KADUNA STATE UNIVERSITY LIBRARY

An Architectural Response to Changing Educational and Social Demdnds

BY

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AHMADU BELLO UNIVERSITY,

ZARIA, NIGERIA

JUNE, 2013

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DECLARATION

I hereby declare that this thesis is my personal undertaking except otherwise acknowledged, and it has not been submitted previously in this university or any other university.



..... 25/01/2013 .....

MUHAMMAD, Muhammad Zia-Ul-Haq. Date

CERTIFICATION

This thesis report entitled "KADUNA STATE UNIVERSITY LIBRARY: *An Architectural Response to changing Educational and Social demands*", meets the regulations governing the award of Master of Science in Architecture of Ahmadu Bello University, Zaria , Nigeria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to my whole family for their unwavering support throughout my academic endeavours.

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To all my friends, and colleagues not mentioned by name, you are surely being appreciated and may the Almighty reward you all abundantly.

ABSTRACT

The academic library program of the 21^{s1} century is undergoing a paradigm shift evident in new allocations of functional spaces as well as its service delivery. The paradigm shift is towards the efficient organisation and management of both print and non-print materials for users that are hitherto, displaying a variety of learning styles. The changes are so profound that it has dispelled the popular notion that the traditional investment in library space is diminishing or that libraries are mere repositories for books. These changes can be attributed to technology; explosion of electronic 'content'; mass digitization projects and the internet. This thesis was aimed at explorin current design issues in contemporary academic library design used to address the changing demands in library spaces. Case studies and a literature review was used to examine the changing educational and social demands in academic libraries and their resultant spatial demand on library design, methods employed in tackling space design issues, and impact of digital technologies on contemporary academic library design. Major findings show that there is a growing acknowledgement that the library is as much about social interaction and intellectual exchange as storage for book; evidence of the enormous changes taking place in the information landscape that is transforming teaching and learning, scholarly communication and the role of "traditional" research library services. Other findings include the growth of library collections, changing character of study space needs, inclusion of the concept of 'commons' in libraries, increasing interdisciplinary work and changes in library instruction programmes. This thesis concludes that although there is a variety of changing demands of educational and social components of academic libraries, they must be carefully balanced in order to achieve a functional design and a synergy of the formal and informal space in the 21st century academic library. Also, there is an increasing awareness of involving the end users (students) in designing libraries that will reflect the students' personal lives as well as the changes taking place in higher education pedagogy. Recommendations include the provision of more social spaces in the form of collaborative spaces and group study spaces, the use of print repositories for low-use or infrequently used print materials that are likely to have duplicates in other libraries. Future research should investigate critically, the difficulties in designing spaces that will cater for the changing educational and social demands of libraries.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The Kaduna State University (KASU) Kaduna, is one of the latest group of state universities licensed by the Federal Government of Nigeria, and regulated by the Nigeria Universities Commission (NUC) to cater for the growing demand of student enrolment into degree-awarding higher institutions in Nigeria. KASU has been established for two reasons—reactive and proactive reasons. Firstly, despite the commendable efforts of the two Federal Government owned universities—Ahmadu Bello University (ABU) in Zaria and the Nigeria Defence Academy (NDA) in Kaduna metropolis—these institutions have not, so far, adequately catered for the university—level educational needs of Kaduna State. Also, the proposed Heritage University (a private university) remains unfulfilled as it is yet to take off. Secondly, the university was established to cater for the projected needs for trained manpower that is capable of contributing to the Kaduna State Economic Empowerment and Development Strategy (KADSEEDS), which is a compliment of the National Empowerment and Development Strategy (NEEDS) initiative.

The university (by its location and connectivity) is destined to make significant contributions to the development of Nigeria and Africa through its research and outreach activities, or through alliances with other universities to promote excellence in various academic areas.

A university library is a valuable and essential part of an institution's teaching and research mission. Its key role is to collect, preserve and provide access to materials. However, enormous changes are taking place in the information landscape that is

transforming, teaching and learning, scholarly communication and the role of "traditional" research library services. The philosophy of warehousing large book collections, 'just-in-case-they-are-needed' is rapidly becoming redundant as users turn their backs on the library as a physical space (Tise, 2008).

The long held tradition conceives libraries as a service building; a mere repository for books where information is held, organized and managed on behalf of its users. But like all public buildings the library has experienced changes over time with consequent changes in its design. This metamorphosis can be linked to the changes in human knowledge since the beginning of recorded human history to the present day use of the computer. From the days when libraries were the exclusive preserve of the royals and elites of a society, to present times where it has become a prerequisite for every enlightened society. These changes have been brought about by technology: explosion of electronic 'content'; mass digitization projects and the internet. Libraries are increasingly becoming computer banks, multimedia centres, bulletin boards, coffee shops, meeting rooms; anything but a storage house for books. In fact, there is a growing acknowledgement that the library is as much about social interaction and intellectual exchange as storage for books.

Several experts have in recent times called for the need to look at the library in a whole new perspective. According to a research paper by Bolan and Ciccarelli (2008), they posited that society pressures libraries to remodel their public space. Bolan said that people like the library space because it remains "uncommercialised" in a much branded society. Thus, the library space needs a makeover based on customer needs where she listed the 10 things library users want from the library as comfortable spaces; meeting

and study rooms; food service (vending is more practical than coffee shops); multi-functional children's areas; supported services (self-check-out, drive-up windows, outside pick-up lockers); Teen friendly areas; retail-oriented merchandising (bookstore-like open shelving); technology (unobtrusive stations, wireless patios, RFD checkout); good way finding (more than just good signs - good paths) and sustainable environment (energy efficiency, green materials, pollution free).

A highlight of the recent changing demands of libraries include; growth of collections, changing character of study space needs, change in or growth of library instruction programs, increasing technological impact on library functions, change in public services other than reference and changes in architectural legibility.

1.2 Problem Statement

Technological advancements mainly in the form of the computer and the internet have impacted significantly on the contemporary academic library and have had a profound influence on the overall outcome of the library system. The use of high-tech equipment and facilities required a lot of functional considerations in library design. This has disproved the popular notion, especially amongst students, that paper materials and information as superfluous and that electronic publication have lessened space requirements in academic libraries and in extreme cases the need for a library building at all. On the contrary, electronic publication and upgraded technologies offer more burdens of additional space requirements.

It is hard to find evidence that the breathtaking innovation in information technology (IT) and the "virtual space" it occupies slowed traditional investment in library space requirements. The clear implication is that the library will maintain a

physical presence on even the most wired of campuses (Bazillion, 2001). According to Barney (1996), the rate of growth of shelving space needs in some areas have increased space requirements and that technology is adding to the demands for libraries to accommodate more print and non-print material.

The social importance of libraries is traditionally to expand the learning capacity of a nation so as to expand its national competiveness and to promote a gracious society. According to Brown and Long (2006), learning is a social process and it does not occur as a response to teaching, but rather as a result of a social framework that fosters learning. As such, well-designed social spaces are likely to increase students' motivation and may even have an impact on their ability to learn (in other words, learning through interactions and exchange of information). This is demonstrated in inclusion of more spaces for social interaction such as for cultural exhibitions, food halls, discussion spaces or rooms, reading commons etc.

In reality, the world is still building bigger and better libraries as library space is becoming more and more important when so many other activities and services are offered. The real challenge to librarians and by extension to architects involved in library design is how to change the image of the library, and the interior space according to the new activities and needs. The future of library architecture is to understand and design systems around the actual behaviour of today's virtual scholar.

What is needed then, in determining the future space needs of libraries is a reassessment of the library building in the light of the probable impact of new or changing demands in library services, and how this is likely to translate into more

specific space requirements for the various functions in order to achieve a sustainable outcome.

1.3 Aim and Objectives

The aim of this thesis is to explore current design issues in contemporary academic library design used to address the changing demands in library spaces. The objectives are as follows:

i. To articulate the changing educational and social demands in academic libraries.
ii. To examine the spatial requirements of the changing demands hand in hand with user requirements.
iii. To examine the methodologies employed in tackling space design issues in library design in the light of increased investments in library space.
iv. To evaluate the impact of digital technologies on the contemporary academic library space.

1.4 Motivation

Since the integration of technology and its spin-offs in most spheres of human endeavours, humanity has been in a desperate race to keep up with the fast-paced advancements made in technology. This has no doubt impacted the very functions of libraries to the point that many lay people believe that the place of the physical library will be no more and that everything in the information realm will be accessible from their desktops or even hand-held devices. The argument here is not the impact of technology alone on library services, it is the complete metamorphosis of the library's functions especially in the 21st century where it is more about a place for social interaction and intellectual exchange than a mere storage for books.

Academic libraries in developing countries are although, aware of the changing demands on libraries, their response to these trends is at best slow or in some cases stagnant. Consequently, academic libraries in the developing countries cannot compete favourably with those of the developed countries. Thus, the primary mission of the academic library to provide organized, inexpensive access to information at par to a global scale is constantly threatened.

This thesis is motivated by the desire to examine those changing demands in libraries that has virtually reshaped the place of the library in the community with a view to provide an opportunity to learn best practices in incorporating these changes.

1.5 Scope and Limitation

The scope of this research will be limited to the possible architectural solutions to changing educational and social demands in libraries. In this regard the write-up will pay special attention to the issue of the impact of digital technologies on libraries.

The author will explore a scheme for a library design as a proposal for Kaduna State University Library with strong emphasis on social components which will also serve as a test bed for how a new library might be configured in the future.

1.6 Architectural Significance

The result of the findings of this thesis will help in guiding architects involved in academic library design on analyzing and consolidating various space design issues that will cater to the changing demand in library spaces.

1.7 Methodology

The methods adopted for sourcing information for this research are;

Literature Review

This included data obtained largely from existing literature in form of conference papers, journals, books, magazines and the Internet sources (including video and audio files relevant to the study). The literature review investigated the changes in library services and the resultant changes in the design of modern libraries, in particular academic libraries. It also investigated the successes and pitfalls encountered in redesigning library spaces to be flexible and collaborative to reflect the demands for automation and more spaces for new public and collaborative uses.

Case Studies

These are detailed studies of similar design solutions within and outside the country. The case studies were chosen from relevant buildings of similar size and use. Other selection criteria are accessibility and availability of information. The results of the case studies give an indication of current practices in integrating emerging technologies in library spaces and attempts to respond to increasing demand for more informal library spaces especially now that society often blur the lines between work and home. Discussion of the findings and recommendations for further discussion are presented.

CHAPTER TWO

HISTORICAL DEVELOPEMENT OF LIBRARIES

2.1 Introduction

The development of libraries over the years has been closely linked to the development of librarianship. It has also been tremendously affected by technological developments mainly in the form of automation of the library.

The art of writing started more than 7000 years ago. The need for man to transmit his thoughts and visions in an external medium to others and the preservation of culture brought about the idea of writing. The need to collect these writings for preservation could have heralded the evolution of libraries. As there are different types of writing, so also are there several kinds of media that have evolved over the years. These include clay tablets, papyrus, stone, parchment, paper, microform, and now the digital medium.

2.2 Definitions of Libraries

A library can simply be described as an organized collection of information resources/materials (Mohammed, 2009). But within that very simple definition, there are many possibilities and many types of information—literary, artistic, graphical, aural, static and animated images—that are encompassed and integrated. The idea of "making information available" is the most important factor, because libraries today make information accessible that is not necessarily housed in the building, or even within the library system itself (Brentrup, R., *et al*, 1996). A library is concerned with the collection, processing, storage and dissemination of recorded information for the purpose of reading, studying and consultation (Aina, 2004).

However, the United Nations Educational, Social and Cultural Organisational (UNESCO) defined a library as an organized building for public books and periodicals and of other reading and audio-visual materials. It also includes the services of library staff able to provide and interpret such materials as are required to meet the informational, research, educational or recreational needs of its users (Murison, 1988).

According to Aguolu (1989), libraries are social agencies designed to conserve knowledge, preserve the cultural heritage, provide information, undergird and underpin education and research and to serve as fountain of recreation.

It can be gleaned from the above definitions that libraries are products of highly developed societies embodying all that have been learned which are recorded, preserved and made available to the present and future generations. The library is seen as a tool for intellectual freedom and economic development. It is the society's most widely accepted and flexible agency for the delivery of information from a variety of sources and formats to the eventual user.

2.3 History of Libraries

2.3.1 Ancient Libraries

Libraries as store houses of books and other forms of records have a historical background that go back to the earliest days of recorded civilisation in Mesopotamia. Together with early civilisations of Egypt, Greece and Rome, these civilisations can be said to have formed the bedrock of the modern library.

In Sumer, an ancient Mesopotamian civilisation, evidences of developed literature were more often found in temples and palaces of kings with indications of a well-

developed cataloguing system. Records of legal contracts, tax returns and bills of sales were collected. They developed their own mode of writing-the cuneiform (see Figure 2.1) where they utilized wedge-shaped strokes, inscribed mainly on clay tablets but also on stone, metals, wax, and other materials. A temple in the Babylonian city of Nippur filled with clay tablets— is the world's first library dated 2500BC (Halsey et al., 2009).



Plate 2.1 The Cunieform
Source: Halsey et al., (2009)

The Phoenicians also made an appreciable contribution to writing and the development of libraries. They were the most notable travellers and traders of the ancient world and in the course of time, they became a very strong sea-power. The Phoenicians had a homogenous civilisation with influences from ancient Egypt and Babylonia. They developed an alphabet and kept records of their business. They inhabited parts of modern day Israel, Syria and Lebanon (Halsey et al., 2009).

Pre-Hellenistic Greece was the first known civilization to establish libraries for use by the popular classes as well as for members of the ruling elite. They developed a

form of writing patterned after that of the Phoenicians (Halsey et al., 2009). Papyrus and parchment were the medium used for recording information. The cheap availability of Papyrus and the enlightened rule of the Ptolemys provided a great impetus for to the translation and editing of books, and libraries were accorded much importance (Fere, 1994).

The Greeks had several famous scholars among who were Aristotle, Archimedes, Hippocrates and Plato. Thus, their works in many disciplines including mathematics, philosophy, astronomy, medicine, poetry etc, was recorded on papyrus. Wealthy Greeks and members of the professional class established private libraries. Many temples in ancient Greece also had libraries. The first truly extensive library was credited to the philosopher Aristotle.

In ancient Egypt, the temple was vital to the well-being of the society and was highly revered by the people. It was regarded as the spiritual, as well as the economic and educational centre of the community. The temple priests dominated the educational system and were thus, the teachers, scholars and scribes. This made it possible for the library to be located in the temple. The ancient Egyptian mode of writing, the Hieroglyphic, was used to record many subjects including agriculture, government and poetry. (Halsey et al., 2009). The papyrus was used as the medium of recording information. In addition to the temple libraries, many kings had libraries attached to their palaces. The famous library of Alexandria, founded by King Ptolemy I, contained probably the largest collection in the ancient world. His son and successor Ptolemy II, was responsible for the library's expansion after he acquired the remnants of the library

amassed by Aristotle in Greece. At a time the library housed more than 700,000 rolls of papyrus. The library was very famous for the quality of its cataloguing.

The Roman Empire acquired large collection of literature from the conquered Greeks as spoils of war (Fere, 1994). Roman officers and wealthy families considered it fashionable to surround themselves with books even though there were hardly used. Thus, by 50BC, many private libraries flourished in Rome because it was seen as a status symbol. Educated Greeks or other conquered educated people were taken as slaves to Rome to work as scribes. By the beginning of the fourth century, many public libraries began to sprout in Rome. Julius Caesar commissioned a public library for Rome before he died in 44 BC. During the reign of Augustus, a library was established by the Aventine Hill. The Roman emperor Hadrian also built a considerable private library for his palatial residence outside of Rome at Tivoli. Other emperors after Augustus also made their own contributions to the development of libraries.

By the end of the 3rd century AD, Rome boasted nearly 30 quasi-public libraries, most of them attached to temples. The Ulpian library, founded by Emperor Trajan in AD 114 was one of the greatest quasi-public libraries in Rome. These libraries divided their scroll collections by language into Greek and Latin sections, organizing them by subject and then alphabetically by author. Prominent citizens also established libraries like Cicero (104-43BC), who established a library in his villa and contributed to the scholarship of the period (Halsey et al., 2009).

2.3.2 Medieval Libraries

The early middle ages was a period during which Christianity played a dominanant role. Monasteries and Christian literature flourshed during this period, hence,

libraries were mostly found in monasteries and cathederals. The parchment codex (an early form of book consisting of bundles of folded parchment sheets inscribed on both sides) replaced the papyrus as the prinicipal medium of recorded knowledge. Christian monks worked in special rooms called the Scriptorium collecting manuscripts and hand-copied them. These manuscripts tried to preserrve the Greek nand Roman cultures in addition to the Bible, poetry, drama, politics and works of great men like Homer and Virgil. For about the next 1,000 years during the Middle Ages (which lasted from the 5th century to the 15th century).

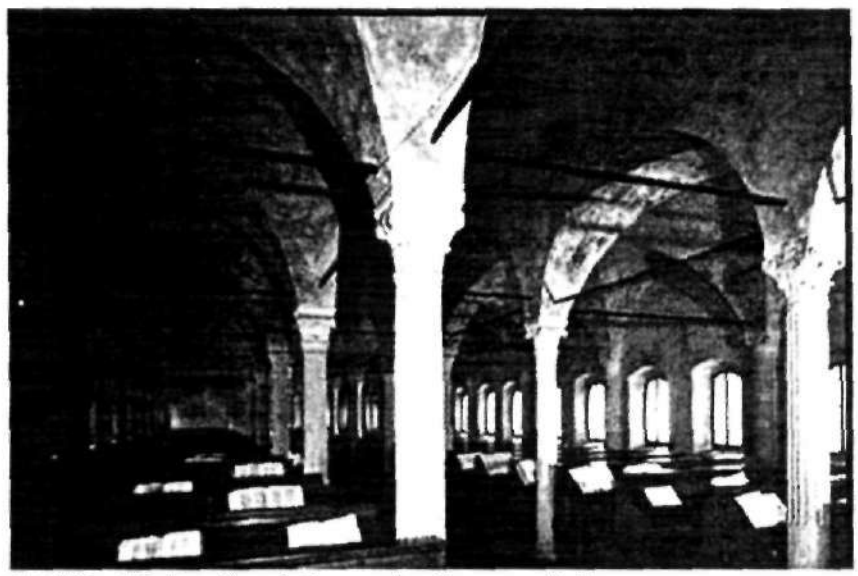


Plate 2.2 The Maltestian Library in Cessna, Italy
Source: Halsey et al., (2009)

Medieval libraries in Europe acquired, copied, and disseminated texts by relying on correspondence between monasteries (Halsey et al., 2009).

The Maltestian Library in Cesena, Italy, is one of the best-preserved examples of a medieval library. Built between 1447 and 1452 A.D., the library collected hand-written,

illustrated manuscripts from throughout Europe. Today, the Maltestian Library contains over 300 medieval manuscripts (see Figure 2.3).

Libraries were also being developed in the Islamic world, especially by the Arabs and Asians during the medieval era in Europe (Halsey et al., 2009). The medium for recording information was the paper, having learnt the art of paper making from China. The library (also called maktaba or madrasah) was established in Mosques (masjids). Famous Islamic libraries include Baitul 'Ilm (House of learning), established 988 in Cairo; Baitul Hikma, 9th century in Baghdad, Iraq; Al-Zaituna Mosque-univeristy, 15th century, Tunisia and the Al-Azhar founded in Cairo in 970 and it is today the oldest existing university in the world.

2.3.3 Modern Libraries

During the Renaissance of Europe, books and libraries played a central role in the revival of interest in the intellectual heritage of ancient Greece and Rome. Libraries were greatly influenced by religious, political and economic trends of that era. Great libraries rose and fell with the fortunes of war and politics (Murison, 1988). The increasing spread of education in Europe and the invention of the movable type of printing by the inventor Johannes Gutenberg (1400-1468) had tremendous influence on European libraries. Printing spread so rapidly throughout Western Europe that by 1600, 20million books were printed for approximately 30,000 titles. Books replaced manuscripts and for the first time, books were arranged on the shelves of the Vatican library (established in mid 14th century by Pope Nicholas V). The Sorbonne library of the University of Paris and the State Royal Libraries in France are also some of the large libraries established across Europe.

Private libraries were also common in the Renaissance. Noble families like the Medici family of Tuscany built extensive private libraries. Libraries of the Renaissance period usually contained works from all periods, classical, medieval and contemporary.

Meanwhile, the university library as an effective tool for research did not exist before the late 18th century. The 19th century German university libraries of Leipzig, Heidelberg and Berlin became prototypes for most of the world. Donations from kings, nobles, and bishops helped spur the growth of libraries at the universities of Oxford, Paris and other European centres of learning (Halsey et al., 2009)

In Great Britain, the Protestant Reformation (16th century religious revolution in the Church which ended the supremacy of the Pope in Western Christendom and the establishment of the Protestant Church) had a major impact on library development. Protestants established libraries as repositories of their faith against the Roman Catholic Church. Municipal libraries were founded in 1600s and the first Public Library Act was passed by the British Parliament in 1850. Private libraries of individuals held impressive collections. These were donated to such establishments like universities and The British Museum. The collections of Thomas Bodley, for instance, were donated to the Oxford University in 1598 and it formally opened to the public in 1602 (Murison, 1988).

Libraries in the United States of America grew at an exponential rate during this period. They were typically private collections of the clergy and physicians which metamorphosed into university libraries. The Harvard university library had its origins from the private collection of John Harvard. Another notable library that evolved that way was the Library of Congress established in Washington, D.C., in 1800. The library served as a reference library for members of the US congress. Thomas Jefferson, a former

American president sold his collections—over 6700 volumes covering many disciplines— to the library after it was destroyed by the British in 1812.

Public libraries were also established throughout America. The middle class's championing of universal literacy and mandatory attendance of public schools provided the impetus for the establishment of public libraries in America. The Boston Public library. The New York Public Library and The Carnegie Library are some examples of early public libraries in America. The American Library was established in 1876. The association also publishes the *Library Journal.* The Dewey Decimal Classification Scheme was devised by Melville Dewey at about the same time (Halsey, et al, 2009)



Plate 2.3 Newcastle City Library, Newcastle, United Kingdom
Source: www.community.newcastle.gov.uk

The International Federation of Library Associations was founded in 1927 Edinburgh. Scotland. It was formed to act as the global voice of the library and information profession.

2.4 Development of Libraries in Africa

The earliest known records of libraries in Africa were found in the temples of Egypt and in the monasteries and cathedrals of Ethiopia (Aguolu, 1989). Also the Islamic civilisation spread to Africa brought the use of writing which created Arabic records in Mosques. However, there was absence of recorded knowledge in African indigenous languages because most of these records were in the foreign languages of Greek, Latin and Arabic.

The rapid development of libraries in Africa can be traced to the European colonialist who implanted their culture and norms. An important legacy of the colonialist was the establishment of libraries which was purely for economic purposes (Ekpe, 1979). The production of export crops during the colonial era brought the need to establish special libraries to assist research institutes set up to advance agricultural production.

The pattern of library development in Africa as described by Holdsworth (1961) reflected the colonials' interests and priority. It showed a progression from the bread and butter libraries necessary for the functions of a state to libraries for trade and professional classes to libraries of institutions of higher learning and finally to public libraries.

Thus, from the 19th century many important libraries were established. This include the South African Public Library, Cape Town (1818); The Fourah Bay College Library, Sierra Leone (1827); the National Library in Cairo (1870); and the first agricultural library in tropical Africa, Zomba, Malawi (1899). Notable 20th century libraries include the libraries of the university colleges of Ibadan, Nigeria and Legon, Ghana established in 1948.

