education”, and because higher education in many countries is public, funding schemes have become increasingly important. While continuing to keep tuition fees at zero or at low levels, many European countries have seen a movement from centrally regulated institutions, in terms of enrolment and subjects taught, more towards decentralisation with output-based funding schemes.

This position is at variance with the situation at the federally-owned universities and medical schools in Nigeria, where the federal government operates a no-tuition fees regime at the undergraduate level. The federal government directs public universities and medical colleges to adopt centrally regulated policy of no-tuition fees at the undergraduate level. This has negatively impacted the financing of medical education at CMUL, because it has substantially reduced the revenue base of the schools. Due to dwindling resources accruing to the federation account, the federal government has not been able to fund the institutions to execute their statutory mandates effectively. It is important that the federal government and the medical institutions should ensure that adequate funding is sourced to improve teaching and learning. To improve funding, the introduction of tuition at the undergraduate level could be considered (Askin, 2007; Kempkes and Pohl, 2010). The corollary to this possibility is the socio-economic implications on the citizenry who are mainly unemployed with majority of the parents living below the poverty level. Appropriate balance need to be struck to ensure that medical schools are able to function effectively. The importance of adequate funding was highlighted using survey developed with inputs from reproductive health experts and family planning programme administrators, Bocanegra et al. (2012), noted that clinics which received Title X funding had implemented greater infrastructure enhancements to promote access and improve the quality of service (delivery) for underserved populations. Funding is an important factor in the provision of quality medical and health services in a country.

Funding of growing students' intakes and proper maintenance of decaying infrastructure, need urgent attention by stakeholders in the educational sector in Nigeria. Collins and Rhoads (2008) also emphasised the importance of adequate funding of education in developing countries for expansion of the size, scope, and quality of the universities. As earlier reiterated in this thesis, the federal government, the dominant party responsible for funding of medical education in the university system, needs to create an enabling environment that facilitates adequate funding of medical education, since it is becoming obvious that the federal government cannot single handedly carry out this important responsibility. The reality of the inadequate funding situation serves as additional impetus for the management of the medical school to identify and harness other sources of generating revenue to support teaching and learning. A review of the income structure of the CMUL shows that the total income realised is broken down into constituent parts to highlight the make-up of its contribution towards the funding pattern of the college. CMUL was able to attract research grants locally and internationally. The college management has placed great emphasis on attracting more resources through research grants, especially foreign grants, as this has the potential of supporting the institutional vision of providing world class medical education to the entire country and beyond. Of equal importance is the need to ensure that the limited financial resources available are utilised maximally in the service delivery of the CMUL.

In estimating the efficiency level in service delivery of medical education in Nigeria, this study employed scientifically systematic procedure that comprises three stages. The first is the restatement of the research hypotheses and identification of a theoretical framework appropriate for addressing the research questions through the specified DEA model. The research selected the output-oriented variable-return-to-scale type DEA method. To complement this quantitative method, questionnaires were also administered to some targeted respondents; selected through a simple random process. They were lecturers/consultants, technologists, administrators as well as finance personnel and students of the CMUL. There were 423 respondents. The research instrument was validated using the World Bank questionnaire on service delivery. The World Bank questionnaire was put together by a team of experts in the relevant field of study. Having settled for the DEA method over the other two methods of obtaining efficiency level of a production unit, there are two prominent methods available in the empirical literature for analysis. These are the Microsoft Excel SOLVER ADD-IN menu and the STATA command. The study selected the former due to its merit over the latter.

In the estimation of the DEA model for this study, a scientific procedure that began with the baseline model and proceeded to measure, in successive order, the marginal effects of both budget and funding, respectively and collectively, was adopted. The inclusion of the budget and funding into the baseline model where the general and academic expenses served as the input variables, while the number of undergraduate and postgraduate students who graduated under the academic sessions of 1991/1992 to 2015/2016 was considered as the output variable, served as the extension of the baseline model. It is instructive to note that the estimations of DEA with the Microsoft Excel ADD-IN go through a series of iteration processes to attain a convergence before a result could be reported. If no convergence was found, no result will be reported, suggesting that the DEA framework is structurally incoherent and could not be estimated. Attaining a level for convergence is important as it is the only way, not to only report the efficiency scores, but also to proceed towards obtaining the sensitivity analysis and limits of the model. It is only through a convergence result that all constraints can be satisfied and all boundary conditions can be considered for the optimality as well as the estimations of the efficiency level of the productive unit, which in this case is the CMUL. The results obtained from the estimations showed an improved efficiency level from the extended models, when budgeting and funding were incorporated in their successive order and when incorporated as a single component. Although the efficiency also improved, there is still much to be done to attain the desirable level of efficiency.

These findings were also corroborated by the analysis of the responses elicited from the targeted respondents through the administration of questionnaires. To further ensure the validity of data instruments, an exhaustive literature review was undertaken. Also, comments, suggestions and recommendations from experts in the Accounting and Finance departments of the University of Lagos were incorporated into the design of the questionnaire. The entire segment of the questionnaire analysis section is divided into three parts. The first part contains the personal information about the distribution of the respondents; the second part revolves around the research questions: while the third, as well as the final part, hinges on the research hypotheses for acceptance or rejection at a given level of significance. Analysis of the first section reveals inherent biases, cultural values and institutional frameworks hindering teaching and learning that would not have been revealed if the study had been based only on the DEA technique.

For the second section, it was deemed necessary to also employ the tool of descriptive statistics, frequencies and percentages to give a precursory look into the questions raised and the responses generated on the impact of budgeting and funding on teaching and learning, as perceived by the teaching staff, students and other stakeholders. Some of the answers obtained were striking. It was found that the responses elicited from the respondents show that the budget and funding structure were likely to impact more meaningfully on medical education at the CMUL if institutional frameworks and appropriate budgetary allocations were observed. On the whole, the implication of the elicited responses was that the existing funding did not positively affect the teaching and learning activities of the medical institution. While these responses have been revealing, a robust conclusion could not be reached with the use of only frequency and percentage analysis of responses without performing formal tests through testing of stated hypotheses. The formal tests were predicated on the basis of chi-square statistics and T-tests.

Evidently, this study is novel in two major ways. It is the first to consider how budgeting impacts funding of public medical education in Nigeria. As a precursor to this, the study earlier examined the current funding situation on teaching and learning at the CMUL through the use of a DEA approach. Secondly, it is the first study to investigate the role played by institutional factors as well as political risks affecting funding of medical education in Nigeria. Also, it is the only study that has modelled different scenarios of baseline and inclusion of extended models of budgeting and funding as productive units for comparison of efficiency levels on the service delivery of medical education. Nevertheless, it is still imperative to underscore how this study aligns with, or differs from, existing empirical works that not only investigated the teaching and learning of medical education but also adopted the DEA technique; although there is none in the case of medical institutions in Nigeria.

This thesis aligns with the study conducted by Salerno (2002), that input quality and competition positively influenced productive efficiency and that public and private research universities should be analysed jointly in such situations. In the case of Salerno (op. cit), federal support for higher education in the US rose steadily up to 1999. The growth was occasioned largely by policy shifts on two dimensions: government commitment for tuition support and, to a lesser extent, institutional support in terms of attracting research grants. As observed in this study, there was also appreciable increase in subventions received by CMUL in absolute terms, just like the situation in Salerno's study. To date, there is no government commitment for tuition support at the undergraduate level but the institutional support for attracting research grants is being addressed by the education managers of CMUL. The attraction of research grants both locally and internationally, clearly places CMUL on good standing in terms of raising finances to support delivery of qualitative medical services in Nigeria. Interestingly, institutions with good research performance have been found to also achieve a good teaching performance (Leitner et al, 2007; Bonaccorsi and Daraio, 2002). Teaching and research are important elements of the core services provided by medical schools such as CMUL. The improvement in attracting research funds would promote teaching; which is an integral part of the services provided by CMUL.

It also returns the same result as Tzeremes and Halkos (2010) which discovered the existence of misallocation of resources and inefficiency in a public-owned university in Germany. It also aligns with Kempkes and Pohl (2010) which confirmed that the size of a university is not necessarily associated with its efficiency. Unlike the findings in the study undertaken by Guajardo (2015), which posited that inefficient institutions would exhibit decreasing returns-to-scale if the level of inputs were to be increased, this study shows that increasing the input variables of budgeting and funding are the precondition for efficient service delivery in the CMUL. In absolute terms, this study is in tandem with the study conducted by Stevens (2001) which noted that inefficiency is negatively recurring as the initial level of inefficiency promotes a current level of inefficiency, and also that institutions with high level of inefficiency at origin become more efficient over time, as evident in the case of the CMUL; comparing the baseline model with the extended models of including budgeting and funding. This contradicts the findings of Leitner et al. (2007), that found a cubic relationship between size and efficiency. The researchers posited that inefficiency is unconnected with size of medical institutions but completely supported McMillan and Data (1998) that inefficiency may not be unconnected to a small sample. In this study, it is concluded that a well-funded CMUL is more efficient than a less funded one; a development which is supported by Stevens (2001) that made a landmark policy recommendation that the introduction of tuition fees in English and Welsh universities served as a booster that motivated less efficient universities to become more efficient.

As a way of measuring the impact of budget and funding requirements on medical education and to further account for the role of institutional factors such as the political risk factors in Nigeria, a multivariate model, predicated on the negotiated funding model is specified. The technique of

Autoregressive Distributed Lag (ARDL) model is employed to investigate the long-run situation and a re-parameterisation of the model is done to capture the short-run dynamics. The results obtained are highly instructive as the tests of analysis such as the unit-root test and granger causality test are highly revealing. The unit-root test indicates that all the variables, except one, are non-stationary and only an integration of order 1 can make the variables stationary at the 5 percent level of significance. The granger causality test suggests that educational funding in Nigeria are not exogenously determined as availability of funds is a strong determinant of how much government pledged and invested in the education sector. In terms of the impact analysis, the estimates from the ARDL model indicate that a long-run equilibrium condition exists among the variables included in the model. This suggests that there is an equilibrium condition that keeps them together into the long-run situation. Both the long-run and short-run impacts show that there is a need for increments in the school fees and other internally generated revenue in order to improve the funding requirements of the public medical institutions in Nigeria. However, the magnitude of the coefficients suggests that more funds can be obtained from other internally generated revenue as against increasing the school fees. Interestingly, budget and funding have been found to be complementary source of raising additional revenue. This information is highly instructive as it provides a better insight to that of the estimates obtained from the DEA which suggests that funding improves efficiency than budget as a mere fiduciary practice. There is a need for more funds for more students to be graduated; particularly at the undergraduate level.

In terms of impact analysis, however, the long-run coefficients obtained indicate that budget impacts positively on the funding requirements of medical education. This has a 1.837 coefficient with T-statistics value of 3.34 and probability value of 0.01. More so, the number of undergraduate students graduated also positively impacts on the funding requirements of the medical institution with 0.0929 coefficient and 0.4289 probability value. This indicates that the higher the number of undergraduate students, the higher the amount of funds needed to see them through graduation. This largely supports that medical education at the undergraduate level are tuition free and it is the constitutional responsibility of the government to provide education at this level to its citizenry. However, the amount of school fees charged by the institution, the other internally generated revenue and the number of postgraduate students graduated are all significantly negatively related to the fund utilisation / requirements of the medical school; at least at the 10 percent level of significance. The school fees is negatively signed with -0.717 coefficient, 2.764 absolute T-statistics value and 0.025 probability value; the other IGR is also negatively sloped at -0.705 and absolute T-statistics value of 2.642 with 0.0296 probability value while the postgraduate is negatively sloped with -0.3448 coefficient, 1.944 absolute T-statistics value and 0.0878 probability value. The implications of these estimates are that an increase in school fees and other IGR significantly reduces the funding requirements of the medical school to be borne by the federal government of Nigeria.

Also, an increase in the number of postgraduate students assists the fund generation capacity of the institution and thus reduces the funding requirements of the institution; albeit at the 10 percent level of significance. Similarly, both the degree of political risks and the level of government involvement in the activities of the medical schools are also negatively related to the funding requirements with -0.1478 and -0.1942 coefficients and 0.804 and 0.435 probability values respectively. These effects are considered negligible. It implies that political risks and government's involvement have negative but negligible impact on the funding requirements for medical education in Nigeria. These further lend credence to the estimates earlier obtained and interpreted under the granger causality test.

The estimates tabulated in Table 4.30 suggests that the error correction term (ECT) is properly signed with negative coefficient of -0.966 and highly significant T-statistics and probability values of 4.908 and 0.008 respectively. This suggests that the recovery back to equilibrium when funding of medical education is affected by economic shock is very high at 96.6 percent rate. This denotes that it will take barely a year for the shock to be corrected. The current level of budget and the level of government involvement are both positively and significantly related to the funding requirements of medical education in the short-run. The coefficient for budget is 2.246 while that of government involvement is 0.226 with T-statistics values of 3.377 and 3.117 coupled with probability values of 0.028 and 0.036 respectively (Table 4.30). The implication here is that the higher the amount budgeted, the higher the amount of funding requirements in the short-run situation. This denotes that there appears complementarity relationship between budgeting and funding as the granger causality test earlier estimated also suggests that funding granger causes budget. However, the involvement of government under the short-run dynamics contradicts the position of the long-run situation as government involvement tends to increase the funding requirement in the former situation but reduces it in the latter situation. This suggests that government's involvement is detrimental in the short-run but could be favourable in the long-run situation.

Interestingly, both the school fees and other internally generated revenue significantly reduce the funding requirements of medical institutions in Nigeria in the short-run situation. This further corroborates the similar outcome in the long-run situation. The implication is that medical institutions should focus on increasing the school fees if the funding requirements are not provided by the government. In terms of magnitude, however, the coefficient of -1.169 and absolute T-statistics value of 3.211 strongly indicate that more can be obtained from other internally generated revenue as against school fees with -0.323 coefficient and absolute T-statistics value of 2.889. In the short-run, neither the number of undergraduate and postgraduate graduated have any effect on the funding requirements of medical institutions in Nigeria with 0.0003 and -0.0007 and 0.617 and 0.618 probability values respectively (Table 4.30). It is important to note that the effect of political risk factor comes with a lag. In fact, the impact of political risk factor only becomes significantly manifest after three years with -2.599 coefficient and T-statistics value of 2.922 with 0.043 probability values. The adjusted coefficient of determination of 0.80 suggests that the independent variables explained for 80 percent effect on the dependent variable and the remaining 20% could be due to other imperceptible extraneous variables. The Durbin Watson statistics of 1.67 indicates that the model does not suffer from first-order serial correlation and the F-statistics value of 6.345 coupled with the probability value of 0.044 confirm the overall fit of the model.

Chapter six Summary, conclusions and recommendations

6.1 Introduction

The broad objective of this study is to examine the role of budgeting and institutional factors on funding of public medical education in Nigeria, using College of Medicine of the University of Lagos as a case study. The funding framework enables medical institutions raise and deploy optimal financial resources to facilitate effective teaching, research and community service. In specific terms, this study examined the impact of budget and institutional factors on funding of teaching and learning of medical education in Nigeria.

The dynamics in today's globalised academic world have brought with it increased demand on the minimum requirements for teaching and learning of medical education at all levels. Consequently, and particularly in respect of tertiary education, the objective of medical education has moved from the number of individuals that have benefited from medical education as a public good, to the quality of the knowledge imparted to students. Arising from the broad and specific objectives, this study generated implications for theory as well as policy and practice of medical education in Nigeria.

6.1.1 Implications for theory

As reported in section 1.2 of chapter one of this study, federally-owned tertiary institutions in Nigeria and medical schools have been bedevilled by a dearth of financial resources, exacerbated by the free tuition policy at the undergraduate level of medical education. Further, the normative and contractual funding model adopted by all federally-owned tertiary institutions is heavily dependent on the financial capacity of federal government, the proprietor to these institutions, to provide the bulk of the funding requirements of the medical schools, such as CMUL. The dwindling funding accruable to the federal government as a result of global economic recession had negatively impacted federation revenue through crude oil sales; translating to poor funding of medical schools by the federal government.

This study responds to the gaps in the literature which include:

a. Limited research on funding of medical education in Nigeria.
b. Lack of relevant studies focusing on other sources of funding other than normative and contractual funding model that may be explored by medical institutions in Nigeria.
c. The application of negotiated funding model to addressing the funding challenges facing medical institutions in Nigeria.

The implications of this study in terms of its significance are discussed in section 1.7 of chapter one of this thesis. Also, this study contributed to the body of knowledge on the global scale. DEA technique is a ready tool for measuring performance of outfits in public and private sectors. It is particularly relevant in determining how efficiency has been attained by education managers. Accordingly, the findings of this study will add significant knowledge to performance measurement tools, using DEA technique in the medical schools.

