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**FLEXIBILITY IN HIGHER EDUCATION FACILITIES:
An Investigation into the Existing Facilities
of the University of Nairobi.** //

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A thesis submitted in fulfilment
for the degree of
Master of Arts, Architecture
in the University of Nairobi.



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February 1983

DECLARATION

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This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with my approval as University of Nairobi supervisor.

Henry Wood

Professor Henry Wood
Department of Architecture,
Faculty of Architecture, Design & Development.

"It is a truism that a university is a society founded for the advancement of learning and the dissemination of knowledge. This means that it is constantly changing, always on its way, its work never completed. Departments expand, contract, quadruple in size, or virtually disappear within a few years, often in defiance of the most knowledgeable and expert forecasts. Every building and each layout, so optimistically and thoroughly designed, seems to become within a decade not only out of date but physically hampering to the future. Any attempt therefore to constrict its movement artificially, either academically or physically, seems doomed, and rightly doomed, to failure."

CASSON AND CONDER
UNIVERSITY OF BIRMINGHAM
DEVELOPMENT PLAN REPORT (1958).

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ABSTRACT

The requirements of higher education in terms of physical facilities or built spaces constantly change. This is because of the very nature of tertiary level education, that search into the unknown for the accumulation of knowledge. The instruments for this advance constantly change as greater understanding is achieved, the built spaces being mere instruments in the process whose requirements can not be absolutely pre-determined.

This study aims at identifying the factors which cause changes in the physical facilities and devising through architectural design the flexibility needed by the facilities to respond smoothly and efficiently. The facilities should lend themselves to re-organisation and multi-use such that they may never be declared redundant as

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2/10
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instruments of higher education dissemination.

This study based on the physical facilities of the University of Nairobi aims at determining the variable factors by physical inspection and analysis of the changes the buildings underwent over a period in use. This also enabled the ranking of these factors in order of severity and change frequency, understanding the elements in the building affected, and devising prototype methods of accommodating changes.

During the course of the study it became evident that a single space capable of accommodating all the teaching/learning activities would permit the ultimate flexibility in use. In an attempt to achieve this the room performance requirements of the activities were determined and when grouped, showed that four different kinds of spaces were capable of housing all these activities.

It also became evident that growth is an inevitable phenomenon in higher education facilities. Thus a system of planning and building had to be devised that could accommodate growth yet maintain the inherent order in the system, every time growth occurred.

The identification and understanding of the causes of changes and the architectural response to these

in the Kenyan situation is the rationale for this study.

This is demonstrated in the final part, by the application of the findings in this study to a design exercise for the University of Nairobi. A facility is developed to be shared by five disciplines who need immediate accommodation on a partly developed site. This facility withstands the eleven factors identified which bring about change and accommodates growth by a combination of nuclear and segmental planning. The built spaces recommended within the segmental infrastructure also respond to the factors causing changes. This prototype facility developed is used to demonstrate the flexibility determined by direct application to the Kenyan context.

ACKNOWLEDGEMENT

I wish to sincerely thank all those who contributed and assisted me in this study, knowingly or unknowingly, without whose help the task would have been impossible.

Thank You.

Parmjeet Singh Thatthi.

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1. INTRODUCTION

Nearly all developing countries rely on aid to develop their higher education facilities, as the task is complex and financially enormous. This makes it crucial for the aid to be used so that it fulfills the requirements of the recipient over the maximum period possible. To enable this, the buildings designed for higher education should be capable of response to the factors which produce changes. The ease with which the response is brought about is the flexibility this study seeks to determine in terms of architectural design.

The built requirements of higher education are as diverse as the numerous disciplines involved.

University
of Nairobi
context

At the University of Nairobi, the only higher education institute that enjoys the status of a University in Kenya, numerous changes have taken place in the physical facilities. In the 1973-74 academic session a management policy decision made the departments of Chemistry and Physics move from the purpose built Science Block at the Main Campus to another part of the campus known as Chiromo. The Department of Geography which was then experiencing space shortage, inherited the space vacated by Chemistry and Physics. Today Geographers' sit on laboratory tables, with a mass of laboratory service mains around them lying idle. The Faculty of Education which had a high increase in student enrollment in 1978/79 session due to a national emphasis on schools, had to be transferred to Kenyatta University College, a constituent college of the University of Nairobi with its campus 40 kms. away. The very impressive finely designed building at the main campus for education had become obsolete in a period of three years after completion! The student enrollment increase resulting in the administrative spaces increase, was accommodated in vacated spaces at the main campus, causing purpose built teaching/learning spaces to be used as administrative offices. A change in the emphasis of teaching/learning methods from instructional to more reference and resource consultation has lead to a new library

complex at the Main Campus. When operational, new equipment such as an audio - reference, computerised cataloguing, and audio-visual aids has necessitated a new complex, making the purpose built old Gandhi Library obsolete. What will the University put the vast volumes of space in this redundant library remains a mystery to the entire University community.

The situation is further complicated by the constant change in the needs of disciplines when new staff assume authority or when emphasis on a particular method of teaching/learning is stressed.

Restructuring in Kenya

Kenya at present is in a phase of re-structuring its higher educational institutions to make them more appropriate to national needs.

Priorities and Objectives

The immediate priorities and needs of higher education in Kenya have been identified as,

- Increase in the student output from all institutions, commencement of work/study programmes for better utilization of available facilities and even provision of continuing education to all age groups who show the initiative. This inevitably means an increase in student enrollment in buildings which are not capable of further growth in most instances as they are purpose-built for

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The implications of these objectives is that major modifications to the existing facilities are necessary for the new requirements to be accommodated. Such changes which are beyond the control of the user, implementer and the management of higher education can only be responded to smoothly if the building is architecturally designed for flexibility.

1.1. METHOD EMPLOYED

In order to determine what causes changes in higher educational buildings a physical inspection of the existing university in Kenya was conducted to compile data to enable;

- Identification of factors which cause changes
- Rank these factors in order of importance
- Development of norms or standards to predict the magnitude and scale of response for reference by future implementers.
- Classification of the changes produced by these factors in order of severity.

This study was conducted in Kenya to enable data to be compiled which is relevant to local conditions.

Similar work has been conducted by UNESCO³ internationally by means of a questionnaire as opposed to physical inspection of which Kenya was not a sample. Some of the factors and their ranking were different from that of Kenya and are discussed in 5.12 and 5.13.

Identification of the factors which caused changes enabled recommendation of architectural responses to be incorporated into the building, making it capable of responding to the change in a smooth transition to accommodate new requirements.

This is the basic method which has been developed in this study to arrive at the design solution which is demonstrated in the final part of the study through application, to the immediate needs² of one of the higher education institutions in Kenya. (refer 9.2 - 9.4).

FOOTNOTES

¹ Second University in Kenya, Report of the Presidential Working Party pp 68-85 (Nairobi: Government Printers, 1981.)

² University Grants Committee of Kenya, first Report, University Education in Kenya, pp 32-34, (Nairobi: Government Printers, 1979).

³ V.G. Onushkin, Planning the Development of Universities Vol. I & II pp 105-131, (Paris: Unesco/Architectural Press, 1973).

2. DATA BASE

Identification of factors which cause changes in higher education facilities, as developed in this study, is by means of locating any changes in a higher education building and determining their cause.

Data

To do this, data was required defining the changes the facility underwent to respond in architectural terms, i.e. floor area, nature of activity, occupancy and capacity, user patterns, furniture and equipment necessary etc. An investigation of the effects of these changes on the building in terms of space usage, services distribution, workstation layouts, room performance requirements etc. enabled the classification of these factors and identifying the frequency of their occurrence.

Architectural mechanisms to respond were also formulated by investigating and studying the effects on the buildings of the case study.

2.1 ACQUISITION OF RELEVANT DATA

Data
sought

This study is based on the data compiled from a physical survey of the University of Nairobi Campus. The physical inspection revealed the changes the 'built envelope' of this institution had undergone, through a period of operation of 12 years in its present status (1970-1982). The effects on the buildings and the 'Room Performance Requirements' of each activity that exists within it were also determined.

Selection
of
Case Study

The selection of the University of Nairobi for the Case Study was due to:

- It being the only institution of higher learning producing graduates in its present status, for the longest period of time in Kenya.
- Academic and applied research exist at a level in a higher education institute, where special demands on facilities are made.
- Consultancy services are now being offered within and outside its establishment.

- The most diverse range of disciplines exists within its establishment.
- The only institution which has an in-service training programme for its local staff development.
- Growth has been continual over the period 1970-1982 in physical space, though mostly quantitative rather than qualitative.
- An institute which is now emphasising on the calibre of its graduates as, it has to date had to fulfil the manpower deficiency.

Survey stages

The survey was conducted by recording data on survey cards in two stages - Disciplines Space Use Analysis and Room Performance Requirement Data, both being specifically designed for this study.

Stage 1

Disciplines Space Use Analysis enabled the location of a change in the buildings and the subsequent search for the cause. In addition a study of the change produced helped in classifying the factors in severity, frequency of occurrence and the elements of the built fabric affected.

Stage 2

Room Performance Requirement Data was gathered when it became apparent that grouping the requirements of activities to produce a single built envelope, capable of housing all of them in the optimum conditions would provide the flexibility needed.

2.2. RESEARCH DESIGN

Factors identified

The survey identified eleven main factors that have caused changes at the University of Nairobi. These range from increased enrollment by discipline, change in teaching/learning methods, curriculum changes to new research and consultancy policies. As most of these are beyond the control of the implementer or the designer, it is vital that the system of build accommodates change in user, student, lecturer, research assistant etc. This implies that partitioning, workstation layouts, services provision, distribution storage/support spaces etc. can all be varied by the users inside a built envelope which permits this. The architectural mechanisms for flexibility to respond to each of the variable factors is devised in this study. (refer 7.0-7.11).

Change in Users

Policy decisions at management level often force buildings in an institution to accommodate a new user. The ability of the building to respond

and provide the requirements of this new user would be an exceptional advance in introducing flexibility in higher education facilities. This is crucial as the disciplines vary greatly in the nature of spaces they need.

Thus a system of build should be devised that enables spaces to accommodate a range of activities as opposed to purpose-built. Thus whenever a new user inherits an existing building, the only variable will be the proportions of the various multi-use spaces needed. In the research design this has been achieved by grouping the room performance requirements data of their activities to produce four distinct Space Types. These accommodate all the activities at the University of Nairobi. (refer 8.1).

Finally, the need for a system of planning which accepts growth in the built-spaces had to be devised. The system should be such that growth is possible through repetition of the basic module, completion or addition at the open ends, such that the inherent order is enhanced and strengthened after growth occurs. The formulation of such a system where the eventual needs and directions are impossible to pre-determine required the analysis and application of the various orders in organisation of built spaces,

Accom-
modating
Growth

to establish the optimum 'system' applicable to higher education facilities.