2.5 Evolution of Libraries in Nigeria

The first library services in Nigeria began in the 1920's with the founding of the Lagos Book Club by expatriate civil servants and some Nigerians (Aguolu, 1989). The Book Club formed the Nucleus of the Lagos Library established in 1932 when the Book Club received a grant of $6,500 from the Carnegie Foundation. The Lagos Library started as a subscription library.

Some prominent educated Nigerians held impressive collections in various fields in their private libraries. Some of these private collections formed the nucleus of notable public and university libraries.

Henry Carr was one such prominent Nigerian whose collection of about 18,000 volumes was bought by the Nigerian government after his death in 1945. The Henry Carr collection formed the nucleus of the University library of the University College, Ibadan established in 1948. The University College Library for some time performed the functions of National Library. The Publication Ordinance passed in 1950 required all publishers to deposit two copies of every book published in Nigeria with the Ibadan University College Library (Aguolu, 1989).

The British Council was opened in 1943, in Lagos, to serve as an information centre during the war as well as provide facilities for people interested in reading. The British Council later established libraries in Kaduna, Enugu, Ibadan and Benin-City.

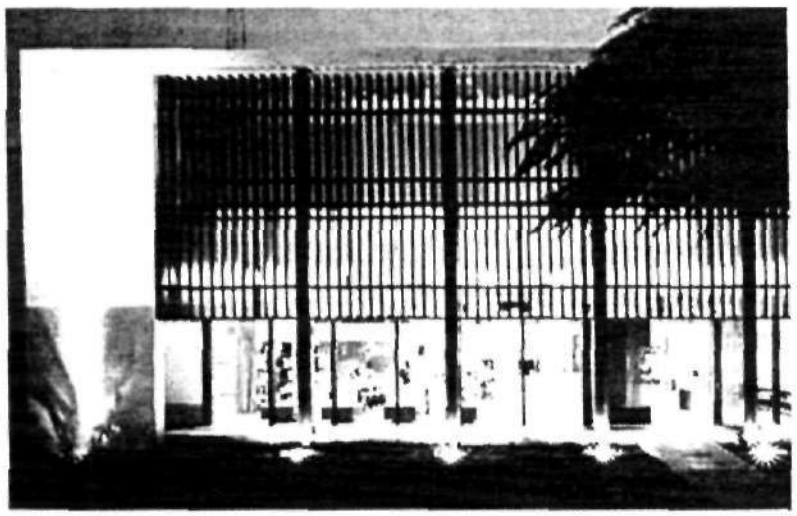


Plate 2.4 British Council, Lagos
Source: Halsey et al., (2009)

2.6 Types of Libraries

A library's facilities and services are meant to serve the varying educational and social needs of a particular community. The type of library located in a particular community is a function of the environmental needs and resources of that area. Hence, libraries are categorized into different types based on the target audience.

2.6.1 Academic Libraries

Academic libraries are libraries attached to post-secondary institutions and are therefore as varied and distinctive as the institutions which they serve. It is pertinent to note that academic institutions are mainly categorized into two namely; university and non-university institutions such as polytechnics, colleges of education, schools of nursing etc (Olanlokun and Salisu, 1993). They perform functions directly related to the mission of each institution. Based on this distinction, academic libraries can be broadly divided into two: university libraries and libraries attached to non-university institutions called college libraries.

University Libraries

A university library supports the objectives of a university in the areas of research, teaching and learning. It is regarded as the heart of the university's intellectual system. To a large extent, the quality of a university is measured by the services of university library because of its unique position in the overall university system.

The users of a university library include students, faculty, researchers, support staff and members of the local community in which the university is located. To the students (undergraduate and postgraduate) the library provides all resources needed for carrying out effective learning and research. To the faculty, it provides resources to support teaching and research. It provides resources and services to support research projects and materials of sufficient quantity and diversity to support research of whatever kind in every subject offered in the university. The support staffs of the university make use of the library for learning and other purposes. The community in which the university is located uses the library for the purpose of consulting local materials collected by the university.

University libraries are sometimes decentralized along faculty and departmental lines, with the main library coordinating the departmental and faculty libraries. This is done to cater for the variety of services and subject fields taught in the university.

The peculiar features of an academic library lie in its enormous storage of bibliographical and audio-visual materials for the use of students, faculty and research workers for their educational and research needs. The academic library has a large proportion of its materials open to users and thus, has a good circulation system.

Differences exist among the libraries in size of the building, specific functions and their modes of operation.

College Libraries

These are libraries attached to tertiary institutions other than a university. Institutions like polytechnics, colleges of education, and schools of nursing fall under this category. The objectives of college libraries are somehow similar to university libraries except that the emphasis is less on research. The main function is to serve the programmes of the college and implement its educational objectives. The collections of college libraries are much smaller in size and scope than a typical university library because it has a limited number of subject fields than a university.

The report of **Symposium 2010 "The Academic Library in 2010: A Vision"** held at the American University Library, Washington DC in March 2005, gave an overview of the core competencies of academic libraries in the 21st century as follows: Integrating library resources and services into campus life; providing welcoming space for intellectual discovery; teaching learners about information retrieval and integration; assembling information resources regardless of format and ownership; creating links to information, whether it is owned or accessed by the library; and promoting ethical standards of information availability and use.

2.6.2 School Libraries

These are libraries attached to schools: pre primary, primary and secondary schools. They supplement the teaching of school children where they cater for children who are eager to read and also for backward children who read with difficulty and who require visual aids and all kinds of incentives to study. School libraries contain more of

audio-visual and graphic materials than other types of libraries. Other materials include periodicals, magazines, books and newspapers.

In recent times many school library have transformed into library resource centres. Items collected in the library include toys, study kits, films, videos and audio tapes, video machines, cassette radios and computers. These items are required to ease learning on the part of the students. Because of the variety of their collections, a school library is sometimes called a media resource.

According to Ralph (1962) the main purposes of school library is to encourage the reading habits of the learner; develop in pupils the ability to learn from books without teachers; breakdown the rigid divisions which the school timetable often creates between different subjects and to give social training.

2.6.3 National Libraries

As the apex library of a country, the national library is the central book depository of that country. It is responsible for the collection and conservation of all copyright publications within the country and other formats of information for the benefit of future generations. This facilitates the publication of the national bibliography of the country on an annual basis, which forms the basis for measuring the published literary production of any country.

Publishers, authors, all government agencies and other corporate bodies in a country are by law mandated to deposit copies of all their publications with the national library. It is expected that national libraries should collect all foreign literature pertinent to the country. It is also responsible for developing public libraries in each country.



Plate 2.5 National Library, China
Source: www.archdaily.com

The national library serves a number of other functions that include serving as the national bibliographic centre, national centre for translation, national lending and document delivery centre, national referral centre, coordinating for library co-operation and resource sharing. The national library is the body responsible for assigning the International Standard Book Number (ISBN) and the International Standard Serial Number (ISSN). The national library is also supposed to represent the country on all library matters at international conferences.

Although a national library is established to serve as nations' libraries' library so to speak, there may however be more than one national library in a country limited by subject matter, for example, The American National Library of Medicine.

2.6.4 Special Libraries

Special libraries are established to serve highly specialised requirements of professional or business groups. Many corporations, private businesses, government agencies, museums, religious institutions, hospitals, associations, and other organizations maintain their own libraries to serve the specialized needs of their employees or

members. This type of library can be delineated by either the subject of its collection, the type of users and the form of the items collected.

Thus, a special library identified by its subject area includes a science library, music library etc, as it collects any form of information material only in that subject area. A map library, museum library or film library is a special library delineated by the form of the items it collects which are films, maps and museum objects. The third unique character of a special library is where it serves only a particular group of users. This includes professional libraries (for users of the same profession), hospital libraries, prison libraries, business libraries etc.

Special libraries often cover a specific and definable subject field. The collections of special libraries depend on the specific needs of the organizations they serve. These parent organisations generally sponsor the special libraries.

The printed collection of special libraries is mainly in the area of periodicals, books, reports (consultancy report, technical reports and feasibility reports), executive summaries and abstracts. In addition to performing the same functions as other libraries, special libraries evaluate, package, and present information to users in ways designed to increase productivity and add to the efficiency of their parent organization. It should however be emphasised that the nature of special libraries is personalised.

2.6.5 Public Libraries

Where other types of libraries are meant for a specific group of users, the public library is not restricted to any group of users. Indeed, the public library has from inception been regarded as a free library set up to provide traditionally, "service to everyone" (Olanlokun and Salisu, 1993). Public libraries offer their services to all

members of the community including young children, people with disabilities and even people who for one reason or the other are incapacitated (hospital patients and prisoners). Public libraries range in size from one room facilities to multi-branch systems serving millions of people in urban areas. Some public libraries provide services to rural areas of their communities with *bookmobiles* (mobile library service), which are trucks, trailers, vans, or buses equipped to serve as travelling lending libraries. This is especially useful when some people are unable to make use of the library because they are disadvantaged.

Public libraries serve as the intellectual, cultural and recreational centre of a community. In order to serve the wide spectrum of its users effectively, the collections of a public library are as varied as all the items that can be collected by any type of library. It is common to find books, periodicals, journals, newspapers and magazines, manuscripts, artefacts, museum projects, audio-visual materials, computer workstations and connection to the internet in a public library.

Many public libraries sponsor exhibits about historical events and popular culture. In addition, they host book-discussion groups, lectures, film screenings, and live performances in auditoriums or public meeting rooms. Other services offered by public libraries range from story hours, crafts, and puppet shows for children, to workshops, concerts and lecture series for users all age groups. The variety of services and activities offered by public libraries is in response to changing community needs. They are generally financed, maintained and supported by governments, local communities and occasionally by non-governmental organisations.

The founding of public libraries can be traced to the early period of human existence; however, those libraries could not be equated to public libraries of recent times. They were the collections of some individuals and were mainly the prerogative of the cream of the society; the wealthy and renowned scholars.

The establishment and development of public libraries in the United Kingdom and other parts of Europe started in the 15th -19th century. They were first established as town halls with the deliberate purpose of creating a free library for all without restrictions to who could or could not use it and were supported by public funds. Similar situation existed in other parts of the Far East such as Japan, China, Korea, Taiwan and Hong Kong. Individual differences should be recognised because of the unique problems and obstacles in the way of library development.

Public libraries in the United States followed the same pattern discussed above. The first modern public library was established in Peterborough, New Hampshire, in 1833. The functions performed by the public libraries in the USA continued to change and in the1960's and 1970's moved swiftly to take materials and various programmes to people who had not been accustomed to come to the public library(mobile library service).

The development of public libraries in Africa reflected the various systems of the colonizing countries and was dependent on the economic viability of such countries. Public libraries in Africa are funded with government grants in agreement with the UNESCO Public Library Manifesto.

In Nigeria, the public library system followed the same development pattern in Western Europe and the United States of America. These libraries evolved from private

libraries to subscription libraries. Notable among the subscription libraries was that founded from the Estate of Tom Jones as provided for in his will. To this day, The Nigerian government; The British Council; The Carnegie Corporation of New York; and some notable individuals were instrumental in the development of the public library in Nigeria.

2.7 Typology of library buildings

Anderson (1963) identified a variety of historic plan types for libraries. The basic plan types include;

2.7.1 Classical Plan Type

This originated in Ancient Rome and was utilised throughout the ancient times and the Renaissance. At first these libraries were attached to temples, later they formed an integral part of cathedrals and dwellings of noble men. It consisted of a single, enormous hall decorated with sculpture and murals, with book shelves placed against the walls. Later galleries were used in the libraries. This plan type has provision for the three elements of a library; readers, books and staff. However, the classical plan type was designed for few books and readers. It ultimately failed because of this limitation and the noise level of large open halls. A typical prototype of the classical plan type; the Roman Library of Ephesus built in AD 107 is shown in Figure 2.6

2.7.2 Medieval Plan Type

This is an improvement of the Classical plan type. It consisted of a room with book shelves projecting from the walls like church pews (Figure 2.7). The room was lit by windows along either side. It developed through several stages into a series of alcoves

created by the bookshelves with tables and chairs in each alcove. The medieval plan type has proved ideally suited for small libraries (for monasteries, cathedrals and small colleges) or even special collections or rooms within larger libraries.

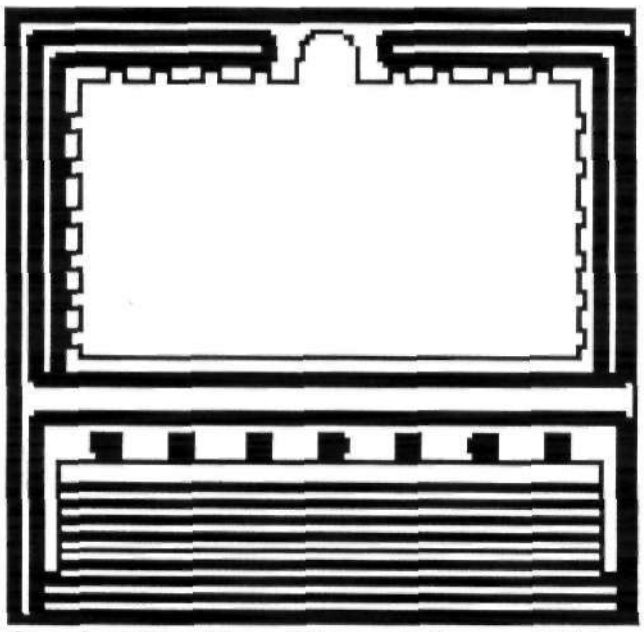


Figure 2.1 Classical Plan Type (Roman Library at Ephesus *A.D. 107*)

Source: Fere, (1994)

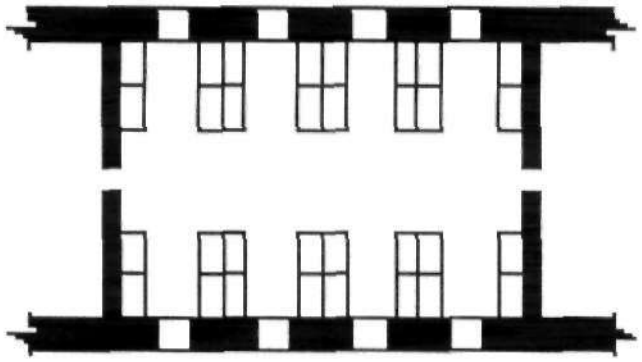


Figure 2.2 Typical Medieval Library Plan

Source: Fere, (1994)

2.7.3 Closed Bookstacks Plan

This plan type became popular in the early 19th century. During that period books began to be produced in much larger quantities and the development of education greatly increased the numbers of readers. It therefore became necessary to separate the elements of the library, especially the readers and books.

The books were kept in closed book stack, while the readers were kept in a separate, large reading room. In one arrangement of the closed book stack, the reading rooms were located on the upper floors while the book stacks were below (Figure 2.8). It solved the problem of having readers and books in close proximity, yet separated. The reading rooms were able to enjoy more sunlight. The Bibliotheque Sainte-Genevieve at the Universite de Paris (1843) is a prototype of this type of arrangement.

Another arrangement consists of a circular reading room surrounded by book stacks, with the catalogues and the staff in the as shown in Figure 2.9. A disadvantage of this type of arrangement is excessive traffic through the reading room.

A rectangular plan with the book stack occupying a central tower and surrounded by the reading areas as shown in Figure 2.10, is yet another arrangement. The book stack tower has been used by major university libraries and is suitable for infrequently used materials; however, greater frequency of demand could create staffing problems.

The closed stack plan can also take the form of a rectangular building, in which the reference staffs were placed between the readers in the front and the closed book stack at back of the building as shown in Figure 2.11.

Finally the development of the electric light made it possible to locate the book stack at the centre of the building and the reading rooms round the outside of the

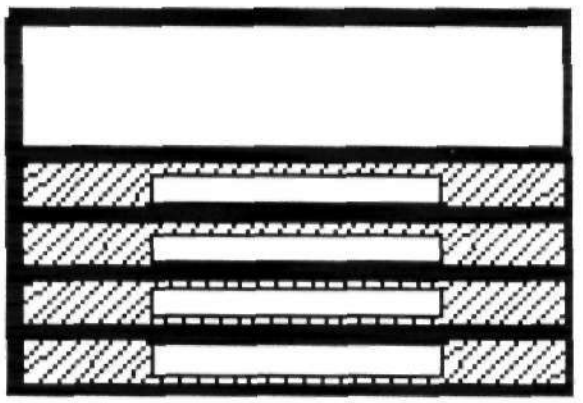


Figure 2.3 Closed Bookstacks with reading rooms on upper floors

Source: Fere, 1994

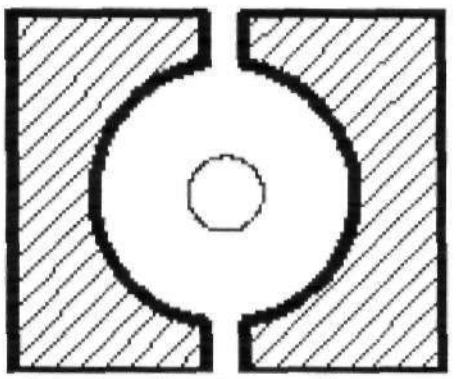


Figure 2.4 Closed Bookstacks: circular reading room surrounded by bookstacks

Source: Fere, (1994)



Figure 2.5 Closed bookstacks: rectangular plan with bookstacks occupying a central tower

Source: Fere, (1994)

Building (Figure 2.12). This provided the readers with good natural light and easy access to the book stacks from all sides.

2.7.4 Open-access Plan

During the middle ages, librarians were faced with a growing demand for books. It is not surprising then that the librarians of that period developed an air of possessiveness where their first impulse was to protect the books from the readers. For instance, books used to be chained to iron-bars on library desks to prevent their being removed, and the various plan types that excluded readers from the stacks.

The 1920's witnessed a paradigm shift in the whole philosophy of librarianship. Service to users became far more important than it had being. On campuses libraries were viewed less as passive repositories of knowledge and more as an integral part of the teaching machinery. The open access plans are the results of efforts in modern times in bringing books and readers together. They developed in the public libraries, and later in colleges and university campuses through the generous building funds provided by renowned American philanthropist, Andrew Carnegie.

One Room Type

This is the simplest form of the of the open access plan. It is popularly known as the "Carnegie rectangle" which is a one room library with an informal loan desk near the entrance. Used in small libraries, readers have free access to the books without any hindrance as shown in (Figure 2.13).

Right / Left Plan

The "Carnegie rectangle" developed into the right/left plan which is simply a rectangular plan with a large room on either side of the loan desk as shown in (Figure 2.14). A small third room is sometimes found behind the loan desk for either a reference

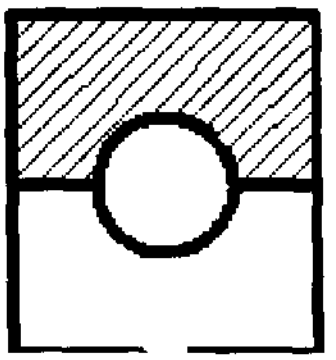


Figure 2.6 Closed bookstacks: rectangular plan with library staff placed between readers and bookstacks

Source: Fere, (1994)

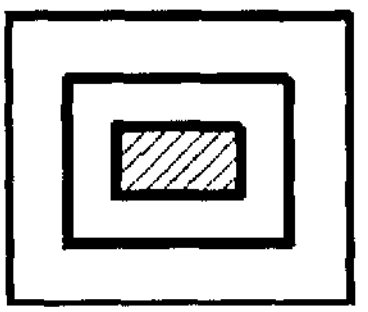


Figure 2.7 Closed bookstacks: centrally located closed bookstacks surrounded by open access reading area and staff offices

Source: Fere, (1994)

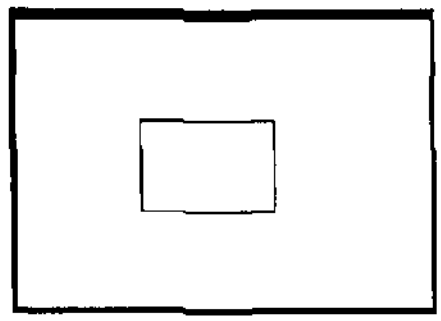


Figure 2.8 Open Access Plan: 'Carnegie Rectangle'

Source: Fere, (1994)

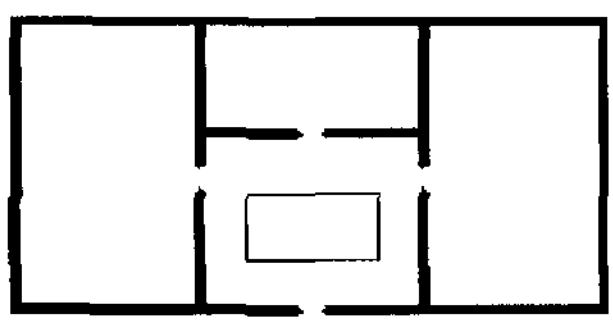


Figure 2.9 Open Access Plan: Right-Left Plan

Source: Fere, (1994)

Collection or staff. The right/left plan is common today in small branch libraries, especially academic branch or departmental libraries

Larger libraries based on the same principle are divided vertically with lending and other activities that generate noise on the ground or entrance level and the reference

section on the upper levels. This plan has proved very successful, resulting in practical, compact and economical building.

2.7.5 Open plans for larger libraries

By the 1920's the open plan became popular with small and medium size libraries. The tightly packed stack of the monumental building of the 20th century created for maximum storage lacked adequate aisle space for browsing. Lighting and ventilation proved inadequate to meet the needs of increased traffic in the stack. The plan could also not be easily converted. The change in the philosophy of library delivery services created a conflict between the form and function of libraries. Consequently, this created a growing dissatisfaction with the monumental libraries where it peaked in the early sixties.

A movement was begun by Angus Snead Macdonald (a manufacturer of library shelving) for simple, wide-open spaces in libraries, broken only by impermanent walls that could be moved as functions in the library changed. This involved the use of carefully spaced columns to carry the upper floors instead of large thick walls. The spaces bounded by these columns, i.e. structural bays were termed "Modules". Thus began the modular era.

The modular library gained popularity by the 2nd World War and it provides a variety of advantages over the fixed function libraries. In the fixed function libraries, stack space was provided in a specific part of the building while reading rooms were designed as architectural entities, the lofty heights of which sometimes not correlated with stack levels and in all cases were two or more levels in height. It offers little flexibility of use, and unless the ratio between books and readers fitted the changing needs of the institution, the building rapidly became obsolete. The rigidity of this plan

type has proved to be its greatest disadvantage. Spaces were designed to serve specific functions and set off by permanent load bearing walls, could be altered only with extreme difficulty.

In the modular buildings, all spaces are interchangeable except for the fixed functions such as toilets, stairs and lobbies. The structure is supported by regularly spaced columns; subdivisions are created by interior non-load bearing walls or partitions made of light materials that can easily be dismantled. The stacks are non-structural elements which consists free standing bookcases that can easily be moved. The "loft space" created by this type of design provides librarians with great wide open spaces, whole floors broken only by a minimal number of fixed vertical elements. Today, architects and librarians work together to achieve complete flexibility through careful planning of the building module and considerable attention to the details of lighting, sound, ventilation and the electronic aspects of the building.