6.1.2 Implications for policy and practice

This research responds to the urgent requirement for a template to drive uniform performance assessment of all federally-owned medical schools in Nigeria, in terms of funds generation and utilisation. Studies in literature using DEA technique were done outside of Nigeria (Section 2.4.1). This study assists to provide a mix between expenditures on core and non-core activities of medical institutions. It further lends credence to the regulations stipulated by National Universities Commission (NUC) – a regulatory arm of government overseeing universities in Nigeria – which stipulates specified ratios between what amount could be internally generated by universities, as well as how total available funds could be spent on academic programmes and other activities of the universities.

Specifically, the following are some of the implications of this study to policy and practice:

- Assist in setting up an implementation model for efficiency measurement in medical institutions using DEA technique.
- Assist in setting up minimum benchmark for performance measurement between core and non-core activities of medical schools.
- Could facilitate on-the-job training needs of medical schools.

6.2 Summary of findings

In terms of the trend analysis and estimations of models, there are four (4) major stylised facts and three (3) evidences obtained on funding of medical education in Nigeria. First, the trend shows that there has been extra-budgetary spending by the CMUL. While this could be attributed to poor internal control system and poor budgetary spending mechanism in the institution, further information obtained rather suggests that there are pressing needs that usually demands additional funding of medical education in the institution. Secondly, the bulk of the funds were utilised in payment of staff salaries. The amount spent on teaching, learning and research is a negligible fraction of the allocated figures for goods and services over the period of the study. The amount set aside for general overhead was largely consumed by running costs, leaving a small amount for teaching and research expenses. Thirdly, the internally generated revenue of the institution has hovered around 4% for decades. This shows the lack of innovation and creativity on the part of the institution and the near absolute reliance on the government as the major financier of the institution through subventions. Also, the teaching hospital, just like the CMUL, also relies heavily on government subvention with little proportion of its revenue generated through patients' fees and other IGR. Consequently, the ability of raising adequate financial resources needed for procurement of equipment and consumables is significantly curtailed. The dearth of funding therefore cuts across both institutions (CMUL and LUTH) and this poses a serious challenge for teaching and learning in medical education in Nigeria.

Nonetheless, the results obtained from estimated models provide three (3) incontrovertible evidences that are highly instructive. Firstly, government expenditure on medical education is not exogenously determined as the amount of fund available usually determines how much to be budgeted on medical education. This suggests that, irrespective of the various stipulations such as the UNESCO requirement of 26 percent of national budget on education, the government follows the negotiated funding model. Secondly, if medical institutions are not provided enough funds, there is bound to be increment in school fees. This could lead to increase in student unrest as this increment is likely to be met with reactions from the students by disturbing campus peace through protests and even sometimes vandalisation of school property. More so, the amount of other funding sources usually determines the amount of fundings to be made available to the institution by the federal government through the budgetary process. This is theoretically plausible as the institution would be spurred to becoming creative in exploiting its resources to the fullest. This will create relative autonomy for the institution. Thirdly, in terms of political risk, it is evident that the funding requirement is not affected by political factors. The implication here is that the political affairs is not allowed to meddle with medical education in Nigeria. This is highly commendable and suggests that the medical institution, in particular and the academic institution in general is still in tune with credibility and devoid of political bickering from the political class and political office holders. Interestingly, both the school fees and other internally generated revenue significantly reduce the funding requirements of medical institutions in Nigeria in the short-run situation. This further corroborates the similar outcome in the long-run situation. The implication is that medical institutions should focus on increasing the school fees and other internally generated revenue sources if the funding requirements are not provided by the government.

In a knowledge-driven world, various stakeholders within the education sector demand that greater efficiency be obtained on funds utilisation. In the specific case of medical education, these scarce human and financial resources are necessary ingredients required to promote effective service delivery. Consequently, universities and their affiliate medical schools continually strive to strike the right balance that would lead to the attainment of their core mandate of teaching, research and community service.

This study examined the impact of budgeting and funding on service delivery in medical education in Nigeria; using the CMUL as a case study. The study clarified conceptual and definitional issues as well as reviewed extant literature; theoretically and empirically. Also, the various models of budgeting and funding were critically examined.

For the empirical literature, evidences were sought from the developed, emerging as well as developing economies and also from the Nigerian economy. In addition, an overview of medical education in Nigeria was provided and trends on budgeting and funding of medical education were also undertaken for the academic sessions from 1991/1992 to 2015/2016. On the basis for empirical estimation, the pay-for-performance (P4P) model of funding, which focused less on quantity and more on achieving outcomes based on performance metrics was involved for this study. The P4P framework was found to be related to the Resilience and Youth Development Module (RYDM) model which explains how input variables were processed to achieve expected outcomes. Premised on this, the DEA technique was employed where the components of input variables, processes and expected outcomes were tested to ascertain the efficiency of resources utilised to provide medical education at the CMUL.

For robustness of analysis, a total of 423 questionnaires were administered to targeted respondents comprising academics/consultants, technologists, financial managers and students of the institution. For the reliability of test of instrument, the Cronbach Alpha and validity tests using World Bank questionnaire were conducted and the analysis centred on three subsections: the demographic, descriptive and hypotheses testing. In the second subsection, the research questions were answered while section three attended to all hypotheses stated. The trends and empirical analysis revealed a number of implications which reinforced the overall conclusion.

6.3 Contributions to knowledge

A review of relevant studies on Nigeria and a number of developing countries indicate that they ignored an appropriate theoretical foundation. In contrast, this study is rested on negotiated funding model and Adolph Wagner's law of increasing state activity. The existing RYDM model which was modified in this study was applied in Nigeria using CMUL as a case study. This model could also be replicated in other climes such as emerging and developing economies.
Secondly, those studies are more qualitative in nature while this study adopts quantitative multivariate analysis and data envelopment technique as the core method for the study. The use of questionnaire serves to elicit responses from key stakeholders whose responses, opinions and feedback could not have been captured in the DEA technique, but considered highly significant towards taking a holistic view of budgeting and funding in the provision of teaching and learning in public medical schools in Nigeria.

On practical application to the corporate environment, this study has contributed in no small measures. First, the distinction of cost into core and non-core costs earmarked the hierarchy and importance of cost components into efficiency analysis. Secondly, the use of the historical data to provide stylised facts provide sufficient background on the trends of general expenses, academic expenses, number of undergraduate and postgraduate students graduated in CMUL. This vital information assists the management in making adequate provisions of basic needs for all the stakeholders in the institutions. The demonstration of various scenario analysis highlights the allowable and disallowable changes that can be made before (in)efficiency could affect the funding of medical education in Nigeria. More so, the fact that economic and financial analysis cannot be considered to be robust without recourse to lag effect, implies that the modelling structure adopted through the use of the ARDL framework is highly instructive as it exhausts the dynamic paths of funding in CMUL.

Finally, the policy relevance of the study is not in doubt as such policies formulation was backed up with quantitative analysis. Data are generated in this study to support request for improved funding of medical education through efficient fund utilisation to engender qualitative service delivery.

6.4 Conclusion

This study affirmed that budgeting and funding were relevant to teaching and learning of public medical education in Nigeria; using the CMUL as a case study. The novel contribution made by this study is that aside the use of integration model of both qualitative and quantitative techniques, a multivariate analysis of cause and effect relationship among the variables of interest were undertaken. There is no study that has adopted such robust investigation approach as was done in this study. Predicated on the above approach, the study contributes immensely to existing literature in significant ways. First, it was able to understudy the dynamic path of funding medical education in Nigeria. Secondly, it accounted for the role played by institutional factors in determining public funding in one of the leading ivory towers in Nigeria. Third, the efficiency of resource allocation from the Federation Accounts was investigated through the application of Data Envelopment Analysis (DEA) alongside some sensitivity analysis that have not been so analysed in previous studies. In tandem with the first objective of assessing the budgetary and funding trends, the study found out that there had been significant structural changes in the trends of budgeting and funding of public medical education in Nigeria. These findings align with the study by Adam (2020). In order to ascertain the efficiency of budget and fund utilisation on public medical education in Nigeria and within the context of the second objective, it was noted that scale-effect did not matter for the estimation of the DEA model as no convergence for optimality could be reached during the iteration process. Prior to the inclusion of budgeting and funding, it was found that the marginal utility of money, as represented by the Lagrange Multiplier, was approximately non-zero as slacks existed within the DEA estimations. Meanwhile, with the inclusion of budgeting or funding, the marginal utility of money became approximately but absolutely zero for the inclusion of both budgeting and funding. The granger causality test obtained through the multivariate analysis suggests that funding of education by the federal government of Nigeria are not exogenously determined as availability of funds in the federation account is a major determinant of how much the federal government is capable of investing in tertiary education.

Bearing in mind this major constraint, both the long run and short run impact from the ARDL model showed that there is a need for increments in the school fees and other internally generated revenues to facilitate improvements in funding requirements to support delivery of medical education in Nigeria. These findings are targeted at the third objective which aimed at investigating the impact of funding requirements of public medical education in Nigeria. The key stakeholders in the study recommended the contextualised funding model in preference to the existing normative and contractual funding model in operation at the CMUL which was considered inappropriate. At an informal level of estimations, using the percentage and frequency distributions, budgeting was found to impact more meaningfully on teaching and learning at the institution and a more formal test of the Levine test of equality of variances also lent credence to this informal submission. As such, the study found that funding was the least effective in the funding of public medical education at the CMUL; though the estimates obtained through the DEA approach could not significantly distinguish between the impacts of both on the funding of medical education.

Also, a discerning implication of the study from trend analysis corroborated a valid conclusion for this study. For two decades and half running, there had been extra budgetary spending as well as poor funding of the CMUL; this could portend grave consequences for sound internal control system and budgetary mechanism. This trend could be an indication of decades of neglect on requisite medical infrastructural facilities needed towards the discharge of quality medical education in the institution. Further, the drive for Internally Generated Revenue (IGR) of the institution was poor; averaging about 4% for more than two decades. This indicated lack of innovative and inventive drive on the part of the institution and the near absolute reliance on the government as the major financier of the institution through subventions.

Besides, inflationary pressures affected the purchasing power of budgetary spending and demand for consumables and reagents grossly affected allocation for capital development. The institution largely relied on foreign donors for its grants; majority of which came from the European Union and the United States agencies, among others. The dwindling global savings and the adverse effect of the global financial cum economic crises have made reliance on foreign donors to be unsustainable. It is instructive to note that the trend in higher institutions of learning is to pursue aggressive and innovative internally generated fund drive so as to reduce the pressure from the dwindling government allocations. In Broome et al (2017), it was recommended that Duke University and similar schools of nursing should pursue aggressive IGR to support its academic and other activities. Ehrenberg (2020) argued that there should be a limit to the amount of increase in school fees to be charged due to the declining purchasing power capabilities of the citizenry. Rather, the study recommended that other sources of raising revenue apart from tuition should be explored by tertiary institutions.

Interestingly, the empirical investigation to address the fourth research objective regarding the role of budgeting and institutional factors found out that institutional elements such as political risk factors do not endanger public medical education in Nigeria. This finding is desirable for a second generation ivory tower such as the CMUL. The sanctity of the medical institution and, by extension the entire university, would be protected as political risks do not dictate the level of funding of the institution. On the reflection of assessing the dynamic path of funding in CMUL, the study revealed that political risks only impacted on fund allocation of the medical institution after the third year. This emphasis is important as, without the use of dynamic framework, it would have suggested erroneously, that political risks could be negligible and hence inconsequential. As a result, strategic placement can entirely wade off the lag effects of these political risks factors of three-years period.

6.5 Recommendations

Arising from the conclusion drawn from this study, the following suggestions are made as policy recommendations:

1. Given that school fees and other internally generated revenues are substitutes to increasing funding from the government, the study recommends that government either provides more funding or give autonomy to medical schools to charge tuition fees at the undergraduate level and also charge appropriately at the postgraduate level.
2. Consequent upon the first recommendation, government will have to increase funding to medical institutions in Nigeria if it has to improve the literacy level of its citizenry and increase the future income earning capacity of its citizens.
3. In the alternative, universities could be made as specialised institutions such as university of engineering, university of technology, and university of medical sciences. This could facilitate optimal utilisation of meagre financial and human resources.
4. Also, aggressive drive towards being innovative and inventive in exploiting untapped resources in order to generate more internal revenue has to be pursued by medical institutions in Nigeria. This could be achieved through consultancy services, rendering of laboratory tests and research activities.
5. Based on the efficiency scores obtained from the DEA, the efficiency of teaching and learning in medical institutions in Nigeria can be attained if funds are judiciously utilised.
6. Currently, the proportion of public budget on education to the national budget is less than 10 percent. However, the proportion of academic budget on total public expenditure in CMUL is less than 1 percent. In accordance to the UNESCO recommendation that 26 percent of the annual budget should be allocated to education, the allocation to academic acitivites like conference attendance, teaching and learning expenses should be substantially increased in preference to non-core costs.
7. While institutional factors do not immediately endanger the level of funding of CMUL, its lag effects could not be completely discounted. Hence, a conducive environment is desirable to achieving a functional funding model.

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APPENDICES

Funding requests, allocations and disbursements over the period of 25 years

(i. e. 1991/1992 – 2015/2016)

Year	Amount requested by CMUL ₦	Amount allocated in budget ₦	Percentage of amount allocated %	Amount received by CMUL ₦	Percentage of amount received %
1991/1992	22,308,224	21,780,660	97.6	19,957,539	89.5
1992/1993	75,197,320	68,472,125	91.1	61,579,576	81.9
1993/1994	76,220,449	75,061,414	98.5	75,558,094	99.13
1994/1995	101,431,571	76,761,154	75.7	162,995,730	160.7
1995/1996	101,136,476	98,661,431	97.6	108,526,152	107.3
1996/1997	118,948,056	118,948,056	100	88,858,550	74.7
1997/1998	438,267,083	124,267,083	28.4	190,092,575	43.4
1998/1999	131,384,978	128,734,978	98	171,335,179	130.4
1999/2000	290,982,432	235,132,342	80.8	254,476,342	87.5
2000/2001	927,318,959	653,652,292	70.5	824,939,290	88.9
2001/2002	1,259,631,999	1,006,631,999	79.9	612,657,982	48.6
2002/2003	1,284,861,414	1,031,861,414	80.3	503,097,229	39.2
2003/2004	1,182,522,153	1,082,522,153	91.5	757,325,030	64.0
2004/2005	2,019,169,803	946,169,803	46.9	615,835,520	30.5
2005/2006	1,601,052,236	975,052,236	60.9	791,906,935	49.5
2006/2007	1,703,439,641	1,102,439,641	64.7	969,105,746	56.9
2007/2008	2,465,351,598	2,364,758,098	95.9	1,276,646,181	51.8
2008/2009	7,142,301,369	2,862,301,369	40.1	1,382,995,154	44.6
2009/2010	3,254,643,143	3,053,863,143	93.8	1,978,111,351	60.8
2010/2011	5,206,690,739	2,049,836,865	39.4	2,187,396,533	42.0
2011/2012	3,496,188,774	1,909,372,886	54.61	1,988,894,986	56.89
2012/2013	3,708,322,741	2,146,454,199	57.88	2,143,052,193	57.79
2013/2014	4,004,375,915	2,080,948,077	51.97	2,348,594,204	58.65
2014/2015	4,562,440,887	2,450,047,313	53.70	2,402,202,276	52.65
2015/2016	4,781,285,392	2,,443,180,357	51.10	2,431,179,375	50.85

Appendix A - Baseline Expenses

Year	General Expenses	Academic Expenses	Undergrad	Postgrad
1991/1992	22,381,342	362,764	219	86
1992/1993	53,145,233	1,310,529	252	77
1993/1994	62,443,242	2,959,341		
1994/1995	80,603,538	3,401,760	232	
1995/1996	111,076,373	4,797,460	190	88
1996/1997	107,445,696	5,894,283	202	77
1997/1998	125,467,574	5,091,012	140	102
1998/1999	214,832,616	5,996,507	167	91
1999/2000	318,237,978	1,218,705	218	92
2000/2001	576,328,478	8,882,583	181	109
2001/2002	669,946,116	8,025,354	93	112
2002/2003	587,783,301	5,172,185	187	90
2003/2004	775,582,441	7,279,389	174	84
2004/2005	774,302,813	3,300,486	169	
2005/2006	936,546,295	4,348,738	317	156
2006/2007	1,002,277,348	9,368,333	220	138
2007/2008	1,460,362,388	8,469,210	358	179
2008/2009	1,431,941,344	19,563,730	181	153
2009/2010	2,055,233,489	9,779,057	272	117
2010/2011	2,458,853,405	8,334,055	229	191
2011/2012	2,414,254,815	52,093,745	240	316
2012/2013	2,455,089,668	10,034,834	282	435
2013/2014	2,719,239,426	14,059,621	535	371
2014/2015	2,413,354,289	19,624,867	386	427
2015/2016	2,206,885,956	30,266,109	465	512