Formulation of the research design involved the development of a prototype facility based on this criteria to be shared by five users of different disciplines. This had to be planned on a partly developed site where the new had to link harmoniously with the existing. (refer 9.3.1).

Design Selection

The system of planning and building adopted and developed in this study is the introduction of a grid of circulation which defines the site into sectors of equal hierarchy. This system has often been used in town planning¹ - City of Chandigarh in India and the typical American cities. Its application at micro level to an institution is demonstrated in the Berlin Free University², Germany by the architect Candelis.

Development

The development of its application in this study is the making of the intersections or nodes of circulation the nuclear points around which a micro-complex for a particular discipline is located. In the adjoining sectors to this nucleus are the four 'SPACE TYPES' of built spaces developed in this study, that may grow independent of each other yet maintain the order established.

The Space Types developed can accommodate a range of activities the application of which is demonstrated in the research design. (refer 9.3 and 9.4).

FOOTNOTES

1

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2

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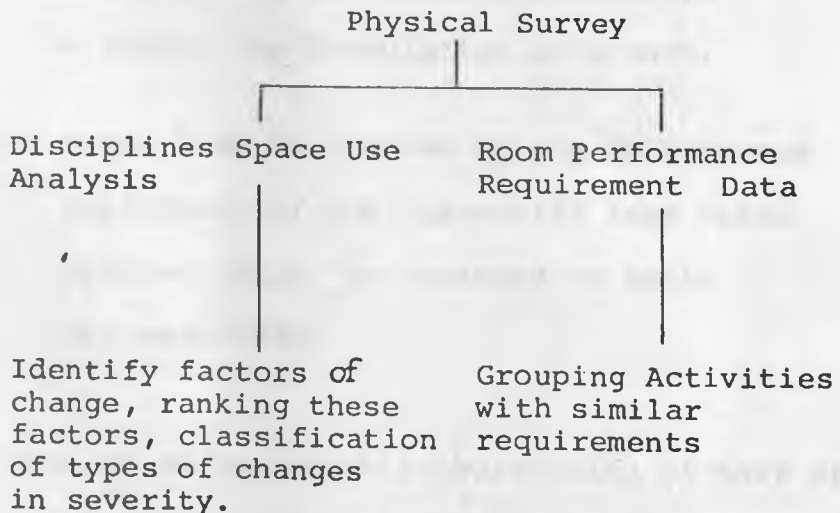
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3. PHYSICAL SURVEY OF UNIVERSITY OF NAIROBI FACILITIES

Research Methodology

The physical survey was conducted in two stages, separate survey cards being developed for each stage.

These are,



Disciplines Space Use Analysis of the survey is to identify and evaluate the changes that have taken place in the University of Nairobi. The changes identified enabled the causes to be determined, ranking these causes in severity and frequency of occurrence, determining the elements of the built envelope affected and finally the formulation of norms and standards for use by future implementers.

Difficulties

The development of norms however was not possible as only 50% of the information desired was available or could be determined due to,

- high rate of staff replacement i.e. expatriate staff replaced with local who having taken over recently, were not familiar with the changes; thus the changes could not be attributed to any one or two of the factors identified to enable the formulation of a norm.
- total lack of records by the Maintenance Department of the University from which changes could be assessed in scale and magnitude.

This is an unavoidable shortcoming of this study and recommendations for the vital data identified in the survey cards should be compiled and maintained by the body controlling the growth of

this or any such institution.

Success

In contrast, the Room Performance Requirements Data for all the activities was much more successful, as 90% of the data sought was obtained. The data which was not available was for courses such as gymnastics, athletics, etc., which are not offered as courses within the University of Nairobi.

This data helped to group spaces with common requirements into space types, four distinct types being eventually realized to be capable of housing all the activities present.

3.1 CLASSIFICATION OF ACTIVITIES AT THE UNIVERSITY OF NAIROBI

Classification of the various types of spaces needed by the numerous activities¹ was necessary to enable the eventual grouping of these.

Criteria

This is done on the basis,

- understudy of the activities in the teaching/learning process in higher education; any support/storage or administrative space was only considered if it influenced the teaching/learning process.

- understudy of the physical requirements of these activities in terms of enclosure, changes in user habits and patterns, equipment/furniture etc.

Classification on this basis showed that all types of teaching/learning activities can be housed in six man classes which for this study have been coded in series 100, 200, 300 etc. to aid reference.

Table 3.1.1 shows this classification together with a few examples in each category.

CODE/CATEGORY	TYPES OF SPACES
100 Instructional	Classrooms, Lecture Theatres etc.
200 Practical/ Demonstration	Laboratories, Workshops, Music rooms, Gymnasia, Cookery Laboratories, Medical Examination/Wards, Agricultural Farms etc.
300 Exchange	Seminar Rooms, Audio-Visual Facilities, Conference Areas, Auditoria, Amphitheatres Multi-purpose Halls etc.
400 Resource	Libraries, Data Banks, Museums, Archives, Audio-Visual Material Storage
500 Administrative	Offices, Conference areas, Typist/Secretarial/Reception, Administrative Records.
600 Support/Storage	Laboratory and Workshop Preparation Rooms.

Table 3.1.1

Classification of Spaces which house all the teaching/learning activities at the University of Nairobi (1970-1982).

Each category of this classification had to be further elaborated giving sub-categories to identify all variations in it. This was to ensure that the samples which were selected for the room performance requirements data, were as diverse in their requirements as possible in order to determine the optimum conditions for the entire category.

An example of such an elaboration of a category is shown as,

CODE/CATEGORY	CODE/SUB-CATEGORY
400 Resource	400 Libraries
	410 Museums
	415 Archives
	420 Data Banks.

The elaboration of all the categories into sub-categories is shown in the identification of the kinds of spaces at the University of Nairobi campus. (refer 4.1).

3.2 SURVEY CARDS

Evolution
of survey
cards

Two types of survey cards were developed after continual revision of the draft of each. This became necessary during the course of study as useful information emerged only after the factors which caused changes became apparent. The design parameters which varied with these factors also became apparent and enabled the variables in requirements of activities, in terms of performance, to be identified.

Data
sought

Discipline's Space Analysis:

The use of space by faculties or institutes over the period 1970- was analysed on the survey cards developed. The use of space by faculties instead of departments (refer 5.11, institutional structure) was chosen because at present buildings or clusters of buildings are assigned to faculties or institutes rather than individual departments. These faculties or institutes are:

- Agriculture
- Architecture, Design and Development
- Arts
- Commerce
- Education
- Engineering
- Law

- Medicine
- Science
- Veterinary Medicine
- Adult Studies
- African Studies
- Development Studies
- Journalism
- Population Studies
- Computer Science

Method
used

An inventory of all the teaching/learning spaces existing in each faculty or institute in the 1981/82 academic session was first recorded. Thereafter all the changes, modifications or additions were recorded in reverse order of academic sessions, finally arriving at the spaces existing in the 1970/71 session. This was repeated for each of the faculties, institutes or schools listed.

Whenever a change in the facilities was identified, the factor or factors which caused it were sought often in vain, making it impossible to assess the level of change brought about to determine a norm.

The spaces were recorded according to the nature of the activity they house and the categorization

developed in 3.1 and 4.1.

Documented
sources

The following data was obtained from the official University of Nairobi calendars¹ (1970-1982)

- Departments
- Inter-disciplinary Units
- Consultancy Units
- Staff numbers; academic and support
- Enrollment
- Courses offered
- Degrees offered.

The floor area analysis and the subsequent changes in it were determined from physical inspection, interview of staff - both academic and support, as well as from the scarce maintenance records available.

Survey
card

All this data was recorded on survey cards called Disciplines Space Use Analysis as shown in Fig. 3.2.1.

Data
sought

The Room Performance Requirements of all the activities was determined from physical inspection of the spaces when in operation in an academic session.

CATEGORY	PCY DESCRIPTION	NO. OF COLLS	CAPACITY (PERSONS)	AREA PER UNIT (SQ. M.)	TOTAL AREA (SQ. M.)	AREA/PERSON (SQ. M.)	REMARKS
RESEARCH	805 Seminars	2	30	38	76	19	in Lecture Theatre
	810 Audio-Visual	-	-	-	-	-	
	806 Lab-rooms	2	-	-	76	-	
	808 Library	1	-	-	720	-	
809	809	1	-	-	720	-	
ACADEMIC	505 Offices	38	2	8	304	40	4.7
	510 Sec/Typist	6	3	10	60	8.4	
	515 Conferences	2	30	2	70	1.9	
	811	811	46	-	-	440	
EXPERIMENTAL	603 Lecture Rep.	1	2	8	8	40	13.6
	620 Controlled Expts	6	4	80	480	20.0	
	625 Photo Lab	1	2	8	28	14.0	
	630 W/Shops	6	2	5	180	12.8	
	640 Consumable Expts	8	-	28	300	-	
812	812	22	-	-	866	-	
813	813	121	-	-	5447	-	
							AGRICULTURE
							1981/82

UNIVERSITY OF NAIROBI - DEPT. OF PHYSICAL FACILITIES, NAIROBI

AGRICULTURE

1981/82

CATEGORY	PCY DESCRIPTION	NO. OF COLLS	CAPACITY (PERSONS)	AREA PER UNIT (SQ. M.)	TOTAL AREA (SQ. M.)	AREA/PERSON (SQ. M.)	REMARKS	
RESEARCH	100 Soil Science	5	40	275	14	16	16	
	110 Agriculture Economics	3	80	450	1.5	7.2		
	200 Forestry Management	2	40	120	1.5	1.5		
	210 Crop Science	11	45	1016	2.1	7.2		
ACADEMIC	220 Animal Production	13	2	35	455	17.0	72	
	215 Agricultural Engineering	8	25	90	720	8.6		
	215 Veterinary Medicine	8	3	30	280	11.7		
	258	258	8	3	30	280		11.7
	814	814	42	-	-	2600		-
							AGRICULTURE	
							1981/82	

UNIVERSITY OF NAIROBI - DEPT. OF PHYSICAL FACILITIES, NAIROBI

AGRICULTURE

1981/82

Fig. 3.2.1

Disciplines Space Use Analysis - eventual survey card used in the physical survey of the University of Nairobi to record the use of spaces by Faculties, Institutes or Schools.