CHAPTER THREE
EDUCATIONAL AND SOCIAL CHANGES IN LIBRARIES

3.1 Introduction

Humanity has always lived in a time of change, but in the past 100 years the conditions of life have been altered in many ways more than in all the previous 2000 years (Ely, 1976). The only constant however, seems to be change itself. Change is endemic, rapid, and often has significant implications. The changes in today's world affects the ideas and activities which we have inherited from the past: the transformations of our natural environment; population explosion; the demand for cleaner alternative sources of energy; the demand for computers and automation; the rising expectations of people; and the apparently inverted value systems call for new ways of coping with the changes that are about us.

3.2 The Meaning of Change

Change is synonymous with innovation because innovation infers change. According to Ely (1976), an innovation is an idea, practice or object perceived as "new" by an individual. The acceptance or adoption of an innovation usually demands some type of change. It is however possible for an innovation to exist apart from an institution or individual, but as soon that institution or individual attempts to adopt or adapt to the innovation, the process of change occurs.

Several experts have argued that there is a popular bias when it comes to the issue of innovation vis-a-vis change. They call that type of bias "*pro-innovation bias*", which assumes that innovation is good and that everyone should adopt the new idea or practice. Rejection in this context is viewed as an unacceptable decision.

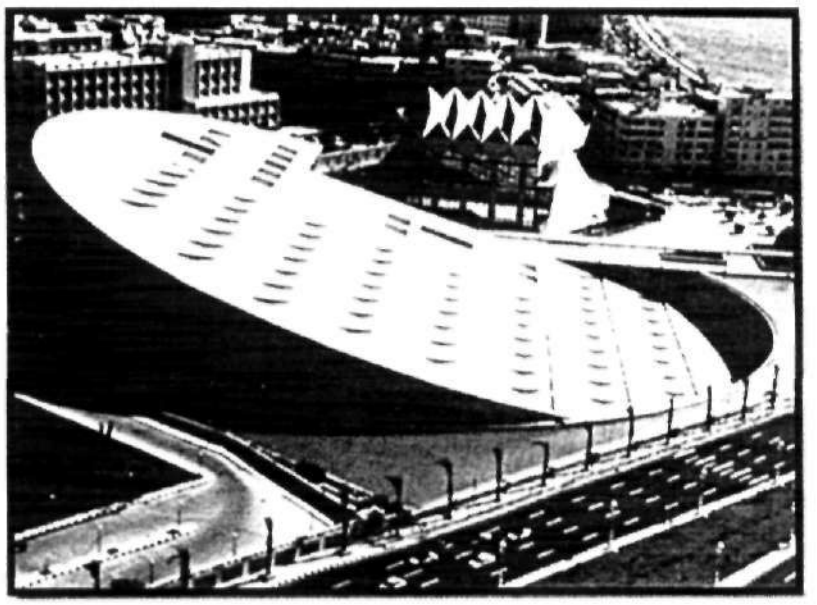


Plate 3.1 Bibliotheca Alexandria, Egypt
Source: Halsey *et al* (2009)

Ely (1976), reports that unknown to most people, many innovations do not have universal usefulness. Some innovations may be appropriate for certain institutions or individuals at some point in time but not for others. The worth of change is in the goodness it brings about because change has no intrinsic value. It is then obligatory for humanity to answer the dilemma presented by change, which is to try to understand the process of change. Thus, there is a need to study the process of change and innovation so that its principles can be used to our advantage.

This research is aware of this dilemma and will try to pick those changes taking place in the library system that can best benefit the Nigerian academic library, and in the process not compromising the library's place in the 21st century.

3.3 Societal Factors Affecting Libraries

The library as an institution, like all other institutions, must look into the future to the possible social, scientific and technological trends that may shape its life. Specialists and librarians have at various seminars and workshop groups discussed the social change and its implications for libraries. Institutions must dispose the notion that social change is a process that alters the status quo. In fact, there is no tranquillity to alter because given the swift transformations in our world; even institutions that are fairly young find themselves woefully out of date. The following are some of those societal factors affecting the library.

3.3.1 Population

In recent years the projections for population growth are staggering and happening sooner than thought. This does say to architects that the proportion of building space must be reconsidered. It places more importance on flexible buildings which can be easily adaptable to changing populations.

The effect of this phenomenon to libraries is the question of whether libraries are to provide full museum and performing art services, and other non-book services. Libraries of post World War II and some recent library developments have incorporated these services. In any case, a library should be designed to offer some of these services if it were to be a cultural centre for the community. There is also the need to re-examine formal reading and study spaces in relation to that devoted to non-print equipment and materials. Perhaps less space for the collection will be required.

3.3.2 Technology

Technology is perhaps the single most important phenomenon affecting how libraries in general, and academic libraries in particular, function. It is especially fuelling increased user demands and expectations for information resources and their timely delivery. Technology may threaten libraries or on the other hand, it may be used to enhance library services in ways yet un-imagined. Non-print materials are still treated as something extra, not as staples of the library operation. They however, have equal priority when the library's budget for resources is allocated.



Plate 3.2 Sorbonne Library interior Paris, France.
Source: Halsey *et al* (2009)

Technology in the form of audio-visual material means richer, more exciting libraries in which traditional services are enhanced, attracting patrons who never before entered the doors of the library. More information becomes available in machine readable form. Libraries are forced to provide a means of accessing

information held in computer data banks. This has marked effect on space allocation and requires special arrangement.

3.3.3 Communication

Closely related to the impact of technology in libraries is the importance of communicating, not just mechanically but in a personal and coherent way. A logical result of the information explosion is the emergence of the knowledge industry, the number one growth industry in this decade. The knowledge industry consists of information technology businesses that specialise primarily in data processing or the development and use of information technology. Hence the library and the users are swamped with an array of information and overwhelmed by communication technology. This is an opportunity for libraries which are in a position to help the individual find what he wants in this forbidden predicament.

This complexity has created more of a need for people to communicate face to face to air their differences and to find solutions. Library meeting rooms and conference rooms must then be provided to fulfil these functions. However, there are questions whether a small multi-purpose room and a single conference room are adequate in today's libraries and how much space will be needed for meeting rooms or conference rooms.

3.3.4 Education

A major educational trend today is the proliferation of alternative patterns of education like schools without walls; open universities; and adult independent learning. This has brought about some practical questions for architects involved in library design. These questions include: the physical arrangement of traditional desks and seating in

libraries; the physical arrangement in libraries serving as information centres; libraries are experimenting with selling services and materials; the place of the Media Centre in an academic library; and how can the number and size of library meeting rooms be determined.

3.4 Changing demands in library services

Libraries and information technology fields are currently engaged in a period of rapid and intense change. Many libraries, particularly those associated with education and research services, are transforming from physical places associated with fixed points of service and physical collections, to multi-faceted providers of remote services providing digital collections in virtual spaces (Jilovsky & Genoni, 2006).

Gayton (2007) asserted that the demand for change in academic libraries has been driven by three seemingly interrelated factors: the increasing use of electronic resources outside the library, the declining circulation of print materials, and falling gate counts. Libraries are continually modifying their collections and services in order to attain the benefits resulting from the rapid shift to digital content. They are doing so at a time when their core services are vulnerable to challenges in the wider, commercial information environment.

In the adoption of the "digital library", with it's anytime, anywhere characteristics; some people have assumed that physical libraries will become obsolete. There is a belief that that the uptake of digital content should have reduced the need for additional space. Yet an examination of the behaviour of students and faculty and of recent renovation and construction of academic and research libraries shows that physical libraries are enjoying a renaissance.

Libraries have traditionally supported the housing of collections, reader services, and the staff who manage the collections and provide services. These three components continue in the 21st century, but librarians, architects, and users/patrons are collaborating to produce elegant and functional designs that reflect new spatial allocations and new purposes. They are also rethinking public spaces to make them more congenial and functional for the modern university student or researcher.

Modern libraries incorporate flexibility and comfort to create an environment that is welcoming and that supports a range of research and learning activities. The changing scope of the "physical" library has secured the place of the university library in the 21st century as the community hub within a university.

Libraries and library environments have changed over the years but have changed rapidly and dramatically in the last decade. It is best to view the changes in a "paradigm shift" in libraries and library services. Todaro (2008) gives a summary of this paradigm shift in Table 3.1 below.

Table 3.1 Summary of the Paradigm shift in library services.

S/No	THEN	NOW
1	All services available only when library was "open"	Many services available 24/7
2	Limited technology for individual use by public	Greatly expanded technology for individual patrons
3	Single or individual product Workstations	One workstation or network now multi-tasks
4	Change in library services hardware, software and patron need occurs once a year or 18 months	Change occurs anywhere from every month to every two to three months—**constant reassessment is needed**
5	Strong reliance on print resources only	Strong reliance on non-print resources
6	Most things available in print, only indexes available electronically	Full text available electronically and some things now available **only** Electronically
7	Patrons spend moderate time with print materials and indexes	Patrons spend expanded time on library hardware
8	Traditional services available such as copying	New services added *on top of old* services such as printing, downloading, basic computer skills such as keyboarding
9	Offer library instruction in traditional ways such as tours, one-on-one, handouts	Expanded offerings on top of traditional such as signage, small group instruction, virtual tours
10	Planning for resources annual or biannual Updates	Rapid change in products drives more frequent updating/greater expenditures
11	Limited hardware and software technology for staff	Greatly expanded hardware and software technology for everyone
12	Not much time spent teaching the tool, rather locating and using content	Now **much** time spent teaching tool or method of finding, and so on
13	Reference in person	Reference in person, virtual, digital, synchronous, asynchronous
14	Fixed, hardwired	Portability
15	Content designed by librarians	Content designed by librarians, patrons, etc. in a shared space

3.4.1 Educational Changes

i. Growth of Collections

Situated at the top of the changes taking place in the physical nature of the libraries is the prediction of future shelf space requirements. Printed books have provided libraries with their reason for existence for the past five centuries. Despite the view that digital formats of information will dominate text and data archives, there is no consensus among librarians that shelf space will shrink. Digital resources are increasingly a part of library acquisitions augmenting their printed forms, but the production of printed texts will continue in substantial volume; either in the form of monographs, bound serials, and cartographic collections (Brentrup, *et al*, 1996).

Taking the issue of the printed monograph (scholarly article, book, paper or thesis) as an example, their acquisitions require the most expansive shelving requirement in new library designs. A net reduction in acquisition rates will be a shift in monograph publication that favours electronic distribution. The prospects for such a shift on a large scale have been met by several mitigating reasons. A major reason is that from the commercial publisher's perspective, scholarly monographs have the most potential for electronic distribution. Monographs are primarily the products of university presses (e.g. Oxford University Press, Cambridge University press, Harvard University etc) who typically recover their production costs for such volumes by extensive publication of trade-books. Scholarly articles have proved to have the highest pre-production costs per unit, marginally recoverable by less expensive distribution formats.

Traditionally, the major obstacles to rapid increases in electronic formats for printed materials are more institutional than technological, and have mainly to do with the

following: copyright considerations and the prevalent hegemony of commercial publishers; distributing costs of production, archiving, and access; editorial and reviewing considerations; assuming responsibility for digital archives, and the status and prestige accruing to publication in established journals.

In recent times respite to these issues has been seen in digital archives (e.g. JSTOR) that alleviate shelving needs to a fraction of current needs while also largely avoiding the institutional problem raised above. The online availability of journals now offers and will continue to offer appreciable relief from shelving space needs. The resultant free space is converted to other uses (Bennett, 2003).

The use of print repositories is another space saving tactic used in modern library design. A print repository is a form of storage that brings together low use items from a number of libraries in a secure environment where they may be held indefinitely. The emphasis is no longer on producing rigid modular space designed for the permanent storage of infrequently used print resources and the individual study desk, but rather on flexible, communal and wired spaces designed to facilitate shared, interactive and ICT-enabled research and learning. The use of print repositories to provide a strategy for long-term storage of print material is being increasingly favoured internationally; as they produce benefits to the networks of libraries they serve, to the individual libraries within the network, and to the communities of researchers that depend upon those libraries. These benefits include reduction in the cost of long-term storage; eliminates duplication within the repository, and encouraging contributing libraries to de-duplicate local collections by ensuring that at least one copy will be permanently retained in the collection; and saves space for the individual libraries. With severe shortages of land and

increasing demand for capital to fund new buildings, the use of print repositories might be the most practical solution available.

Print repositories may be purpose-built and sometimes housed in existing buildings adapted for the purpose. Although many research libraries operate 'stores', which might either be 'local' or 'remote', the repository is distinguished by its collaborative element. That is, a repository serves as a storage site for two or more libraries. It is a cost effective solution to collections storage, and also a way for institutions to work together and pool resources to manage significant portions of their holdings. Incorporating a shared inventory control system, print repositories are subject to common standards for barcodes and labelling, and library materials are stored in standardised units (Bridegam, 2001).

On the other hand there is a very high reduction in acquisitions of cartographic collections, microtext and microfiche resources. This has been made possible by the availability of computer-based storage and display devices which enable large amount of data to be quickly displayed, correlated and analysed.

The implication of the growth of collections in library spaces remains in the use of flexible spaces and observing future trends in the availability of information in varying formats that will have future implications for space use.

ii. Changing Character of Study Space Needs

Thomas (2003) observed that typically, libraries require an array of rooms created to support different work styles and levels of work. Such rooms are usually either large open halls or individual study spaces in the form of carrels or small rooms. Recently, libraries are experiencing changes in the character of study space needs. The integration of technology into the academic enterprise has changed the way people work, bringing

varying activities into proximity that hitherto rarely intersected. Increasingly, library spaces are flexible and networked, bringing together formal and informal activities in a seamless environment that acknowledges that learning can occur anytime, at any place, in either physical or virtual spaces.

Also, today's students have attitudes, expectations, and constraints that differ from students of even ten years ago. Spaces designed in the 1950's are not likely to fit perfectly with students of the 21st century because learning spaces often reflect the people and learning approach of the times (Lippincott, 2006). Many of today's students favour active, participatory, experiential learning—the learning style they exhibit in their personal lives. They are also highly social, connecting with friends, family, and faculty face-to-face and online. It is now common to find Facebook.com, instant messaging, and cell phone photos coexisting with conversations over coffee in the library. However, these behaviours that they exhibit may not match their self-expressed learning preferences when sitting in a large lecture hall because the focal point at the front of the room sends a strong signal about how learning will occur.

Increasingly, academics are assigning students collaborative projects. To support these activities libraries are creating group study spaces with such facilities as internet connections, whiteboards and soundproof walls. This category of rooms is growing in new buildings and demand remains high. Also, advanced students conducting dissertation research seek enclosed, locked studies where they can store books and lock up valuable items. However, librarians note a pattern of behaviour that makes them hesitate to allocate more single study space. The graduate students work in spurts and spend only a limited portion of their time at their carrels. A creative solution is the design of a

continuum of spaces from individual to group. This helps target the appropriate space to the user need and moves beyond the rigid, one-size-fits-all character of some earlier library designs.

A related developing trend is that students work on a 24-hour clock, and many of them seek study spaces where they can work at any hour without undue interruptions. Consequently libraries are incorporating secure 24-hour study spaces into their buildings. However, these spaces are designed in such a way that they are capable of being closed off from the rest of the library. They cost less to operate during non-peak hours, and they often require some form of identification for admittance. The primary purpose of this facility is for study and computer use; there is no high demand for collection access or reference service.

Faculty studies in the library are also undergoing change where there are a declining number of faculties making regular visits to the physical library. With pervasive access to many resources electronically and competing demands for their time, they are as likely to use library services and collections remotely from their offices, homes, or from another location. Study spaces dedicated to faculty use are often empty and used chiefly as bookshelves. As a result, libraries are rethinking space for faculty, fashioning a flexible set of rooms that can be assigned for different durations, depending on the nature of the their work. The rooms may be assigned on a daily basis or be communal spaces in which multiple desks are available for use, but not permanently assigned to an individual.

iii. Information Commons

The use of information commons is probably the most popular change in the study space needs in modern libraries. Also referred to as reading commons, learning commons or simply commons, (often used interchangeably) they describe facilities with different missions although, in practice, there is no direct correlation between the name and what the facility offers. An Information commons is dedicated to learning electronic-research and document-creation skills. It is a collaborative learning space where students can access, use and create information. It enhances learning, providing an environment for students that is both academic and social, and fosters a sense of community on campus (Lippincott, 2005). By providing a centralized, interdisciplinary and fully configured learning commons among its space and resources, the library bridges the gap between campus life and academic culture (Wand, 2005).

From this definition an Information commons is not just a new name that institutions give to renovated library spaces, a glorified computer lab or a library reference area that has been spruced up with new furniture and equipped with a large number of computer workstations.

In today's world where students mix academic and social activities, and growing up in a world with media in many formats at their fingertips; developing spaces where students can collaborate outside the classroom provides support for an increased emphasis on teamwork, both in and outside higher education. Frequently, the information commons occupies one floor of a library facility, generally a main service floor, which often includes or replaces the library's reference area.

Among the major differences between an information commons and computer labs in traditional academic libraries is that the technology in an information commons is intentionally more pervasive than in most traditional academic libraries. Some information commons have hundreds of computers configured with a rich application suite as well as space for laptops. The software used is much more extensive than that available in typical libraries, including word-processing, presentation, and spreadsheet software, at a minimum. In addition, some workstations have statistical packages, geographic information systems (GIS), or multimedia production and editing capabilities. In contrast, workstations in many traditional library reference areas limit what users can do, namely, check the library's catalogue or access licensed information products and Web resources, but do not allow for writing papers, manipulating data, or developing presentations.

Another distinguishing trait between an information commons and traditional libraries is the way in which they accommodate groups. Traditional libraries have focused on providing quiet space for individual study. Occasionally, a few group study rooms are available, but they are considered a peripheral feature of the library. In an information commons, much of the space is configured for use by small groups of students, reflecting students' desire for collaborative learning and combining social interaction with work. Information commons frequently have furniture built to accommodate several people sharing a common computer and provide large tables where several students can use their laptops while working together, comfortable seating areas with upholstered furniture to encourage informal meetings, cafés with food and drink,

and group study rooms, often with a computer and screen, so students can work together efficiently on projects.



Plate 3.3 Information Commons at The Saltire Centre, Glasgow Caledonian University Glasgow, United Kingdom
Source: JISC (2006)

Many information commons also incorporate classrooms equipped with a variety of technologies, including computers and projectors, smart boards, video editing equipment, and videoconferencing capabilities. Often one or two classrooms are set aside for the library's information literacy instruction program.

As such, the central theme of today's library is how to reconceptualise library spaces to facilitate active, social, and experiential learning. Today's library spaces are increasingly flexible and networked, bringing together formal and informal activities in a seamless environment that acknowledges that learning can occur anyplace, at any time, in either physical or virtual spaces.

iv. Increasing Interdisciplinary Work

Undoubtedly, there is an increasing intersection of the different disciplines especially in the Sciences. Nowadays, teams of scientists come together to explore the intersection of their disciplines to solve some of Man's several questions about the universe. Just as they work together in libraries to consolidate their different efforts, so do the disciplinary (or departmental) libraries. This consolidation has the added benefit of creating a more effective and efficient delivery of library services since it eliminates redundancy and allows staff to be deployed at fewer service points. The reduction of service points is another theme in library buildings. This is so because if in a university there are libraries distributed in several locations, student or faculty who need to consult materials in different locations might be discouraged and this acts a barrier to seeking out information at all. Thus, the consolidation of collections and services saves users of multiple resources time. Librarians are also able to derive advantages from having only one person to staff a desk in off-peak hours, rather than two or more.

v. Changes in Library Instruction Programmes

As electronic research skills are becoming an enduring legacy of one's higher education experience, universities are taking steps to ensure "information literate" graduates. Academic libraries have embraced the potential of the internet developing innovative ways to meet the needs of users. One of these ways is to deliver automated bibliographic instruction in the form of web-based tutorials. Web based tutorials or Web based training (WBT) is an innovative approach to bibliographic instruction. It expands upon computer based training with activities like discussion forums, mail lists and chat

sessions. According Tobin and Kesselman (2000) library instruction literature point to active learning as the best means to deliver bibliographic instruction.

The more electronic resources libraries acquire and make available to users, the greater the demand for instruction in how to access and use those resources effectively and efficiently. Consequently, as library instruction programs adapt to meet the demand, a need arises to create a space in the library specifically designed for instructional purposes and hands-on learning. The need for such a space is especially apparent if the library is responsible for Internet training or is cancelling print resources in order to fund electronic ones. These electronic classrooms are also called computer classrooms, media-equipped classrooms, or media laboratories, and can refer to any number of classroom configurations. Regardless of name or configuration, these spaces are complex environments. Thus, as the instructional mission of the library is becoming more important, due in large part to the introduction of technology, more square footage needs to be supplied for this function (Bazillion, 2001). The needs of library instructors, students, computer technology, computer technicians and the electronic resources themselves must all be taken into account as the spaces are planned and built.

3.4.2 Social Changes

Social activities or non-book activities have traditionally been used as a means to stimulate the use of books in libraries. Not unmindful of the fact that theirs was a specialised institution, librarians justified non-book activities on the grounds that they stimulated reading. The chief devices used by public libraries to educate and attract members were serving food, scheduling lectures, staging exhibitions, excursions, games (mainly board games), pageants and plays, and offering lectures and classes. At first it

was thought that such activities stimulated "good" reading, but later the claim was that they only stimulated reading of whatever quality. However, evidence accumulated over a century show that non-book activities do not make readers. Thus, non-book activities do not make readers out of non-readers or instil a love of books per se, but increase library usage or attendance, in effect to tend the moral and social uplift of the community.

Historically, patrons have come to academic libraries not only for the intellectual resources they offer, but for the spaces in which to seriously engage those resources. The rise of electronic resources may mean remote access, but many still come anyway. What is valued is the "communal" experience of seeing and being seen by others, quietly engaged in the same serious, studious activity.

The plight of the academic library as it currently exists is rooted in the idea that academic libraries are little more than storage facilities for printed materials. It can be argued that academic libraries were never designed with user aesthetics in mind, having been designed first and foremost as places to collect, access, and preserve print collections. But the increasing use of electronic resources off-campus has resulted in both declining circulation of print materials and reduced use of reference services in academic libraries (Gayton, 2007). These trends have led to numerous claims of the impending death of the traditional academic library. It is not clear that the declining use of print collections is creating an exodus from academic libraries, or even that such an exodus exists. Studies show that gate counts in academic libraries have steadily increased, with significant increase in universities offering postgraduate programmes, whereas print circulation is declining.

There is however, confusion between a communal academic library and a social academic library. There is a profound difference between a space in which library users are engaged in social activity and a space in which they are engaged in communal activity. Social activity in a library involves conversation and discussion among people, about either the work at hand or more trivial matters. Communal activity in a library involves seeing and being seen quietly engaged in study. Demas (2005) reports that "One of the powerful attractions of libraries is the unique pleasure of being alone, in a quiet place, while simultaneously being in a public place associated with scholarship". Unfortunately these two activities are not always compatible. However, many writers increasingly see academic libraries as social, rather than communal spaces. The library is taking on a more extroverted character as libraries realize how potent that social element can be in fostering learning. Other writers have argued that we live in a noisy society where the exchange of energies is accompanied by sound. Thus, the preservation of communal spaces is important because it is in fact this quiet force of energy that many comment on in their love for libraries (Gayton, 2007). The trick for academic libraries is to create inviting communal spaces for study and research without falling into the trap of making the library a social gathering place. Indeed, it is worth emphasizing that solitary study is also a social act—the act of reading is itself a social interaction between text and reader.

3.4.3 Components of the social academic library

Specific recommendations vary about the components of the "social" academic library. There are two basic ideas: integrating technological and information resources in what is often described as an "information commons" and bringing non-traditional functions like classrooms, event programming, and cafés into the library.