APPENDIX B

Answer Report - DEA_Analysis : Baseline_Expenses

Target Cell (Value Of)

Cell	Name	Original Value	Final Value
$D$31	(Nbillion) LHS	26011233822	16.41101074

Adjustable Cells

Cell	Name	Original Value	Final Value
$F$2	1991/1992 Weight (λ)	0-Jan	30-Sep
$F$3	1992/1993 Weight (λ)	1	-1987.77282
$F$4	1993/1994 Weight (λ)	1	12.76715741
$F$5	1994/1995 Weight (λ)	1	498.6053738
$F$6	1995/1996 Weight (λ)	1	1
$F$7	1996/1997 Weight (λ)	1	1
$F$8	1997/1998 Weight (λ)	1	1
$F$9	1998/1999 Weight (λ)	1	1
$F$10	1999/2000 Weight (λ)	1	1
$F$11	2000/2001 Weight (λ)	1	1
$F$12	2001/2002 Weight (λ)	1	1
$F$13	2002/2003 Weight (λ)	1	1
$F$14	2003/2004 Weight (λ)	1	1
$F$15	2004/2005 Weight (λ)	1	1
$F$16	2005/2006 Weight (λ)	1	1
$F$17	2006/2007 Weight (λ)	1	1
$F$18	2007/2008 Weight (λ)	1	1
$F$19	2008/2009 Weight (λ)	1	1
$F$20	2009/2010 Weight (λ)	1	1
$F$21	2010/2011 Weight (λ)	1	1
$F$22	2011/2012 Weight (λ)	1	1
$F$23	2012/2013 Weight (λ)	1	1
$F$24	2013/2014 Weight (λ)	1	1
$F$25	2014/2015 Weight (λ)	1	1
$F$26	2015/2016 Weight (λ)	1	1
$F$27	Efficiency Weight (λ)	1	8.8753E-09

Constraints

Cell	Name	Cell Value	Formula
$D$34	Postgraduate LHS	19.92576745	$D$34>=$F$34
$D$32	(Nbillion) LHS	0.929197691	$D$32<=$F$32
$D$31	(Nbillion) LHS	16.41101074	$D$31<=$F$31
$D$33	Undergrad LHS	1.100809156	$D$33>=$F$33
$D$35	Σλ LHS	4	$D$35>=$F$35

APPENDIX C

Microsoft Excel 12.0 Sensitivity Report

Worksheet: DEA_Analysis - Baseline_Expenses

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$F$2	1991/1992 Weight (λ)	30-Sep	0-Jan	0	0	0
$F$3	1992/1993 Weight (λ)	-1987.77282	0	0	0	0
$F$4	1993/1994 Weight (λ)	12.76715741	0	0	0	0
$F$5	1994/1995 Weight (λ)	498.6053738	0	0	0	0
$F$6	1995/1996 Weight (λ)	1	0	0	0	1E+30
$F$7	1996/1997 Weight (λ)	1	0	0	0	1E+30
$F$8	1997/1998 Weight (λ)	1	0	0	0	1E+30
$F$9	1998/1999 Weight (λ)	1	0	0	0	1E+30
$F$10	1999/2000 Weight (λ)	1	0	0	0	1E+30
$F$11	2000/2001 Weight (λ)	1	0	0	0	1E+30
$F$12	2001/2002 Weight (λ)	1	0	0	0	1E+30
$F$13	2002/2003 Weight (λ)	1	0	0	0	1E+30
$F$14	2003/2004 Weight (λ)	1	0	0	0	1E+30
$F$15	2004/2005 Weight (λ)	1	0	0	0	1E+30
$F$16	2005/2006 Weight (λ)	1	0	0	0	1E+30
$F$17	2006/2007 Weight (λ)	1	0	0	0	1E+30
$F$18	2007/2008 Weight (λ)	1	0	0	0	1E+30
$F$19	2008/2009 Weight (λ)	1	0	0	0	1E+30
$F$20	2009/2010 Weight (λ)	1	0	0	0	1E+30
$F$21	2010/2011 Weight (λ)	1	0	0	0	1E+30
$F$22	2011/2012 Weight (λ)	1	0	0	0	1E+30
$F$23	2012/2013 Weight (λ)	1	0	0	0	1E+30
$F$24	2013/2014 Weight (λ)	1	0	0	0	1E+30
$F$25	2014/2015 Weight (λ)	1	0	0	0	1E+30
$F$26	2015/2016 Weight (λ)	1	0	0	0	1E+30
$F$27	Efficiency Weight (λ)	8.8753E-09	0	0	0	0

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$D$34	Postgraduate LHS	19.92576745	0	0	1E+30	1E+30
$D$32	(Nbillion) LHS	0.929197691	0	0	1E+30	1E+30
$D$31	(Nbillion) LHS	16.41101074	0	0	1E+30	1E+30
$D$33	Undergrad LHS	1.100809156	0	0	1E+30	1E+30
$D$35	Σλ LHS	4	0	1	3	1E+30

APPENDIX D

Baseline + Budget

Year	General Expenses	Academic Expenses	Budget	Undergrad	Postgrad	Weight (λ)
1991/1992	22381342	362764	2,122,600	219	87.1055336	1
1992/1993	53145233	1310529	2,637,620	252	77.9250508	1
1993/1994	62443242	2959341	4,900,335		-0.0102275	1
1994/1995	80603538	3401760	6,207,524	232	-0.0553431	1
1995/1996	111076373	4797460	6,837,484	190	88.8562381	1
1996/1997	107445696	5894283	5,731,576	202	77.7132532	1
1997/1998	125467574	5091012	8,064,617	140	102.980641	1
1998/1999	214832616	5996507	9,082,724	167	91.6737158	1
1999/2000	318237978	1218705	15,304,896	218	92.6056215	1
2000/2001	576328478	8882583	23,270,273	181	109.143346	1
2001/2002	669946116	8025354	28,612,132	93	112.022704	1
2002/2003	587783301	5172185	52,187,622	187	89.9450667	1
2003/2004	775582441	7279389	56,831,259	174	83.4852759	1
2004/2005	774302813	3300486	38,179,514	169	-1.3386355	1
2005/2006	936546295	4348738	61,540,361	317	156.080495	1
2006/2007	1002277348	9368333	77,703,338	220	137.610264	1
2007/2008	1460362388	8469210	126,483,004	358	178.199902	1
2008/2009	1431941344	19563730	131,059,259	181	150.843485	1
2009/2010	2055233489	9779057	118,097,002	272	114.424521	1
2010/2011	2458853405	8334055	140,096,663	229	188.546936	1
2011/2012	2,414,254,815	52,093,745	250,852,688	240	316	1
2012/2013	2,455,089,668	10,034,834	333,499,542	282	435	1
2013/2014	2,719,239,426	14,059,621	232,772,970	535	371	1
2014/2015	2,413,354,289	19,624,867	227,408,829	386	427	1
2015/2016	2,206,885,956	30,266,109	291,766,629	465	512	1
			Efficiency			1
			LHS		RHS	
Gen_Expenses		(Nbillion)	2.6E+10	<=	111076373	
Academic_Expenses		(Nbillion)	2.5E+08	<=	107445696	
Total Income		(Nbillion)	2.25E+09	<=	125467574	
Undergrad		(Nbillion)	5909	>=	214832616	
Postgraduate		(Nbillion)	3998.758	>=	318237978	
Σλ				4	=	1

APPENDIX E - Answer Report 2

Worksheet: DEA_Analysis - Baseline+Budget

Target Cell (Max)

Cell	Name	Original Value	Final Value
$E$33	(Nbillion) LHS	3998.757844	23476.92825

Adjustable Cells

Cell	Name	Original Value	Final Value
$G$2	1991/1992 Weight (λ)	1	19.50745802
$G$3	1992/1993 Weight (λ)	1	17.13094916
$G$4	1993/1994 Weight (λ)	1	-0.543743954
$G$5	1994/1995 Weight (λ)	1	-0.984969216
$G$6	1995/1996 Weight (λ)	1	18.19493031
$G$7	1996/1997 Weight (λ)	1	16.03855341
$G$8	1997/1998 Weight (λ)	1	20.91630279
$G$9	1998/1999 Weight (λ)	1	17.456381
$G$10	1999/2000 Weight (λ)	1	15.32035133
$G$11	2000/2001 Weight (λ)	1	15.15834457
$G$12	2001/2002 Weight (λ)	1	13.80665461
$G$13	2002/2003 Weight (λ)	1	4.486484451
$G$14	2003/2004 Weight (λ)	1	0.480781846
$G$15	2004/2005 Weight (λ)	1	-14.19455314
$G$16	2005/2006 Weight (λ)	1	13.97245287
$G$17	2006/2007 Weight (λ)	1	5.939457264
$G$18	2007/2008 Weight (λ)	1	0.30722894
$G$19	2008/2009 Weight (λ)	1	-6.227884715
$G$20	2009/2010 Weight (λ)	1	-17.00402487
$G$21	2010/2011 Weight (λ)	1	-8.992457847
$G$22	2011/2012 Weight (λ)	1	-34.29380918
$G$23	2012/2013 Weight (λ)	1	-21.19557764
$G$24	2013/2014 Weight (λ)	1	8.886701005
$G$25	2014/2015 Weight (λ)	1	25.11916907
$G$26	2015/2016 Weight (λ)	1	31.84488611
$G$27	Efficiency Weight (λ)	1	7.37716E-05

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$E$29	(Nbillion) LHS	-22321578.36	$E$29<=$G$29	Not Binding	22329772.64
$E$30	(Nbillion) LHS	7926.442064	$E$30<=$G$30	Binding	0
$E$31	(Nbillion) LHS	9255.945034	$E$31<=$G$31	Binding	0
$E$32	(Nbillion) LHS	39877.1178	$E$32>=$G$32	Not Binding	24028.56968
$E$33	(Nbillion) LHS	23476.92825	$E$33>=$G$33	Binding	0

APPENDIX F – Sensitivity Report 2

Microsoft Excel 12.0 Sensitivity Report

Worksheet: DEA_Analysis - Baseline+Budget

Adjustable Cells

Cell	Name	Final Value	Reduced Gradient
$G$2	1991/1992 Weight (λ)	19.50745802	0
$G$3	1992/1993 Weight (λ)	17.13094916	0
$G$4	1993/1994 Weight (λ)	-0.543743954	0
$G$5	1994/1995 Weight (λ)	-0.984969216	0
$G$6	1995/1996 Weight (λ)	18.19493031	0
$G$7	1996/1997 Weight (λ)	16.03855341	0
$G$8	1997/1998 Weight (λ)	20.91630279	0
$G$9	1998/1999 Weight (λ)	17.456381	0
$G$10	1999/2000 Weight (λ)	15.32035133	0
$G$11	2000/2001 Weight (λ)	15.15834457	0
$G$12	2001/2002 Weight (λ)	13.80665461	0
$G$13	2002/2003 Weight (λ)	4.486484451	0
$G$14	2003/2004 Weight (λ)	0.480781846	0
$G$15	2004/2005 Weight (λ)	-14.19455314	0
$G$16	2005/2006 Weight (λ)	13.97245287	0
$G$17	2006/2007 Weight (λ)	5.939457264	0
$G$18	2007/2008 Weight (λ)	0.30722894	0
$G$19	2008/2009 Weight (λ)	-6.227884715	0
$G$20	2009/2010 Weight (λ)	-17.00402487	0
$G$21	2010/2011 Weight (λ)	-8.992457847	0
$G$22	2011/2012 Weight (λ)	-34.29380918	0
$G$23	2012/2013 Weight (λ)	-21.19557764	0
$G$24	2013/2014 Weight (λ)	8.886701005	0
$G$25	2014/2015 Weight (λ)	25.11916907	0
$G$26	2015/2016 Weight (λ)	31.84488611	0
$G$27	Efficiency Weight (λ)	7.37716E-05	0

Constraints

Cell	Name	Final Value	Lagrange Multiplier
$E$29	(Nbillion) LHS	-22321578.36	0
$E$30	(Nbillion) LHS	7926.442064	0
$E$31	(Nbillion) LHS	9255.945034	1.31192E-06
$E$32	(Nbillion) LHS	39877.1178	0
$E$33	(Nbillion) LHS	23476.92825	0

APPENDIX G – Limits Report 2

Microsoft Excel 12.0 Limits Report 2

Cell	Target Name	Value
$E$33	(Nbillion) LHS	23476.92825

Cell	Adjustable Name	Value	Lower Limit	Target Result	Upper Limit	Target Result
$G$2	1991/1992 Weight (λ)	19.50745802	19.50745802	23476.92825	19.50745802	23476.9282
$G$3	1992/1993 Weight (λ)	17.13094916	17.13094916	23476.92825	17.13094916	23476.9282
$G$4	1993/1994 Weight (λ)	-0.54374395	-0.54374395	23476.92825	-0.54374395	23476.9282
$G$5	1994/1995 Weight (λ)	-0.98496921	-0.98496921	23476.92825	-0.98496921	23476.9282
$G$6	1995/1996 Weight (λ)	18.19493031	18.19493031	23476.92825	18.19493031	23476.9282
$G$7	1996/1997 Weight (λ)	16.03855341	16.03855341	23476.92825	16.03855341	23476.9282
$G$8	1997/1998 Weight (λ)	20.91630279	20.91630279	23476.92825	20.91630279	23476.9282
$G$9	1998/1999 Weight (λ)	17.456381	17.456381	23476.92825	17.456381	23476.9282
$G$10	1999/2000 Weight (λ)	15.32035133	15.32035133	23476.92825	15.32035133	23476.9282
$G$11	2000/2001 Weight (λ)	15.15834457	15.15834457	23476.92825	15.15834457	23476.9282
$G$12	2001/2002 Weight (λ)	13.80665461	13.80665461	23476.92825	13.80665461	23476.9282
$G$13	2002/2003 Weight (λ)	4.486484451	4.486484451	23476.92825	4.486484451	23476.9282
$G$14	2003/2004 Weight (λ)	0.480781846	0.480781846	23476.92825	0.480781846	23476.9282
$G$15	2004/2005 Weight (λ)	-14.1945531	-14.1945531	23476.92825	-14.1945531	23476.9282
$G$16	2005/2006 Weight (λ)	13.97245287	13.97245287	23476.92825	13.97245287	23476.9282
$G$17	2006/2007 Weight (λ)	5.939457264	5.939457264	23476.92825	5.939457264	23476.9282
$G$18	2007/2008 Weight (λ)	0.30722894	0.30722894	23476.92825	0.30722894	23476.9282
$G$19	2008/2009 Weight (λ)	-6.22788471	-6.22788471	23476.92825	-6.22788471	23476.9282
$G$20	2009/2010 Weight (λ)	-17.0040248	-17.0040248	23476.92825	-17.0040248	23476.9282
$G$21	2010/2011 Weight (λ)	-8.99245784	-8.99245784	23476.92825	-8.99245784	23476.9282
$G$22	2011/2012 Weight (λ)	-34.2938091	-34.2938091	23476.92825	-34.2938091	23476.9282
$G$23	2012/2013 Weight (λ)	-21.1955776	-21.1955776	23476.92825	-21.1955776	23476.9282
$G$24	2013/2014 Weight (λ)	8.886701005	8.886701005	23476.92825	8.886701005	23476.9282
$G$25	2014/2015 Weight (λ)	25.11916907	25.11916907	23476.92825	25.11916907	23476.9282
$G$26	2015/2016 Weight (λ)	31.84488611	31.84488611	23476.92825	31.84488611	23476.9282
$G$27	Efficiency Weight (λ)	7.37716E-05	7.37716E-05	23476.92825	7.37716E-05	23476.9282

APPENDIX H – Baseline + Funding (Subvention Grant)