Through a preliminary survey, five samples of each sub-category of space were identified, the selection of samples being on the basis of;

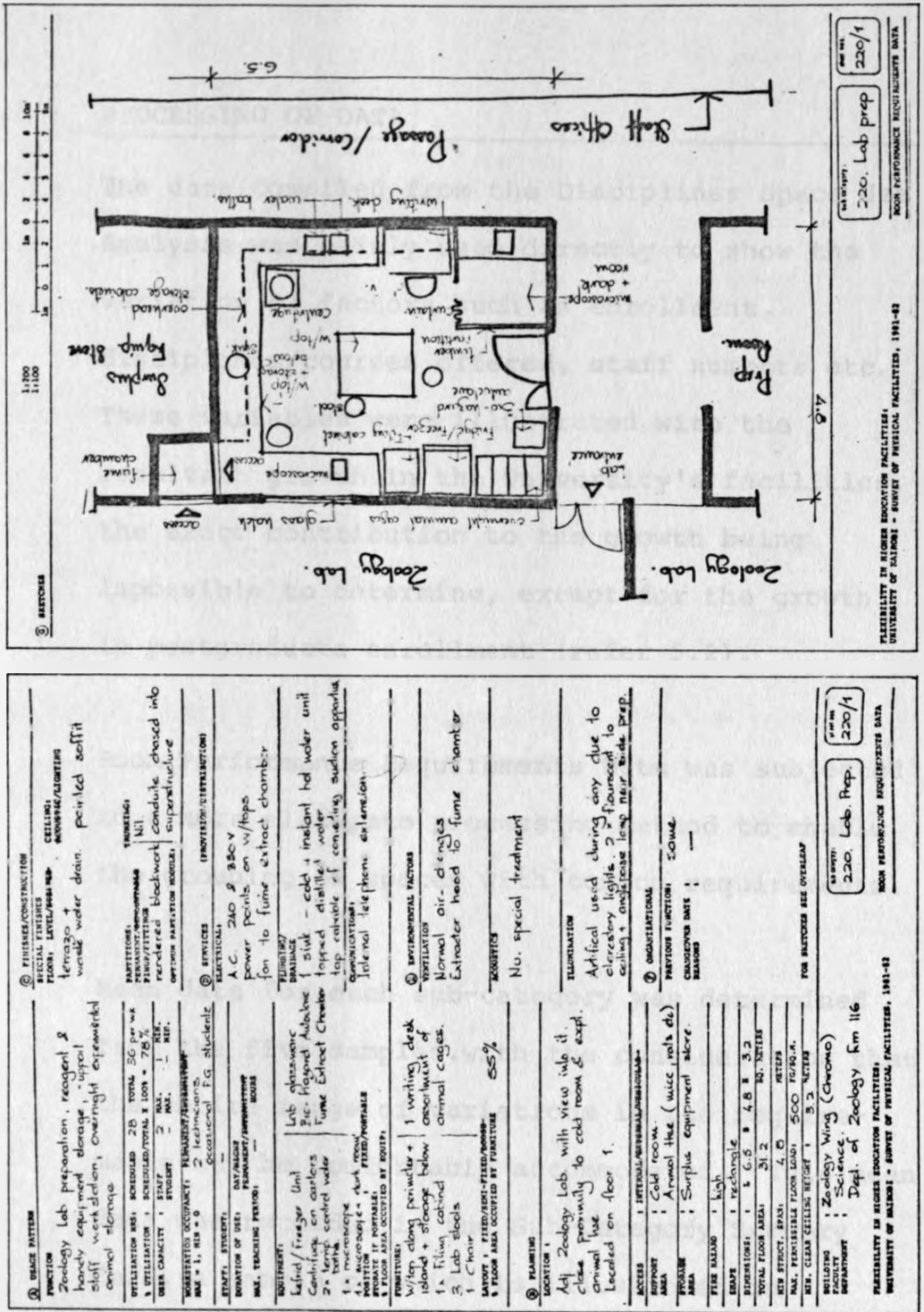
- the maximum diversity in the accommodation necessary for the particular activity.
- the average of the five would produce mean data for a particular sub-category which could be tabulated to enable grouping of activities with common requirements.

These results for each of the five samples of the 38 sub-categories identified were recorded in the Room Performance Requirement Data Survey card developed as shown in Fig. 3.2.2.

Survey
card

The data sought in this card is that of architectural design parameters which would have to be variable to permit multi-use of the space. This data can be grouped as follows:-

- A. Usage patterns
- B. Planning
- C. Construction/Finishes
- D. Services
- E. Environmental Factors
- F. Organisational
- G. Sketches.



<p>④ DRAIN SYSTEM</p> <p>FUNCTION Zoology Lab preparation, reagent & bench equipment storage, upper staff work station, overnight experimental animal storage</p> <p>OPERATION USE: SCHEDULED 2/3 TOTAL 50 per wa UTILIZATION 1. SCHEDULED/TOTAL x 100% = 78% USER CAPACITY: 1. STAFF 2. MAX. 1. REF. 3. REF.</p> <p>INSTALLATION OCCUPANCY: FURNITURE/STAIRWAY/STAFF MAX = 1, REF = 0 Occasional Pg students</p> <p>STAFF: STUDENT STATION OF USE: MAX. NUMBER FURNITURE/STAIRWAY/STAFF BOSS</p> <p>MAX. TEACHING PERIOD: ---</p> <p>EQUIPMENT: Lab glassware 2ic. High/Low Abutene 2. Temp control water Fume Extract Chamber 1. Temp. machine 1. Microscope 4. Microscope - dark room POSITION 1. PORTABLE, 2. FIXED/PORTABLE 3. FLOOR AREA OCCUPIED BY EQUIP.</p> <p>FURNITURE: w/top along perimeter + island + storage below 1. Filing cabinet 2. Lab stools 3. Chair</p> <p>LAYOUT: 1. FIXED/REF-FIXED/PORTABLE 5 FLOOR AREA OCCUPIED BY FURNITURE 65%</p>	<p>⑤ FINISHES/CONSTRUCTION</p> <p>SPECIAL FINISHES: FLOOR: LINOLEUM WALLS/PANELLING: ANTI-MOULD/ANTI-ODOR CEILING: MINERAL WOOL/ALUMINUM ventile water drain. perforated soffit</p> <p>STAIRWAYS: PARTITIONS: 1. SCHEDULED 2/3 TOTAL 50 per wa FIXED/FITTINGS: rendered blackwood OPTION: PARTITION MODULE, 1 superstructure</p> <p>SERVICES: (PROVISION/UTILIZATION) ELECTRICAL: A.C. 240 @ 350V power points on w/tops fan to fume extract chamber</p> <p>ENVIRONMENTAL FACTORS: VENTILATION Normal air - d engines Extractor hood to fume chamber</p> <p>ILLUMINATION Artificial used during any due to clerestory lights. 2 fluorescent to ceiling + analgesic lamp near wide prep.</p> <p>⑥ ORGANIZATIONAL</p> <p>PARTITION FUNCTION: SOME CONVERSION USE: --- MARKERS</p> <p>ACQUISITION No. special treatment</p> <p>FOR FURTHER SEE OVERLAY</p>
<p>⑦ PLANNING</p> <p>LOCATION 1: Adj Zoology Lab with view into it. close proximity to cold room & expl. animal use Located on floor 1.</p> <p>ACCESS: 1 INTERNAL/EXTERNAL/STAIRWAY SUPPORT AREA: 1 Cold room. FRONT AREA: 1 Animal use (succ. rats etc) BACK AREA: 1 Surplus equipment store.</p> <p>FIRE RISK: 1 high</p> <p>SHAPE: 1 rectangular</p> <p>DIMENSIONS: 1 6.5 x 4.8 x 3.2</p> <p>TOTAL FLOOR AREA: 31.2</p> <p>NET STRUCT. SPAN: 4.0 METERS</p> <p>MAX. PERMISSIBLE FLOOR LOAD: 5000 kg/m²</p> <p>MIN. CLEAR CEILING HEIGHT: 3.2 METERS</p> <p>BUILDING FACILITY DEPARTMENT: 1 Zoology Wing (Chromo) 2 Science 3 Dept. of Zoology Bm 116</p>	<p>⑧ ENVIRONMENTAL FACTORS</p> <p>VENTILATION Normal air - d engines Extractor hood to fume chamber</p> <p>ACQUISITION No. special treatment</p> <p>ILLUMINATION Artificial used during any due to clerestory lights. 2 fluorescent to ceiling + analgesic lamp near wide prep.</p> <p>⑨ ORGANIZATIONAL</p> <p>PARTITION FUNCTION: SOME CONVERSION USE: --- MARKERS</p> <p>FOR FURTHER SEE OVERLAY</p>

SCALE: 1:1000
DATE: 22/01
BY: 220. Lab. Prep.
ROOM PERFORMANCE REQUIREMENTS DATA
UNIVERSITY OF NAIROBI - SURVEY OF PHYSICAL FACILITIES, 1981-82

FOR FURTHER SEE OVERLAY
DATE: 22/01
BY: 220. Lab. Prep.
ROOM PERFORMANCE REQUIREMENTS DATA
UNIVERSITY OF NAIROBI - SURVEY OF PHYSICAL FACILITIES, 1981-82

Figure 3.2.2

Room Performance Requirements Data - survey card developed to record the physical inspection to determine the common requirements of teaching/learning activities at the University of Nairobi in the 1981/82 academic session.

3.3 PROCESSING OF DATA

Direct
use of
data

The data compiled from the Disciplines Space Use Analysis was mainly used directly to show the variation of factors such as enrollment, disciplines/courses offered, staff numbers etc. These variables were illustrated with the resultant growth in the University's facilities, the exact contribution to the growth being impossible to determine, except for the growth in postgraduate enrollment (refer 5.2).

Processed
data use

Room Performance Requirements Data was subjected to a more elaborate processing method to enable the grouping of spaces with common requirements.

Mean data
determined

Mean data for each sub-category was determined from the five samples with the consideration that the entire range of variations in the requirements can be comfortably accommodated. This mean data was recorded in the Sub-Category Summary Card, a sample of which is illustrated in Fig. 3.3.1.

Grouping
data

In order to identify spaces with common requirements, the mean data for all the sub-categories was tabulated (refer 4.2).

FOOTNOTES

¹University of Nairobi, Academic Calendars
1970-1982 (Nairobi: University Press).

University of Nairobi, Annual Reports, 1972-1981.
(Nairobi: University Press).

4. PHYSICAL SURVEY RESULTS

4.1 IDENTIFICATION OF THE KINDS OF SPACES AT THE UNIVERSITY OF NAIROBI CAMPUS

The teaching/learning activities identified in the physical survey were categorized and these categories were further elaborated to define the variations of spaces needed for that activity.

This definition is on the basis of room use nature of the activity in a category, and is referred to as sub-category. These sub-categories are also coded for reference.

The spaces identified and coded are listed in table 4.1.1 with examples of possible activities accommodated by them.