For many, the idea of the information commons is simply to integrate technical resources, information sources, and staff support. For others, the purpose of the information commons is to serve new, collaborative models of teaching and learning. Beagle (1999) argues that a "key feature of the Information Commons is the coordinated and extended set of study and workspaces offering an array of options ranging from traditional individual study to collaborative conference areas. It is important to note that in this view of the information commons, facilities for group work are seen as a supplement to, rather than a replacement for, individual study spaces. For some however, the information commons is central to the idea of the social library. Bennett (2005) defines information commons as "spaces where learning is the primary activity and where the focus is on facilitating the social exchanges through which information is transformed into knowledge.

Non-library functions being added to academic libraries include cafés, art galleries, social and event spaces and classrooms. The purpose of non-library services is to qualitatively enhance the library as a resource and to create an atmosphere conducive to sustained, serious academic work. The report of the large-scale study of academic library construction and renovation between 1995 and 2002 in the United States by Harold Shill and Shawn Tonner, show a significant increase in the number of libraries reporting the addition of non-library functions after remodelling projects:

i. Conference rooms (41.1 percent)*
ii. Computer labs (34.1 percent)
iii. Seminar rooms (31.8 percent)*
iv. Multimedia production centres (26.6 percent)
v. Cafés (24.9 percent)*
vi. Educational technology centres (15.6 percent)
vii. Art galleries (15.1 percent)*
viii. General use classrooms (15 percent)*
ix. Auditoria (10.4 percent)*
x. Research institutes (4.1 percent)
xi. Bookstores (2.8 percent)
xii. Writing labs (0.4 percent)

From the list above, those facilities asterisked have little or no connections to the traditional mission of the academic library but however, have the largest increases in space requirements. These facilities can all be found elsewhere on university campuses.

Factors like quality of user work space, quality of layout, quality of natural lighting, number of data ports, quality of telecommunication infrastructure and quality of overall ambience which are conducive to an inviting and studious environment in these non-library spaces increase library use. Because non library functions do not meaningfully increase library use, whereas the presence of quality study spaces does, this suggest that it would be more fruitful for academic libraries to devote their limited resources to improving and expanding communal study space.

However, there is nothing wrong in introducing new functions and services as long as the new services will serve the needs of academic library users and will not detract from existing, and valued ones (Peterson, 2005). As such, with a library providing a multitude of services, harmony can be achieved by separating the noisier, more active

elements from the quieter ones, as well as by displaying clear signs explaining the different areas of the library and the codes of conduct expected of individuals within differing spaces. This would provide users with a clearer orientation as to what is expected and where to get it, making them feel more at more comfortable.

Some writers have however expressed the fear that separation of activities portends the relegation of the communal library to the background given the centrality of communal study and research to the academic library. Indeed, the social model of the academic library undermines communal spaces in three ways. First, library resources are finite, and money spent creating new social spaces reduces the money available for redeveloping communal spaces. Second, social spaces take up valuable library real estate, often at the expense of communal spaces. Third, and most important, social spaces are incompatible with communal spaces, and creating adequate separation between them is difficult. Frischer (2005) proposes that the same consideration should be given to the communal spaces as to information commons and cafes in modern library designs. Gayton (2007) also echoed this perspective by stressing that academic library designs must restore and rejuvenate communal library spaces.

More often those who advocate a new model for the academic library lose sight of the distinction between intellectual conversations with library resources (communal spaces) and conversations in the library (social spaces). The challenge for the academic library of the future is to encourage communal spaces and mitigate the negative consequences of social spaces. This involves striking a balance among an opposing range of functions. Some examples include: solitude versus interaction; quiet versus noise; conservation versus food and drink; and limited hours versus 24/7 expectations. It is

much too easy to either opt for the status quo or succumb to the latest vogue and introduce changes for the wrong reasons. The successful library meets all of its needs through a careful, iterative process of consultation, compromise, and design (Demas and Scherer, 2002).

3.5 Technology in Libraries

Technology in all its ramifications is part of our everyday life. It has been a major success story to a lot of human endeavours. Technology and technological innovation is not the only cause or catalyst for transformation, even so, it is one of the most pervasive forces for change in all work environments.

The benefits of technology in libraries have been so pervasive over the years that experts have declared that the book will become obsolete, its functions assumed by electronic circuitry. And libraries, as the institutions we have known them to be, are doomed to extinction. However extensive the potentials of technology may seem, the book (a technology in its own right) has survived thus far the real and imagined threats of the radio, film, television and the World Wide Web. Bazillion (2001) asserted that libraries integrate and civilise the technology, they are not replaced by it. To conclude that libraries are old fashioned because today's students rather surf the internet is also incorrect.

Jilovsky & Genoni (2006) stated that one of the impacts of the "digital revolution" on libraries has been to bring about changes in the utilisation of physical space. This is generally a response to the increased demand for space to be provided for public access computing facilities; and for shared, networked teaching and learning areas, often referred to as a learning commons or information commons. Consequently, space

previously available for storage of physical collections is being encroached upon and in many cases significantly reduced. Furthermore, a discreet institution and its professional staff are responsible for the preservation of scholarly record in whatever format published, a fact that the advent of digital media won't alter.

The growth of technology has made the library even more important because it enables access to electronic content, services, and training that would otherwise be unavailable to information seekers. In this rapidly changing environment, libraries are hard-pressed to transform and be cutting edge while struggling to balance constituent needs, maintain hardware and software as well as information appliances; budget to maintain diverse formats and the classic or "traditional" with the new; multi-type library collaborations; and the constant challenges of the *.com, .gov, .edu and .net* environments (Todaro, 2008).

This phase that the library is passing through is similar to the one that affected the cinema when the television technology spread. As the television provided better entertainment at home, the cinema gradually lost a considerable part of its audience and it had to respond to the challenge by providing a higher standard of audio-visual production which is not possible at home. Similarly, the library had to take an active role as an information dissipation centre not only as an active participant in the teaching and learning programme at all levels but as one of the prime movers of the teaching process.

Virtually all aspects of academic libraries is affected by the technology of today and tomorrow including all library programs and services; service delivery; constituent/patron interactions and use; policy design and implementation; facility design; librarians and library staff; available print, media, virtual and digital information

and research content as well as constituent-designed 2.0 information and research content (Todaro, 2008). Indeed, as higher education moves aggressively into technology-enhanced learning, academic libraries find themselves in the throes of a revolution. Modern library design requires a rethink of the entire educational mission, at least in part with the aim of integrating new technologies that allow digital resources to supplement and expand the library's traditional print collections.

3.5.1 The Book in the Digital revolution

The book is a technology that most people forget. But it is a form of technology that will have to share its dominance with any other form of truly potent technology and media (Prince-Ramus, 2006). It is a superbly designed, functional and infinitely useful technology more beloved than any gadget in a supermarket (Levy, 2007). It is a more reliable storage device than a hard-disk drive with a user interface that requires no instruction manual; and, it is instant-on and requires no batteries. In fact, many people think it so perfect an invention that it can't be improved upon. Yet, there is no technological creation in the library that has been threatened by the digital revolution than the book. Its existence has been predicted to be on the brink of extinction since the advent of the computer. Even literary critics are bemoaning a possible demise of print culture.

Electronic reading devices have offered e-readers digitized versions of music, video and short-form reading since the beginnings of the early Web. One such device is the Amazon Kindle (released November 2007) touted to be as good as the physical book in a lot of respects and do things that ordinary books can't do (Levy, 2007). The Amazon Kindle projects an aura of *bookishness* with dimensions of a paperback and tapering of its width that emulates the bulge towards a book's binding. Like other e-book readers such as the Sony e-reader (released September 2006), the Barnes & Noble's Nook (released November 2009) and tablet PC's such as the Apple IPad (released April 2010), it features competitive battery life, on-board memory, wireless connectivity and it is lightweight.



Plate 3.4 Amazon Kindle
Source: https://kindle.amazon.com



Plate 3.5 Sony E-reader
Source: www.cnet.com



Plate 3.6 Barnes&Noble Nook E-reader
Source: http://gdgt.com/barnes-noble/nook



Plate 3.7 Apple Ipad Tablet PC
Source: www.cnet.com



Plate 3.8 Google Story HD E-reader
Source: www.cnet.com

Looking at the tempting and apparent formidable capabilities of the likes of the Amazon Kindle and other such electronic reading devices suggests that the use of the book is fast approaching an end (Levy, 2007). This is not forgetting the cooperation of publishers in releasing digital versions of new books and backlists (the first chapter of almost any book is available as a free sample on the Kindle). The question that has been on the minds of many is if the Kindle and its kin will replace the book that has shone for centuries as the bedrock of our civilisation. Hard-line book lovers have protested that nothing could replace the book. Computers may have taken over every other stage of the process—the tools of the research, composition and production—but that final mile of the process, where the reader's mind melds with the author would always be sacrosanct. Victor Nell in a 1988 book titled "Lost in a Book" wrote that there is trancelike state that heavy readers enter when consuming books for pleasure called "ludic reading". Such a state cannot be easily duplicated by electronic devices, although some attempts have been made.

There are however, other features of electronic reading devices that threaten the place of the book. The e-reader cost less than traditional books (up to half the price). Makers of e-readers say this is so because due to restrictive anti-piracy software you can't lend or resell them. However, major publishers are resisting the idea of charging less for e-books because the royalties enjoyed will be lost. However, if book sales will double with e-books and the royalties stay the same, they might reconsider (Patterson, 2007). Another feature of the e-reader is the connectivity issue where it could be persistently connected to the Web and to each other, a sort of an "*always-on*" book. Although the connectivity has a positive effect on the publishing business model (increased revenue), it

means that readers have a more prominent role in the literary community. Ben Vershabow, associate director of The Institute of the Future of the Book in Brooklyn, New York says that the idea of authorship will change and become more of a process than a product. Using blogs and online forums, readers have inputs in book authorship (like rewriting endings or changing something entirely), something not many authors will condone, at least for now. Also, there are huge initiatives underway to digitize entire libraries like the Amazon *"Search Inside the Book Project"* and the Google *"Print Library Project"* (changing the face of scholarship). Furthermore, studies show that heavy internet users read more books than those who do not.

All these ideas are detested by traditionalists. They claim that the printed, bounded, and paid-for books are ideals which should not be breached and are here to stay for a very long time. Truly, the awesome technology of the book and people's love for them will keep them vital for years to come. However, the possibilities digitisation of the book offers, it is likely that in the next 50 years the place of the book will come to an end (Levy, 2007).

3.6 The Academic Library in the 21st Century

The value mission of the library is that it is a source of intellectual and knowledge coherence for the university. More than any other campus enterprise, the library symbolizes the distinct characteristics of the university and its mission across all disciplines: to develop the human intellect through teaching and learning and to contribute through research to the expanding body of human knowledge. It offers learners venues to explore the breadth and depth of information and to create new knowledge from their own experiences. The library is the place where the university is a university;

where learning and research are unrestrained by disciplinary boundaries (Wand, 2005). However, libraries in the 21st century face a lot of competition from many sources of information providers whom also seek to become the "hub of information and technology" (Martin, 2009). This role has traditionally been the library's role, and there is good reason why libraries should be wary of these new competitors—they are outperforming libraries in many areas.

The report of *Symposium 2010 "The Academic Library in 2010: A Vision"* held at the American University Library, Washington, DC in March 2005, projected that the academic library and university missions in the 21st century will be closely aligned as technology enables the synergistic interdependence of their services. The scholar, student, and administrator become the central focus as the library becomes less visible and more integrated into the infrastructure of the enterprise. The changes will be in the allocation of resources and the library access points. Recognizing that services will be in demand on site and off site on a 24/7 basis, the 21st century library will be adaptable to changing conditions with easily navigable web and building sites, designed to respond to a broad range of needs and preferences (Duguid and Brown, 2000). Today's academic libraries shift their resources significantly toward digital material rather than print or analogue. Librarians select information resources learners can trust and make those resources as mobile and portable as possible, including those available through handheld devices.

3.7 Architectural Response to Changing Educational and Social Demands

The academic library is integral to learning in the digital age while continuing its traditional contributions to knowledge management. Libraries and universities are adjusting their services and facilities to create supportive learning environments for these 'digital' students. It has evolved into a forum for students to collaborate, engage in healthy debate, create and challenge ideas, and experience learning and discovery in a multitude of meaningful ways. Outlined below are some design solutions for the future needs of libraries.

i. Plan for Change

The ability to alter an original design to suit a new situation is of extreme value in modern library design. The best way to plan for the future is to maximize flexibility in the space and building systems. Design solutions include movable or reconfigurable furniture and temporary wall partitions to serve the long-term function of space and the immediate need for a variable work environment. The site for a building should be such that additional buildings or additions to the main building can easily be constructed at some time in the future. Flexibility also applies to the design of lighting, power, and HVAC systems to accommodate adaptability to ensure a smoother transition as spaces become repurposed.

ii. Create a Sense of Space

Today's academic libraries serve multiple roles on campuses. Each comes with its own design opportunities. Firstly, spaces are designed to promote group study and collaboration which is critical to student success. Secondly, providing individual, quiet and contemplative spaces that blend the formal and informal to suit the divergent learning styles of each individual. Finally, specialty space including cafes, lounges, and meeting places for student activities are to be considered.

iii. Design for Collaboration

Collaboration has changed nearly every facet of pedagogy and therefore every aspect of design of academic libraries. Students are encouraged to discover and share knowledge with other students while professors assist in this collaborative discovery process. The pedagogical paradigm has shifted from a "sage on the stage" to a "guide on the side." This new approach to learning and teaching requires spaces that promote group interaction and discussion. Design solutions include; breakout areas, group study rooms, and videoconferencing spots, to allow for the healthy cross-fertilization of ideas.

iv. Infuse Library Spaces With Technology

Every space in a library should be informed by technology, with a baseline level that includes wireless Internet and access to public computers equipped with library research software programs and printing capabilities. Additionally, there should be presentation practice rooms equipped with projection systems, distance learning classrooms with videoconferencing, lockers with built-in outlets to charge personal devices, virtual

visualization environments, electronic communication rooms that enable users to collaborate with other institutions via electronic flip charts, and advanced computing labs.

v. Circulation Zones as Integral Spaces

Some of the most successful and well-used areas can grow from "spaces between the spaces." For example, a corridor can become a gallery when lined with a rotation of student art, or it can be widened to provide seating for student gatherings. An unused wall surface can become a message board. Converting unused areas into spaces that encourage interaction bring the environment to life.

vi. The Library as a Home to New Services

Libraries are becoming a hub for specialty uses. Services that once were scattered across campus can be relocated to the library for maximum accessibility by students and encourage greater use of the library. Some examples are tutoring and writing centres, group study rooms, presentation rooms, seminar rooms and classrooms, distance learning rooms, cafés and light dining venues, student and faculty lounges, radio stations or podcast facilities, and art galleries.

vii. Integrating The "Commons" Concept Into The Library

The commons has become the "heart and soul" of many libraries. Also referred to as an information, learning, or e-commons, it is a partnership of computer technology services and library research resources. Collaboration is encouraged, and students can talk freely.

Food and drink are allowed, and cafés and vending machines are often provided. The commons serves the way today's student uses the library, often 24/7, and is a central location for students to exchange ideas and work with various technologies.

viii. Designing For Unique Funding Sources

Funding for libraries is challenging because they are interdepartmental and therefore cannot obtain support via study-related grants. Bring revenue-generating tenants into the library, such as cafés or retail spaces like bookstores. Creating specialty spaces is a way to draw upon varied funding sources from other departments.

ix. Sustainability

This refers to the larger picture of the use of sustainable materials and design initiatives to cater for the increasing consciousness about the hazardous environments we live in. Students are more productive and perform better in spaces with sustainable characteristics, students and faculty suffer from fewer illnesses, and the overall life cycle costs of the building are decreased by using efficient systems and products. Major areas where sustainability impacts library design includes:

Materials: recycled, renewable and sustainable materials are one of the most pervasive, effective, available and affordable aspects of the design

Energy: this considers the source of power for the library and how power will be used. Using compact fluorescent bulbs (CFLs) or light emitting diodes (LEDs) instead of incandescent light bulbs can significantly lessen the power needed to sustain the library

Water: includes collecting rainwater on site and using to maintain the landscape or appropriate plumbing

HVAC: design of the building that allows natural ventilation if possible and efficient air circulation. Operable windows will provide fresh air and a connection to the outdoors

Light: having natural light throughout a library space reduces total power consumption. Many studies have shown that students perform better when near a window rather than in an enclosed room with artificial light.

Equally important is capturing the students' perspectives when planning libraries. In the face of the paradigm shift in higher education, their views are critical in planning a successful library. Other end users of the library facility including IT personnel, library staff and faculty should be included in the discussion for planning libraries. Their perspectives will give a fuller understanding of how the library is to be designed.

CHAPTER FOUR

CASE STUDIES

4.1 Introduction

The basic ideal of any academic research is to gain knowledge about the existing situation. Case studies carried out reflected the scope and intent of the research by investigating the merits and problems, and principles of planning associated with the design of modern academic libraries. The study investigated planning solutions to communal as well as social spaces in libraries.

4.2 Case Study 1: Central Library, Seattle, USA.

Location: Seattle, Washington State, United States.

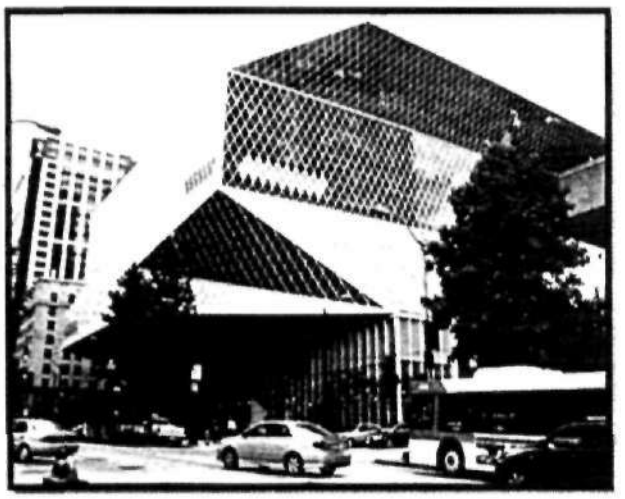


Plate 4.1 Seattle Public Library

Source: Jacobs *et al* (2004)



Figure 4.1 Structural system

Source: Jacobs *et al* (2004)

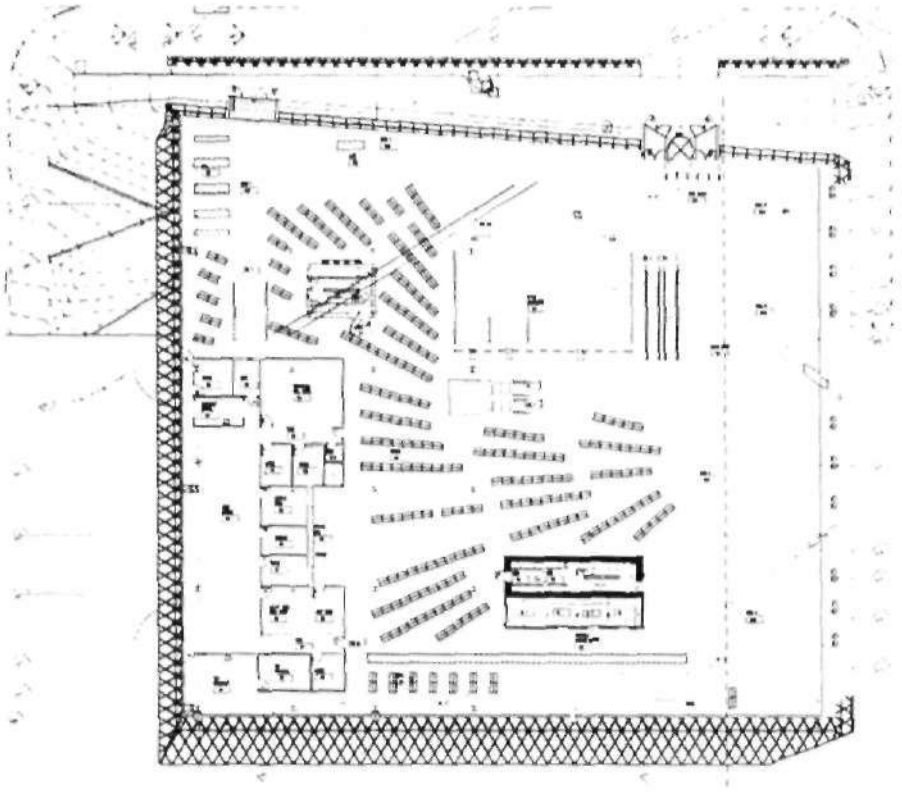


Figure 4.2 Typical floor plan (level 2) of Seattle Public Library

Source: Jacobs *et al* (2004)

History: There was the need to expand The Seattle Public Library, and in 1998 the Seattle taxpayers gave the go-ahead to construct four new branches of the Library and improvement to all 22 branches of the public library complex. The new ambitious Central Library in downtown Seattle commissioned in May 2004 is part of the four new branches of The Seattle Public Library. Designed with growth in mind by Dutch architect Rem Koolhaas and Canadian architect Joshua Prince-Ramus, the Central Library has a capacity for more than 1.45 million books and materials as compared to 900,000 volumes in the old building.

Planning: The 11-level Central Library was planned to cater for emerging trends in both social and communal spaces in modern library design. An unusual building for a public library and hailed as a masterpiece of contemporary culture. The Central Library sprawls for 362,987 square feet, with an additional 49,000 square feet for underground parking for about 143 vehicles.

The idea used to develop the design of the library was based on the "*Hyper-rational process*" proposed by architect Joshua Prince-Ramus. Although this process has no signature or authorship, but rather a product of teamwork, it takes rationality to a whole new level transcending all the pre-conceived ideas that normally come with what people call rationality. It challenges the *high modernist* notion of flexibility that singular spaces can be generic (almost all activities can take place in the space) particularly in the light of operational costs dwarfing capital cost in terms of design parameters.

The architects discovered that with the "*uniform flexibility*" of the high modernists, spaces designed for activities that were of immediate need started to dwarf the possibility of every other activity in the future. An example is social roles of libraries engulfed by the expansion of books.

The architects' reacted to this by using "*compartmentalised flexibility*". Activities whose evolution can easily be predicted (i.e. some certainty of the spectrum of what will happen in the future) such as parking, book stack and staff services, were designed in a series of five platforms or boxes at all levels of the building, while those activities that can't be easily predicted in 20-30 years (reading rooms and some social spaces) were designed in between the platforms and pushed off-centre of the core of the building (Figure 4.2). This explains the unusual form of the building.

Structure: The structure is constructed of reinforced concrete and steel in a diagonal grid system designed to withstand lateral forces caused by wind or earthquakes. The steel "skin" serves double duty for economic reasons. Apart from lateral stability, its dimensions were designed for structure and also to hold on to every piece of glass. The glass has a layer of stretched metal impregnated in it such that from the exterior of the building it is opaque, while in the interior it is entirely transparent.

Merits:

i. Spaces have adequate circulation and allow flexibility.
ii. It acknowledges the social function of libraries and the necessity of planning for it.
iii. The invention of the "living room" recognises the public's need for a public free space where they can eat, play chess and shop at the same place they can read or study other library material. In other words, outdoors incorporated into the interior.
iv. The book spiral that spans form the 6^{th} to the 10^{th} floor allows the Dewey numbers to run interrupted.
v. The building has sustainable systems that lessen its energy and environmental impact.