Year	General Expenses	Academic Expenses	Subvention Grant	Undergrad	Postgrad	Weight (λ)
1991/1992	22381342	362764	19,957,539	219	86	1
1992/1993	53145233	1310529	61,579,576	252	77	1
1993/1994	62443242	2959341	75558094			1
1994/1995	80603538	3401760	162995730	232		1
1995/1996	111076373	4797460	108526152	190	88	1
1996/1997	107445696	5894283	88858550	202	77	1
1997/1998	125467574	5091012	190092575	140	102	1
1998/1999	214832616	5996507	171335179	167	91	1
1999/2000	318237978	1218705	254476342	218	92	1
2000/2001	576328478	8882583	824939290	181	109	1
2001/2002	669946116	8025354	612,657,982	93	112	1
2002/2003	587783301	5172185	503,097,229	187	90	1
2003/2004	775582441	7279389	757,325,030	174	84	1
2004/2005	774302813	3300486	615,835,520	169		1
2005/2006	936546295	4348738	791,906,935	317	156	1
2006/2007	1002277348	9368333	969,105,746	220	138	1
2007/2008	1460362388	8469210	1,276,646,181	358	179	1
2008/2009	1431941344	19563730	1,382,995,154	181	153	1
2009/2010	2055233489	9779057	1,978,111,351	272	117	1
2010/2011	2458853405	8334055	2,167,706,906	229	191	1
2011/2012	2,414,254,815	52,093,745	2,287,992,156	240	316	1
2012/2013	2,455,089,668	10,034,834	2,259,605,678	282	435	1
2013/2014	2,719,239,426	14,059,621	2,539,848,325	535	371	1
2014/2015	2,413,354,289	19,624,867	2,306,737,438	386	427	1
2015/2016	2,206,885,956	30,266,109	2,083,034,227	465	512	1
				Efficiency		7.65E-06
			LHS		RHS	
Gen_Expenses		(Nbillion)	2.603E+10	<=	849.6955	
Academic_Expenses		(Nbillion)	249634657	<=	821.922	
Total Income		(Nbillion)	2.449E+10	<=	959.7831	
Undergrad		(Nbillion)	5909	>=	1643.394	
Postgraduate		(Nbillion)	4003	>=	2434.409	
Σλ			5	=	1	

APPENDIX I – Answer Report 3

Worksheet: Baseline+Funding(Subventn_Grant)

Target Cell (Max)

Cell	Name	Original Value	Final Value
$E$35	(Nbillion) LHS	4003	5120.990214

Adjustable Cells

Cell	Name	Original Value	Final Value
$G$2	1991/1992 Weight (λ)	1	3.483685554
$G$3	1992/1993 Weight (λ)	1	3.016480353
$G$4	1993/1994 Weight (λ)	1	0.64266794
$G$5	1994/1995 Weight (λ)	1	0.249069931
$G$6	1995/1996 Weight (λ)	1	3.119509143
$G$7	1996/1997 Weight (λ)	1	2.881069231
$G$8	1997/1998 Weight (λ)	1	3.173744039
$G$9	1998/1999 Weight (λ)	1	2.881128822
$G$10	1999/2000 Weight (λ)	1	2.47539026
$G$11	2000/2001 Weight (λ)	1	0.357819477
$G$12	2001/2002 Weight (λ)	1	1.330698236
$G$13	2002/2003 Weight (λ)	1	1.188045332
$G$14	2003/2004 Weight (λ)	1	-0.20605669
$G$15	2004/2005 Weight (λ)	1	-2.11631747
$G$16	2005/2006 Weight (λ)	1	1.709025363
$G$17	2006/2007 Weight (λ)	1	0.367780861
$G$18	2007/2008 Weight (λ)	1	-0.003005406
$G$19	2008/2009 Weight (λ)	1	-1.203914612
$G$20	2009/2010 Weight (λ)	1	-5.268651892
$G$21	2010/2011 Weight (λ)	1	-4.101433024
$G$22	2011/2012 Weight (λ)	1	-5.178565928
$G$23	2012/2013 Weight (λ)	1	2.827766768
$G$24	2013/2014 Weight (λ)	1	1.369908
$G$25	2014/2015 Weight (λ)	1	2.430870405
$G$26	2015/2016 Weight (λ)	1	6.110899798
$G$28	Efficiency Weight (λ)	7.64965E-06	1.60917E-05

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$E$31	(Nbillion) LHS	-397473604.6	$E$31<=$G$31	Not Binding	397475392
$E$32	(Nbillion) LHS	1728.983955	$E$32<=$G$32	Binding	0
$E$33	(Nbillion) LHS	2018.986616	$E$33>=$G$33	Binding	0
$E$34	(Nbillion) LHS	6336.574549	$E$34>=$G$34	Not Binding	2879.552445
$E$35	(Nbillion) LHS	5120.990214	$E$35>=$G$35	Binding	0

APPENDIX J - Sensitivity Report 3

Microsoft Excel 12.0 Sensitivity Report

Worksheet: Baseline+Funding(Subventn_Grant)

Adjustable Cells

Cell	Name	Final Value	Reduced Gradient
$G$2	1991/1992 Weight (λ)	3.483685554	0
$G$3	1992/1993 Weight (λ)	3.016480353	0
$G$4	1993/1994 Weight (λ)	0.64266794	0
$G$5	1994/1995 Weight (λ)	0.249069931	0
$G$6	1995/1996 Weight (λ)	3.119509143	0
$G$7	1996/1997 Weight (λ)	2.881069231	0
$G$8	1997/1998 Weight (λ)	3.173744039	0
$G$9	1998/1999 Weight (λ)	2.881128822	0
$G$10	1999/2000 Weight (λ)	2.47539026	0
$G$11	2000/2001 Weight (λ)	0.357819477	0
$G$12	2001/2002 Weight (λ)	1.330698236	0
$G$13	2002/2003 Weight (λ)	1.188045332	0
$G$14	2003/2004 Weight (λ)	-0.20605669	0
$G$15	2004/2005 Weight (λ)	-2.11631747	0
$G$16	2005/2006 Weight (λ)	1.709025363	0
$G$17	2006/2007 Weight (λ)	0.367780861	0
$G$18	2007/2008 Weight (λ)	-0.003005406	0
$G$19	2008/2009 Weight (λ)	-1.203914612	0
$G$20	2009/2010 Weight (λ)	-5.268651892	0
$G$21	2010/2011 Weight (λ)	-4.101433024	0
$G$22	2011/2012 Weight (λ)	-5.178565928	0
$G$23	2012/2013 Weight (λ)	2.827766768	0
$G$24	2013/2014 Weight (λ)	1.369908	0
$G$25	2014/2015 Weight (λ)	2.430870405	0
$G$26	2015/2016 Weight (λ)	6.110899798	0
$G$28	Efficiency Weight (λ)	1.60917E-05	0

Constraints

Cell	Name	Final Value	Lagrange Multiplier
$E$31	(Nbillion) LHS	-397473604.6	0
$E$32	(Nbillion) LHS	1728.983955	0
$E$33	(Nbillion) LHS	2018.986616	0
$E$34	(Nbillion) LHS	6336.574549	0
$E$35	(Nbillion) LHS	5120.990214	0

APPENDIX K - Limits Report 3

Microsoft Excel 12.0 Limits Report
Worksheet: DEA_Analysis - Limits Report 3

Cell	Target Name	Value
$E$35	(Nbillion) LHS	5120.990214

Cell	Adjustable Name	Value	Lower Limit	Target Result	Upper Limit	Target Result
$G$2	1991/1992 Weight (λ)	3.483685554	3.483685554	5120.990214	3.483685554	5120.990214
$G$3	1992/1993 Weight (λ)	3.016480353	3.016480353	5120.990214	3.016480353	5120.990214
$G$4	1993/1994 Weight (λ)	0.64266794	0.64266794	5120.990214	0.64266794	5120.990214
$G$5	1994/1995 Weight (λ)	0.249069931	0.249069931	5120.990214	0.249069931	5120.990214
$G$6	1995/1996 Weight (λ)	3.119509143	3.119509143	5120.990214	3.119509143	5120.990214
$G$7	1996/1997 Weight (λ)	2.881069231	2.881069231	5120.990214	2.881069231	5120.990214
$G$8	1997/1998 Weight (λ)	3.173744039	3.173744039	5120.990214	3.173744039	5120.990214
$G$9	1998/1999 Weight (λ)	2.881128822	2.881128822	5120.990214	2.881128822	5120.990214
$G$10	1999/2000 Weight (λ)	2.47539026	2.47539026	5120.990214	2.47539026	5120.990214
$G$11	2000/2001 Weight (λ)	0.357819477	0.357819477	5120.990214	0.357819477	5120.990214
$G$12	2001/2002 Weight (λ)	1.330698236	1.330698236	5120.990214	1.330698236	5120.990214
$G$13	2002/2003 Weight (λ)	1.188045332	1.188045332	5120.990214	1.188045332	5120.990214
$G$14	2003/2004 Weight (λ)	-0.20605669	-0.20605669	5120.990214	-0.20605669	5120.990214
$G$15	2004/2005 Weight (λ)	-2.11631747	-2.11631747	5120.990214	-2.11631747	5120.990214
$G$16	2005/2006 Weight (λ)	1.709025363	1.709025363	5120.990214	1.709025363	5120.990214
$G$17	2006/2007 Weight (λ)	0.367780861	0.367780861	5120.990214	0.367780861	5120.990214
$G$18	2007/2008 Weight (λ)	-0.00300540	-0.00300540	5120.990214	-0.00300540	5120.990214
$G$19	2008/2009 Weight (λ)	-1.20391461	-1.20391461	5120.990214	-1.20391461	5120.990214
$G$20	2009/2010 Weight (λ)	-5.26865189	-5.26865189	5120.990214	-5.26865189	5120.990214
$G$21	2010/2011 Weight (λ)	-4.10143302	-4.10143302	5120.990214	-4.10143302	5120.990214
$G$22	2011/2012 Weight (λ)	-5.17856592	-5.17856592	5120.990214	-5.17856592	5120.990214
$G$23	2012/2013 Weight (λ)	2.827766768	2.827766768	5120.990214	2.827766768	5120.990214
$G$24	2013/2014 Weight (λ)	1.369908	1.369908	5120.990214	1.369908	5120.990214
$G$25	2014/2015 Weight (λ)	2.430870405	2.430870405	5120.990214	2.430870405	5120.990214
$G$26	2015/2016 Weight (λ)	6.110899798	6.110899798	5120.990214	6.110899798	5120.990214
$G$28	Efficiency Weight (λ)	1.60917E-05	1.60917E-05	5120.990214	1.60917E-05	5120.990214

APPENDIX L – Baseline + Budget + Funding (Subvention Grant)

Year	General Expenses	Academic Expenses	Budget	Subvention Grant	Undergrad	Postgrad	Weight (λ)
1991/1992	22381342	362764	2,122,600	19,957,539	219	86	1
1992/1993	53145233	1310529	2,637,620	61,579,576	252	77	1
1993/1994	62443242	2959341	4,900,335	75558094			1
1994/1995	80603538	3401760	6,207,524	162995730	232		1
1995/1996	111076373	4797460	6,837,484	108526152	190	88	1
1996/1997	107445696	5894283	5,731,576	88858550	202	77	1
1997/1998	125467574	5091012	8,064,617	190092575	140	102	1
1998/1999	214832616	5996507	9,082,724	171335179	167	91	1
1999/2000	318237978	1218705	15,304,896	254476342	218	92	1
2000/2001	576328478	8882583	23,270,273	824939290	181	109	1
2001/2002	669946116	8025354	28,612,132	612,657,982	93	112	1
2002/2003	587783301	5172185	52,187,622	503,097,229	187	90	1
2003/2004	775582441	7279389	56,831,259	757,325,030	174	84	1
2004/2005	774302813	3300486	38,179,514	615,835,520	169		1
2005/2006	936546295	4348738	61,540,361	791,906,935	317	156	1
2006/2007	1002277348	9368333	77,703,338	969,105,746	220	138	1
2007/2008	1460362388	8469210	126,483,004	1,276,646,181	358	179	1
2008/2009	1431941344	19563730	131,059,259	1,382,995,154	181	153	1
2009/2010	2055233489	9779057	118,097,002	1,978,111,351	272	117	1
2010/2011	2458853405	8334055	140,096,663	2,167,706,906	229	191	1
2011/2012	2,414,254,815	52,093,745	250,852,688	2,287,992,156	240	316	1
2012/2013	2,455,089,668	10,034,834	333,499,542	2,259,605,678	282	435	1
2013/2014	2,719,239,426	14,059,621	232,772,970	2,539,848,325	535	371	1
2014/2015	2,413,354,289	19,624,867	227,408,829	2,306,737,438	386	427	1
2015/2016	2,206,885,956	30,266,109	291,766,629	2,083,034,227	465	512	1
					Efficiency		1
				LHS		RHS	
Gen_Expenses		(Nbillion)		2.603E+10	<=	1.11E+08	
Academic_Expenses		(Nbillion)		249634657	<=	1.07E+08	
Budget		(Nbillion)		2.251E+09	<=	1.25E+08	
Funding		(Nbillion)		2.449E+10	>=	2.15E+08	
Undergrad		(Nbillion)		5909	>=	3.18E+08	
Postgraduate		(Nbillion)		4003	>=	5.76E+08	
Σλ					=	1	

APPENDIX M - Answer Report 4

Worksheet: [DEA_Analysis_Revised_Final

Target Cell (Max)

Cell	Name	Original Value	Final Value
$H$26	2015/2016 Weight (λ)	1	10.57192743

Adjustable Cells

Cell	Name	Original Value	Final Value
$H$2	1991/1992 Weight (λ)	1	0.985368431
$H$3	1992/1993 Weight (λ)	1	0.962444754
$H$4	1993/1994 Weight (λ)	1	0.940088584
$H$5	1994/1995 Weight (λ)	1	0.930844834
$H$6	1995/1996 Weight (λ)	1	0.897848622
$H$7	1996/1997 Weight (λ)	1	0.887383982
$H$8	1997/1998 Weight (λ)	1	0.891725838
$H$9	1998/1999 Weight (λ)	1	0.837165538
$H$10	1999/2000 Weight (λ)	1	0.839400803
$H$11	2000/2001 Weight (λ)	1	0.660795731
$H$12	2001/2002 Weight (λ)	1	0.609942036
$H$13	2002/2003 Weight (λ)	1	0.662564266
$H$14	2003/2004 Weight (λ)	1	0.561009408
$H$15	2004/2005 Weight (λ)	1	0.605037849
$H$16	2005/2006 Weight (λ)	1	0.513671838
$H$17	2006/2007 Weight (λ)	1	0.430502314
$H$18	2007/2008 Weight (λ)	1	0.211248481
$H$19	2008/2009 Weight (λ)	1	0.110856871
$H$20	2009/2010 Weight (λ)	1	-0.048022276
$H$21	2010/2011 Weight (λ)	1	-0.22865253
$H$22	2011/2012 Weight (λ)	1	-6.207470103
$H$23	2012/2013 Weight (λ)	1	-5.615138565
$H$24	2013/2014 Weight (λ)	1	0.784141768
$H$25	2014/2015 Weight (λ)	1	-0.361171012
$H$26	2015/2016 Weight (λ)	1	10.57192743
$H$27	Efficiency Weight (λ)	1	3.62302E-06

Constraints

Cell	Name	Cell Value	Formula
$F$29	(Nbillion) LHS	-418157517.2	$F$29<=$H$29
$F$30	(Nbillion) LHS	389.2781706	$F$30<=$H$30
$F$31	(Nbillion) LHS	454.5718403	$F$31<=$H$31
$F$34	(Nbillion) LHS	2088.051024	$F$34>=$H$34
$F$33	(Nbillion) LHS	4382.464628	$F$33>=$H$33
$F$32	(Nbillion) LHS	778.3433952	$F$32>=$H$32

APPENDIX N - Sensitivity Report 4

Worksheet: DEA_Analysis_Revised

Adjustable Cells

Cell	Name	Final Value	Reduced Gradient
$H$2	1991/1992 Weight (λ)	0.985368431	0
$H$3	1992/1993 Weight (λ)	0.962444754	0
$H$4	1993/1994 Weight (λ)	0.940088584	0
$H$5	1994/1995 Weight (λ)	0.930844834	0
$H$6	1995/1996 Weight (λ)	0.897848622	0
$H$7	1996/1997 Weight (λ)	0.887383982	0
$H$8	1997/1998 Weight (λ)	0.891725838	0
$H$9	1998/1999 Weight (λ)	0.837165538	0
$H$10	1999/2000 Weight (λ)	0.839400803	0
$H$11	2000/2001 Weight (λ)	0.660795731	0
$H$12	2001/2002 Weight (λ)	0.609942036	0
$H$13	2002/2003 Weight (λ)	0.662564266	0
$H$14	2003/2004 Weight (λ)	0.561009408	0
$H$15	2004/2005 Weight (λ)	0.605037849	0
$H$16	2005/2006 Weight (λ)	0.513671838	0
$H$17	2006/2007 Weight (λ)	0.430502314	0
$H$18	2007/2008 Weight (λ)	0.211248481	0
$H$19	2008/2009 Weight (λ)	0.110856871	0
$H$20	2009/2010 Weight (λ)	-0.048022276	0
$H$21	2010/2011 Weight (λ)	-0.22865253	0
$H$22	2011/2012 Weight (λ)	-6.207470103	0
$H$23	2012/2013 Weight (λ)	-5.615138565	0
$H$24	2013/2014 Weight (λ)	0.784141768	0
$H$25	2014/2015 Weight (λ)	-0.361171012	0
$H$26	2015/2016 Weight (λ)	10.57192743	0
$H$27	Efficiency Weight (λ)	3.62302E-06	0