TABLE 4.1.1

Identification of the Kinds of Spaces at the University of Nairobi Campus, 1982

SUB-CATEGORIES	ACTIVITY
100 INSTRUCTIONAL	
105 Classrooms	Mathematics, Law, Literature, Philosophy, Business Studies, Historical etc.
110 Lecture Theatres	General theoretical instruction and demonstration in all disciplines.
200 PRACTICAL/DEMONSTRATION	
205 Special Classrooms	Fine Art, Geology, Typing, Sewing etc.
210 Class Laboratory	Chemistry, Physics, Zoology, Botany, Bio-Chemistry, any lab where instruction and practical work possible.
215 Individual Laboratory	1-3 workstation labs.
220 Laboratory Preparation.	Mainly a support facility to labs but sometimes used for academic research at U.O.N. campus.
225 Special Laboratories	Domestic Cooking, Languages, Textile Design, etc.
230 Studios	Architectural studies, Design etc.
235 Health, Convalescence	Wards and Clinics
240 Health Treatment/Diagnostic	Examination and Test areas
245 Workshops	Mechanical, Timber, Metal etc.
250 Individual workshops	1-3 work station units.
255 Experimental Land	Agricultural Farms, Botanical Gardens.
260 Gymnasia	Physical Education
265 Sports Field	Athletics and Games
270 Music	Practice, Composition and Performance
300 EXCHANGE/DISPLAY	
305 Seminars	Group study, working parties, or discussion space.
310 Audio-Visual	Projected visual and sound display
315 Performance	Drama, Music etc.
320 Address	Speech, Debates, Forums etc.
325 Exhibition	Displays, Compositions etc.

TABLE 4.1.1 (contd)
 Identification of the Kinds of Spaces at the University
 of Nairobi Campus, 1982

SUB-CATEGORY	ACTIVITY
400 RESOURCE	
405 Libraries	Printed matter, micro-film records
410 Museums	Historical & archeological finds, wild-life species & replicas.
415 Archives	Historical records
420 Data Banks	Data stored in computers, punch cards, microfilm etc.
500 ADMINISTRATION	
505 Offices	Academic and administrative staff workstations.
510 Secretarial/Typist/Reception	Administrative Support Staff with some daily record storage.
515 Conference Areas	Discussion, policy decision spaces of both advisory and executive nature.
520 Special Offices	Workshop, lab administration etc.
600 SUPPORT/STORAGE	
605 Lecture preparation	Staff ante room for personal effects and temporary work/station
610 Laboratory preparation	Support room, with some equipment storage, permanently manned by technician. Often used for post-graduate research workstation
615 Special Laboratory preparation	Similar to above but also used as control room as in case of language lab etc.
620 Controlled Factor Storage/ Workstation	Cold-rooms, Dark rooms etc.
625 Photographic Lab	Photographic processes
630 Radio-Active Sources	X-ray, Sesiem Source etc.
635 Workshop preparation	Workshop support often acting as admin office with some special tool storage
640 Consumable Education Materials Stores	Stationery, data books usually mixed with old admin. records
645 Administrative Records	Storage of records usually associated with executive role offices.
650 Computer Unit	Computer operations & processing systems

4.2 IDENTIFICATION OF ROOM PERFORMANCE REQUIREMENTS OF SPACES

To enable easier grouping of the requirements of activities in terms of room performance, selected data from the Room Performance Requirements - Summary Cards was tabulated. The data tabulated was that which would influence the nature of a space accommodating the activity. (See table 4.2.1).

The grouping of activities to produce the minimum different types of spaces is discussed in 8.i.

Two factors which were also tabulated but did not influence the groupings were the utilization rate and staff to student ratio when in session. These are listed separately in the tables to show the level of input by staff and frequency of use in session.

The requirements of Services and Environmental Factors were graded in magnitude as follows:-

High	99 - 67%
Mod	66 - 37%
Low	33 - 0%
-	non-existent

UNIVERSITY OF LIBRARY MANOBI

U
S
C
D
R
H

	PARTITIONS type, optimum module (metres)	CEILING HEIGHT min. clear (m)	ELECTRICAL	PLUMBING/ DRAINAGE	COMMUNICATIONS GAS	VENTILATION optimum type	ACOUSTIC	ILLUMINATION	REMARKS	UTILIZATION RATE STAFF, STUDENT RATIO
perma- nent 1.2	2.7	low	-	-	natur	cell treat	natur	Some partitioned into offices, floors, asked for blacked visibility	52% 1:45	
fixed	5.0	mod	low	low	mech	walls cell- ing treat- ed	black- out + mod. artf	-	20% 1:200	
perma- nent 1.2	2.7	mod	low	-	natur	-	-	-	36% 1:50	
perma- nent	3.0	high	high	high	natur fume extr- act	-	natur mod+ artf.	-	27% 1:10	
fixed	3.0	high	high	high	natur fume extr- act	-	natur mod. + artf + black- out	Mainly p.g. & applied research	55%	
fixed	3.0	high	high	high	natur fume	-	natur mod. + artf + black- out	Mainly a support space to main lab but used as individual labs in absence of these	78%	
fixed	2.6	high	mod	mod	natur + extrac	-	natur mod + artf	-	28% 1:25	
amount flex- ible in-up	3.0	low	-	-	natur	ceil- ing treat	natur high + artf	Mainly work stations but used as examination area.	18% 1:15	
perma- nent + flex- ible	3.0	high	mod	mod	natur	-	natur mod	Low utilization rate since mainly non-ed. space	4% 1:10	
perma- nent + flex- ible	3.0	high	mod	mod	natur + mech	-	artf high	Low utilization rate due to mainly non-ed. space	4% 1:5	
perma- nent	3.2	high	high	low	natur	-	natur mod	Few disciplines like architecture have w/ shops as support rather than prac/ demo teaching spaces	15% 1:18	
perma- nent .5	3.0	high	high	low	natur	-	natur mod	-	35%	
-	-	-	-	-	-	-	-	-	-	
Facilities exist at UON but no course conducted in it.									- ditto -	

TA	ROK	Da	Un.	SOI	PARTITIONS type, optimum module (netral)	CEILING HEIGHT min. clear (m)	ELECTRICAL	PLUMBING/ DRAINAGE	COMMUNICATIONS GAS	VENTILATION optimum type	ACOUSTIC	ILLUMINATION	REMARKS	UTILIZATION RATE STAFF, STUDENT RATIO
					area- vent 2.7 2.9	low	low	-	-	natur	ceiling creat	mod + artf In uncheduled mod + time of fur black audio visual out display	often use for private study 314 1:25	
					area- 5.0	mod	-	-	-	mech ceiling creat	wall + ceiling black creat out	low + black out	-	204
					norman 6.0	mod	-	-	-	mech + natur	wall + ceiling creat	natur low + artf low + artf activities	often used for 154	
					-	low	-	-	*	natur or mech creat	natur wall, ceiling creat	artf open air special amphitheatre black- out	84 1:500	
					amount 3.0	mod	low	-	-	natur	ceiling creat	black out	commonly doubles as examination space	54
					amount 3.9	mod	-	-	-	natur	ceiling creat	natur mod + artf mod	-	-
					mean 3.0	low	low	-	-	natur	-	artf mod + special	Survey covered only the exhibited spaces & not the instructional	104 1:8
					mean 2.7	low	-	-	-	natur	cell creat	natur mod + artf mod	Insufficient samples & the available spaces not ideal - ditto -	354
					mean 2.7	low	-	-	-	natur	cell creat	natur mod + artf mod	Flexibility in room division from advantage an advantage	924
					mean 2.7	low	-	-	-	natur	cell creat	natur mod + artf mod	- ditto -	924
					mean 1.0	low	-	-	-	mech cell wall creat privat mod	natur cell wall creat privat mod	natur mod + artf mod	-	104
					mean 1.0	low	low	low	low	natur	-	natur mod + special	-	854

TRA	RO	DA	UN	SO	FRONTATIONS type, optimum module (metres)	CEILING HEIGHT min. clear (m)	ELECTRICAL	PLUMBING/ DRAINAGE	COMMUNICATIONS GAS	VENTILATION optimum type	ACCOUSTIC	ILLUMINATION	REMARKS	UTILIZATION RATE STAFF, STUDENT RATIO
	man	3.0	low	low	natur	-	natur	-	natur	-	natur	mod	-	45%
	man	3.0	high	mod	natur	cell	natur	cell	natur	cell	natur	mod	-	65%
	man	3.0	high	mod	natur	cell	natur	cell	natur	cell	natur	mod	-	8%
	man	3.0	mod	mod	natur	-	natur	-	natur	-	natur	mod	photographic dark-rooms or black-out cold rooms	1:10
	count	3.0	mod	mod	natur	-	natur	-	natur	-	natur	mod	-	3%
	man	4.0	high	mod	natur	low	natur	low	natur	low	natur	mod	-	1:2
	man	3.0	mod	low	natur	cell	natur	cell	natur	cell	natur	mod	cookerly lab, languages lab, chemicals & re- agents, physics equip etc.	45%
	man	3.0	mod	low	natur	creat	natur	creat	natur	creat	natur	mod	-	-
	man	3.0	low	-	natur	-	natur	-	natur	-	artf	mod	-	-
	man	3.0	high	-	natur	-	natur	-	natur	-	artf	mod	-	12%
	man	3.0	high	-	air	cell	air	cell	air	cell	artf	mod	-	1:3
	man	3.0	high	high	natur	mod	natur	mod	natur	mod	natur	mod	-	65%

5. IDENTIFICATION OF FACTORS CAUSING CHANGES IN PHYSICAL FACILITIES

The physical needs of any higher education institute change over time, making the constant need to modify, replace or add to its existing establishment. These adaptations can be termed as changes. The level of change can be both quantitative such as addition or replacement of space or qualitative such as new room performance requirements.

These factors which have caused changes to the physical facilities of the University of Nairobi buildings, in teaching/learning spaces, have been identified with the changes they have produced over the period 1970-1982 as;

- Student enrollment by discipline

- Student population at undergraduate, post-graduate or doctorate level.
- Staff to student ratio and the calibre of teaching and support staff.
- Full-time, part-time, work/study courses.
- Disciplines and inter-disciplinary institutes
- Courses offered and curricula changes.
- Methods and trends of teaching/learning.
- Research and consultancy policy.
- Institute and discipline size policy
- Governance system.
- Growth and change policy.

5.1 STUDENT ENROLLMENT BY DISCIPLINE

Determining
of spatial
needs

The space requirement of any higher education institute is estimated from the enrollment of full time students (F.T.student) or equivalent full time students.

This is by means of data¹ compiled for the minimum gross floor areas required by a full time student in any discipline.

Enrollment
changes

Any increase in enrollment, results in the need for more space or a 'saturated' facility. In practice however this is usually accommodated with certain amount of over-provision initially with the institution attaining saturation at some point in its use.

At the University of Nairobi the growth in the teaching/learning floor area of the physical facilities for each academic session since 1970-71 session, was determined through the physical survey (Discipline's Space Use Analysis). This growth in floor area was expressed as a percentage of the total teaching/learning floor area in that respective year. The results when compared with the growth in enrollment show the resultant growth in facilities in Fig. 5.1.1.

Definition

Growth in the teaching/learning floor-area in this study can be defined as follows:-

- All teaching/learning spaces inclusive of any administration, support or storage directly associated with them.
- Any increase in the floor-area by new additions.