Demerits:

i. Over dependence on artificial lighting and ventilation.
ii. The book stack (book spiral) is too far from the ground to save money on the structure of the building.
iii. To some users, the sharp/angular form of the building is unwelcoming and cold, and lacking delight to the senses.

Major Findings:

i. The design process used two core positions; that the book and other technologies, and social roles as important in contemporary library design.

ii. Social roles of libraries may constitute as high as two-thirds of a new library's building programme.

iii. The facility employs an ingenious idea about flexibility (compartmentalised flexibility) in library design that challenges the traditional idea about flexibility championed by high modernists.

4.3 Case Study 2: Robinson Library, Newcastle, United Kingdom.

Location: University of Newcastle upon Tyne, Newcastle Upon Tyne, United Kingdom.

History: The Robinson Library was completed in 1996 to serve as the university library of the University of Newcastle upon Tyne. With regular upgrading over the years, the library now boasts of 380 new extra reader spaces, 100 IT places, 9 group study rooms, 2700 metres shelving, bindery, and a special collections unit.

Planning: The library was planned in a monoblock of five levels with one level below street level. The ground level holds the circulation desk, control desk, information commons, cafeteria, and serials. Levels 2- 4 holds the reader areas and book stacks interspersed with audio-visuals and single study and group study rooms. Staff services and the bindery are housed in the underground level with a loading bay at the back.



Plate 4.2 Robinson Library, Newcastle University
Source: www.commons.wikimedia.org

Structure: The structure is designed as a reinforced concrete frame with glass curtain wall.

Merits

i. Good natural and artificial lighting.
ii. Fire fighting staircase and system.
iii. IT and layout PC clusters.
iv. Self service book issue and return systems.
v. 24 hours book returning service.

Demerits

i. Restricted area for expansion.
ii. Parking too far away from main block.

Major Findings

i. Choice of structural system is really important in terms of future expansion
ii. Close planned facilities are difficult to expand.

4.4 Case Study 3: David Wilson Library, University of Leceister, United Kingdom

Location: University of Leicester, Leicester City, United Kingdom

History: The David Wilson Library, established in 1975, is the main university library of University of Leicester. Refurbishment and extension of the library was carried out by Associated Architects, UK costing an estimated £32million was completed in April 2008. Doubling its size, the library now serves a student population of 21,000 students and overall population of 23,000 people. Following extensive consultation with students and academic staff, the key design priorities were: a seamless extension, the introduction of fresh air and natural light, creation of a range of study environments including group study, provision of key services, a designated study area for postgraduate students and a welcoming and modern ambience. Key facilities include: wireless network, 2 IT training rooms, Student Learning Centre, and a 500 seat lecture theatre with associated seminar rooms. Awards won by the new library include: 2008 RIBA East Midlands Award for Architecture, 2008 Leicester Civic Society Award for Architecture, and IStructE Structural Awards.

Planning: The library is planned on a 5-level steel and glass structure including a basement. The ground floor houses main reception desk, IT training rooms, self service book issue and return and a help zone. Floors 1-3 house various group study rooms, seminar rooms, photocopiers, PC zones and reading rooms for the Sciences, Social Sciences, Law, Medicine, Engineering and the Arts and Humanities. The basement houses a special collection suite, DVD viewing rooms, printed journals, photocopiers and Group Study Rooms.



Figure 4.3 Typical floor plan (ground floor), David Wilson Library

Source: University of Leicester. (2011)

Structure: The structure is steel and glass framed structure with glass curtain wall.

Merits

i. A range of Group Study Rooms recognises the paradigm shift in higher education which encourages group study.

ii. Noise breakout is controlled by book stacks and enclosed study rooms positioned between circulation spaces and readers.

iii. Minimal need of air conditioning.

iv. Integrated IT facilities including IT training rooms.

v. Extensive consultations with students and academic informed the refurbishment of the library.



Plate 4.3 Graduate Reading Room in the David Wilson Library

Source: Fyfe, (2013)

Major Findings

i. Creation of a range of study environments including group study facilities.

ii. The library's low energy consumption won it the BREEAM (Building Research Establishment Energy Assessment Method) excellent rating for using three silicon photovoltaic technologies.

4.5 Case Study 4: Kashim Ibrahim Library, Zaria, Nigeria

Location: Ahmadu Bello University, Zaria, Nigeria

History: The Kashim Ibrahim Library (KIL) was commissioned in 1976 as the main university library of Ahmadu Bello University, Zaria. Designed by Egbor and Associates, it is the main library in the Ahmadu Bello University library complex which is made up of 11 satellite libraries in some institutes, centres and faculties of the university. The library has steadily grown over the decades to hold more than 2 million volumes of books, serials, theses, journals and online databases. The automation of KIL is at advanced stage where it is currently enjoying the MacArthur Foundation donation of $400,000 for digitisation and automation of library resources till the year 2011. This includes the digitisation of thesis and dissertations submitted to the university; the establishment of a Library webpage; and creation of hotspots for internet browsers. A recent milestone is the establishment of MTN/ABU Universities Connect Net library, a collaborative project of MTN Universities Connect project and Ahmadu Bello University.

Planning: The library is a 3-storey structure with a careful demarcation of reader, book, and staff services on the different levels. The ground floor houses the main control, circulation desk, serials, reference, new books display, information service unit and general technical area. The second floor houses study carrels, administrative offices, audio-visuals unit and reading rooms for the Art and Social Science disciplines. The third floor houses the reserve books room, documents, rare books and theses and Science, Technology and Librarianship reading rooms. The reading rooms are open plans placed

on the longitudinal ends of the buildings such that escape staircases lead directly outside (see Figure 4.7).

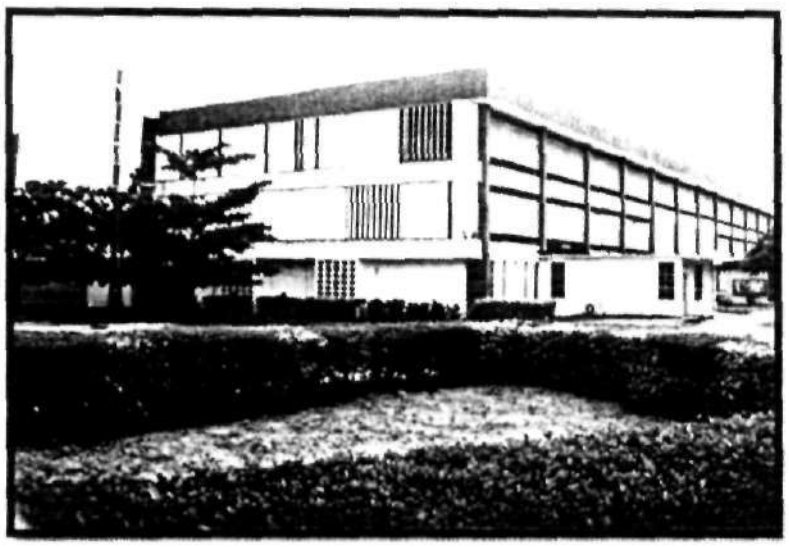


Plate 4.4 Kashim Ibrahim Library, Zaria
Source: Field Work, 2010

Structure: The structure is designed as a reinforced concrete structure. The floors and roof are also of reinforced concrete. Sand/cement block walls are used for exterior walls and internal partitions.

Merits

i. Flexibility achieved by the modular design of the library
ii. Spacious and comfortable reading spaces.
iii. Good natural and artificial lighting.
iv. MTN/ABU Universities Connect Net library affirms the library's commitment to the automation of the library.

Demerits

i. Inadequate electricity power supply.

ii. Security issues especially on the vandalisation of library resources.
iii. No facilities for Reading commons and teleconference services.
iv. The carving out of space from the Reference area to house the MTN/ABU Universities Connect Net library, has affected adequate lighting in the reference area.
v. The users' toilets on the ground floor are poorly ventilated and this generates bad odours.
vi. Adequate ventilation is a problem especially in offices because the design of the library was based on mechanical ventilation that has not been achieved.

Major Findings

i. Efforts are being made to improve the social roles of the library. A case in point is the reactivation of the catering service.
ii. The library is repositioned to cope with the exigencies of the digital age.
iii. Plans are underway to provide 24-hour service in the library.

4.6 Case Study 5: Saltire Centre Glasgow, UK

Location: Glasgow Caledonian University, Scotland, UK

History: The Saltire Centre is a landmark building at the cutting edge of contemporary higher education thinking. Opened in January 2006, it replaces an outdated library with a 21st century library that supports conversational learning. Although called a "Learning Centre", it reflects the core belief of the university (and most tertiary institutions) in its design: that learning depends on dialogue and debate, and differences in learning styles. It recognises the social origins of learning and the need for interaction between learners on different levels and in different forms. The £16 million building is not only a library and resource centre, but also a student service centre and the major social space within

the university where students meet, converse as well as study. The Saltire Centre boasts a wide range of study environments from the monastic to the highly interactive. These include cafes, group areas, incidental places on circulation routes, silent "monk cells" and terraced south facing gardens.

Planning: The innovative Saltire Centre is a monoblock with centralized services closely linked together. The ground floor is easily the "student service mall" providing a one-stop-shop for students. The Learning cafe provides relaxed group study space. A five storey high glazed atrium and exhibition space has enticing views of the ground floor service mall. It also has south-facing roof-top terraces as additional social and civic spaces.



Plate 4.5 Learning Café, Saltire Centre
Source: JISC (2006)

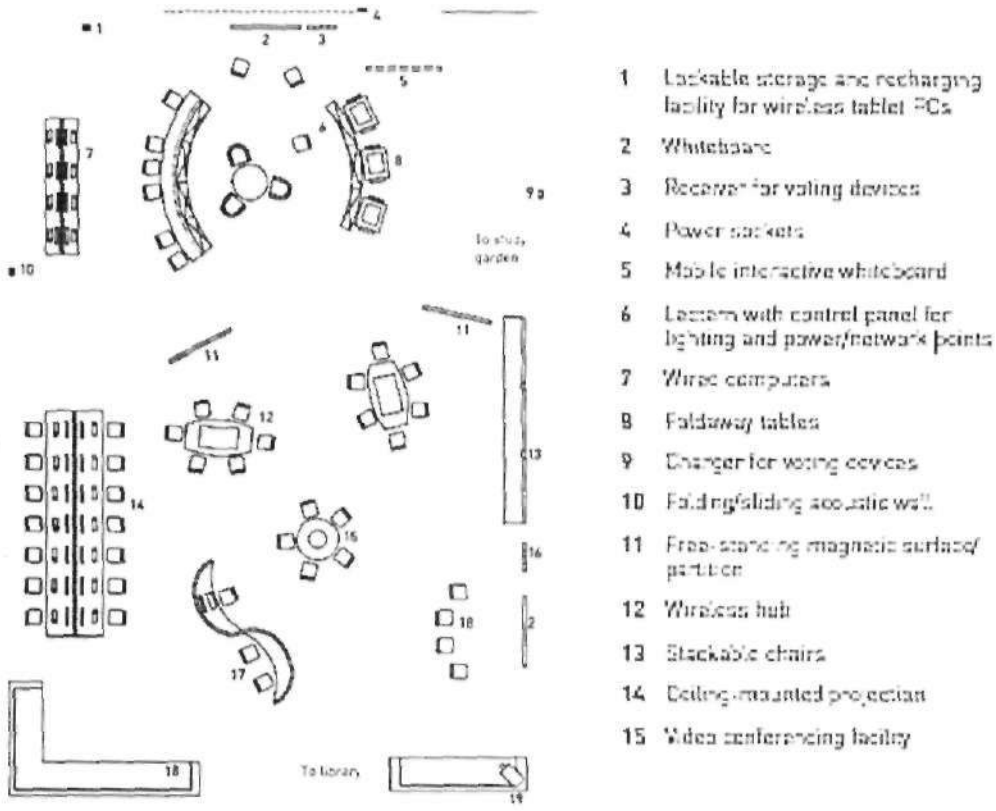


Figure 4.4 Layout of the Learning café, The Saltire Centre

Source: JISC (2006)

Merits

i. A wide range of study environment.

ii. The building plays to the individuality of students by creating micro-environments in response to their wide range of learning styles.

iii. The pervasive use of technology in the learning centre enhances the flexibility of the learning space.

iv. This scheme has made good use of a difficult site between two existing building.

v. The glazed atrium provides maximum natural lighting, ventilation and environmental control within the building.

Major Findings

i. The Saltire Centre overtly encourages conversation as the basis for all learning, and seeks to engage the whole community as co-learners.

ii. The building is a self-regulating environment which places discussion on an equal footing with solitary learning.

iii. Its social area is the hub of the campus where essential support services are also located.

iv. The design of the Saltire Centre illustrates the partnership between students and administrators.

v. The scheme is popular with students, faculty and the community alike.

vi. Within the UK market the project is viewed as a benchmark for higher education and the entire spectrum of schools and colleges.

4.7 Summary of findings for case studies

Table 4.1 below presents a summary of findings for the case studies conducted for this research work.

Table 4.1 summary of findings of case studies

S/NO	NAME	PLANNING	STRUCTURE	MAJOR FINDINGS
1	Seattle Public Library, Seattle, USA	(1) Planned as a 11-level building that caters for emerging trends in both social and communal spaces in modern library design (2) Architects used compartmentalised flexibility where activities with easily predicted evolution designed as core spaces of the building, while those activities with difficult predictions for their evolution were designed in-between the core spaces and pushed off-centre. Thus, the unusual shape of the building.	(1) Reinforced concrete and steel in a diagonal grid system designed to withstand lateral forces caused by wind or earthquakes (2) Steel skin serves double function for economic reasons: lateral stability and privacy achieved by impregnating the glass with stretched metal. Thus, opaque outside but transparent inside.	(1) Design process used two core positions: the book and other technologies, and social roles as vital in contemporary library design (2) Social roles of libraries may constitute as high as 2/3 of a new library's building programme. (3) Use of sustainable systems that lessen its energy and environmental impact (4) Spaces have adequate circulation and allow flexibility
2	Robinson Library, Newcastle University, UK	(1) Planned as a monoblock of 5 levels with one level below street level housing staff services and bindery (2) Ground level houses circulation desk, information commons and serials. (3) Levels 2-4 houses reader services interspersed with audio-visuals, single and group study rooms	(1) Reinforced concrete frame with glass curtain wall.	(1) Choice of structural system vital for future expansion (2) Flexibility of electrical services ensures easy reconfiguration of spaces (4) Good natural and artificial lighting (3) Close planned facilities are difficult to expand.
3	David Wilson university library, Leicester, UK	(1) Planned on a 5-level steel and glass structure including a basement (2) Ground floor houses main reception desk, IT training rooms, self service	(1) Steel and glass framed structure with glass curtain wall	(1) Range of study environments recognises the paradigm shift higher education (2) The library's low energy consumption won it the BREEAM

		book issue and return and a help zone (3) Floors 1-3 house various group study rooms, seminar rooms, photocopiers, PC zones and reading rooms.		(Building Research Establishment Energy Assessment Method) excellent rating for using three silicon photovoltaic technologies (3) Extensive students-academics collaboration informed the design.
4	Kashim Ibrahim Library, Ahmadu Bello University, Zaria, Nigeria	(1) Planned on a 3-level reinforced concrete structure (2) Ground floor houses the main control, circulation desk, serials, reference, new books display, information service unit and general technical area. (3) Floors 2-3 houses study carrels, administrative offices, audio-visuals unit, disciplines the reserve books, government documents, rare books and theses and reading rooms. (3) The reading rooms are open plans placed on the longitudinal ends of the buildings such that escape staircases lead directly outside	(1) Reinforced concrete structure.	(1) Efforts are being made to improve the social roles of the library (2) Plans are underway to provide 24-hour service in the library. (3) Flexibility achieved by the modular design of the library (4) Good natural and artificial lighting
5	Saltire Centre, Glasgow Caledonian University, Glasgow, UK	(1) Planned as a 5-level monoblock with centralized services closely linked together (2) The five storey high glazed atrium and exhibition space has enticing views of the ground floor service mall. (3) It also has south-facing roof-top terraces as additional social and civic spaces.	(1) Reinforced concrete structure.	(1) The Saltire Centre overtly encourages conversation as the basis for all learning, and seeks to engage the whole community as co-learners. (2) The design of the Saltire Centre illustrates the partnership between students and administrators.

				(3) Viewed as a benchmark for higher education and the entire spectrum of schools and colleges in the UK (3) Its social area is the hub of the campus where essential support services are also located. (4) The pervasive use of technology enhances the flexibility if the learning space.

CHAPTER 5
THE PROJECT SITE

5.1 Introduction

The city of Kaduna developed in the first instance in the dual capacity of a garrison town and administrative centre of colonialism. It also served as the seat of government for the Northern Nigerian Protectorate. The capital territory of Kaduna was established in 1956, this combined the Kaduna township area, the urban district of Kaduna and the European reservation area which altogether covered an area of about 120Sq.Km. It lies between latitude 10°31′ N of the equator and longitude 7° 17′E of the Greenwich meridian. It is bordered by Kano and Katsina states to the north, Plateau state to the east. Niger state to the west and FCT Abuja to the south.

Kaduna State is credited to have a large number of tertiary institutions which include; The Ahmadu Bello University in Zaria, The Nigerian Defence academy (NDA) in Kaduna, The Kaduna Polytechnic (a Federal polytechnic) in Kaduna, and The Nuhu Bamalli Polytechnic (a State polytechnic) in Zaria. The Kaduna State University was established to cater for the growing demand of degree-awarding higher institutions in Nigeria. The present location of the main campus of the university was once an all-female secondary school, the Tafawa Balewa Girls Secondary School

5.2 Site Location

The Kaduna State University (KASU) has two campuses located in Kaduna metropolis and Kafanchan city, both colonial creations designed to connect the region to the then British colonial system. The main campus occupies the former Ahmadu Bello

University Teaching Hospitals (ABUTH) and its school of Nursing, and the adjacent secondary school—Tafawa Balewa Girls Secondary School—all along Tafawa Balewa Way. The three sites occupy about 30 Ha in area. Except for the Guinness Eye Centre all the buildings are bungalows of varying dimensions. Temporary academic instruction is conducted in these buildings. The second site is located at the former ABUTH School of Medical Records along Maiduguri Road.

The exact site for the proposed university library is located on the main campus of the Kaduna State University on Tafawa Balewa Way in Unguwan Rimi GRA (see figure 5.1).



Plate 5.1 Location of KASU Campus.
Source: www.maps.google.com

5.3 Site Selection Criteria

The site adopted has been carefully analyzed, with some factors taken into consideration to determine its potentials regarding the purpose of the project. The suitability of the site was analyzed using the following criteria;

5.3.1 Site Context

i. Geography

Finding the proper site for a library is contingent upon understanding whom the library might be serving (Padilla, 2002). An academic library used by both students and faculty from virtually all areas on the campus as well as those whom might come from off the campus is usually sited centrally in relation to major academic structures. However, a university library can be placed on the outskirts or edge of a campus.

As important as centrality is for site selection, it is not a simple criterion. Centrality can be measured by distance, by accessibility, by relative density, by population distribution, or by proximity to other land uses such as student hostels and the academic area. But centrality is also perceptual and there may not be an overwhelming consensus on where the centre is on a large campus. When evaluating different sites in the selection process each of these issues must be considered.

Three alternative sites **A, B, C** were marked out on the campus. The centrality of the site in relation to other land uses offers the maximum proximity. The chosen site (**A**) satisfies all the measurements of centrality including distance, accessibility and proximity (see figure 5.2). Another determining factor is the availability of land especially for future expansion.

ii. **Soil**

Understanding soil conditions, including the relative stability of the soil and its capacity to support a structure (bearing capacity), is an essential component in site selection. The chosen site has soil properties that are common to all Zaria soil groups. Its lateritic nature makes it suitable for even the most advanced structural purpose.

iii. **Site Infrastructure**

The availability and location of infrastructure is a criterion for assessing a site. Infrastructure refers to the provision of services including but not limited to power for equipment, heating and cooling, water, data and telephone lines and the elimination of waste and storm runoff from the site. Ideally, a potential site will have basic services provided up to the edge of the property line or along a public right-of-way. On occasion, services and utilities already in place on a site may need to be relocated to accommodate the proposed building. The cost implication for such actions must be factored in the project budget. Costs for making the connection to the utilities must also be factored into the project budget. The site selected gives the least cost implication compared to other sites considered for the project.

5.3.2 Accessibility

i. **Vehicular and Pedestrian access**

The geography of a site has a close relationship with accessibility of the said site to users. Indeed, the centrality of a site ensures easy accessibility (Padilla, 2002). The relationship between parking (whether open lot or in a parking structure) and the library entry is an important aspect in site planning for libraries. Where possible, it may be

advantageous to have the parking ingress and egress off a secondary street. These issues where considered in selecting the site.

5.3.3 Site Orientation

i. Views

In library design, building sites should be evaluated in terms of the views out from the library itself, and views of the structure from other locations. Views out to designed and natural landscapes from key public spaces and reading rooms in the library can enhance patron's experience. Conversely, views of the library from the surroundings may provide opportunities to improve the library visibility if it is located at a prominent position. The selected site will give more opportunities for views out of the library and to the library from surrounding buildings.



Plate 5.2 Layout of Proposed site
Source: www.maps.google.com

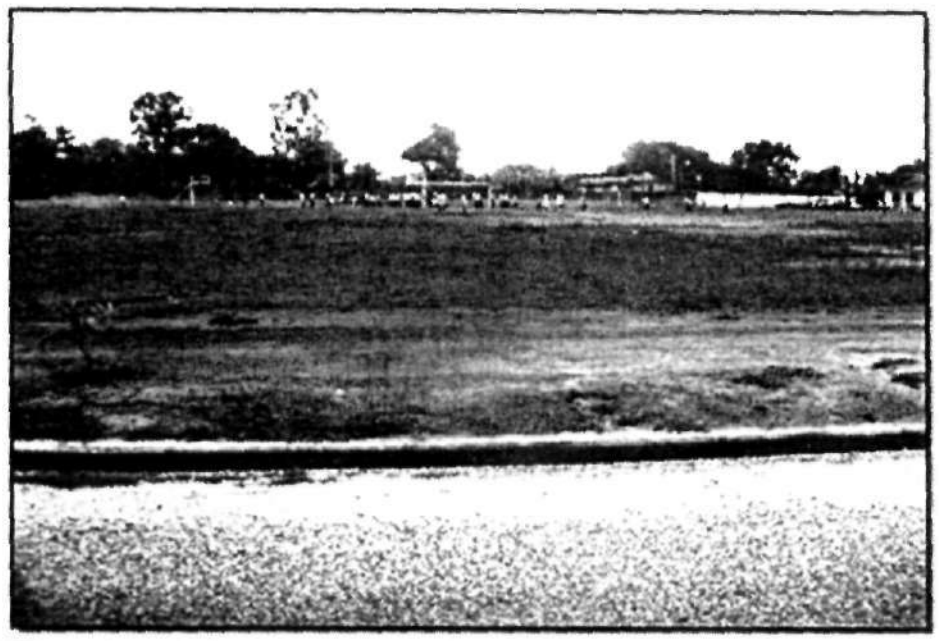


Plate 5.3 West view of the proposed site from an access road
Source: Field Work, 2010



Plate 5.4 South-West view of the proposed site.
Source: Field Work, 2010

5.4 Site Features

5.4.1 Topography and Vegetation

The land slopes from South-East to North-West, with about 20m between the highest and the lowest points. The lowest part is marshy at certain times of the year. The terrain is generally level with uniform pattern throughout the entire location.