Constraints

Cell	Name	Final Value	Lagrange Multiplier
$F$29	(Nbillion) LHS	-418157517.2	0
$F$30	(Nbillion) LHS	389.2781706	0
$F$31	(Nbillion) LHS	454.5718403	0
$F$34	(Nbillion) LHS	2088.051024	0
$F$33	(Nbillion) LHS	4382.464628	0
$F$32	(Nbillion) LHS	778.3433952	0

APPENDIX O – Limits Report 4

Worksheet: [DEA_Analysis_Revised] Limits Report 4

Cell	Target Name	Value
$H$26	2015/2016 Weight (λ)	10.57192743

Cell	Adjustable Name	Value	Lower Limit	Target Result	Upper Limit	Target Result
$H$2	1991/1992 Weight (λ)	0.985368431	0.985368431	10.57192743	0.985368431	10.57192743
$H$3	1992/1993 Weight (λ)	0.962444754	0.962444754	10.57192743	0.962444754	10.57192743
$H$4	1993/1994 Weight (λ)	0.940088584	0.940088584	10.57192743	0.940088584	10.57192743
$H$5	1994/1995 Weight (λ)	0.930844834	0.930844834	10.57192743	0.930844834	10.57192743
$H$6	1995/1996 Weight (λ)	0.897848622	0.897848622	10.57192743	0.897848622	10.57192743
$H$7	1996/1997 Weight (λ)	0.887383982	0.887383982	10.57192743	0.887383982	10.57192743
$H$8	1997/1998 Weight (λ)	0.891725838	0.891725838	10.57192743	0.891725838	10.57192743
$H$9	1998/1999 Weight (λ)	0.837165538	0.837165538	10.57192743	0.837165538	10.57192743
$H$10	1999/2000 Weight (λ)	0.839400803	0.839400803	10.57192743	0.839400803	10.57192743
$H$11	2000/2001 Weight (λ)	0.660795731	0.660795731	10.57192743	0.660795731	10.57192743
$H$12	2001/2002 Weight (λ)	0.609942036	0.609942036	10.57192743	0.609942036	10.57192743
$H$13	2002/2003 Weight (λ)	0.662564266	0.662564266	10.57192743	0.662564266	10.57192743
$H$14	2003/2004 Weight (λ)	0.561009408	0.561009408	10.57192743	0.561009408	10.57192743
$H$15	2004/2005 Weight (λ)	0.605037849	0.605037849	10.57192743	0.605037849	10.57192743
$H$16	2005/2006 Weight (λ)	0.513671838	0.513671838	10.57192743	0.513671838	10.57192743
$H$17	2006/2007 Weight (λ)	0.430502314	0.430502314	10.57192743	0.430502314	10.57192743
$H$18	2007/2008 Weight (λ)	0.211248481	0.211248481	10.57192743	0.211248481	10.57192743
$H$19	2008/2009 Weight (λ)	0.110856871	0.110856871	10.57192743	0.110856871	10.57192743
$H$20	2009/2010 Weight (λ)	-0.048022276	-0.048022276	10.57192743	-0.048022276	10.57192743
$H$21	2010/2011 Weight (λ)	-0.22865253	-0.22865253	10.57192743	-0.22865253	10.57192743
$H$22	2011/2012 Weight (λ)	-6.207470103	-6.207470103	10.57192743	-6.207470103	10.57192743
$H$23	2012/2013 Weight (λ)	-5.615138565	-5.615138565	10.57192743	-5.615138565	10.57192743
$H$24	2013/2014 Weight (λ)	0.784141768	0.784141768	10.57192743	0.784141768	10.57192743
$H$25	2014/2015 Weight (λ)	-0.361171012	-0.361171012	10.57192743	-0.361171012	10.57192743
$H$26	2015/2016 Weight (λ)	10.57192743	10.57192743	10.57192743	10.57192743	10.57192743
$H$27	Efficiency Weight (λ)	3.62302E-06	3.62302E-06	10.57192743	3.62302E-06	10.57192743

APPENDIX P

Multivariate data

Year	Subvention Grant	Budget	Undergrad	Postgrad	gov_gdp	politrisk	sch_fees	other_igr
1992	19,957,539	2,122,600	219	86	0.47296		164,487	1,958,113
1993	61,579,576	2,637,620	252	77	0.95959	53.5	265,245	2,372,375
1994	75558094	4,900,335			0.80530	53.0833	49,404	4,850,931
1995	162995730	6,207,524	232		1.22225	54.3333	282,845	5,924,679
1996	108526152	6,837,484	190	88	1.59230	52.3333	1,267,300	5,570,184
1997	88858550	5,731,576	202	77	1.96527	53.0833	925,610	4,805,966
1998	190092575	8,064,617	140	102	2.18115	47.1666	1,387,783	6,676,834
1999	171335179	9,082,724	167	91	4.22144	42.5	1,822,395	7,260,329
2000	254476342	15,304,896	218	92	2.95952	50.1666	3,352,875	11,952,021
2001	824939290	23,270,273	181	109	4.02898	45.75	3,116,273	20,154,000
2002	612,657,982	28,612,132	93	112	3.51600	46.625	3,705,020	24,907,112
2003	503,097,229	52,187,622	187	90	3.86624	38.7916	9,868,230	42,319,392
2004	757,325,030	56,831,259	174	84	4.07246	41.5416	15,024,526	41,806,733
2005	615,835,520	38,179,514	169		4.86218	43.7083	14,002,139	24,177,375
2006	791,906,935	61,540,361	317	156	4.84555	44.2083	36,897,115	24,643,246
2007	969,105,746	77,703,338	220	138	5.71006	46	46,743,515	30,959,823
2008	1,276,646,181	126,483,004	358	179	7.04334	43.8333	66,099,120	60,383,884
2009	1,382,995,154	131,059,259	181	153	6.92591	43.5	50,016,265	81,042,994
2010	1,978,111,351	118,097,002	272	117	7.68064	45.625	49,009,260	69,087,742
2011	2,167,706,906	140,096,663	229	191	8.19331	45.2916	74,237,029	65,859,634
2012	2,287,992,156	250,852,688	240	316	7.68462	46	176,068,696	74,783,992
2013	2,259,605,678	333,499,542	282	435	8.20218	45.1041	126,861,205	206,638,337
2014	2,539,848,325	232,772,970	535	371	6.83126	45.5052	148,072,790	84,700,180
2015	2,306,737,438	227,408,829	386	427	7.22773	45.4752	137,527,560	89,881,269
2016	2,083,034,227	291,766,629	465	512	7.555211	45.5211	146,906,692	144,859,937

APPENDIX Q

Vector Autoregression Estimates

Sample (adjusted): 1998 2016
Included observations: 16 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	FUNDING	BUDGET	GOV_GDP	UNDERGRAD	POSTGRAD	POLITRISK
FUNDING(-1)	0.678307	0.024783	1.03E-09	-5.81E-08	1.27E-07	3.17E-10
	(0.17428)	(0.09063)	(2.8E-09)	(1.6E-07)	(1.5E-07)	(1.1E-08)
	[3.89196]	[0.27346]	[0.36752]	[-0.37325]	[0.85601]	[0.02996]
FUNDING(-2)	-0.074117	0.111255	-5.36E-10	3.62E-08	1.07E-07	-3.04E-09
	(0.13094)	(0.06809)	(2.1E-09)	(1.2E-07)	(1.1E-07)	(8.0E-09)
	[-0.56605]	[1.63401]	[-0.25508]	[0.30927]	[0.96267]	[-0.38235]
BUDGET(-1)	8.756015	0.218391	1.72E-08	1.06E-06	-1.04E-07	-1.71E-08
	(1.66348)	(0.86500)	(2.7E-08)	(1.5E-06)	(1.4E-06)	(1.0E-07)
	[5.26366]	[0.25247]	[0.64611]	[0.71322]	[-0.07325]	[-0.16918]
BUDGET(-2)	13.35723	-1.595022	-8.31E-09	2.07E-06	-6.44E-07	7.13E-08
	(2.59842)	(1.35117)	(4.2E-08)	(2.3E-06)	(2.2E-06)	(1.6E-07)
	[5.14052]	[-1.18048]	[-0.19940]	[0.89135]	[-0.29165]	[0.45098]
GOV_GDP(-1)	-1.82E+08	2809142.	-0.019939	12.68283	-20.46667	1.611596
	(6.1E+07)	(3.2E+07)	(0.97291)	(54.1907)	(51.5771)	(3.68837)
	[-2.99400]	[0.08906]	[-0.02049]	[0.23404]	[-0.39682]	[0.43694]
GOV_GDP(-2)	-2.18E+08	22578205	0.531285	-81.32647	-24.57010	-2.204672
	(8.1E+07)	(4.2E+07)	(1.29610)	(72.1928)	(68.7109)	(4.91365)
	[-2.69178]	[0.53733]	[0.40991]	[-1.12652]	[-0.35759]	[-0.44868]
UNDERGRAD(-1)	980652.8	176149.4	0.002971	-0.287209	0.297038	0.001292
	(458991.)	(238673.)	(0.00736)	(0.41006)	(0.39028)	(0.02791)
	[2.13654]	[0.73804]	[0.40354]	[-0.70041]	[0.76108]	[0.04630]
UNDERGRAD(-2)	2849656.	-32342.65	0.007774	0.348367	0.035150	0.002642
	(530769.)	(275997.)	(0.00851)	(0.47418)	(0.45132)	(0.03227)
	[5.36892]	[-0.11718]	[0.91321]	[0.73467]	[0.07788]	[0.08186]
POSTGRAD(-1)	-2738963.	-21863.86	-0.013760	0.137134	0.714815	0.025265
	(1078724)	(560931.)	(0.01730)	(0.96372)	(0.91724)	(0.06559)
	[-2.53908]	[-0.03898]	[-0.79526]	[0.14230]	[0.77931]	[0.38517]
POSTGRAD(-2)	-12313682	650912.2	0.001483	-0.858943	-0.174185	-0.048152
	(2545487)	(1323640)	(0.04083)	(2.27412)	(2.16444)	(0.15478)
	[-4.83746]	[0.49176]	[0.03633]	[-0.37770]	[-0.08048]	[-0.31109]
POLITRISK(-1)	-20886422	1665859.	-0.053799	2.692810	3.261292	0.250770
	(1.0E+07)	(5400270)	(0.16657)	(9.27809)	(8.83061)	(0.63149)
	[-2.01117]	[0.30848]	[-0.32297]	[0.29023]	[0.36932]	[0.39711]
POLITRISK(-2)	-1.26E+08	6227199.	0.009062	-24.84398	-5.670954	-0.405958
	(2.5E+07)	(1.3E+07)	(0.39947)	(22.2503)	(21.1772)	(1.51442)
	[-5.07411]	[0.48084]	[0.02268]	[-1.11657]	[-0.26779]	[-0.26806]
C	8.96E+09	-5.36E+08	3.102014	1459.818	179.5918	55.37876
	(1.9E+09)	(9.9E+08)	(30.4878)	(1698.17)	(1616.26)	(115.582)
	[4.71300]	[-0.54201]	[0.10175]	[0.85964]	[0.11112]	[0.47913]
R-squared	0.998659	0.976662	0.940331	0.944933	0.966220	0.414112
Adj. R-squared	0.993296	0.883308	0.701656	0.724663	0.831098	-1.929442
Sum sq. resids	1.54E+16	4.16E+15	3.955640	12272.25	11117.03	56.85189
S.E. equation	71591128	37227026	1.148280	63.95898	60.87426	4.353232
F-statistic	186.2102	10.46196	3.939794	4.289895	7.150752	0.176702
Log likelihood	-298.6949	-288.2319	-11.52345	-75.84308	-75.05217	-32.84590
Akaike AIC	38.96186	37.65399	3.065431	11.10538	11.00652	5.730738

Schwarz SC	39.58959	38.28172	3.693159	11.73311	11.63425	6.358466
Mean dependent	1.35E+09	1.28E+08	5.761880	256.7500	211.3125	44.89984
S.D. dependent	8.74E+08	1.09E+08	2.102273	121.8904	148.1210	2.543427

Determinant resid covariance (dof adj.)	0.000000
Determinant resid covariance	0.000000

Null Hypothesis: FUNDING has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.418217	0.8909
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(FUNDING) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.619822	0.0014
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOG(BUDGET) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.366662	0.5811
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LOG(BUDGET)) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.540412	0.0017
Test critical values:	1% level	-3.752946	

5% level	-2.998064	
10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.
Null Hypothesis: GOV_GDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.115780	0.6914
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(GOV_GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.733687	0.0000
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: UNDERGRAD has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.385424	0.8942
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(UNDERGRAD) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.421139	0.0000
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOG(POSTGRAD) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.577004	0.9848
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: POLITRISK has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.429329	0.1452
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(POLITRISK) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.586497	0.0000
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: SCH_FEES has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.423437	0.8899
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOG(SCH_FEES) has a unit root

Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.177146	0.6669
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LOG(SCH_FEES)) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.921813	0.0001
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOG(OTHER_INTERNAL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.339279	0.5941
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LOG(OTHER_INTERNAL)) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.054162	0.0005
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Granger Causality Test
Pairwise Granger Causality Tests
Date: 01/18/18 Time: 10:17

Sample: 1992 2016
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
BUDGET does not Granger Cause FUNDING	23	0.72280	0.4990
FUNDING does not Granger Cause BUDGET		26.5840	4.E-06
GOV_GDP does not Granger Cause FUNDING	23	10.1330	0.0011
FUNDING does not Granger Cause GOV_GDP		1.44520	0.2618
SCH_FEES does not Granger Cause FUNDING	23	0.43843	0.6518
FUNDING does not Granger Cause SCH_FEES		9.75284	0.0014
UNDERGRAD does not Granger Cause FUNDING	20	0.22893	0.7981
FUNDING does not Granger Cause UNDERGRAD		6.91814	0.0074
POSTGRAD does not Granger Cause FUNDING	16	0.51784	0.6096
FUNDING does not Granger Cause POSTGRAD		2.67518	0.1130
OTHER_INTERNAL does not Granger Cause FUNDING	23	1.73348	0.2049
FUNDING does not Granger Cause OTHER_INTERNAL		21.0503	2.E-05
POLITRISK does not Granger Cause FUNDING	22	1.52113	0.2468
FUNDING does not Granger Cause POLITRISK		0.13155	0.8776
GOV_GDP does not Granger Cause BUDGET	23	2.99882	0.0752
BUDGET does not Granger Cause GOV_GDP		1.78895	0.1956
SCH_FEES does not Granger Cause BUDGET	23	9.56585	0.0015
BUDGET does not Granger Cause SCH_FEES		0.58551	0.5671
UNDERGRAD does not Granger Cause BUDGET	20	1.39673	0.2778
BUDGET does not Granger Cause UNDERGRAD		7.51773	0.0055
POSTGRAD does not Granger Cause BUDGET	16	0.79182	0.4772
BUDGET does not Granger Cause POSTGRAD		1.13102	0.3575
OTHER_INTERNAL does not Granger Cause BUDGET	23	9.56585	0.0015
BUDGET does not Granger Cause OTHER_INTERNAL		44.5759	1.E-07
POLITRISK does not Granger Cause BUDGET	22	0.22192	0.8033
BUDGET does not Granger Cause POLITRISK		0.04661	0.9546
SCH_FEES does not Granger Cause GOV_GDP	23	1.15472	0.3374
GOV_GDP does not Granger Cause SCH_FEES		3.06539	0.0715
UNDERGRAD does not Granger Cause GOV_GDP	20	0.66468	0.5290
GOV_GDP does not Granger Cause UNDERGRAD		1.56076	0.2422
POSTGRAD does not Granger Cause GOV_GDP	16	0.58260	0.5748
GOV_GDP does not Granger Cause POSTGRAD		0.92441	0.4255
OTHER_INTERNAL does not Granger Cause GOV_GDP	23	2.78997	0.0880
GOV_GDP does not Granger Cause OTHER_INTERNAL		5.68828	0.0122
POLITRISK does not Granger Cause GOV_GDP	22	0.28336	0.7567