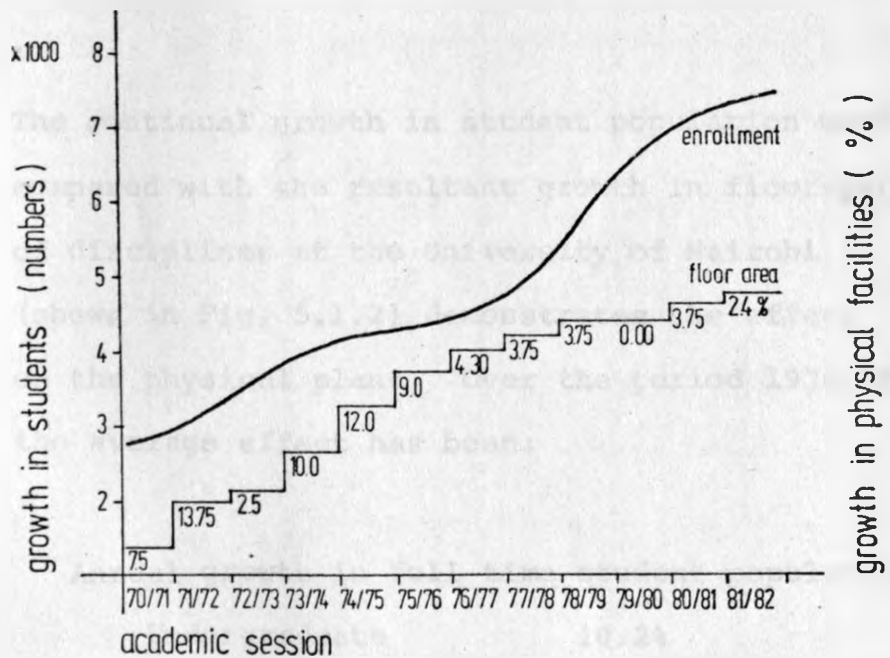


Figure 5.1.1

Enrollment and Physical Growth Trends at the U.O.N. Campus, 1970-82.

(Data Source: Discipline's Space Use Analysis)

- Any floor area from re-furbishing an existing space for teaching/learning or to a more a specialized role such as laboratory, practical/demonstration space etc. from an idle space.

Disciplines requirements

The data used in determining the floorspace requirements also varies according to disciplines. Any change in the student enrollment may result in inadequacy or overprovision of floor area in that discipline.

U.O.N. case

The continual growth in student population when compared with the resultant growth in floorspace of disciplines at the University of Nairobi (shown in Fig. 5.1.2) demonstrates the effect on the physical plant. Over the period 1970-82, the average effect has been:

Annual growth in full time student population,	
Undergraduate	10.2%
Postgraduate	22.6%

Corresponding annual growth in teaching/learning floor area is 7.03%.

Thus theoretically, should the present growth rate continue, the floor area should double in 14 years, showing the frequency of change an institution undergoes.

5.2 STUDENT POPULATION AT UNDERGRADUATE, POSTGRADUATE AND DOCTORATE LEVEL

Factors outside a higher education institute determine the level of training within each discipline in it, making future planning in an institution very uncertain. The highest rated factor responsible for this is the calibre of a nation's manpower needs.

Space
shortage

The effect on the built envelope is mainly lack of space wherever postgraduate and doctoral programmes are emphasised, since their floor-area requirements are higher than that of undergraduates (see table 5.1.3).

Planning
difficulties

Planning for the postgraduate and doctorate courses is made difficult by the erratic demand for their space, both in quantity and quality, as two research projects in one field may need different room performance requirements.

Complex
equipment

Equipment required by the various levels of training is more complex and delicate to handle the higher the level of training. As resources are scarce when the facility is started, this equipment usually follows later with the result that the building has to be modified to house it. Typical examples of such situations are cold rooms, radio-active sources, photographic dark

rooms, electron microscopes or computer terminals.

The use of this complex equipment often has to be regulated to allow only experienced users. This means lockable compartments or rooms or as in some instances a full time support technician who also has to be accommodated. Introduction of complex equipment also results in considerable modifications to the services. Power voltages, plumbing and drainage, room temperature control equipment, or even a space to house the plant such as transformers, compressors, etc. have to be provided.

Academic research

Postgraduate teaching/learning mainly involves research. Most of the postgraduates at the University of Nairobi are in the local staff development programme to replace expatriate staff and so are considered as 'junior staff'. This enables them to share staff offices to conduct research or use the laboratory or workshop preparation rooms as individual workstations which have been sufficient for academic research. When applied research is emphasised, that which arises out of a need for an investigation, then special individual labs and workstations will have to be added to house the researcher and his equipment.

Increase in postgraduate enrollment and the corresponding growth in the type of spaces which have been used by them, in the period 1970-1982, at the University of Nairobi is shown in Fig. 5.2.1.

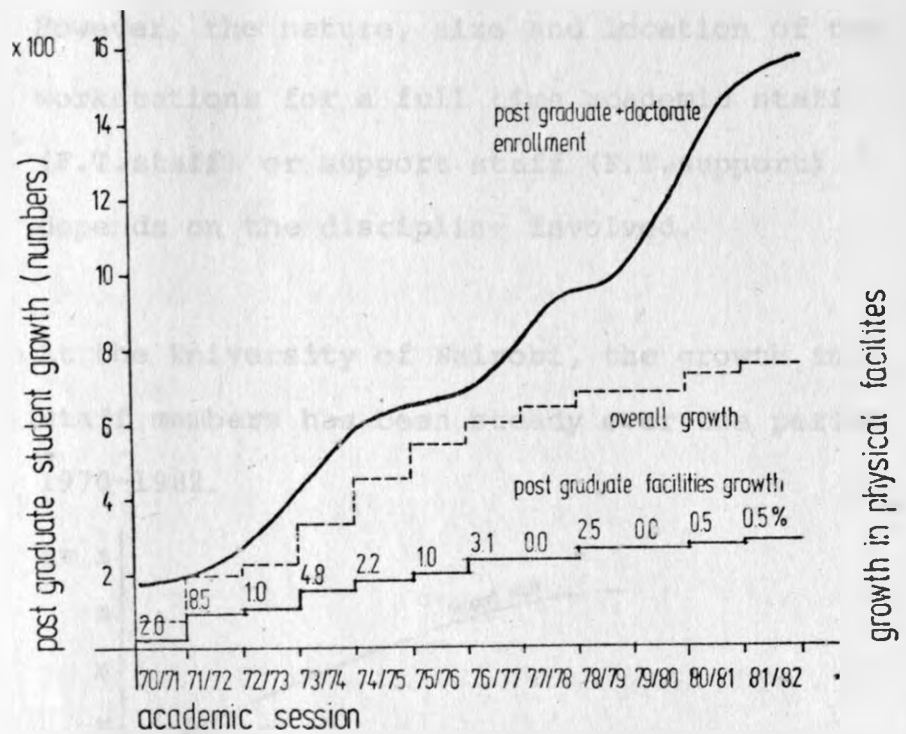


Figure 5.2.1

Growth in Postgraduate Enrollment & the Corresponding growth in facilities at the University of Nairobi, 1970-82.

5.3 STAFF TO STUDENT RATIO AND THE CALIBRE OF STAFF

Staff numbers

Floorspace to accommodate staff is also determined by the number of staff employed in an institution.

However, the nature, size and location of the workstations for a full time academic staff (F.T.staff) or support staff (F.T.support) depends on the discipline involved.

At the University of Nairobi, the growth in staff members has been steady over the period 1970-1982.

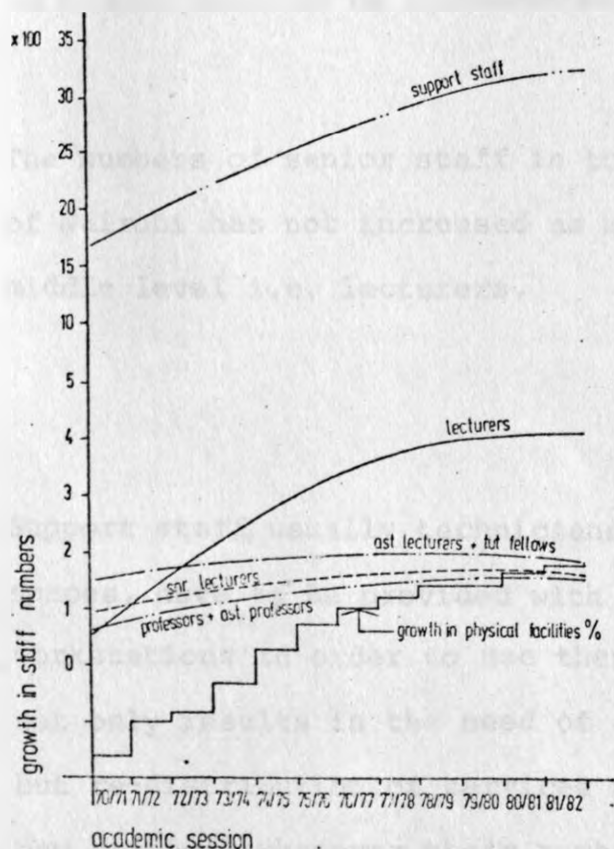


Figure 5.3.1

Growth of Staff Employed at the University of Nairobi and the resultant annual growth of physical facilities, 1970-1982

Calibre
of staff

The calibre of staff employed affects the physical facilities more than the numbers employed. Senior staff usually are specialized in some manner requiring complex equipment and special space to house and use it. A specialist

Special
Equipment

A specialist in environmental science in the discipline of Architecture will require specialized acoustic and illumination laboratories. The equipment will have to be housed so that demonstrations in use and control over inexperienced users is possible.

The use of equipment may eventually be frequent enough to justify a full time technician who will also have to be accommodated.

The numbers of senior staff in the University of Nairobi has not increased as much as the middle level i.e. lecturers.

Support
staff

Support staff, usually technicians for various spaces, have to be provided with specialized workstations in order to use them fully. This not only results in the need of additional space but re-distribution of services to supply their new stations whenever their numbers increase.

Staff to student ratio also varies according to disciplines since the depth of study and the number of constituent courses in a field of study vary considerably. This influences the level of staff in-put and thus their numbers and calibre.

At the University of Nairobi, the overall staff to student ratios over the period 1970-82 are shown in figure 5.3.2.