The university main campus lies within the vegetation zone of the Guinea Savannah grassland. In its natural state the vegetation consists of what is often called the "orchard bush" which is a continuous cover of well developed trees about 10 to 15 meters tall. These trees can often be dense enough to suppress grass growth. However, for economic reasons, most of these trees have been felled for firewood, while the cultivation, burning and grazing activities have turned the region into open and park-like grassland. The natural grass cover can reach a height of 120cm.

5.4.2 Geology

Kaduna city lies on the Cambrian basement type of geology with a structure that is a varied mixture of granite types. Over this granite lies decomposed materials and laterite often eroded by the many streams and the natural forces of rain, wind and the process of growth and death of vegetation.

The main campus is generally overlain by thick overburden layer of stiff laterite, compact clay and coarse gravels which range between depths of 0.6 to 7.0 metres; these layers are underlain by weathered coarse pebbles. This is further underlain by fresh hard bedrock of Precambrian crystalline basement complex, gneiss, older granites with whale black and granite schist. Granite and migmatites often dominate the rock in many areas of the Basement complex.

5.4.3 Soil

Most of Kaduna state lies within the so-called "Zaria" soil group. This soil was formed from drift deposits, which mantle the solid sedimentary and Precambrian granite rocks. It is up to 5 meters deep and tends to become water logged with heavy rain and cracks during the dry season.

5.5 Site Climate

The university planning manual produced by the NUC has categorised the Nigerian climate into 4 main zones; hot/dry, warm/dry, warm/humid and hot/humid. Kaduna falls in the warm-dry climatic zone. The micro-climatic conditions in each location as defined by the environmental matrix (i.e. average daily temperature, humidity, average wind speeds etc) affects the design of buildings, their orientation and relations as shown in Table 5.1. The Hot-Dry and the Warm-dry zones are predominantly in the Northern part of Nigeria, while the Warm-Humid and the Hot-Humid zones are predominantly in the southern part of the country.

5.5.1 Rainfall

Generally, all parts of Nigeria have heavy rainfall sometime during the year. In the extreme, it may only be one heavy storm a year, while in the south, heavy rainfall continues for up to six months in the year. Very often the rainfall comes with high winds. This means that this wind-driven rain may be sometimes travelling horizontally.

Table 5.1 State Capitals in each Climatic Zone

HOT-DRY ZONE	WARM-DRY ZONE	WARM-HUMID ZONE	HOT-HUMID ZONE
Bauchi	Abuja	Akure	Abeokuta
Birnin-Kebbi	Jalingo	Awka	Asaba
Damaturu	Jos	Enugu	Benin
Dutse	**Kaduna**	Ibadan	Calabar
Gombe	Lafia	Ilorin	Ikeja
Gusau	Minna	Lokoja	Owerri
Kano	Yola	Makurdi	Port-Harcourt
Katsina		Osogbo	Umuahia
Maiduguri		Ado-Ekiti	Uyo
Sokoto		Bayelsa	Yenogoa

Source: Department of Agricultural Extension and Services, IAR, ABU Zaria (2009)

5.5.2 Temperature and Relative Humidity

In human terms, net radiation is felt as air temperature the response to which is greatly influenced by humidity conditions in the air. The temperature is highest during the dry season when there is little or no cloud cover in the sky

This low relative humidity coupled with the high afternoon temperatures account for the desiccating effect of the dry season. In the rainy season the relative humidity is much higher especially in the morning hours when it can reach as high as 95%. Even

though the temperature is slightly lower, the effect is a heat trap, which causes a general feeling of discomfort.

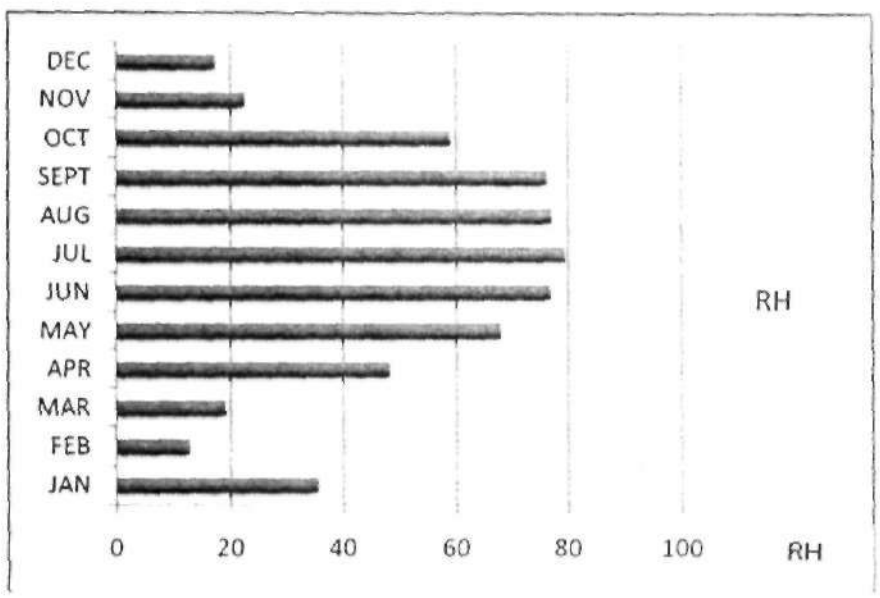


Figure 5.5 Relative Humidity

Source: Department of Agricultural Extension and Services, IAR, ABU Zaria (2009)

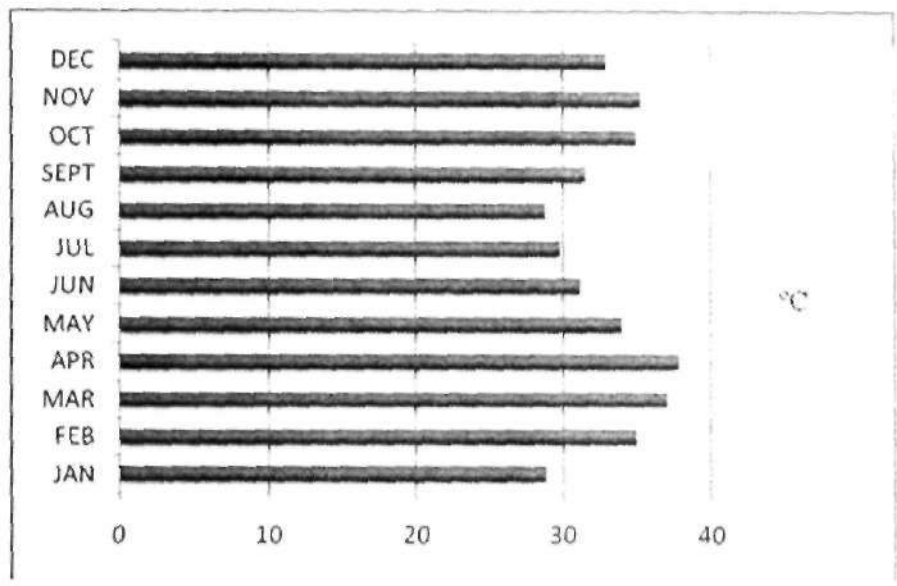


Figure 5.6 Maximum Temperature

Source: Department of Agricultural Extension and Services, IAR, ABU Zaria (2009)

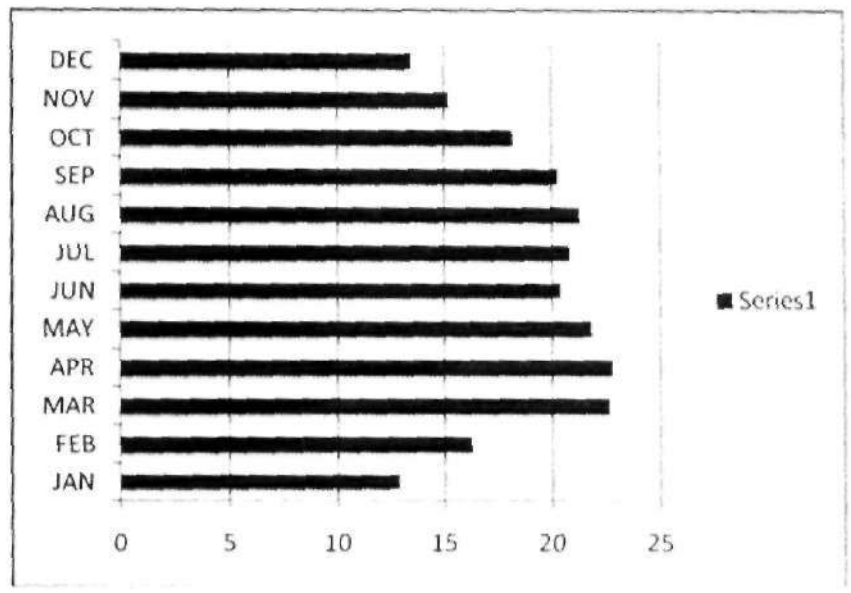


Figure 5.7 Minimum Temperature

Source: Department of Agricultural Extension and Services, IAR, ABU Zaria (2009)

5.5.3 Wind Pattern

There are two major air masses that dominate the climate in Kaduna and by extension, other cities in the Warm-Dry Zone. They are the Tropical Maritime Air Mass (monsoon) whose direction is South-Westerly as shown in Table 5.2. The other critical wind is the hot-dry Harmattan wind from the North-East Zone of the country.

a. **The Monsoon**: This is a moist, cool, air mass with the long history of sea tracking over the South Atlantic Ocean. It is South-Westerly in direction and has a small decrease in temperature with height. This is associated with the wet season.
b. **The Harmattan:** This is a dry and hot air mass with a large decrease of temperature with height. It has a long history of desert tracking before reaching

Kaduna. As a North-Easterly wind, the Harmattan wind is developed over the Sahara desert and is therefore warm, dry and blows in the opposite direction, North-east to South-West. This is associated with dry season in the months between October and March. As the dominant wind it brings with it dry, cloudless but dust laden conditions.

Table 5.2 Wind Directions for State Capitals in the Warm-Dry Zone

Source: Department of Agricultural Extension and Services, IAR, ABU Zaria (2009)

PLACE (WARM-DRY ZONE)	PREDOMINANT WIND DIRECTION	NUMBER OF MONTHS
Jos	SW	7
Kaduna	**SW**	**6**
Abuja	SW	7
Minna	SW	7
Yola	SW	7
Jalingo	SW	7
Lafia	SW	7

5.5.4 Sunshine Hours and Cloud Cover

Kaduna is exposed to about 2,000 hours of sunshine annually. The monthly variation in the amount of sunshine follows the general trend of an increase from over 275 hours in the district (approximately 92 hours per day). Essentially, there is a general

decrease in sunshine hours as rainy season progresses and an increase in sunshine hours as the rain slowly diminish in the month of August.

CHAPTER 6

DESIGN REPORT

6.1 Design Brief

The proposal for the Kaduna State University (KASU) library building is such that it recognises the growing role of the social component of an academic library, and the changing experiences and aspirations of the 21st century learner as well as the increasing investment in technology-rich study paces.

The library building has the following spaces carefully classified according to the different floors:

i. Ground floor

This is the first point of call to the library building with such spaces as the entrance hall with a generous waiting area; reception/enquiry desk; a cafeteria; serials; information commons; open-access catalogue (OPAC); media lab; instructional commons; learning commons; compact shelving and reserve books; administrative and technical offices and a bindery (see Appendix I). A central atrium begins on this floor and is capped by the roof deck reading area.

Some spaces like the cafeteria and the express zone serve as unique funding sources for the library and are accessible to users without passing through security. The ambiance of the entrance hall is designed to create a sense of excitement about learning as well as offering clear, accessible information about the building. The use of touch panel screen at the OPAC nook will serve this purpose. The learning commons and instructional commons is an exciting concept for a space with a broad range of student learning and

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faculty development services. Flexible spaces for study and group work and good access for people with disabilities are constants in the building.

i. First floor

The first floor is segregated to house the University Librarians' office, group study rooms, a graduate reading room; reading rooms for Education and Social Sciences/Management; reader services and a staff lounge (see Appendix I).

ii. Second floor

This floor houses the reference area, group study rooms, reader services, and reading rooms for Medicine and Law, and Sciences and Engineering (see Appendix I).

iii. Roof deck

This level houses a study area under the covered roof deck and a roof garden both accessible from the main staircase. This space is designed in such a way that users enjoy the open space as a tool for stimulating further insights or creativity for problems at hand. Users can also enjoy the carefully designed roof garden for quiet contemplation. The roof garden can also help reduce heat gain to the roof slab of the second floor. The covered study area can however accommodate only a limited number of readers at a particular time for study and computer use (laptop computer); there is no high demand for collection access or reference service (see Appendix I).

iv. Circulation spaces

The core of the building houses a central staircase and a lift for the mobility challenged and the visually impaired for vertical circulation. Staff and reader toilets; fire escape staircase; and book lifts are also designed as cores in the building. Horizontal circulation is enhanced by careful arrangement of spaces for orientation and the careful use of signage for way finding.

6.2 Design Concept

The design concept evolved from an idea that draws upon a specific observation: the developing role of the social component of the academic library. There are however two basic theories to this idea. The first theory is that the very survival of the educational component of the library—which has enjoyed a near total dominance for the past 100 years—is constantly threatened by its social component. The second theory is that the social component of the academic library (where digital technologies and experiential learning styles are its main drivers) is now it's "*second*" responsibility, and it's poised to overtake the educational component into extinction.

This observation suggests that these two components are engaged in a constant battle for dominance in the library program of the 21st century academic library. Thus, the concept of the letters "***L's in conflict***" was adopted to describe a new library building for two once-warring factions that must forge a balance that brings together the "*formal*" and "*informal*" activities in a seamless environment that acknowledges that learning can occur anytime, at any place, in either a physical or virtual space. This concept is best expressed in the general floor plan organisation of the building.

The Kaduna State University Library was designed in such a way that the two L's (rotated and aligned opposite each other) each represent the educational and social component of the library (see figure 6.1). The flexibility of the library building to serve the long-term function of space and the immediate need for a variable work environment was safeguarded by using movable or reconfigurable furniture and temporary wall partitions.

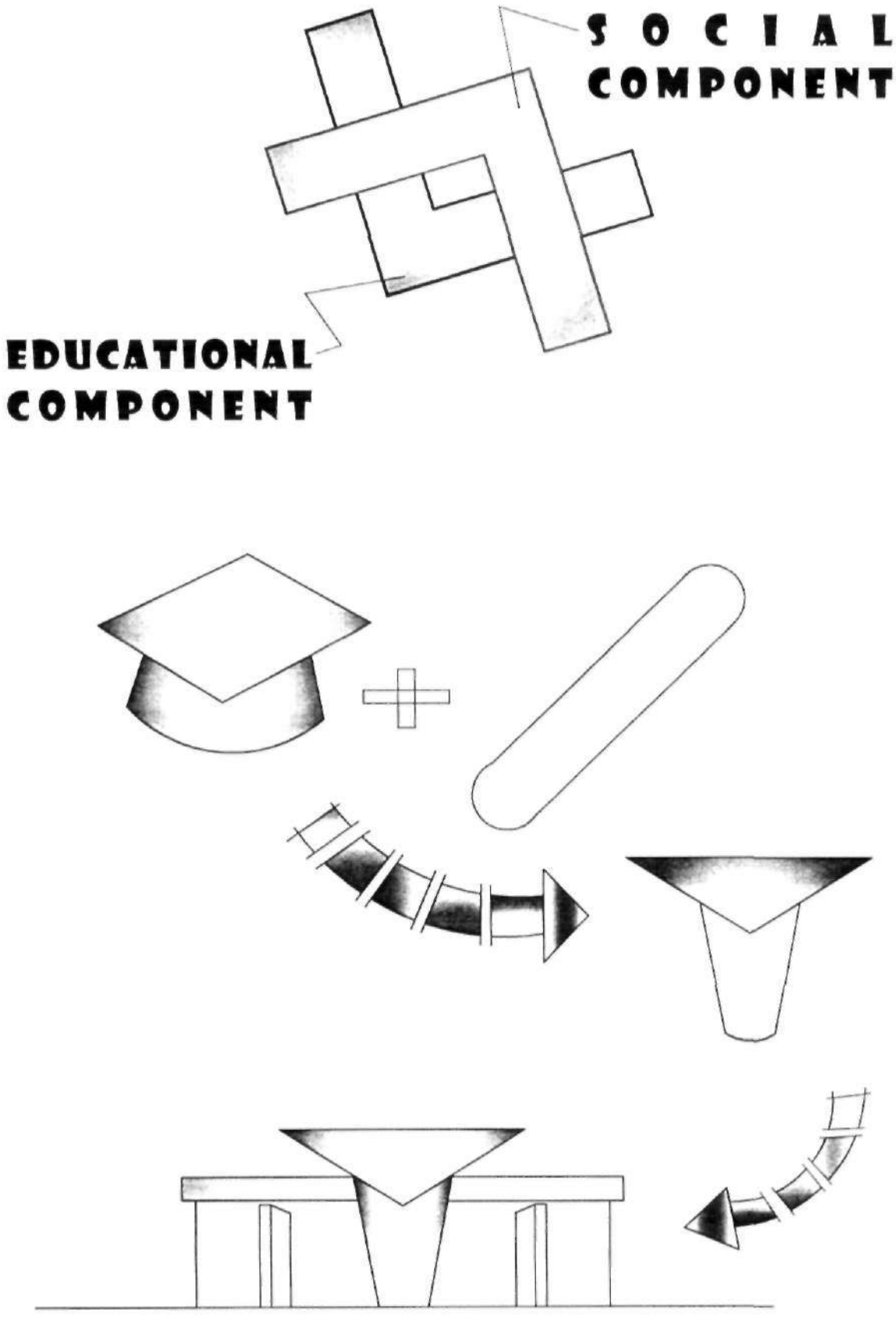


Figure 6.1 Concept development

6.3 Form Concept

The overall form of the KASU library building is such that the general shape of the "L's in conflict" is expressed in elevation (see Appendix II). However, at their point of intersection, the cylindrical form of an academic scroll was used which is eventually 'capped' by the Bachelor's degree square-shaped cap without its tassel. The square shape of the cap is rotated in such a way that one of its corners although dipped, is perpendicular to a tangent drawn on the curvature of the cylindrical shape formed by the academic scroll.

6.4 Site Concept/Zoning

The site was zoned majorly with solar and wind orientations and views in mind. Knowing the local solar and wind patterns is essential to good design. A building exposure to sun translates to heat gain. This can be beneficial during the colder times of the year. To mitigate heat gain in a warm climate like Kaduna suggests the use of adequate natural ventilation. This will also reduce dependence on air conditioning and the consequent reduction in energy costs.

The orientation of the building is such that the main entrance faces the West, while the reader services and reading rooms face the North and South of the site respectively. Although the reading rooms of the library are on the southern part of the site—which is typically exposed to the greatest increment of heat gain—the use of sun shading devices especially on this part of the building will help reduce this effect (see Appendix II). The sprawl or horizontality of the building's mass with windows will take advantage of the wind orientation on the site.

In terms of views out from the proposed library, the orientation of the building will be such that the reading rooms on that are mainly on south to the south-eastern part of the site will enjoy views out to designed and natural landscapes from which can help enhance patron's experience.

6.5 Functional Analysis

The ground floor is arranged with a clear depiction of patrons/visitors routes when arriving at the library building. The arrival is either via the main entrance for all patrons and visitors; out-of-hours entrance for access to those library services that do not require high demand for reader and reference services (compact shelving/reserve books and information and instructional commons); and the service entrance meant strictly for books, furniture and other library equipment free from all encumbrances for easy access to storage and sorting (see figure 6.2). Gentle ramps are designed at the main entrance and in the entrance hall for the mobility challenged and the visually impaired. The service entrance and the out-of-hours entrance with their accompanying stairs, and the central stair adjacent the atrium provide vertical access through all floors of the building.

The first point of call is the enquiry/information desk which is centrally located strategic to the entrances. From there other facilities like the serials, staff facilities, information commons, toilets and administration offices are located in a radial fashion about the central enquiry/information core. The open access catalogue (OPAC) is conveniently placed in a nook from the main entrance.

The first floor of the library building is the first point for serious study as it houses two large reading rooms for education, social sciences and management disciplines. These are supported by group study rooms that will cater for patrons that wish for some

privacy for animated discussions without disturbing the peace of the larger reading rooms. A graduate reading room is also provided to cater for the unique requirements of graduate students. The first floor also houses the offices for the University Librarian, the Deputy University Librarian and their secretarial staff. Reader services, a staff lounge and toilets are also available on this floor. The floor is accessed either via the central staircase and the lift designed for the mobility challenged and the visually impaired.

The second floor also houses large reading rooms for serious study for Medicine, Law, Sciences and Engineering disciplines. Also, group study rooms adjoin these reading rooms. Reader services, toilets are also on this floor.

The last floor is a roof deck that houses a small study area accessible from the main staircase only. A limited number of users can enjoy the open space as a tool for stimulating further insights or creativity for problems at hand. This special space supports laptop use via wireless hotspots.

6.6 Special Design Considerations

6.6.1 Room Acoustics Consideration

Library planners and designers are required to develop objective acoustical standards for library spaces. Indeed, as the engineering and architectural design of the project evolves, the design should be reviewed in light of the agreed upon acoustical program requirements for the library project (Salter, 2002). However, as acoustics is typically not a code requirement, the library stakeholders should ensure that the library's acoustical needs are well defined and that there is a follow through particularly for verification testing after the ventilation system has been installed and balanced.