GOV_GDP does not Granger Cause POLITRISK		1.04031	0.3748
UNDERGRAD does not Granger Cause SCH_FEES	20	0.09321	0.9115
SCH_FEES does not Granger Cause UNDERGRAD		13.8060	0.0004
POSTGRAD does not Granger Cause SCH_FEES	16	0.65490	0.5386
SCH_FEES does not Granger Cause POSTGRAD		4.73208	0.0329
OTHER_INTERNAL does not Granger Cause SCH_FEES	23	0.58551	0.5671
SCH_FEES does not Granger Cause OTHER_INTERNAL		44.5759	1.E-07
POLITRISK does not Granger Cause SCH_FEES	22	0.27709	0.7613
SCH_FEES does not Granger Cause POLITRISK		0.02185	0.9784
POSTGRAD does not Granger Cause UNDERGRAD	16	11.1507	0.0023
UNDERGRAD does not Granger Cause POSTGRAD		1.23418	0.3284
OTHER_INTERNAL does not Granger Cause UNDERGRAD	20	7.10548	0.0067
UNDERGRAD does not Granger Cause OTHER_INTERNAL		1.14354	0.3450
POLITRISK does not Granger Cause UNDERGRAD	20	0.65202	0.5351
UNDERGRAD does not Granger Cause POLITRISK		0.28026	0.7595
OTHER_INTERNAL does not Granger Cause POSTGRAD	16	7.26278	0.0098
POSTGRAD does not Granger Cause OTHER_INTERNAL		5.10882	0.0270
POLITRISK does not Granger Cause POSTGRAD	16	0.52478	0.6058
POSTGRAD does not Granger Cause POLITRISK		0.09449	0.9106
POLITRISK does not Granger Cause OTHER_INTERNAL	22	0.12511	0.8832
OTHER_INTERNAL does not Granger Cause POLITRISK		0.01812	0.9821

Dependent Variable: D(LOG(FUNDING))
Method: Least Squares
Date: 01/17/18 Time: 07:26
Sample (adjusted): 1999 2016
Included observations: 15 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.347753	0.169815	-2.047831	0.0865
D(LOG(FUNDING(-1)))	1.827572	0.579844	3.151834	0.0198
D(LOG(BUDGET))	0.775748	0.305902	2.535933	0.0443
D(GOV_GDP(-1))	-0.089615	0.106446	-0.841881	0.4321
D(UNDERGRAD)	0.002619	0.001293	2.025785	0.0892
D(UNDERGRAD(-1))	0.002154	0.000999	2.156433	0.0744
D(POSTGRAD(-1))	-0.000959	0.001645	-0.583014	0.5811
D(LOG(POLITRISK(-1)))	1.176910	1.082492	1.087224	0.3187
ECT(-1)	-0.961574	0.220737	-3.498207	0.0129

R-squared	0.746493	Mean dependent var	0.111004
Adjusted R-squared	0.408483	S.D. dependent var	0.366678
S.E. of regression	0.282012	Akaike info criterion	0.589977
Sum squared resid	0.477186	Schwarz criterion	1.014807
Log likelihood	4.575173	Hannan-Quinn criter.	0.585452

F-statistic	2.208497	Durbin-Watson stat	1.501127
Prob(F-statistic)	0.175021		

Dependent Variable: LOG(FUNDING)
Method: ARDL
Date: 01/17/18 Time: 10:32
Sample (adjusted): 1993 2016
Included observations: 21 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): LOG(BUDGET) LOG(GOV_GDP) LOG(UNDERGRAD) LOG(POSTGRAD) LOG(POLITRISK)
Fixed regressors: C
Number of models evalulated: 32
Selected Model: ARDL(1, 0, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(FUNDING(-1))	-0.094716	0.226193	-0.418740	0.6818
LOG(BUDGET)	0.745635	0.238403	3.127622	0.0074
LOG(GOV_GDP)	0.589789	0.356706	1.653432	0.1205
LOG(UNDERGRAD)	-0.221020	0.252145	-0.876560	0.3955
LOG(POSTGRAD)	-0.092040	0.242013	-0.380309	0.7094
LOG(POLITRISK)	1.130360	1.249192	0.904873	0.3808
C	5.505526	5.416181	1.016496	0.3266

R-squared	0.960365	Mean dependent var	20.34398
Adjusted R-squared	0.943378	S.D. dependent var	1.200996
S.E. of regression	0.285781	Akaike info criterion	0.594020
Sum squared resid	1.143391	Schwarz criterion	0.942194
Log likelihood	0.762795	Hannan-Quinn criter.	0.669582
F-statistic	56.53679	Durbin-Watson stat	2.160732
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 01/17/18 Time: 10:33
Sample: 1993 2016
Included observations: 20
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.628674	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79

2.5%	2.96	4.18
1%	3.41	4.68

ARDL

Dependent Variable: D(LOG(FUNDING))
Method: ARDL
Date: 01/17/18 Time: 10:57
Sample (adjusted): 1997 2016
Included observations: 18 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (0 lag, automatic): D(LOG(BUDGET))
D(LOG(GOV_GDP)) D(LOG(UNDERGRAD)) D(LOG(POSTGRAD))
D(LOG(SCH_FEES)) D(LOG(OTHER_IGR)) D(LOG(POLITRISK))
Fixed regressors: C
Number of models evalulated: 2
Selected Model: ARDL(2, 0, 0, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(LOG(FUNDING(-1)))	-0.314817	0.215743	-1.459221	0.1826
D(LOG(FUNDING(-2)))	-0.785928	0.241143	-3.259181	0.0115
D(LOG(BUDGET))	3.859525	1.174953	3.284832	0.0111
D(LOG(GOV_GDP))	-0.407905	0.504315	-0.808829	0.4420
D(LOG(UNDERGRAD))	0.195156	0.233152	0.837034	0.4269
D(LOG(POSTGRAD))	-0.724302	0.397336	-1.822895	0.1058
D(LOG(SCH_FEES))	-1.506583	0.542790	-2.775629	0.0241
D(LOG(OTHER_IGR))	-1.471506	0.554101	-2.655666	0.0290
D(LOG(POLITRISK))	-0.310464	1.213271	-0.255890	0.8045
C	0.263746	0.107412	2.455447	0.0396

R-squared	0.708600	Mean dependent var	0.161663
Adjusted R-squared	0.380775	S.D. dependent var	0.366942
S.E. of regression	0.288750	Akaike info criterion	0.653668
Sum squared resid	0.667011	Schwarz criterion	1.148319
Log likelihood	4.116989	Hannan-Quinn criter.	0.721874
F-statistic	2.161520	Durbin-Watson stat	1.692619
Prob(F-statistic)	0.145659		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 01/17/18 Time: 11:00
Sample: 1997 2016
Included observations: 17
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	3.325968	7

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.03	3.13
5%	2.32	3.5
2.5%	2.6	3.84
1%	2.96	4.26

ARDL 2

Dependent Variable: D(LOG(FUNDING))
Method: ARDL
Date: 01/17/18 Time: 11:06
Sample (adjusted): 1997 2016
Included observations: 18 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): D(LOG(BUDGET))
D(LOG(GOV_GDP)) D(LOG(SCH_FEES)) D(LOG(OTHER_IGR))
D(LOG(POLITRISK))
Fixed regressors: D(LOG(UNDERGRAD)) D(LOG(POSTGRAD)) C
Number of models evalulated: 64
Selected Model: ARDL(2, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(LOG(FUNDING(-1)))	-0.314817	0.215743	-1.459221	0.1826
D(LOG(FUNDING(-2)))	-0.785928	0.241143	-3.259181	0.0115
D(LOG(BUDGET))	3.859525	1.174953	3.284832	0.0111
D(LOG(GOV_GDP))	-0.407905	0.504315	-0.808829	0.4420
D(LOG(SCH_FEES))	-1.506583	0.542790	-2.775629	0.0241
D(LOG(OTHER_IGR))	-1.471506	0.554101	-2.655666	0.0290
D(LOG(POLITRISK))	-0.310464	1.213271	-0.255890	0.8045
D(LOG(UNDERGRAD))	0.195156	0.233152	0.837034	0.4269
D(LOG(POSTGRAD))	-0.724302	0.397336	-1.822895	0.1058
C	0.263746	0.107412	2.455447	0.0396

R-squared	0.708600	Mean dependent var	0.161663
Adjusted R-squared	0.380775	S.D. dependent var	0.366942
S.E. of regression	0.288750	Akaike info criterion	0.653668
Sum squared resid	0.667011	Schwarz criterion	1.148319
Log likelihood	4.116989	Hannan-Quinn criter.	0.721874
F-statistic	2.161520	Durbin-Watson stat	1.692619
Prob(F-statistic)	0.145659		

*Note: p-values and any subsequent tests do not account for model selection

ARDL Bounds Test
Date: 01/17/18 Time: 11:08
Sample: 1997 2016
Included observations: 18
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.490268	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

ARDL Cointegrating And Long Run Form
Dependent Variable: D(LOG(FUNDING))
Selected Model: ARDL(2, 0, 0, 0, 0)
Date: 01/17/18 Time: 11:57
Sample: 1992 2016
Included observations: 18

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FUNDING(-1), 2)	0.785928	0.241143	3.259181	0.0115
DLOG(BUDGET, 2)	3.859525	1.174953	3.284832	0.0111
DLOG(SCH_FEES, 2)	-1.506583	0.542790	-2.775629	0.0241
DLOG(OTHER_IGR, 2)	-1.471506	0.554101	-2.655666	0.0290
DLOG(POLITRISK, 2)	-0.310464	1.213271	-0.255890	0.8045
DLOG(UNDERGRAD, 2)	0.195156	0.233152	0.837034	0.4269
DLOG(POSTGRAD, 2)	-0.724302	0.397336	-1.822895	0.1058
DLOG(GOV_GDP, 2)	-0.407905	0.504315	-0.808829	0.4420
CointEq(-1)	-2.100745	0.322206	-6.519884	0.0002

Cointeq = D(LOG(FUNDING)) - (1.8372*D(LOG(BUDGET)) -0.7172
*D(LOG(SCH_FEES)) -0.7005*D(LOG(OTHER_IGR)) -0.1478
*D(LOG(POLITRISK)) + 0.0929*D(LOG(UNDERGRAD)) -0.3448
*D(LOG(POSTGRAD)) -0.1942*D(LOG(GOV_GDP)) + 0.1255)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(BUDGET))	1.837217	0.549644	3.342560	0.0102
D(LOG(SCH_FEES))	-0.717166	0.259456	-2.764115	0.0245
D(LOG(OTHER_IGR))	-0.700469	0.265078	-2.642496	0.0296
D(LOG(POLITRISK))	-0.147788	0.576097	-0.256533	0.8040
D(LOG(UNDERGRAD))	0.092899	0.111500	0.833171	0.4289
D(LOG(POSTGRAD))	-0.344784	0.177336	-1.944244	0.0878
D(LOG(GOV_GDP))	-0.194171	0.236093	-0.822436	0.4347
C	0.125549	0.046489	2.700595	0.0270

Diagnostic Tests

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.708621	Prob. F(9,8)	0.6918
Obs*R-squared	7.984413	Prob. Chi-Square(9)	0.5357
Scaled explained SS	0.950311	Prob. Chi-Square(9)	0.9995

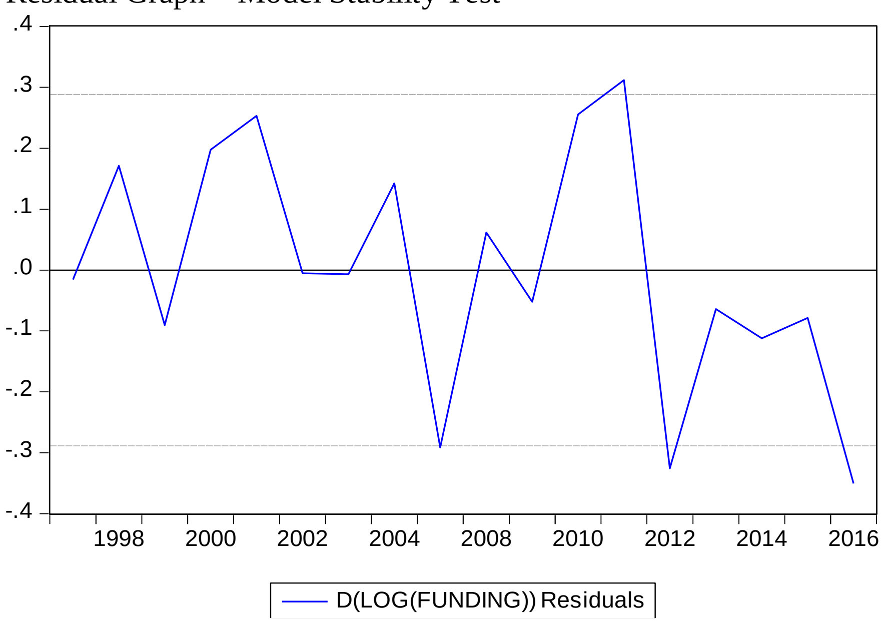
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.019901	Prob. F(2,6)	0.9804
Obs*R-squared	0.118616	Prob. Chi-Square(2)	0.9424

Date: 01/17/18 Time: 11:56
Sample: 1992 2016
Included observations: 18

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |* . |	. |* . |	1	0.086	0.086	0.1583	0.691
.**| . |	.**| . |	2	-0.256	-0.266	1.6381	0.441
***| . |	.**| . |	3	-0.367	-0.342	4.8680	0.182
. |* . |	. |* . |	4	0.141	0.146	5.3828	0.250
. |*** |	. |**. |	5	0.393	0.265	9.6629	0.085
. |**. |	. |**. |	6	0.253	0.214	11.585	0.072
. *| . |	. |* . |	7	-0.137	0.081	12.195	0.094
***| . |	. *| . |	8	-0.374	-0.175	17.229	0.028
. | . |	. |* . |	9	0.039	0.081	17.290	0.044
. | . |	***| . |	10	0.008	-0.360	17.293	0.068
. |* . |	. *| . |	11	0.178	-0.096	18.919	0.063
. | . |	. | . |	12	-0.028	0.010	18.967	0.089

Residual Graph – Model Stability Test



APPENDIX R

Questionnaire analysis results

1. What is your employment/academic status in this medical school?

	FREQUENCY	%
Lecturer/Consultant	128	
Technologist	38	
Finance officer	59	
Administrator	56	
Student	106	
Others	14	
TOTAL	401	

2. What is your position in this medical school?

	FREQUENCY	%
Managerial	28	
Senior staff	262	
Student	106	
Others	5	
TOTAL	401	

3. If you are a student, please specify your course of study

	FREQUENCY	%
MBBS and BDS	82	
Other students	24	
TOTAL	106	

4. If you are a student, please specify your level of study

	FREQUENCY	%
500 Level	63	
600 Level	43	
TOTAL	106	

5. How long have you been working in this institution?

	FREQUENCY	%
0 – 5 years	58	
6 – 10 years	52	
11 – 15 years	49	
16 – 20 years	42	
21 years and above	94	
TOTAL	295	

SECTION B

6. The mission of the medical school is made known to its immediate constituency and the health sector it serves.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	36	
Disagree	45	
Undecided	52	
Agree	162	
Strongly Agree	106	
TOTAL	401	

7. The medical school ensures that the mission encompasses the health needs of the community, the needs of the health care system and other aspects of social accountability.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	34	
Disagree	49	
Undecided	42	
Agree	170	
Strongly Agree	106	
TOTAL	401	

8.The medical school ensures that the mission encompasses medical research attainment

RESPONDENTS	FREQUENCY	%
Strongly Disagree	33	
Disagree	53	
Undecided	53	
Agree	155	
Strongly Agree	107	
TOTAL	401	

9. The medical school ensures that the mission encompasses aspects of global health.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	30	
Disagree	54	
Undecided	60	
Agree	164	
Strongly Agree	93	
TOTAL	401	

CURRICULUM

10. The curriculum and instructional learning methods adopted, stimulate, prepare and support students to take responsibility for their learning process.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	33	
Disagree	54	
Undecided	42	
Agree	192	
Strongly Agree	80	
TOTAL	401	

11. The medical school teaches the principles of scientific method.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	30	
Disagree	47	
Undecided	55	
Agree	170	
Strongly Agree	99	
TOTAL	401	