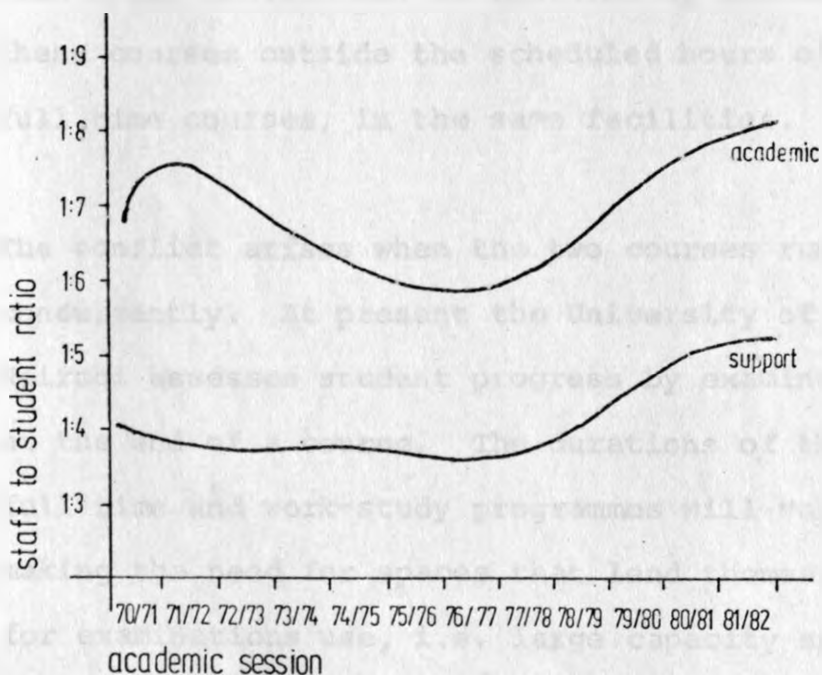


Figure 5.3.2

Academic/Support Staff to Student Ratios at the University of Nairobi, 1970-82

(Data Source: Discipline's Space Use Analysis)

5.4 FULL TIME, PART TIME WORK STUDY COURSES

Enrollment
& staff
increase

Policy changes at national level such as the introduction of continuing higher education for all ages or refresher courses means an increase in the overall student enrollment and the subsequent increase in the staff. The effect on the facilities is as discussed (see 5.1 and 5.3). However if these courses are introduced in the form of part-time study/work programmes, the then space utilization is improved by conducting these courses outside the scheduled hours of full time courses, in the same facilities.

Course
durations

The conflict arises when the two courses run concurrently. At present the University of Nairobi assesses student progress by examinations at the end of a course. The durations of the full time and work-study programmes will vary making the need for spaces that lend themselves for examinations use, i.e. large capacity spaces, as well as be used in the daily teaching/learning process for smaller groups. In a system of continuous assessment,, the additional space would still be necessary.with the flexibility.

The method of continuous assessment will however

Administrative space.

increase the administrative type of space as student progress will have to be monitored and records maintained so that reference and accessibility is easier. This might mean a full time support staff member or even complex equipment such as a computer.

5.5 DISCIPLINES AND INTER-DISCIPLINARY INSTITUTES

Disciplines
change

The disciplines or degrees offered by any institution determines its need in scale and type of space. In higher education the disciplines offered change due to;

- Need for manpower of a particular type at national level
- Increased depth of study into a field of study through research, to justify a new specialized discipline or inter-disciplinary institute.
- Change in the number of disciplines and inter-disciplinary institutes is one of the factors which has caused growth and change in the physical facilities of the University of Nairobi. Figure 5.5.1 demonstrates the changes in the disciplines at this campus and additions of new ones, all of which have had to be housed in appropriate buildings.

Education
level

The depth of study in a discipline viz. undergraduate, postgraduate or doctorate level, influences the needs in a discipline. The needs of different types of spaces within a particular field of study can vary making it necessary for a system of multi-use to be incorporated. Table 5.5.2 demonstrates this for two randomly chosen disciplines.

University of Nairobi 1970-82

Year	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83
REGISTRATION													
ADMISSIONS													
STUDENT SERVICES													
FINANCE													
ACADEMIC SERVICES													
LIBRARY													
SPORTS													
UNIVERSITY HOUSES													
UNIVERSITY STORES													
UNIVERSITY SOCIETY													
UNIVERSITY PRESS													
UNIVERSITY BOOKS													
UNIVERSITY PUBLICATIONS													
UNIVERSITY PRESS													
UNIVERSITY STORES													
UNIVERSITY SOCIETY													
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USE OF TEACHING/LEARNING SPACES PER WEEK

DISCIPLINE LEVEL	INSTRUCTIONAL	PRACTICAL/ DEMONST.	EXCHANGE	RESOURCE	SUPPORT	REMARKS
Bachelor of Science BSc. Botany	10	9	8	1	-	3 yr Undergrad.
Master of Science MSc. Botany	4	16	6	4	-	2 yr Postgrad.
Doctor of Science PhD. Botany	-	20-26	4	8	6-12	3 yr Doctorate
Bachelor of Arts B.A. Philosophy	6	-	8	4	-	3 yr Undergrad.
Master of Arts M.A. Philosophy	2	1	10	8	-	2 yr Postgrad.
Doctor of Philosophy PhD Philosophy	-	4	15-20	10-15	-	3 yr Doctorate

TABLE 5.5.2

Use of teaching/learning spaces by Disciplines as the depth of study changes.

5.6 COURSES AND CURRICULUM CHANGES

Internal
changes

In addition to external demands on a discipline, its constituent courses undergo metamorphic changes. This metamorphic change is due to new knowledge, diversification or specialization of a course, new equipment, feedback from research all leading to greater understanding of the unknown and change in the needs from physical facilities. Courses constantly change, are restructured or their durations vary making complex demands on the accommodating spaces.

Difficulties
in assessing
level of
change

To determine the effect of this factor on the growth of the physical facilities at the University of Nairobi has been impossible as records of the resultant changes to the facilities could not be differentiated in the physical inspection/survey. However the growth in the number of courses is shown in Fig. 5.6.1

Quantitative/
qualitative
growth.

The comparison of the growth of disciplines to the growth of the courses which constitute the disciplines, shows that courses have increased or their curricula been revised more extensively than an increase in the disciplines offered. This can be taken as an institute's qualitative growth, a factor which results in more efficient usage patterns, internal re-organization and

and modification to the physical plant.

Variation in
requirements
of courses

The requirements of courses in teaching/ learning spaces also vary as demonstrated by the number of hours a type of space is used by some courses in table 5.6.2.

Any change in the curriculum causes the use of facilities to change with greater demand for a particular type unless the spaces are capable of multi-use.

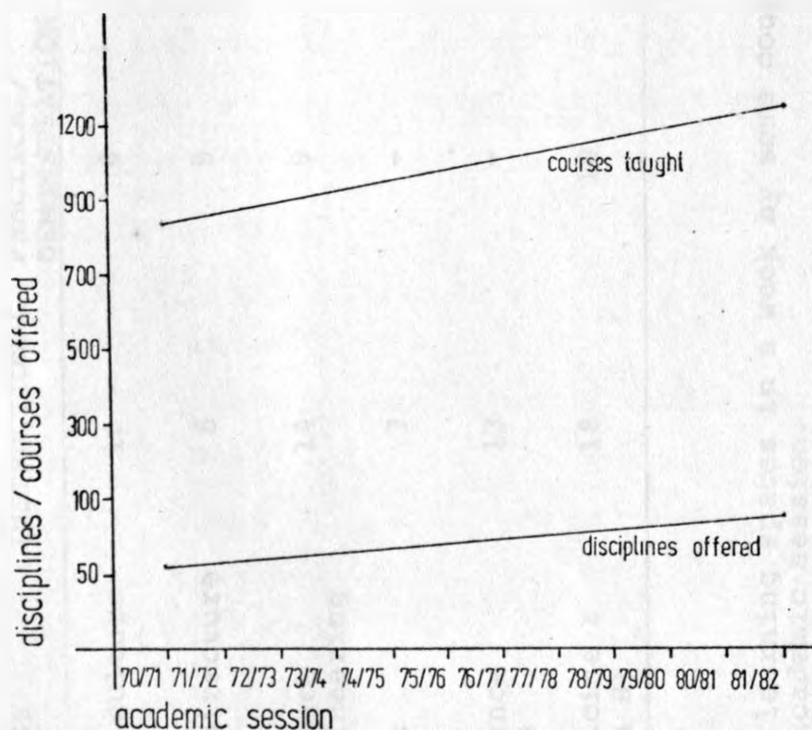


Figure 5.6.1

Growth in the number of disciplines offered and the courses taught at the University of Nairobi 1970 - 1982.

UTILIZATION OF TEACHING/LEARNING SPACES (USAGE HOURS PER WEEK):

DISCIPLINE/COURSE	INSTRUCTIONAL	PRACTICAL/ DEMONSTRATION	EXCHANGE	RESOURCE	SUPPORT	REMARKS
Bachelor of Agriculture BSc. (Agric.)	16	6	-	-	6	Undergrad - 3 yrs
Bachelor of Architecture B.Arch	8	9	3	-	2	Undergrad - 5 yrs
Bachelor of Science BSc. (Eng), Engineering	14	9	1	1	1	Undergrad - 3 yrs
Bachelor of Arts B.A. Sociology	7	-	9	-	4	Undergrad - 3 yrs
Bachelor of Science BSc. Mathematics	13	-	8	-	12	Undergrad - 3 yrs
Bachelor of Medicine & Surgery (M.B. Ch B)	18	10	-	-	4	Undergrad - 5 yrs

TABLE 5.6.2

Use of teaching/learning spaces in a week by some courses undertaken at the University of Nairobi in the 1981/82 academic session.

Variation
in require-
ments in
sessions

The situation is further complicated by the fact that the requirements may also vary in a semester or academic session. This results in under-utilization of some types of spaces in certain periods of the year as shown in table 5.6.3.

Course
options
and
combinations

Different course options and combinations also result in the need for more instruction space of smaller capacity as the main student body is fragmented into smaller groups which have to be tutored separately.

One such case is the undergraduate programme of Zoology where specialization is possible in the curriculum as,

- 3:1:1 Three subjects in year 1, one in remainder
- 3:2:1 Three in year 1, two in year 2, one in year 3
- 3:2:2 Three in year 1, two in year 2, two in year 3.

Subject	Terms 1 & 3: (Academic Tutoring (USAGE HOURS PER WEEK)			Terms 2: Major Project (USAGE HOURS PER WEEK)		
	INSTRUCTION	PRACTICAL/ DEMONSTRATION)	RESOURCE	EXCHANGE	FIELDWORK
Higher Surveying	2	2)			
Computations	2	3)			
Geodesy/Photogrammetry	2	4)	4	1	12
Major Project	0	3)			
Management for Surveyors	2	1)			
TOTAL	8	13		4	1	12

TABLE 5.6.3

Variation in the use of teaching/learning spaces by postgraduate diploma course of Geodesy & Photogrammetry at the University of Nairobi in one academic session.

This results in large capacity spaces in year one, gradually getting smaller as the course continues. The 3:1:1 students also have to be provided with workstations of higher calibre since they are expected to undertake research with practical orientated teaching/learning methods.

Curricula changes

Curricula changes invariably result in rescheduling the use of spaces, change in the course durations and introduction of specialized support spaces such as dark rooms, radio-active sources, electron microscopes etc., making additional demands on the services distribution.