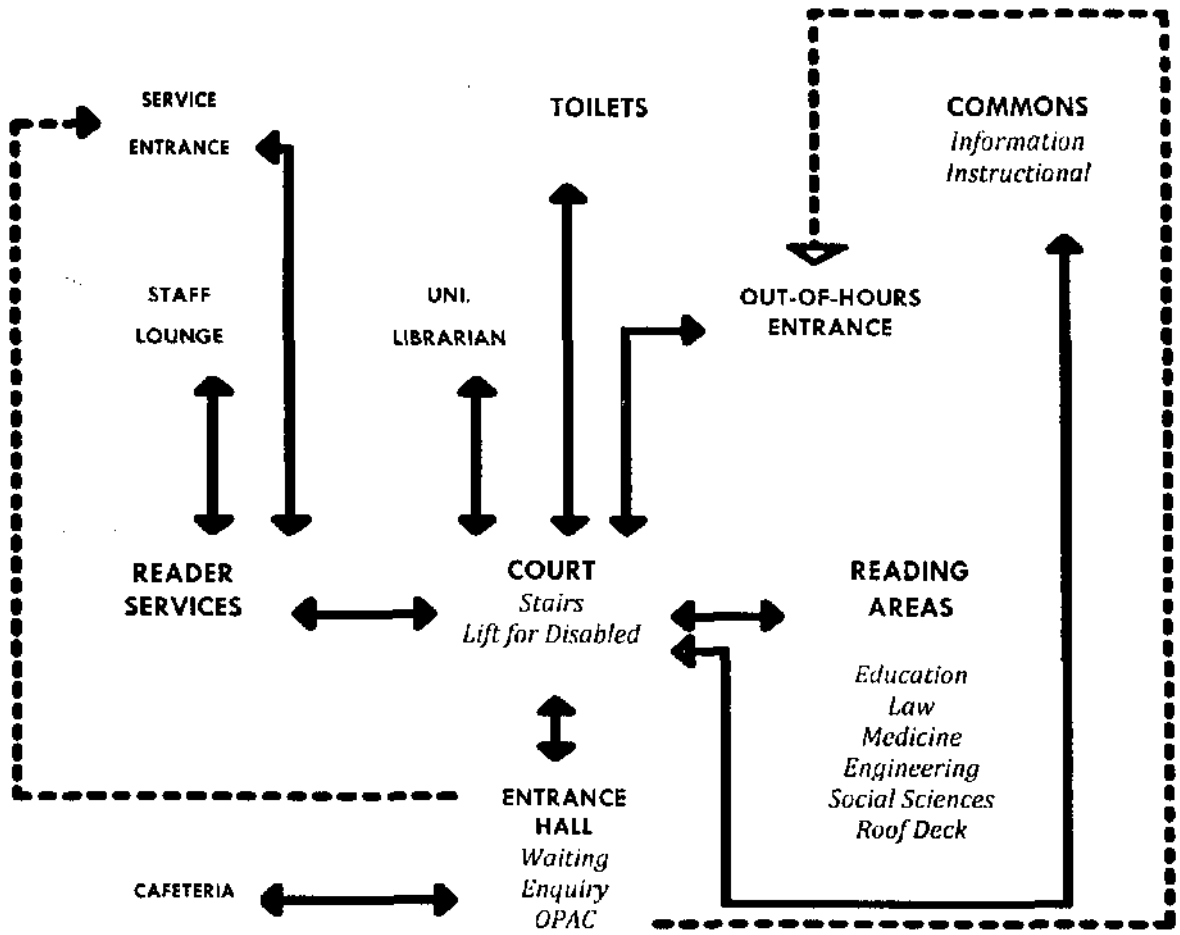


Figure 6.2 Major Functional Relationships

Source: Author

To this end, the design principles for room acoustics in library spaces typically focus on the locations and extent of sound absorbing material, to reduce reverberation and the interference with speech, as well as the shape of rooms to achieve acceptable acoustic characteristics in meeting and presentation rooms. For wall construction in reading rooms including group study, information commons, instructional commons and

conference rooms, a single layer of gypsum board on the external walls and on stud partition walls would provide the needed sound insulation.

Floor and ceiling construction are required to provide acoustical separation between adjacent spaces (airborne sound insulation) and to reduce the sound of footfalls and other impact sounds from an upper floor (impact insulation). Both the impact and air-borne insulation can be achieved by the use of specially designed acoustic ceilings and carpets or a resilient floor underlayment.

6.6.2 Raised Floor System.

This is for the distribution of critical services (power, voice, and data cables) and mobile workstations to accommodate changes in patron, equipment, and storage needs over time particularly in the information commons and staff offices.

6.6.3 Ceiling Height

This is to provide an adequate ceiling space that will accommodate large ductwork for HVAC system and water sprinkler system for fire emergencies. A ceiling heght of 3.85m is proposed to cater for this particular requirement.

6.6.4 Compartmentation

This is to help in limiting the spread of fires in case of fire outbreaks. It includes the use of fire resistant doors, ceilings, floors to limit the spread of fire and smoke. This technique was used in the reference and reserve books areas that hold special collections.

6.6.5 Zero-Step Entry

This is to cater for the physically challenged and the requirements of Universal Design. A gentle ramp of $\leq 6\%$ is proposed for the entrance and throughout the building

to serve this purpose. Furthermore, an elevator specially designed for the physically challenged is designed adjacent to the atrium to cater for vertical transportation in the building.

6.7 Construction methods

The construction is a reinforced concrete frame structure with partition wall infills within the interior, intertwined with stud partitions wall. The different units are constructed independent of each other but connected with the use of expansion gaps that will allow for differential loading conditions and settlement.

(i) Foundations

The library building is constructed on strip foundations with deep rooted column bases that allow for extra floor addition in the future.

(ii) Frames

The frame is a reinforced concrete frame consisting of concrete columns, beams and a raised floor system for the distribution of critical services (power, voice, data, and HVAC) and mobile workstations to accommodate changes in employee, equipment, and storage needs over time.

(iii) Exterior Walls

These are sandcrete hollow blocks that are laid in stretcher masonry bonds all around the building envelope.

(iv) Partitions

These are of two major types with gypsum cladding for sound absorption. The partitions for static spaces like the stairways, lift shafts, ramps, toilets, etc are made of 150mm sandcrete block walls. The partitions of flexible spaces like the offices, group study rooms, interiors of reading rooms and other such spaces that

do not require much security risk, are demountable stud partition walls which are modular and repetitive.

(v) Services

The arrangement of services is such that it allows delivery to all parts of the building horizontally as well vertically. Ducts are located in strategic positions to conceal vertical composition of pipes and trunking systems. The IT cables and intercommunication cables are enclosed in the raised floor system network of the whole cabling system for the building with outlets where necessary.

(vi) Materials and Finishes

The use of materials in various spaces is influenced by the function of the space. Reading rooms, group study rooms and learning commons should have floor finishes which provide both grip and noise cancellation to minimise unwanted sounds in such spaces. Walls of such spaces should have finishes that are acoustically effective.

6.8 Schedule of accommodation

To determine the number of bookstacks, the following assumptions were made:

a. According to the NUC requirement, a university library for a new university can hold between 5,000–10,000 volumes of books before the first accreditation.
b. The ratio of collection size between the Sciences and Social sciences is 60% for Sciences and 40% for Social Sciences.
c. The equation: **size of collections / capacity per unit** is used to determine the number of bookstacks required (Siems and Demmers, 2002)

But, capacity of shelving section is determined from the equation:

volumes per linear foot of shelf x number of shelves x width of shelf

i. where **8** is the average volumes per linear foot of shelf for common print materials,
ii. Assuming 6 as the number of shelves for a 1.9m high, 250mm deep, double faced, cantilever-style Steel shelving (complete with canopy top and end panels).
iii. Assuming the width for a typical, industry standard Cantilever-style Steel shelving as 3ft.

Therefore, capacity of shelving section is: **8 x 6 x 3 = 144 volumes**. This translates to 288 volumes for a double faced, cantilever-style Steel shelving.

Assuming a projected collection size of 10,000 volumes, and substituting the figures in the equation at (c) i.e. **No. of Stacks unit = size of collections/capacity per unit**

Then, **10000 / 288 = 35** stacks unit (approx). However, 60% (21) stacks will house the Science volumes and 40% (14) stacks will house the Social Science volumes.

a. Using a structural grid of 6m x 6m, the suitable centre-line distances between shelving units is 1.2m – 1.5m for open-access shelves and 1.6m – 2m for Reading Areas respectively. This will help achieve adequate circulation in the bookstacks
b. For the periodicals in the Serials section, a 1.7m high, 3 – sloped display shelves is used
c. A minimum of 300mm deep shelving units are used for Reference, Technical and Sciences collections.

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In order to meet the space requirements of the NUC standard guides for universities, the writer has adopted the following assumptions:

i. The student population of 3,750 represents the Full Time Equivalent (FTE) and not actual headcount.

ii. This figure was derived from the NUC requirement of providing accommodation for 25% of projected student population.

iii. The university brief projected a student population of 15,000 students for the first of three phases of population growth for the university.

iv. The unit areas given are 'usable areas' only, without consideration for 'balance areas' (corridors, storage spaces, toilets, service rooms).

Table 6.1 Schedule of Accommodation for Ground Floor

READER SERVICES						
No	Room	Unit Area (Usable) m^2	Balance Area (35%)	Total Area	No Reqd.	Total (m^2)
1.	OPAC	36	13	49	1	$49m^2$
2.	SERIALS	185	65	250	1	$250m^2$
3.	INFORMATION COMMONS	306	107	413	1	$413m^2$
4.	MEDIA LAB	72	25	97	1	$97m^2$
5.	INSTRUCTIONAL COMMIONS	117	41	158	1	$158m^2$
6.	COMPACT SHELVING & RESERVE BOOKS	227	79	306	1	$306m^2$
7.	CAFETERIA	172	60	232	1	$232m^2$
SUB-TOTAL		1115	390	1505		$1505m^2$
ADMINISTRATIVE AND TECHNICAL SERVICES						
8.	ACQUISITIONS & PROCESSING	216	76	292	1	$292m^2$
9.	TECHNICAL SERVICES	24	8	32	3	$97m^2$
10	STAFF LOUNGE	54	19	73	1	$73m^2$
SUB-TOTAL		294	103	397		$462m^2$
GRAND TOTAL		1409	493	1902		$1967m^2$

Table 6.2 Schedule of Accommodation for First Floor

READER SERVICES						
No	Room	Unit Area (Usable) m^2	Balance Area (35%)	Total Area	No Reqd.	Total (m^2)
1.	EDUCATION	317	111	428	1	428m^2
2.	SOCIAL SCIENCES&MANAGEMENT	410	144	554	1	554m^2
3.	GRADUATE READING ROOM	95	33	128	1	128m^2
4.	GROUP STUDY (1)	90	32	122	1	122m^2
5.	GROUP STUDY (2)	124	43	167	1	167m^2
SUB-TOTAL		1036	363	1399		1399m^2
ADMINISTRATIVE AND TECHNICAL SERVICES						
6.	UNIVERSITY LIBRARIAN	36	13	49	1	49
7.	DEP. UNIVERSITY LIBRARIAN	36	13	49	1	49
8.	CONFEERENCE ROOM	54	19	73	1	73
9.	SECRETARY	36	13	49	2	98
10	GEN. WAITING	36	13	49	1	49
11	ACQUISITIONS & PROCESSING	216	76	292	1	292m^2
12	STAFF LOUNGE	54	19	73	1	73m^2
SUB-TOTAL		468	166	634		683
GRAND TOTAL		1504	529	2033		2082m^2

Table 6.3 Schedule of Accommodation for Second Floor

READER SERVICES						
No	Room	Unit Area (Usable) m^2	Balance Area (35%)	Total Area	No Reqd.	Total (m^2)
1.	MEDICINE & LAW	474	168	642	1	$642m^2$
2.	SCIENCES & ENGINEERING	496	174	670	1	$670m^2$
3.	REFERENCE AREA	238	83	321	1	$321m^2$
4.	GROUP STUDY (1)	90	32	122	1	$122m^2$
5.	GROUP STUDY (2)	124	43	167	1	$167m^2$
SUB-TOTAL		1422	500	1922		1922
ADMINISTRATIVE AND TECHNICAL SERVICES						
6.	ACQUISITIONS & PROCESSING	216	76	292	1	$292m^2$
7.	STAFF LOUNGE	54	19	73	1	$73m^2$
SUB-TOTAL		270	95	365		365
GRAND TOTAL		1692	595	2287		$2287m^2$

Table 6.4 Schedule of Accommodation for Roof Deck

READER SERVICES						
No	Room	Unit Area (Usable) m^2	Balance Area (35%)	Total Area	No Reqd.	Total (m^2)
1.	ROOF DECK STUDY	313	110	423	1	$423m^2$
GRAND TOTAL		313	110	423		$423m^2$

a. The summation of the total floor area for all the 4 floors is thus:

   $1967 + 2082 + 2287 + 423 = 6759m^2$

   Also, Total Usable Area (m^2) = $4918m^2$ and Total Balance Area (m^2) = $1722m^2$

b. The Building coverage is derived from the quotient of the Total Floor Area (m^2) and the number of floors. Thus: $6759/4=1690m^2$ (approx)

CHAPTER 7
SUMMARY, CONCLUSIONS AND RECOMMMENDATIONS

7.1 Summary

This thesis has explored the various changing demands of the educational and social components of academic libraries and their resultant spatial demand on contemporary library design. The study has discovered that there is at present a re-emergence of the social component of the contemporary academic library and it appears poised to overtake the educational component. Another important discovery is the pervasive use of digital technologies in academic libraries. Typically, digital technologies have had a profound influence on the overall outcome of the library system suggesting lessened space requirements and in the extreme, has spawned a popular notion among library users and non-users alike that the library building as we know it will cease to exist in the near future.

Despite these seemingly alarming discoveries, this study has discovered that the world is still building bigger and better libraries. Today, librarians, architects and patrons are collaborating to produce elegant and functional designs that reflect new spatial allocations and new purposes. However, employing a careful balancing of the these two components (educational and social) that brings together the '*formal*' and '*informal*' library activities in a seamless environment acknowledges that learning can occur anytime, at any place in either the physical or virtual space. The academic library will continue to maintain a physical presence on even the most wired of campuses (Bazillion, 2001).

7.2 Conclusions

Based on the results obtained in this research, the following conclusions were drawn:

1. The demand for change has been driven by three seemingly interrelated factors: the increasing use of electronic resources outside the library; the declining circulation of print materials; and falling gate counts
2. There is a variety of changing demands of educational and social components of academic libraries including changing character of study space needs; growth of collections; increasing interdisciplinary work; change in library instruction programmes; inviting communal spaces for learning and research in the form of the information commons; cafes; seminar rooms; conference rooms etc.
3. A highlight of the architectural solutions to these changing demands include: integrating the 'commons' concept into the library, designing spaces that will enhance collaborations, infusing library space with technology, circulations zones to be regarded as integral spaces in libraries, flexible spaces that will cater for future space needs and sustainable design.
4. There is an increasing awareness of involving the end users (students) in designing library spaces because the 21st century student has certain aspirations for library spaces that reflect their personal lives. These include more collaborative spaces (a result of active, participatory learning styles); more flexible and networked spaces, 24 hour study spaces and group study spaces equipped with wireless connection.
5. Digital technologies play a vital role to the very survival academic libraries on today's campuses. Thus, the academic library as a communal hub must integrate the various demands for technology in the library space particularly as the library enjoys the singular

opportunity of enhancing digital technologies to such heights that it is not easily obtainable outside the library building.

6. There is a greater demand for more spaces for library instructional programs and hands-on learning (media laboratories or computer classrooms); a direct consequence of the increasing integration of technology in the library program.

7.3 Recommendations

Based on the results obtained in this research, the following was recommended:

1. It is vital for library planners, architects and other stakeholders to make a careful analysis of the changing demands of both the educational and social components of the academic library viz-a-vis the peculiar requirements of the changes in higher education pedagogy in the 21st century.

2. The provision of more social spaces in the form of collaborative spaces and group study spaces.
3. The creation of opportunities for students to collaborate on new and renovation library proposals. This will help in increasing the patronage of academic libraries in Nigerian Universities.
4. Nigerian academic libraries should consider the use of print repositories for low-use or infrequently used print materials that are likely to have duplicates in other libraries. This can serve as an effective space saving tactic and long-term storage of print material.
5. University libraries should avail themselves of the opportunity of alleviating shelving requirements by subscribing to digital archives that hold millions of publications like JSTOR, EBSCOHOST and COMPENDEX etc.

6. Faculty and Graduate students tend under use the individual spaces assigned to them. As a move to check this, a continuum of spaces from individual to group can be designed that takes into consideration the peak and off-peak periods of use in a day/semester. In other words, no permanent space assigned for an individual.
7. Future research should investigate critically, the difficulties in designing spaces that will cater for the changing educational and social demands of libraries.

7.4 Contributions to knowledge

Firstly, the re-emergence of the social component of the contemporary academic library was demonstrated in the inclusion of more collaborative spaces (group study rooms and the 'commons' concept) in the proposed university library.

Secondly, the pervasive use of digital technologies in contemporary academic libraries has suggested lessened space requirements and the obsolescence of the library building in the extreme. However, there is in fact more space demand to house library instructions and hands-on learning programmes to enable users to access and use those resources efficiently and effectively. The proposed university library includes a media laboratory and an instructional commons to serve this purpose.

Thirdly, the current trend is to involve the end users (students) to make meaningful contributions to designing some library spaces. To reflect this trend, collaborative spaces like the commons, roof-top reading area and group study spaces were carefully designed to capture the learning preferences (active, participatory, experiential learning) of today's virtual scholar which is a reflection of their highly social personal lifestyles.