12. The curriculum incorporates the contributions of the behavioural sciences.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	32	
Disagree	41	
Undecided	74	
Agree	180	
Strongly Agree	74	
TOTAL	401	

13. The curriculum incorporates the contributions of the social sciences

RESPONDENTS	FREQUENCY	%
Strongly Disagree	33	
Disagree	65	
Undecided	87	
Agree	155	
Strongly Agree	61	
TOTAL	401	

14. The curriculum incorporates the contributions of the medical ethics.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	33	
Disagree	38	
Undecided	38	
Agree	184	
Strongly Agree	108	
TOTAL	401	

15. The curriculum incorporates the contributions of the medical jurisprudence.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	32	
Disagree	50	
Undecided	95	
Agree	144	
Strongly Agree	80	
TOTAL	401	

16. The curriculum incorporates the contributions of the biomedical sciences.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	30	
Disagree	38	
Undecided	51	
Agree	188	
Strongly Agree	94	
TOTAL	401	

17. The medical school ensures operational linkage between the educational training and practice after graduation

RESPONDENTS	FREQUENCY	%
Strongly Disagree	32	
Disagree	71	
Undecided	62	
Agree	146	
Strongly Agree	90	
TOTAL	401	

18. The medical school ensures that the curriculum reflects the needs of the community

RESPONDENTS	FREQUENCY	%
Strongly Disagree	40	
Disagree	40	
Undecided	51	
Agree	180	
Strongly Agree	90	
TOTAL	401	

19. The medical school improves the learning environment regularly.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	50	
Disagree	98	
Undecided	58	
Agree	123	
Strongly Agree	72	
TOTAL	401	

ASSESSMENT OF STUDENTS

20. The medical school uses assessment principles, methods and practices that ensure the attainment of intended educational outcomes.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	35	
Disagree	50	
Undecided	50	
Agree	181	
Strongly Agree	85	
TOTAL	401	

21. The medical school uses assessment principles, methods and practices that promote student learning.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	35	
Disagree	54	
Undecided	61	
Agree	165	
Strongly Agree	86	
TOTAL	401	

The following statements contained in questions 22 and 23 describe certain attributes of a medical trainee which I want to ascertain how well this medical school has been able to impart such to you. Please rate yourself on a scale of 1 – 5 (1 – least confident and 5 – very confident) for each of the attributes described below:

22. Ability to carry out a consultation with a patient independently.

RESPONDENTS	**FREQUENCY**	**%**
Least Confident	9	
Not Confident	13	
Undecided	15	
Confident	45	
Very Confident	24	
TOTAL	106	

23. Diagnose and manage clinical cases.

RESPONDENTS	**FREQUENCY**	**%**
Least Confident	9	
Not Confident	11	
Undecided	21	
Confident	42	
Very Confident	23	
TOTAL	106	

STAFF TRAINING AND DEVELOPMENT

24. Staff training and development policy allows a balance of capacity between teaching, research and service functions.

RESPONDENTS	**FREQUENCY**	**%**
Strongly Disagree	25	
Disagree	42	
Undecided	65	
Agree	108	
Strongly Agree	55	
TOTAL	295	

25. Staff training and development policy ensures recognition of meritorious academic activities.

RESPONDENTS	**FREQUENCY**	**%**
Strongly Disagree	24	
Disagree	33	
Undecided	73	
Agree	96	
Strongly Agree	69	
TOTAL	295	

26. Staff training and development policy ensures that clinic service functions and research are used in teaching and learning.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	23	
Disagree	27	
Undecided	65	
Agree	111	
Strongly Agree	69	
TOTAL	295	

27. Staff training and development policy ensures sufficient knowledge of the curriculum amongst staff.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	24	
Disagree	26	
Undecided	80	
Agree	28	
Strongly Agree	137	
TOTAL	295	

28. Staff training and development policy includes teacher training, development, support and appraisal.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	21	
Disagree	39	
Undecided	6	
Agree	105	
Strongly Agree	124	
TOTAL	295	

29. Staff training and development policy ensures the medical school takes into account teacher- student ratio.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	28	
Disagree	49	
Undecided	73	
Agree	96	
Strongly Agree	49	
TOTAL	295	

EDUCATIONAL RESOURCES

PHYSICAL FACILITIES

30. The medical school has sufficient physical facilities for staff and students.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	80	
Disagree	152	
Undecided	43	
Agree	68	
Strongly Agree	58	
TOTAL	401	

31. The medical school ensures a learning environment, which is safe for staff, students and patients.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	63	
Disagree	102	
Undecided	56	
Agree	113	
Strongly Agree	67	
TOTAL	401	

32. Medical students have enough exposure to laboratory equipment.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	57	
Disagree	119	
Undecided	64	
Agree	94	
Strongly Agree	67	
TOTAL	401	

33. The Lagos University Teaching Hospital provides clinical exposure facilities adequate for training.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	48	
Disagree	93	
Undecided	83	
Agree	112	
Strongly Agree	65	
TOTAL	401	

34. There has been significant increase in the ICT facilities in the classrooms.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	56	
Disagree	99	
Undecided	71	
Agree	115	
Strongly Agree	60	
TOTAL	401	

35. The library facilities have improved to international standards.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	65	
Disagree	107	
Undecided	78	
Agree	91	
Strongly Agree	60	
TOTAL	401	

36. Staff training aretailored towards improvement of skills and competences for improved productivity.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	26	
Disagree	45	
Undecided	63	
Agree	104	
Strongly Agree	57	
TOTAL	295	

37. There is regular provision of electricity supply in library and teaching areas.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	66	
Disagree	127	
Undecided	56	
Agree	97	
Strongly Agree	55	
TOTAL	401	

38. The hostel facilities are suitable for students.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	118	
Disagree	103	
Undecided	58	
Agree	70	
Strongly Agree	52	
TOTAL	401	

MEDICAL RESEARCH

39. The medical school uses medical research as a basis for the educational curriculum

RESPONDENTS	FREQUENCY	%
Strongly Disagree	39	
Disagree	79	
Undecided	91	
Agree	128	
Strongly Agree	64	
TOTAL	401	

40. The medical school formulates and implements a policy that fosters the relationship between medical research and education.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	36	
Disagree	69	
Undecided	84	
Agree	149	
Strongly Agree	63	
TOTAL	401	

41. The medical school produces large publications of peer- reviewed journal articles.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	35	
Disagree	75	
Undecided	94	
Agree	125	
Strongly Agree	72	
TOTAL	401	

42. The medical school has recorded huge success in attracting external research funding.

RESPONDENTS	**FREQUENCY**	**%**
Strongly Disagree	42	
Disagree	87	
Undecided	111	
Agree	102	
Strongly Agree	59	
TOTAL	401	

43. The institutional discoveries of the medical school were translated into commercialisation values and award of patients' rights.

RESPONDENTS	**FREQUENCY**	**%**
Strongly Disagree	52	
Disagree	87	
Undecided	134	
Agree	79	
Strongly Agree	49	
TOTAL	401	

EDUCATIONAL BUDGET AND RESOURCE ALLOCATION

44. The budgeting allocation for your department has increased in the last 5 years

RESPONDENTS	FREQUENCY	%
Strongly Disagree	41	
Disagree	69	
Undecided	110	
Agree	38	
Strongly Agree	37	
TOTAL	295	

45. There is room for improvement for budget allocation for your department?

RESPONDENTS	FREQUENCY	%
Strongly Disagree	25	
Disagree	32	
Undecided	69	
Agree	99	
Strongly Agree	70	
TOTAL	295	

46. The medical school operates a dedicated budget specifically for curriculum activities.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	46	
Disagree	62	
Undecided	146	
Agree	94	
Strongly Agree	53	
TOTAL	401	

47. The medical school allocates the resources dedicated for curriculum equitably to meet the educational needs

RESPONDENTS	FREQUENCY	%
Strongly Disagree	51	
Disagree	79	
Undecided	129	
Agree	89	
Strongly Agree	53	
TOTAL	401	

48. Funding has been adequate to meet the needs of College of Medicine of the University of Lagos.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	102	
Disagree	136	
Undecided	72	
Agree	42	
Strongly Agree	49	
TOTAL	401	

49. Tuition fees are charged at undergraduate level.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	64	
Disagree	78	
Undecided	60	
Agree	110	
Strongly Agree	89	
TOTAL	401	

50. The tuition fees are to be charged at market rate

RESPONDENTS	FREQUENCY	%
Strongly Disagree	72	
Disagree	92	
Undecided	93	
Agree	83	
Strongly Agree	61	
TOTAL	401	

51. Students loans and welfare support scheme should be introduced

RESPONDENTS	FREQUENCY	%
Strongly Disagree	44	
Disagree	37	
Undecided	37	
Agree	122	
Strongly Agree	161	
TOTAL	401	

52. Scholarships schemes are available for award to deserving students.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	45	
Disagree	79	
Undecided	65	
Agree	129	
Strongly Agree	83	
TOTAL	401	

53. Students should be allowed to defer payment of tuition fees until after graduation and employment

RESPONDENTS	FREQUENCY	%
Strongly Disagree	91	
Disagree	113	
Undecided	65	
Agree	70	
Strongly Agree	62	
TOTAL	401	

54. I am familiar with the funding model adopted by College of Medicine of the University of Lagos

RESPONDENTS	FREQUENCY	%
Strongly Disagree	36	
Disagree	68	
Undecided	79	
Agree	65	
Strongly Agree	47	
TOTAL	295	

55. The normative and contractual funding model adopted by CMUL facilitates improved funding

RESPONDENTS	FREQUENCY	%
Strongly Disagree	30	
Disagree	47	
Undecided	130	
Agree	52	
Strongly Agree	36	
TOTAL	295	

56. There are inefficiencies in the normative and contractual funding model in use at CMUL.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	25	
Disagree	39	
Undecided	121	
Agree	60	
Strongly Agree	50	
TOTAL	295	

57. Improvement in funding for medical education in federally owned institutions would be achieved by a review of the normative and contractual funding model.

RESPONDENTS	FREQUENCY	%
Strongly Disagree	24	
Disagree	28	
Undecided	77	
Agree	99	
Strongly Agree	67	
TOTAL	295	

58. The following have been proposed as appropriate funding models of tertiary education in Nigeria:

i. Access -Equity -Cost -Sharing Model
(focuses more on equal access to higher education and ability to pay by the student).

ii. Contextualised Formula-Funding Model
(funding of universities to encourage programmes in science and technology with potential to accelerate impact on Nigeria's socio-economic development).

iii. Performance-Based Funding Model
(aimed at rewarding universities for efficiency in teaching, research and community service).

iv. Host-Proprietor-University-User Funding Model
(all beneficiaries of the location and service of the university to contribute to funding of university).

v. Pay-for-Performance (P4P) Funding Model
(focuses more on outcomes, associating performance with quality and non-quality measures).

RESPONDENTS	**FREQUENCY**	**%**
Access Equity Model	66	
Contextualised model	96	
Performance based	47	
Host- Proprietor University	33	
Pay for Performance	53	
TOTAL	295	

Please tick as appropriate:

How would you rate proposed funding model to address funding requirements of medical education in Nigeria and why?

RESPONDENTS	**FREQUENCY**	**%**
Undecided	51	
Fair	40	
Good	65	
Very Good	68	
Excellent	71	
TOTAL	295	

Appendix S

Key theses relevant to area of study

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">1.</td><td>The effect of some contigent variables on Universities’ Accounting Systems and Performances Management</td><td>Abbas Alimoradi Sharifabadi (2012)</td><td rowspan="2">Application of contingency theory to investigate the effects of decentralisation of authority, budget constraint and competitive position for better quality and high performance in teaching and research, the accounting systems and performance management of Iran’s State Higher Education Institutions. Administration of questionnaires on Government Universities and results analysed Structural Equation Modelling (SEM) was used as the main data analysis technique.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
Choice of budgeting method, particularly participative budgeting, over other accounting aspects was highlighted. Also, importance of employing comprehensive performance measures as well as use of accounting information in Performance Management was revealed.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">2.</td><td>‘Commodification’ of knowledge: challenges and Opportunities of a State Funded University – A University of Botswana Case Study</td><td>Innocent Sipho Botshelo (2009)</td><td rowspan="2">Triangulation method using caser study approach was adopted. This was broken down into 3 phases: Secondary documentary data; Semi-structured interviews with members of the senior management staff at UB that served to clarify, confirm, refute and/or corroborate documentary research outcomes. Third phase combined both quantitative and qualitative data collected from the different sources.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
- UB embraced the notion of knowledge based economy through advancing the intellectual and human resource capacity of the nation and the international community.
- UB did not seem to have a resource allocation model but had a budgeting system that did not support commodification of knowledge.
- There was no staff allocation model to manage human resource which constitutes 67% of the total budget of the institution.
- Data base of the institution was grossly inadequate and this was a major contributing factory to the lack of clear business processes in certain critical areas of the institution.
- The need to strengthen systems, processes and quality control mechanisms became evident in order to facilitate and support data collection and establishment of data base.</td></tr>
</table>

S/N	TITLE	AUTHOR	METHODOLOGY
3.	Comparative Perspectives on Initial Primary Teacher Education and Training in England and Pakistan.	Ahmed Mah-E-Rukh	An exploratory cross-national study much adopted Bereday's comparative methodology to investigate the juxtaposition of two teacher education programmes from countries having different cultural and social backgrounds.
	MAIN FINDINGS: A number of factors were found to contribute to the perceived adequacy of the professional preparation of student teachers. These include enriched curriculum, availability and quality of physical facilities and educational resources, support from the principal stakeholders (in form of funding, staff development etc).		

S/N	TITLE	AUTHOR	METHODOLOGY
4.	Exploring Financing Options for Higher Education in Jamaica	Nkrumah-Young Kofi K	Qualitative methodology was used combining interviews and secondary data analysis as the research approach.
	MAIN FINDINGS: In financing HE, the government had the options of total state financing, privatisation or shared responsibility. Shared responsibility could be further sub-divided into upfront charges with a mortgage loan or ICT to support indigent students or deferred payment, with graduate taxes or ICT. The option of formulaic funding model also emphasised based either by enrolment or graduation rate or the fixed formula approach. Formulaic funding by output however, was deemed to be the best option for accountability and promotion of efficiency and quality.		