Additional spaces required

Increases in course durations cause a shortage of spaces as those available are occupied for longer intervals with the resulting need for additional spaces.

Since curricula changes result from incorporation of research findings, research facilities when added to higher education institutes result in more frequent changes than when the research findings come from beyond the establishment.

5.7

METHODS AND TRENDS OF TEACHING AND LEARNING

Various methods have evolved in the dissemination of knowledge each with its own requirements. Their constant development through educational psychology and new aids have caused frequent changes in the physical plant and still newer methods.

Methods
currently
in use

The main teaching/learning methods currently in use at the University of Nairobi are,

- Traditional classroom type instruction using chalk/blackboard.
- Group teaching, discussion and exchange method of teaching/learning.
- Display of information e.g. physical display such as pin-up or processed material in the form of audio-visual display.
- Practical/demonstration such as medical surgery, drama, workshops, laboratories, skill development etc.
- Resource reference such as libraries, data banks etc.

Effects on
physical
facilities

The direct effect on the physical facilities is demonstrated by a study in capacity, staff to student ratio and internal floorspace utilization of a space 10 x 10 meters (area = 100 square metres), with the hypothetical superimposing of the teaching/learning methods on it.

Data
source

The data for this study was obtained from Disciplines's Space Use Analysis of the physical' survey, (see 3.2) . The data was mathematically adjusted for an area of 100 square meters for an uninterrupted 2 hours student contact time.

The results are shown in figures 5.7.1 to 5.7.4

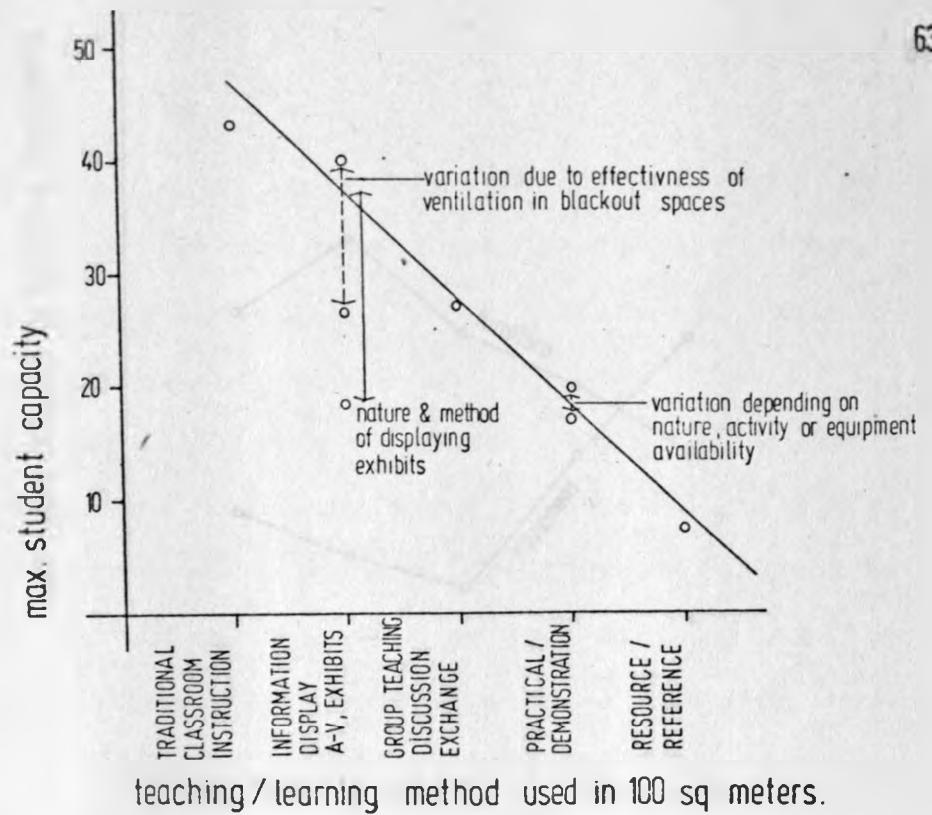


Figure 5.7.1

Variation in the maximum capacity of a space using different teaching/learning methods.

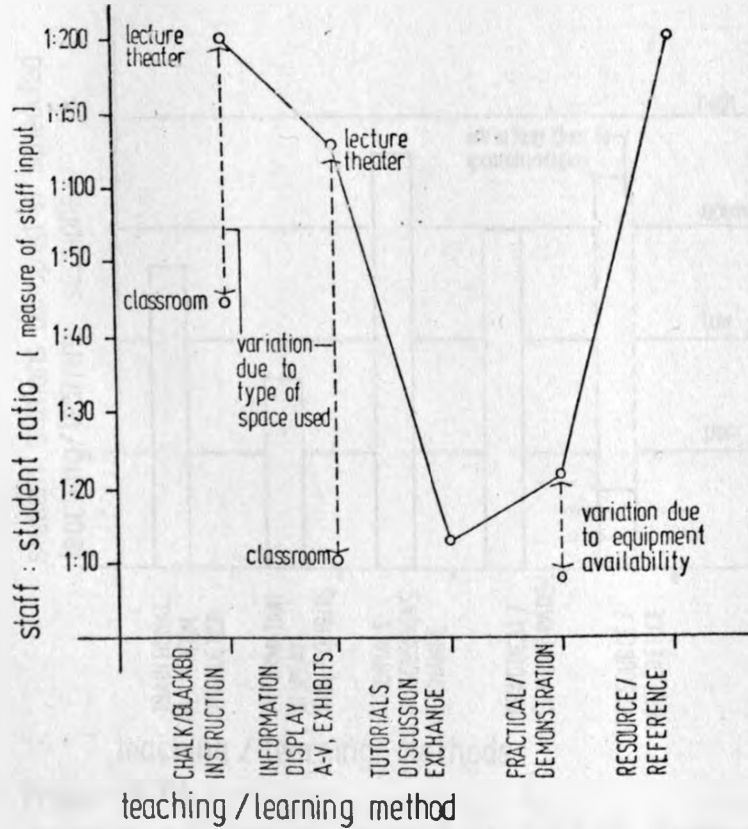


Figure 5.7.2

Variation in the staff:Student ratio using different teaching/learning methods.

student stations occupied in scheduled teaching/learning sessions

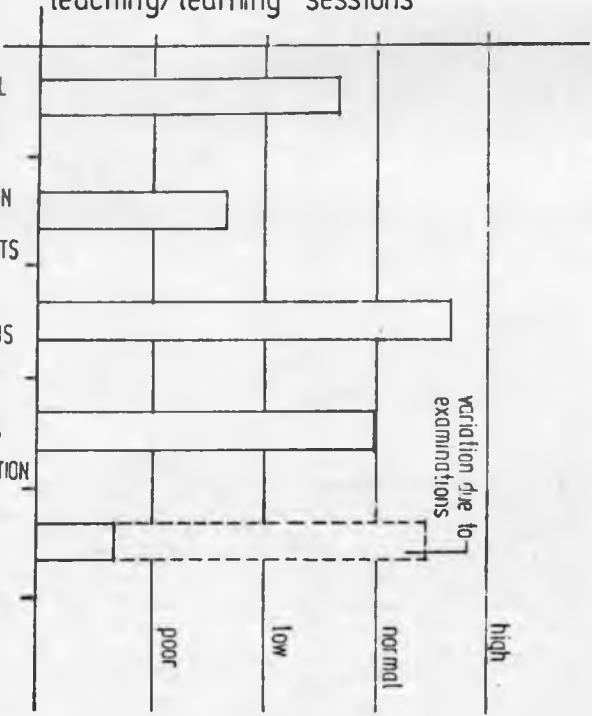
teaching / learning methods

- TRADITIONAL CLASSROOM INSTRUCTION
- INFORMATION DISPLAY A-V, EXHIBITS
- TUTORIALS DISCUSSIONS EXCHANGE
- PRACTICAL / DEMONSTRATION
- RESOURCE / REFERENCE

variation due to examinations

poor low normal high

Figure 5.74. Number of spaces occupied during different teaching methods in scheduled use of spaces



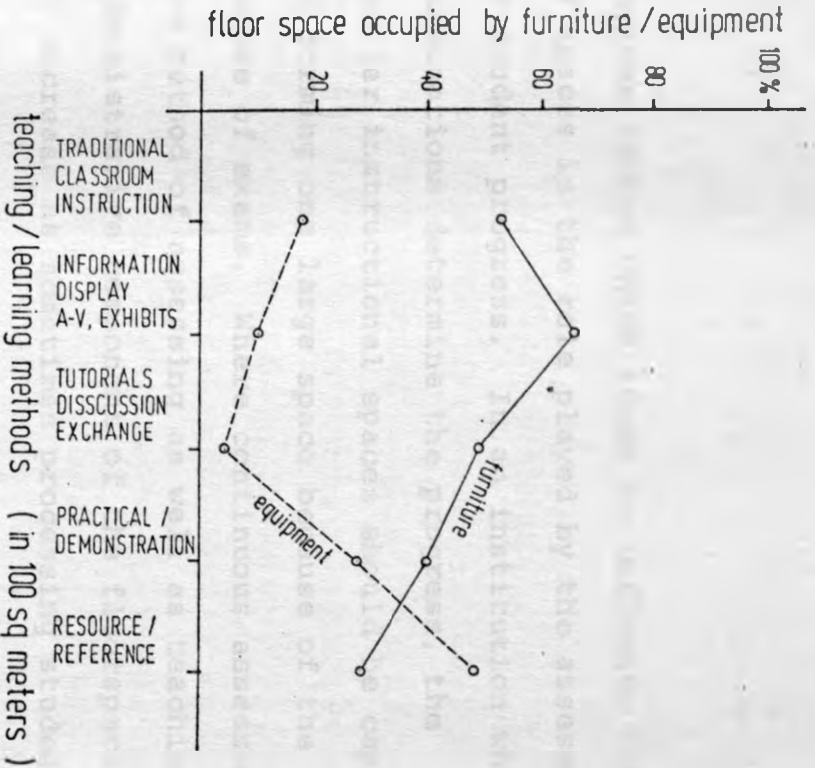


Figure 5.7.3.

Floorspace Utilization for Equipment/
Furniture by various teaching methods

**Assessment
procedures**

Another factor which tends to influence the use of spaces is the role played by the assessment of student progress. In an institution where examinations determine the progress, the smaller instructional spaces should be capable of forming one large space because of the very nature of exams. Where continuous assessment is the method of assessing as well as teaching, the administrative component of the floorspace tends to increase as sometimes processing student progress may require a support staff or computer facilities.

5.8 RESEARCH AND CONSULTANCY POLICY

Types of
research

Research in higher education is of two types - mandatory research, that which is required by a course curriculum and applied research, that which arises out of necessity. Both invariably evolve because of the very nature of higher education or as in the University of Nairobi, due to the necessity of local staff development programmes which is of a mandatory nature.