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APPENDIX I

Floor Plans of proposed KASU Library

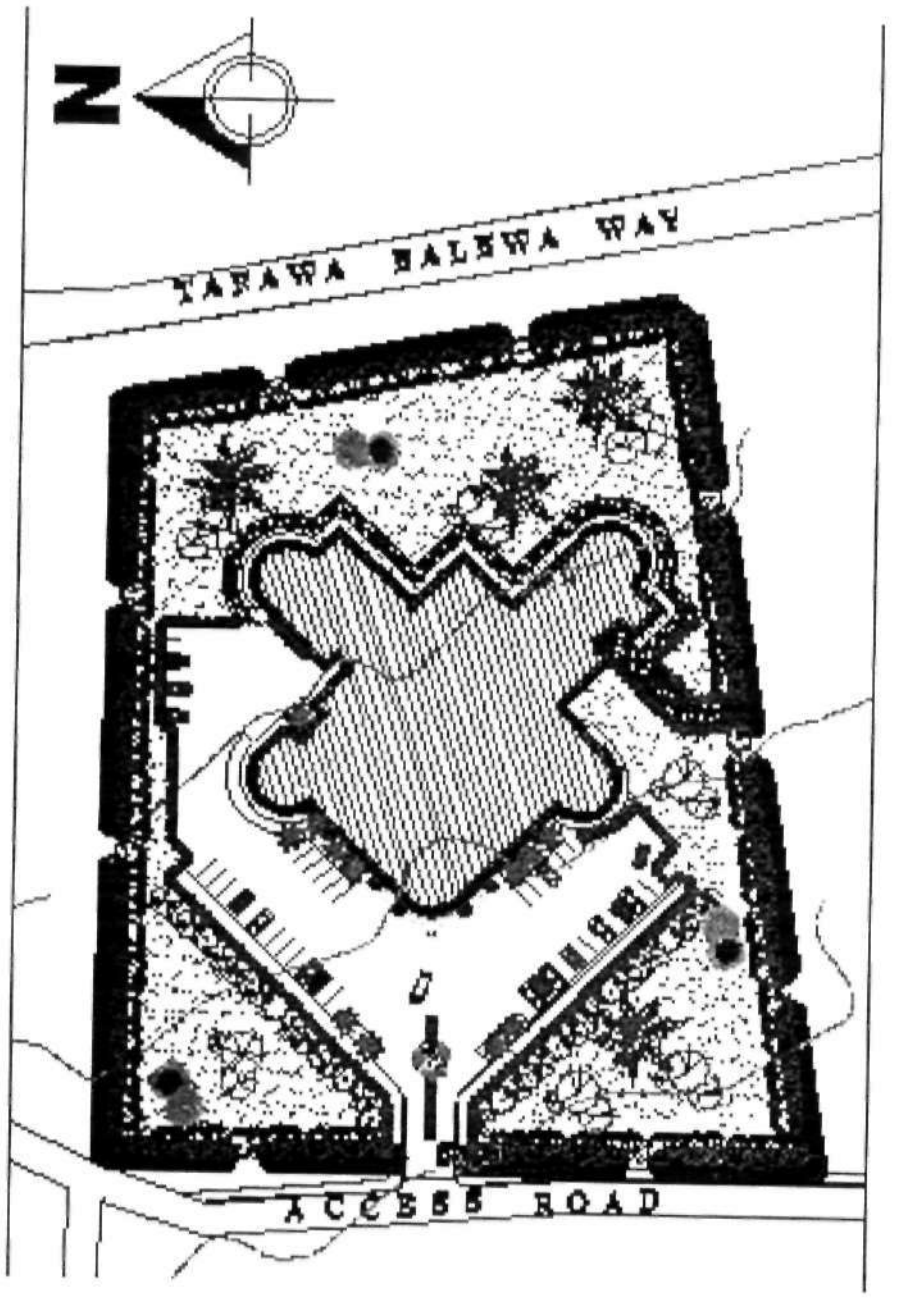


Figure API-1 Site Plan

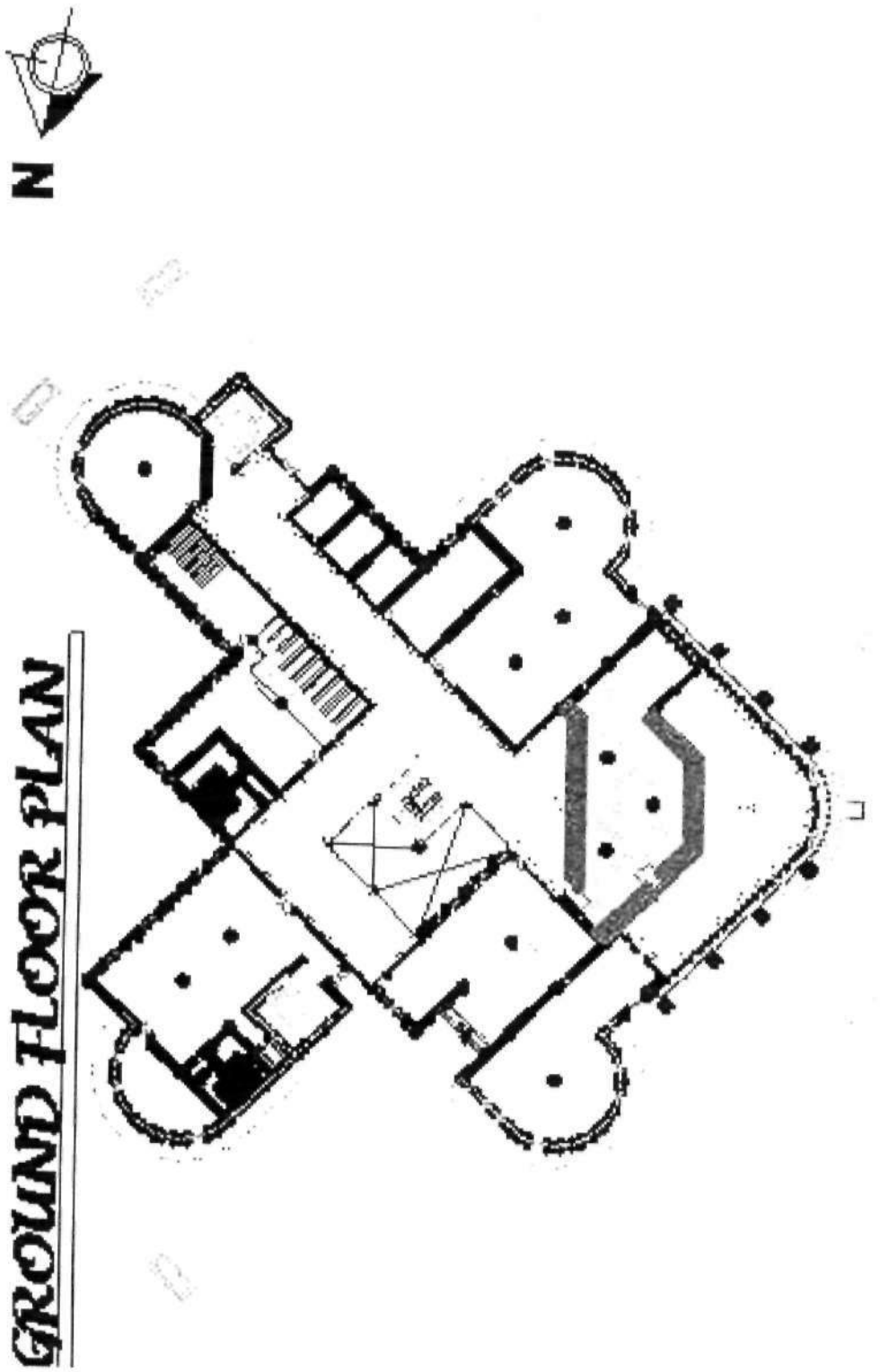


Figure API-2 Ground Floor Plan

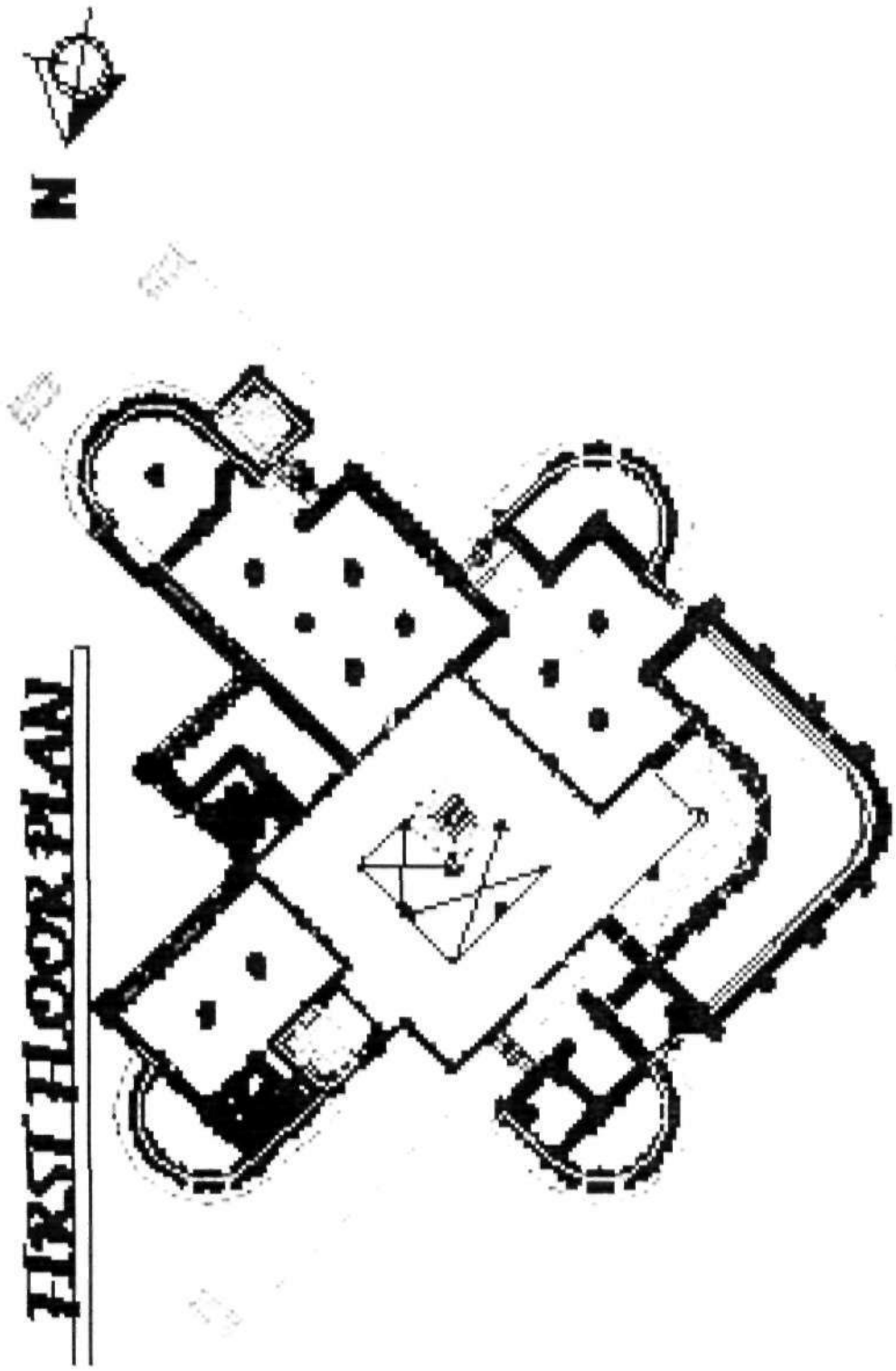


Figure API-3 First Floor Plan

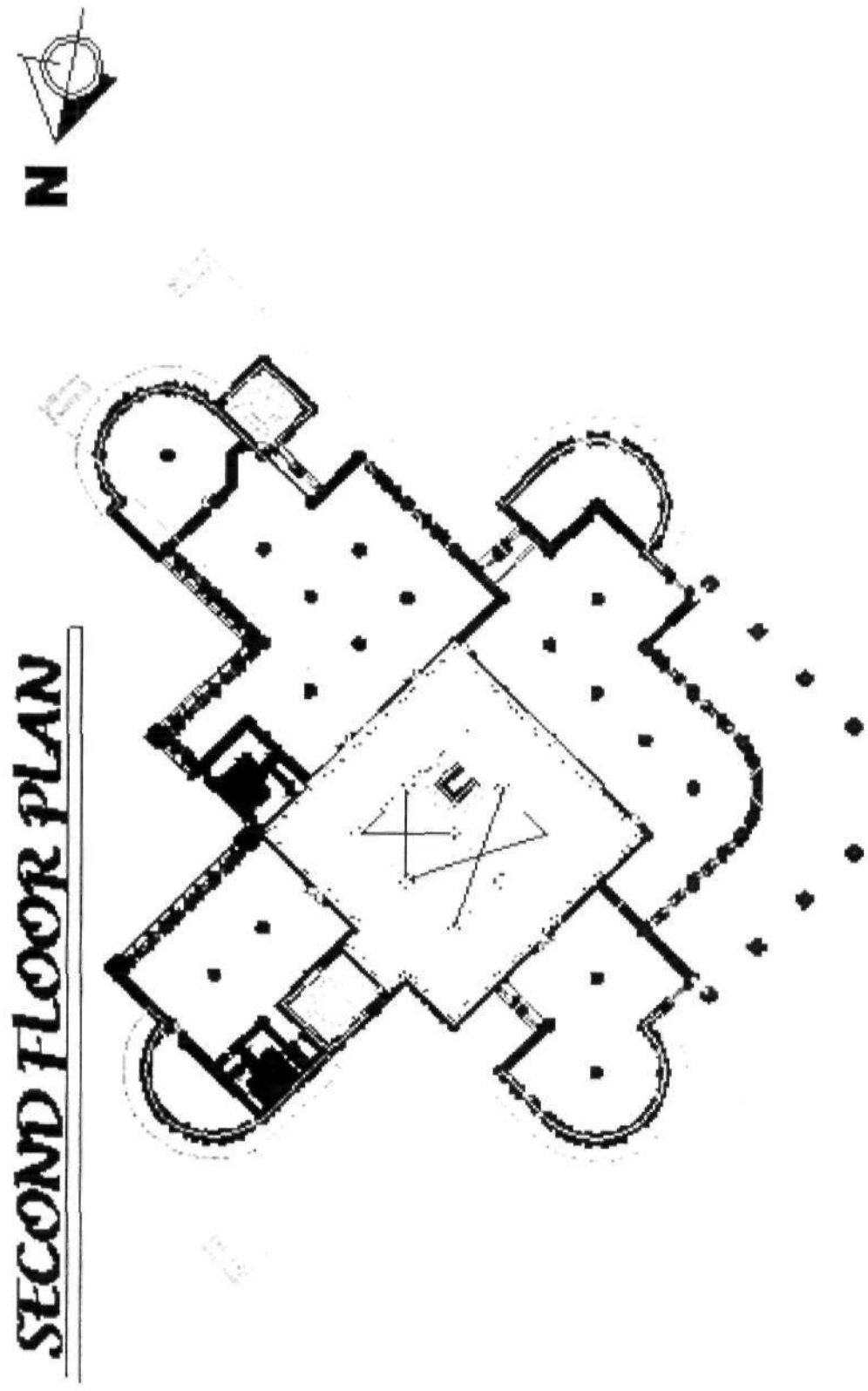


Figure API-4 Second Floor Plan

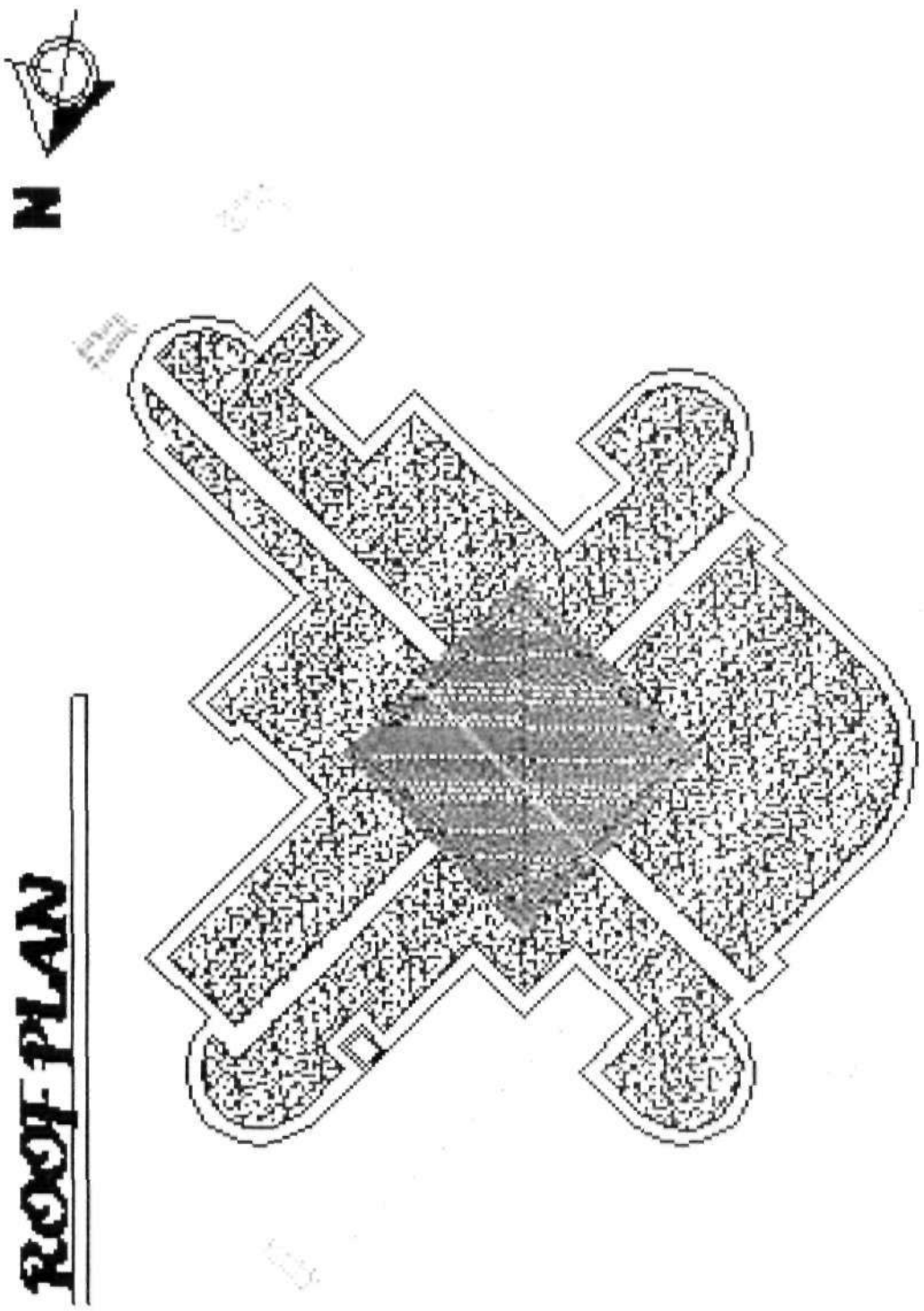


Figure API-6 Roof Plan

APPENDIX II

Sections and Elevations for Proposed KASU Library

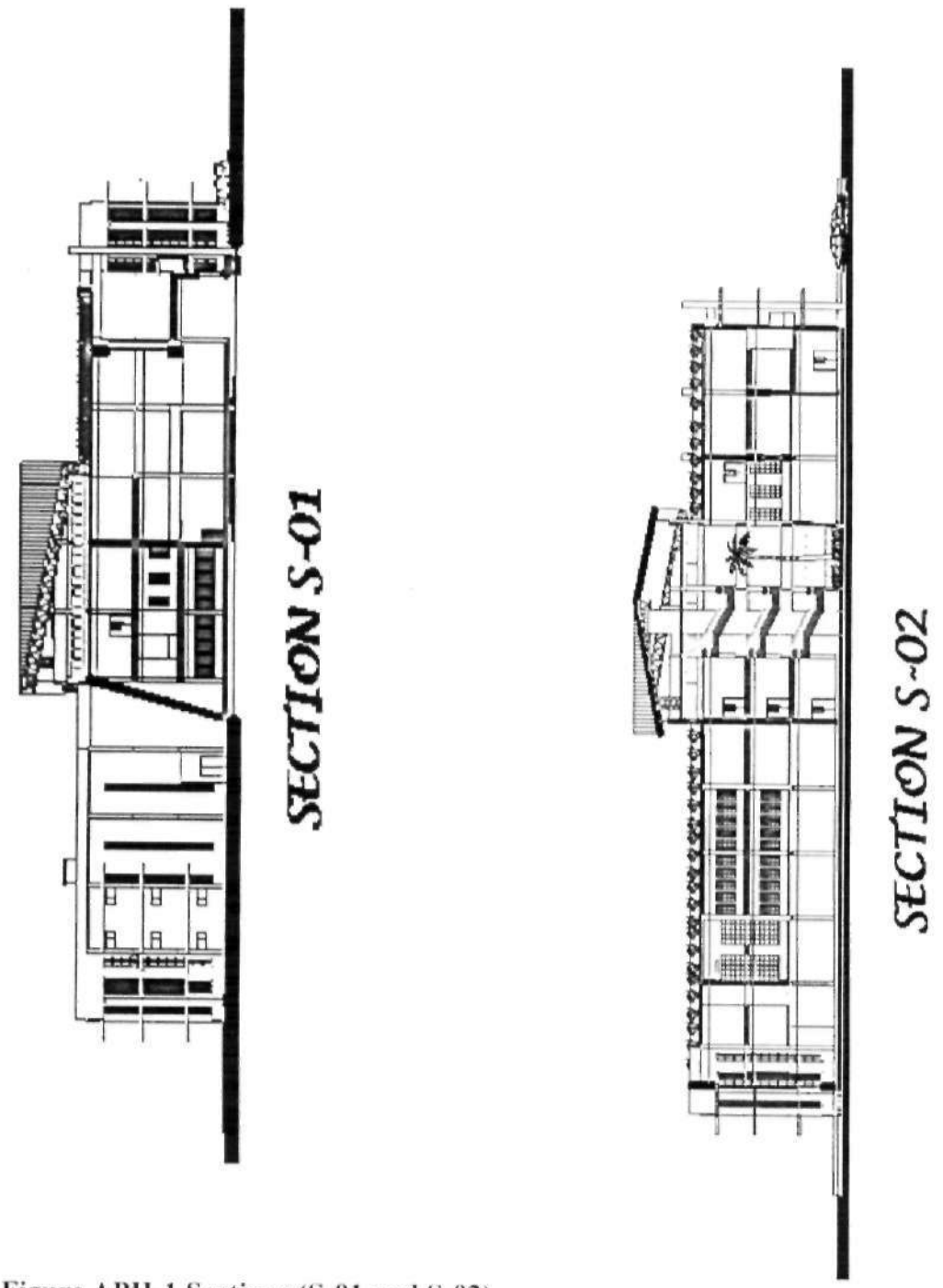


Figure APII-1 Sections (S-01 and S-02)

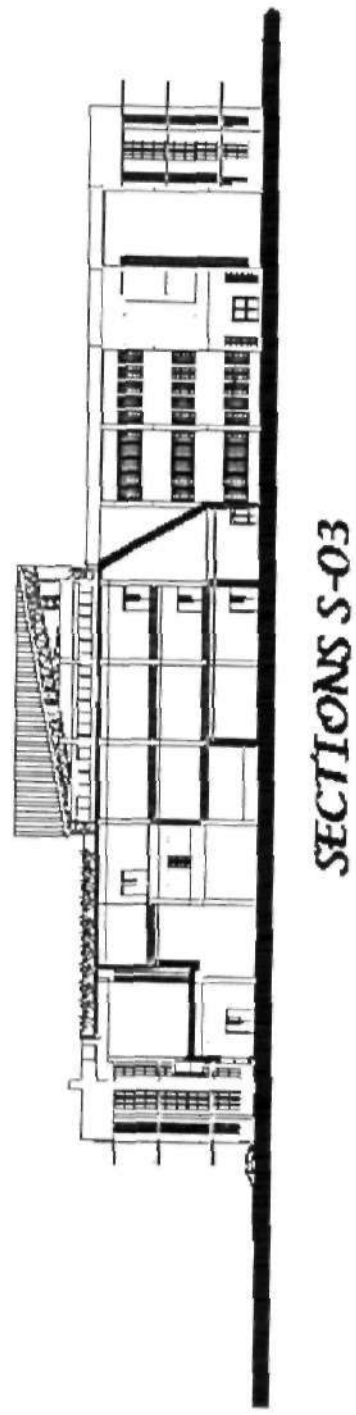


Figure APII-2 Sections (S-03)

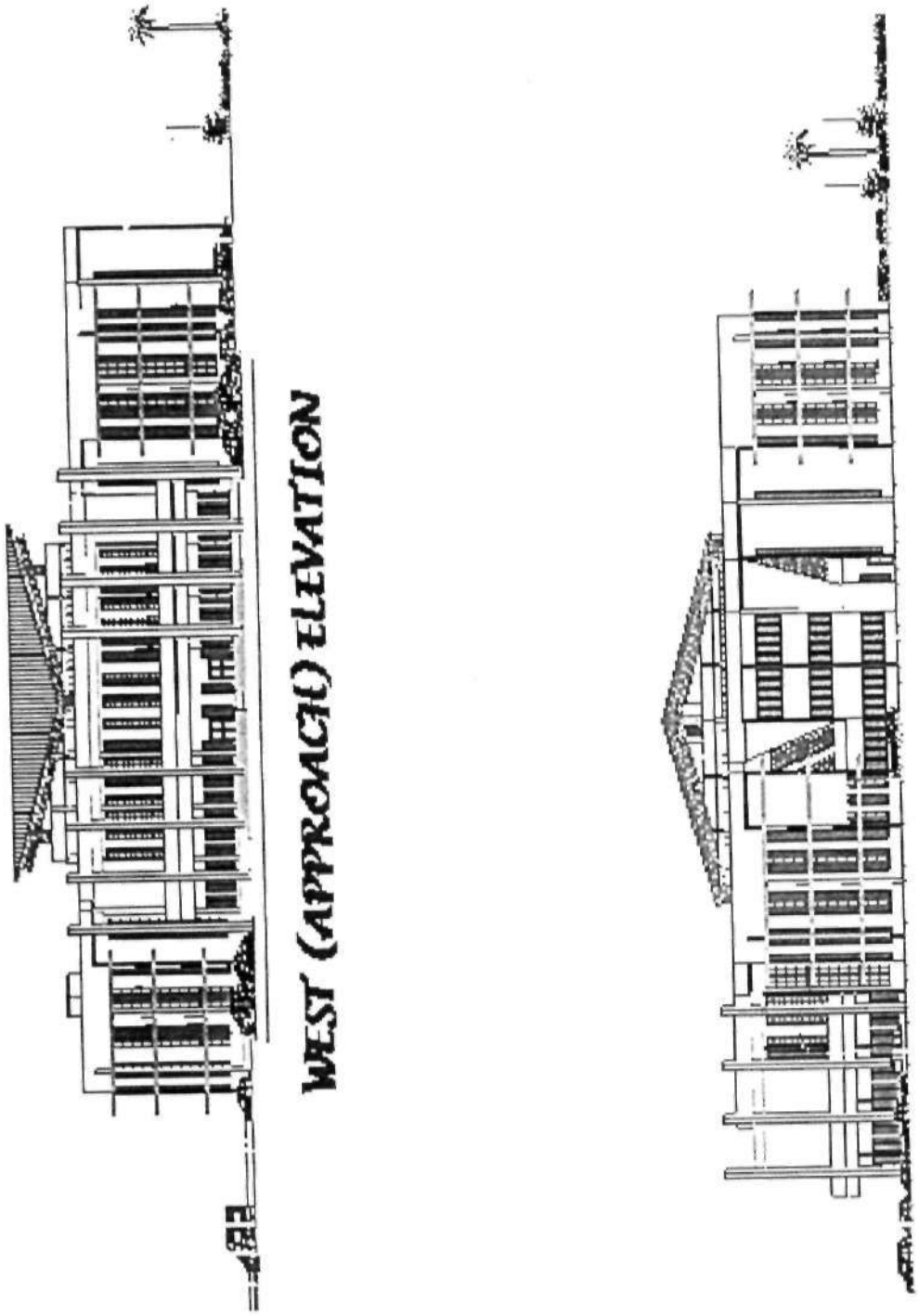
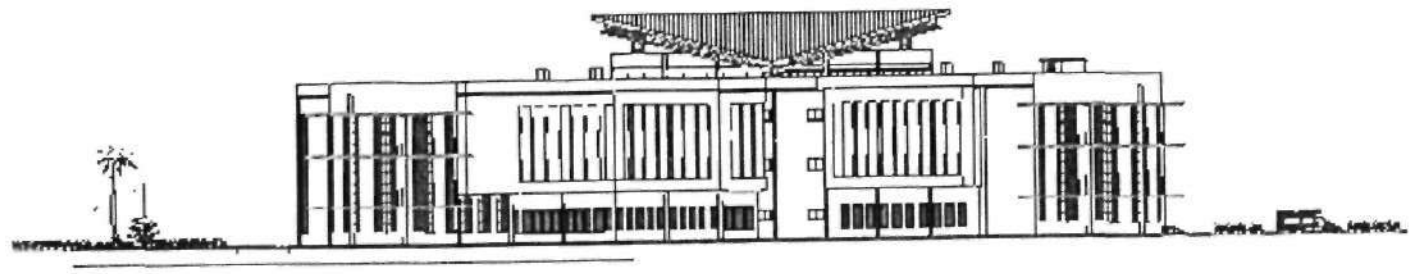
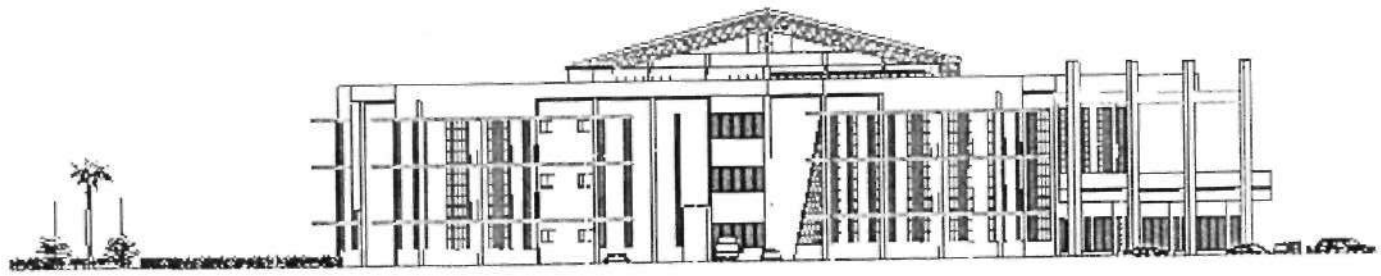


Figure APII-3 Elevations (West and South)

0000493



EAST (REAR) ELEVATION



NORTH (LEFT) ELEVATION

Figure APII-4 Elevations (East and North)