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">5.</td><td>Formula Funding and Special Educational needs. Main area: To investigate the principles and practice for allocating additional resources to provide for pupils with SEN but without statements.</td><td>Marsh Alan John (1998)</td><td rowspan="2">Research questions:
(1) How does the conceptualisation of special educational needs impact upon policy within Local Education Authorities?
(2) What principles or criteria should be considered when evaluating a funding formula and how do they relate to the purpose of the additional funding?
(3) How can the existing SEN formula in Whiteshire be improved?
(4) What is the impact on school budgets of using different special educational needs indicators?
The methodology adopted was literature review and case studies of two LEAs (Whiteshire and Mercia).</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
The study recommended budget allocation model which incorporates the provision of the curriculum related staffing (CRS) funding on SEN pupil based on National Curriculum Assessments (NCA).</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">6.</td><td>Dual Management Structure of Medical Education in Nigeria: Implications for Efficiency.</td><td>Ipaye, Taiwo Folashade (2008)</td><td rowspan="2">Quantitative method using questionnaire to measure factors that determine efficiency which were defined as organisation, goals, objectives resource availability, personnel and access to training facilities. Chi-square test, the analysis of Variance ANOVA, Bar charts and pie charts were applied in the study to measure relationships among variables.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
The study discovered relationship in management structure in the medical school and the teaching hospital. It highlighted function overlap by NUC and MDCN in their supervisory roles at the medical school and the teaching hospital respectively. The study recommended application of the principle of “unity of command” and the setting up of a Health and Education Service Commission.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">7.</td><td>Funding higher education in Uruguay: a policy question.</td><td>Abadie Panambi (2009)</td><td rowspan="2">Qualitative approach and multi-modal tools- viz. documents, literature, semi-structured interviews, a Focus Group and Speeches at Parliamentary sessions.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
1(a) Historical funding model used in Uruguay up to 1990s has evolved into incremental model.
1(b) New funds, or increases in previous years' allocations are tied to certain specific purposes determined in the Budget Laws.
2. Resources are allocated to the system by the Parliament on a decentralised basis to maintain accountability by the institutions who maintain broad decision-making powers.
3. The emerging political leadership had shown commitment to devote more funds to the finance of public higher education, as a major improvement to the insufficient fund allocation devoted historically to education sector. The study also revealed that the current funding model is not being considered for improvement.
4. Study suggested that in the future, the authorities may expand the mechanism of allocating funds earmarked for special programmes to incorporate some kind of strategic orientations. Other issues highlighted include:
(a) further funding for public institutions may be originated in the collection of the graduate tax.
(b) formula funding model is not likely to be introduced as a future model for the sector.
(c) the introduction of a tuition-fee scheme is improbable in the short term because the availability of further funding by the government will reduce the pressures to introduce alternative funds to complement public revenues. Also, the political dispensation in Uruguay at the time of doing the research historically does not support tuition-fee education policy.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">8.</td><td>Human capital theory and the financing of higher education in Oman.</td><td>Al-hajry Amur Sultan (2002)</td><td rowspan="2">The main objective of the study is to review alternative funding mechanisms for the future development of higher education by evaluating and analysing social and private rates of return to investment. The methodology adopted is the human capital concept that considers education as a form of economic investment; consequently cost-benefit and rates of return analysis were used in order to achieve an efficient utilisation of resources.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
- The study revealed that the public cost of higher education in Oman was much higher than the cost to the individual.
- The allocation of additional public resources for higher education was not justified on economic basis.
- Private (contribution) towards the cost of education was required to reduce public cost and improve social rates of return.
- There arose the need to develop funding model that would enable individual students to contribute towards the cost of their education without affecting their access to higher education.
- The study recommended the adoption of graduate income tax method of funding by students which would enable the institution to recover the cost of educating the student from deductions from the individual’s income after graduation and during the first twenty years of employment.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">9.</td><td>Funding mechanisms and quality assurance systems in higher education in Egypt. In comparative Perspective</td><td>Alshamy Alsaeed Saad Alsaeed (2011)</td><td rowspan="2">A comparative study of funding methods and quality assurance systems (QAS) in higher education in UK and Egypt with the aim of identifying implications for Egypt was undertaken. Qualitative methodology and analysis of secondary data was adopted. The analytical and evaluative tools chosen was the application of the concepts of autonomy, accountability, efficiency and equity. Document analysis and semi-structured interviews were conducted.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
-Various forms of funding and QAS differed in their consequence for the autonomy, accountability, efficiency and equity of universities.
- Expectations of policy pronouncements and the experience of those working in the universities were arguably not in congruence.
- Factors of governance and culture have implications in the relationship between funding and QAS.
- The study consequently concluded that changes to funding and QAS in Egypt needed to be reformed and developed in ways that would address issues of governance and culture.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">10</td><td>Healthcare financing: how does Turkey compare?</td><td>Akhmedjonov Alisher, Guc Yunus and Akinci Fevzi (2011)</td><td rowspan="2">Descriptive data drawn from the World Health Organisation, World Bank, OECD and Turkish Statistical Institute established correlations between life expectancy at birth and the predictor variables.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
The study discovered that an increase in share of GDP devoted to healthcare was associated with higher life expectancy in high-income countries (HI) because only these countries reached a level of healthcare spending that was high enough to have a potentially positive impact on life expectancy.</td></tr>
</table>

<table>
<tr><th>S/N</th><th>TITLE</th><th>AUTHOR</th><th>METHODOLOGY</th></tr>
<tr><td rowspan="2">11</td><td>Does government funding complement or substitute private research funding to universities?</td><td>Muscio, Alessandro, Quaglione Davide and Vallanti Giovanna (2013).</td><td rowspan="2">Probit and tobit panel data models estimated on financial data of Italian universities engaged in research in the Engineering and Physical Sciences.
Denote by yit department i’s private funding collected at time t, the dynamic panel Tobit model with department unobserved effects is:
it = xit + ci + ct+ uit ,
i = 1, . . . , N; t = 1, . . . , T
yit =it where xit is a set of department specific characteristics including the amount of government funding (namely European Union, MIUR, other public bodies, and internal university transfers) received in previous years, ci are the (random) department-specific effects, ct are the year effects, uit is the error term. The year effects are included to account for cyclical variation in private funding.</td></tr>
<tr><td colspan="2">MAIN FINDINGS:
Government funding to universities complements funding from research contracts and consulting, contributing to increasing universities’ collaboration with industry and activating knowledge transfer processes.</td></tr>
</table>

S/N	TITLE	AUTHOR	METHODOLOGY
12	Investigating technical and scale efficiencies of Australian Universities through data envelopment analysis.	Avkiran Necmi K (2001)	DEA technique using production approach to develop the 3 models.
	MAIN FINDINGS: Study revealed the relative efficiency levels of the 3 broad categories of performance, highlighting the areas of improvement for the inefficient unit.		

S/N	TITLE	AUTHOR	METHODOLOGY
13	The impact of size and specialisation on universities' department performance: A DEA analysis applied to Austrian universities.	Leitner Karl-Heinz, Prikoszovits Julia, Schaffhauser-Linzatt Michaela, Stowasser Rainer and Wagner Karin (2007)	Input-oriented DEA model using multiple input and output variables. Choice of input and output variables made through correlation analysis and OLS regression.
	MAIN FINDINGS: The result revealed performance differences and scale effects. Also, evidence was found that the size of a department influences its overall and specialisation performance.		

S/N	TITLE	AUTHOR	METHODOLOGY
14	An Application of the Data Envelopment Analysis Methodology in the Performance Assessment of the Zaragoza University Departments.	Martin Emilo (2003)	DEA methodology to measure efficiency of input variables as a function of the output variables.
	MAIN FINDINGS: Relative performance/ efficiency of each of the departments was revealed. Also highlighted was the existence of differences in the strengths and weaknesses between departments of different areas.		

S/N	TITLE	AUTHOR	METHODOLOGY
15	The determinants of economic efficiency in English and Welsh universities	Stevens P.A. (2001)	DEA technique incorporating quadratic SFE cost functions. Three models formulated to measure input and output quality.
	MAIN FINDINGS: The amount of random error attributable to efficiency found to be statistically significant, suggesting that economies of scale and scope estimates in cost functions may be biased. Changes in inefficiency depended negatively on initial inefficiency. The dispersion of efficiency scores was shown to decline in every time period, suggesting that overall cost efficiency has become less variable among English and Welsh universities.		

S/N	TITLE	AUTHOR	METHODOLOGY
16	The relative efficiency of Canadian universities	McMillan and Data (1998).	DEA technique used to measure efficiency of 45 Canadian universities. 9 models were formulated, with three of the models to examine cost efficiency.
	MAIN FINDINGS: The study population was grouped into three categories: comprehensive universities with medical schools (CUMED); comprehensive universities without medical schools (CUnoMED) and primarily undergraduate universities (UGU).The findings from the DEA analysis showed the mean efficiency scores for the CUMED group varied between 91% and 98% with an average mean efficiency score of 94%.		

S/N	TITLE	AUTHOR	METHODOLOGY
17	A DEA approach for measuring university departments' efficiency	Tzeremes and Halkos (2010)	The study uses Data Envelopment Analysis (DEA) to determine the performance levels of 16 departments of a public owned university, using the constant returns toscale (CRS) and variable returns to scale (VRS) models superintendent on bootstrap techniques to determine accurate performance estimates.
	MAIN FINDINGS: The study reveal the existence of misallocation of resources or/and inefficient application of departments' policy development.		

S/N	TITLE	AUTHOR	METHODOLOGY
18.	Evaluating the efficiency of faculties in Qassim University using Data Envelopment Analysis	Al-Shayea and Battal (2013)	The output oriented model with variable return to scale was used to estimate efficiency score.
	MAIN FINDINGS: The result showed that (10) FQU or 55.5% are efficient with average 0.88 in term of variable return to scale efficiency. FQU obtained average scale efficiency 0.68 and only three FQU get the optimum size.		

S/N	TITLE	AUTHOR	METHODOLOGY
19.	The efficiency of German universities: some evidence from parametric and non-parametric methods	Kempkes and Pohl (2010)	Application of Data Envelopment and Stochastic frontier analysis on 1998–2003 data of 72 public German universities to determine the efficiency of publicly financed universities in Germany.
	MAIN FINDINGS: East German universities have performed better in total factor productivity change compared to those in West Germany. However, when looking at mean efficiency scores over the sample period, West German universities appeared at the top end of relative efficiency outcomes.		

Appendix T

Information Letter

I am Olalekan Nurudeen Lawal.I am of the Faculty of Business and Law at Leeds Beckett University, Leeds, United Kingdom.

I am doing a Ph.D and my research area is funding of medical education in Nigeria.I am carrying out my study on how medical schools could efficiently utilise budgeting and funding at their disposal to provide effective service delivery of teaching, research and service.

I am in the process of administering questionnaire for the purpose of collecting data that could assist in developing the funding model for my study.You have been identified as a stakeholder whose input is relevant for the policy framework and guidelines.

I would be grateful if you could oblige your participation in this project.

Thank you.

Yours sincerely,

Olalekan Nurudeen Lawal

Appendix U

Consent Form

I have read the information letter about a study being carried out by Olalekan Nurudeen Lawal of the Faculty of Business and Law at the Leeds Beckett University, Leeds, United Kingdom.

1. I have been asked to participate in the research through the completion of structured questionnaire and I understand what I am being asked to do.
2. I consent to participate for this project.
3. I consent to the content of the questionnaire being coded for anonymity
4. I understand that the filling of the questionnaire is voluntary.
5. I understand that I have the right to withdraw my participation from the research at any time.

Participant’s name (BLOCK CAPITALS):

Participant’s signature: ……………………………… Date: …………………………………..

Appendix V

Questionnaire

Lecturers and Consultants, Finance Officers, Administrators and Students.

Dear Sir/Madam,

I am Olalekan Nurudeen Lawal, a Ph.D student of Leeds Beckett University, Leeds, England.I like to inform you that the enclosed questionnaire is on my research topic in Ph.D. programme.The topic of my thesis is "Efficiency of budgeting and funding structure of public medical education in Nigeria".

Since the result of this study could be useful for universities and medical schools and the success of this research depends on completion of the questionnaire, I should be grateful if you devote about fifteen minutes of your valuable time to complete the attached questionnaire.

Be assured that the information given shall be treated as strictly confidential.Kindly try as much as possible to answer all the questions.

Thank you for your co-operation and support.

Lekan Lawal

SECTION A

1. What is your employment/academic status in this medical school?

   () Lecturer/Consultant () Technologist () Finance officer

   () Administrator () Student () Others

2. What is your position in this medical school?

   () Managerial () Senior staff () Student () Others

3. If you are a student, please specify your course of study …….................................

4. If you are a student, please specify your level of study ………………………………

5. How long have you been working in this institution?

   () 0 – 5 years

   () 6 – 10 years

   () 11 – 15 years

   () 16 – 20 years

   () 21 years and above

SECTION B

The following statements describe your assessment of the quality of medical education of your Institution. Please tick in the row that best described your opinion. There are no right or wrong answers.

KEY:	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
	1	2	3	4	5
	☐	☐	☐	☐	☐

S/N	MISSION AND OUTCOMES OF MEDICAL EDUCATION	1	2	3	4	5
6	The mission of the medical school is made known to its immediate constituency and the health sector it serves					
7.	The medical school ensures that the mission encompasses the health needs of the community, the needs of the health care system and other aspects of social accountability					
8.	The medical school ensures that the mission encompasses medical research attainment					
9.	The medical school ensures that the mission encompasses aspects of global health					

S/N	CURRICULUM	1	2	3	4	5
10.	The curriculum and instructional learning methods adopted, stimulate, prepare and support students to take responsibility for their learning process.					
11.	The medical school teaches the principles of scientific method					
12.	The curriculum incorporates the contributions of the behavioural sciences.					
13.	The curriculum incorporates the contributions of the social sciences.					
14.	The curriculum incorporates the contributions of the medical ethics.					
15.	The curriculum incorporates the contributions of the medical jurisprudence.					
16.	The curriculum incorporates the contributions of the biomedical sciences					
17.	The medical school ensures operational linkage between the educational training and practice after graduation					
18.	The medical school ensures that the curriculum reflects the needs of the community					

S/N	CURRICULUM	1	2	3	4	5
19.	The medical school improves the learning environment regularly					

S/N	ASSESSMENT OF STUDENTS	1	2	3	4	5
20.	The medical school uses assessment principles, methods and practices that ensure the attainment of intended educational outcomes.					
21.	The medical school uses assessment principles, methods and practices that promote student learning.					

The following statements contained in questions 22 and 23 describe certain attributes of a medical trainee which I want to ascertain how well this medical school has been able to impart such to you. Please rate yourself on a scale of 1 – 5.
(1 – least confident and 5 – very confident) for each of the attributes described below:

Least confident	Not confident	Undecided	Confident	Very confident
1	2	3	4	5
☐	☐	☐	☐	☐

S/N		1	2	3	4	5
22.	Ability to carry out a consultation with a patient independently.					
23.	Diagnose and manage clinical cases					

KEY:

Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1	2	3	4	5
☐	☐	☐	☐	☐

S/N	STAFF TRAINING AND DEVELOPMENT	1	2	3	4	5
24.	Staff training and development policy allows a balance of capacity between teaching, research and service functions.					
25.	Staff training and development policy ensures recognition of meritorious academic activities.					
26.	Staff training and development policy ensures that clinic service functions and research are used in teaching and learning					
27.	Staff training and development policy ensures sufficient knowledge of the curriculum amongst staff					
28.	Staff training and development policy includes teacher training development, support and appraisal.					

S/N	STAFF TRAINING AND DEVELOPMENT	1	2	3	4	5
29.	Staff training and development policy ensures the medical school takes into account teacher- student ratio					

EDUCATIONAL RESOURCES

S/N	PHYSICAL FACILITIES	1	2	3	4	5
30.	The medical school has sufficient physical facilities for staff and students					
31.	The medical school ensures a learning environment, which is safe for staff, students and patients					
32.	Medical students have enough exposure to laboratory equipment.					
33.	The Lagos University Teaching Hospital provides clinical exposure facilities adequate for training.					
34.	There has been significant increase in the ICT facilities in the classrooms.					
35.	The library facilities have improved to international standards.					
36.	Staff training are tailored towards improvement of skills and competences for improved productivity.					
37.	There is regular provision of electricity supply in library and teaching areas.					
38.	The hostel facilities are suitable for students.					

S/N	MEDICAL RESEARCH	1	2	3	4	5
39.	The medical school uses medical research as a basis for the educational curriculum					
40.	The medical school formulates and implements a policy that fosters the relationship between medical research and education					
41.	The medical school produces large publications of peer- reviewed journal articles					
42.	The medical school has recorded huge success in attracting external research funding					
43.	The institutional discoveries of the medical school were translated into commercialisation values and award of patients' rights.					

S/N	EDUCATIONAL BUDGET AND RESOURCE ALLOCATION	1	2	3	4	5
44.	The budgeting allocation for your department has increased in the last 5 years					
45.	There is room for improvement for budget allocation for your department?					
46.	The medical school operates a dedicated budget specifically for curriculum activities.					
47.	The medical school allocates the resources dedicated for curriculum equitably to meet the educational needs.					
48.	Funding has been adequate to meet the needs of College of Medicine of the University of Lagos.					
49.	Tuition fees are charged at undergraduate level.					
50.	The tuition fees are to be charged at market rate					
51.	Students loans and welfare support scheme should be introduced					
52.	Scholarships schemes are available for award to deserving students.					
53.	Students should be allowed to defer payment of tuition fees until after graduation and employment.					
54.	I am familiar with the funding model adopted by College of Medicine of the University of Lagos.					
55.	The normative and contractual funding model adopted by CMUL facilitates improved funding.					
56.	There are inefficiencies in the normative and contractual funding model in use at CMUL.					
57.	Improvement in funding for medical education in federally owned institutions would be achieved by a review of the normative and contractual funding model.					

58. The following have been proposed as appropriate funding models of tertiary education in Nigeria:

i Access -Equity -Cost -Sharing Model
(focuses more on equal access to higher education and ability to pay by the student).

ii Contextualised Formula-Funding Model
(funding of universities to encourage programmes in science and technology with potential to accelerate impact on Nigeria's socio-economic development).

iii Performance-Based Funding Model
(aimed at rewarding universities for efficiency in teaching, research and community service).

iv Host-Proprietor-University-User Funding Model
(all beneficiaries of the location and service of the university to contribute to funding of university).

v Pay-for-Performance (P4P) Funding Model
(focuses more on outcomes, associating performance with quality and non-quality measures).

Please tick as appropriate:
How would you rate proposed funding model to address funding requirements of medical education in Nigeria and why?

	Undecided 1	Fair 2	Good 3	Very good 4	Excellent 5
(i)	☐	☐	☐	☐	☐
(ii)	☐	☐	☐	☐	☐
(iii)	☐	☐	☐	☐	☐
(iv)	☐	☐	☐	☐	☐
(v)	☐	☐	☐	☐	☐

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Thank you.