An institution's research calibre is a measure of its source for technological and cultural advancement but this only commences when the institution can spare the resources from its primary task, that of graduate manpower.

Difficulties
created

Thus both research and consultancy services evolve with time resulting in congestion in facilities as these have not been designed to accommodate them.

Effect
at
U.O.N.

At the University of Nairobi, research and consultancy has not been a major factor in the growth of physical facilities. Mandatory research has been accommodated in existing instruction, exchange or support spaces as potential staff are treated as 'junior staff' while training. Consultancy in this campus has

been recently started, and so is accommodated in the administrative spaces. Both may attain a level when special spaces for them would have to be added.

Effect on facilities

A more direct effect on the facilities is the increase in mainly support and even academic staff which has to be accommodated to man the research and consultancy programmes when the volume of work justifies it.

Curriculum revision

The research also contributes to curriculum revision which in turn may affect the facilities.

Income

Research and consultancy can generate some income which enables complex equipment used in these to be provided for, mainly affecting the space available and the services distribution on which the equipment relies.

Intermittent use

The utilization of research and consultancy spaces is intermittent with layouts often specialized or purpose built. A system in which they may be better utilized can be an advantage when justifying their incorporation to the system.

5.9 INSTITUTE AND DISCIPLINE SIZE POLICY

Role at
National
level

To establish the size and complexity of a higher education institute, its role in manpower training at national, regional or town level must be defined and any change in this role, changes the activities in the institute and its physical space needs. As resources permit new institutes are created which assume the role of the predecessors. These in turn can be upgraded to higher training levels or specialize in certain fields changing the use and needs of the existing physical plant. Such a situation has been the movement of the Faculty of Education from the University of Nairobi to Kenyatta University College in the 1977/1978 academic session. This required the upgrading of Kenyatta University College to offer full time degree courses in addition to diploma as well as a more specialized role to both institutions at the national level.

Upgrading
institutes

Effects
of role
changes

Effects of this move were the modification and change in the usage pattern of both facilities plus the adoption of spaces which had been designed for educationalists by other disciplines.

Discipline
size

At a smaller scale the maximum enrollment possible in a discipline for it to function in manageable proportions, should also be defined so as to alert educational planners to the need for a new facility for the discipline. Lack of definition has often caused changes in the physical facilities which have made a discipline unmanageable or the increase in enrollment has been negligible when compared to the cost involved.

Utilization
rates

Another factor which has caused underutilization and the ever present demand for more space has been the territorial attitudes of individuals to spaces at the University of Nairobi. This has also been caused by most of the spaces being purpose built rather than capable of multi-disciplinary use, an architectural design parameter that can reduce the amount of space needed. It does, however, require a central scheduling system to ensure smooth continuity and standardization of course durations.

space
economy

5.10 FINANCIAL SOURCES AND PROGRAMMING

Types of
expenditure

All institutes have to budget for,

- Recurrent expenditure: running and maintenance costs
- Capital Expenditure: new facilities or modifications to existing.

Effect
of sources

The source of financing for these can cause changes in the physical facilities. A source such as a government may dictate the enrollment, growth, role at national level or research and consultancy policy all of which influence the facilities or their use. When higher education is provided on a commercial basis, the facilities have to compete with those of new institutes.

Surplus finances invariably result in greater growth or changes to the existing often unnecessary expansion.

U.O.N.
case

The trend at the University of Nairobi has been a drop in the growth of facilities, which is a measure of capital expenditure, whenever enrollment has increased, which is a measure of recurrent expenditure. This is demonstrated by Fig. 5.10.1

Programming
at national
policy
level

Programming of higher education may affect the physical space requirements of institutes. The restructuring of the entire educational system in Kenya as recommended by the Presidential Working Party on the Second University means that the University of Nairobi's space requirements will change. These recommend that the duration at tertiary level of education be longer by having a year of pre-university training. This means that basically the volume of student body will increase with a resultant increase in facilities. Work/study programmes can also have a similar effect as the duration of courses also increases.

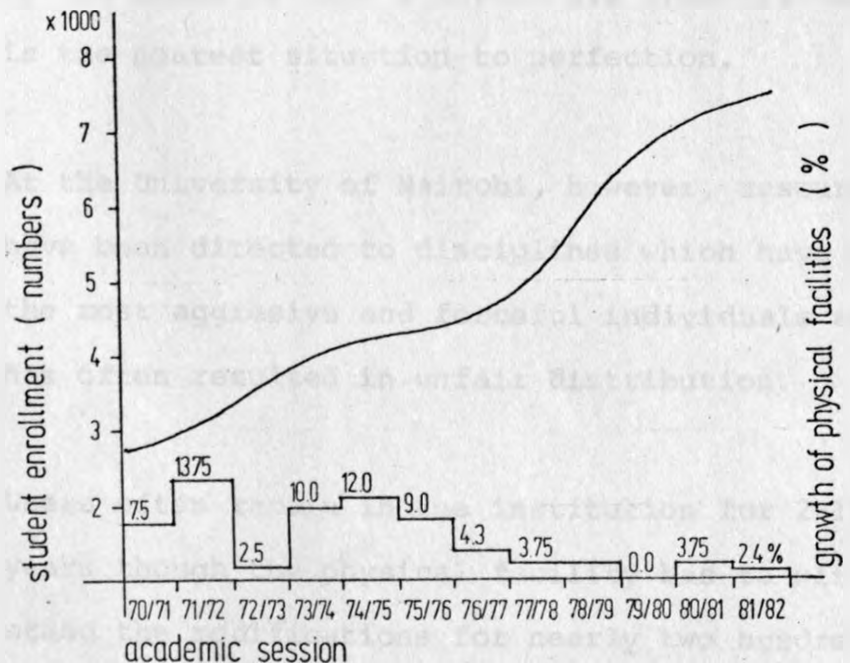


Figure 5.10.1

Growth of student enrollment and the corresponding annual growth in facilities at University of Nairobi, 1970 - 1982.

5.11 INSTITUTIONAL STRUCTURE

Resourcefulness & competence of bodies governing growth

The management of an institution, both academically and non-academically, may create changes in the physical facilities. The instruments existing in the set up that define the directions and growth trends in academic spaces influence these by their competence and resourcefulness in defining and accomplishing their priorities. A well conceived policy enables the most appropriate changes or additions so as to avoid continual complaints by the users of the facility. A system of construction which enables adjustments to spaces by the users or with a little aid from craftsmen is the nearest situation to perfection.

Possible solution

U.O.N. case

At the University of Nairobi, however, resources have been directed to disciplines which have had the most aggressive and forceful individuals and has often resulted in unfair distribution.

Users often remain in the institution for 2-15 years though the physical facility has to withstand the modifications for nearly two hundred plus years. Thus it is crucial that the changes brought about be given careful forethought to avoid reversals by new users.

The institutional structure² and the roles the various bodies play in the management at the University of Nairobi is shown in Fig. 5.11.1.

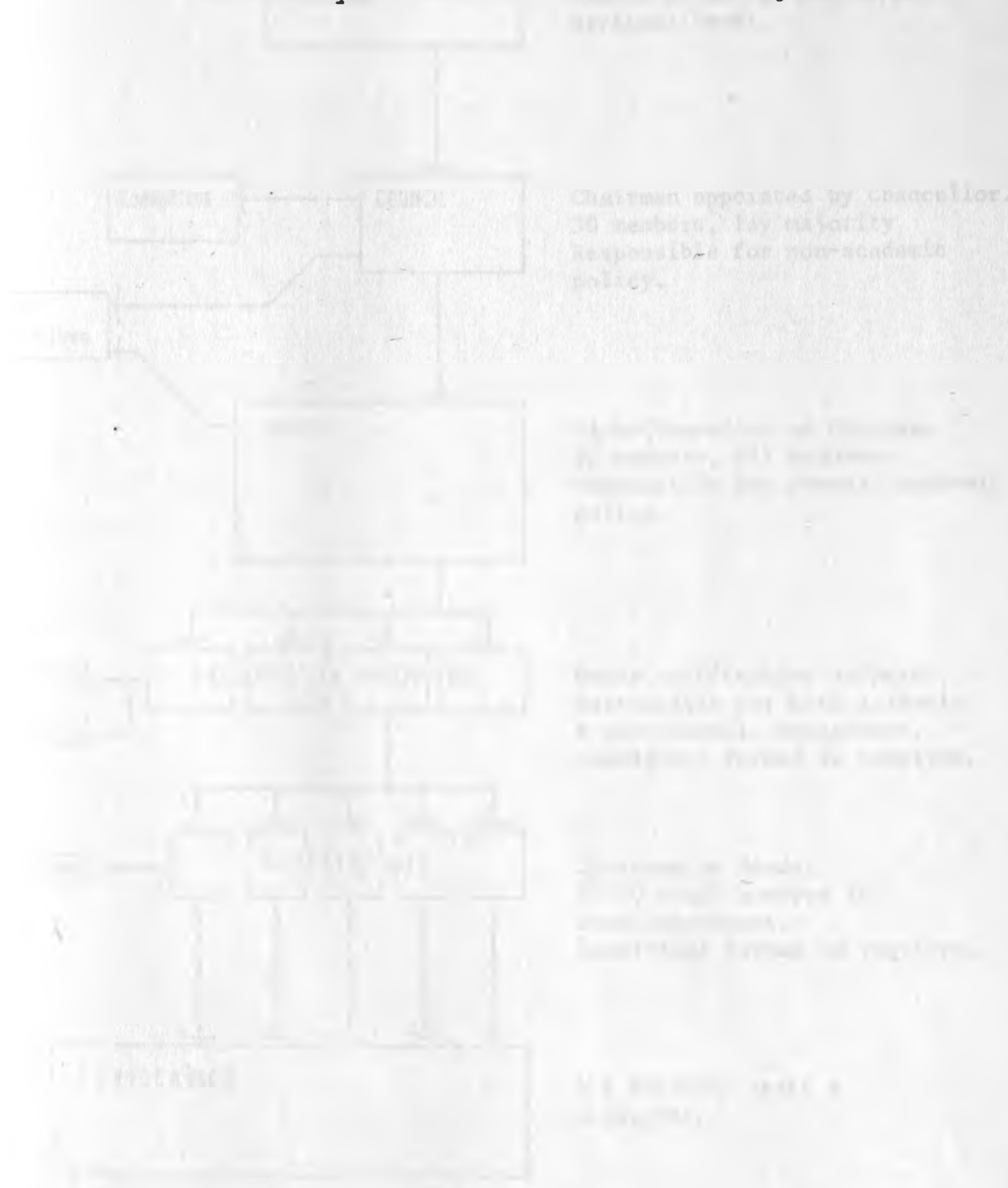


Fig. 5.11.1 Institutional structure and roles of the various bodies at the University of Nairobi.

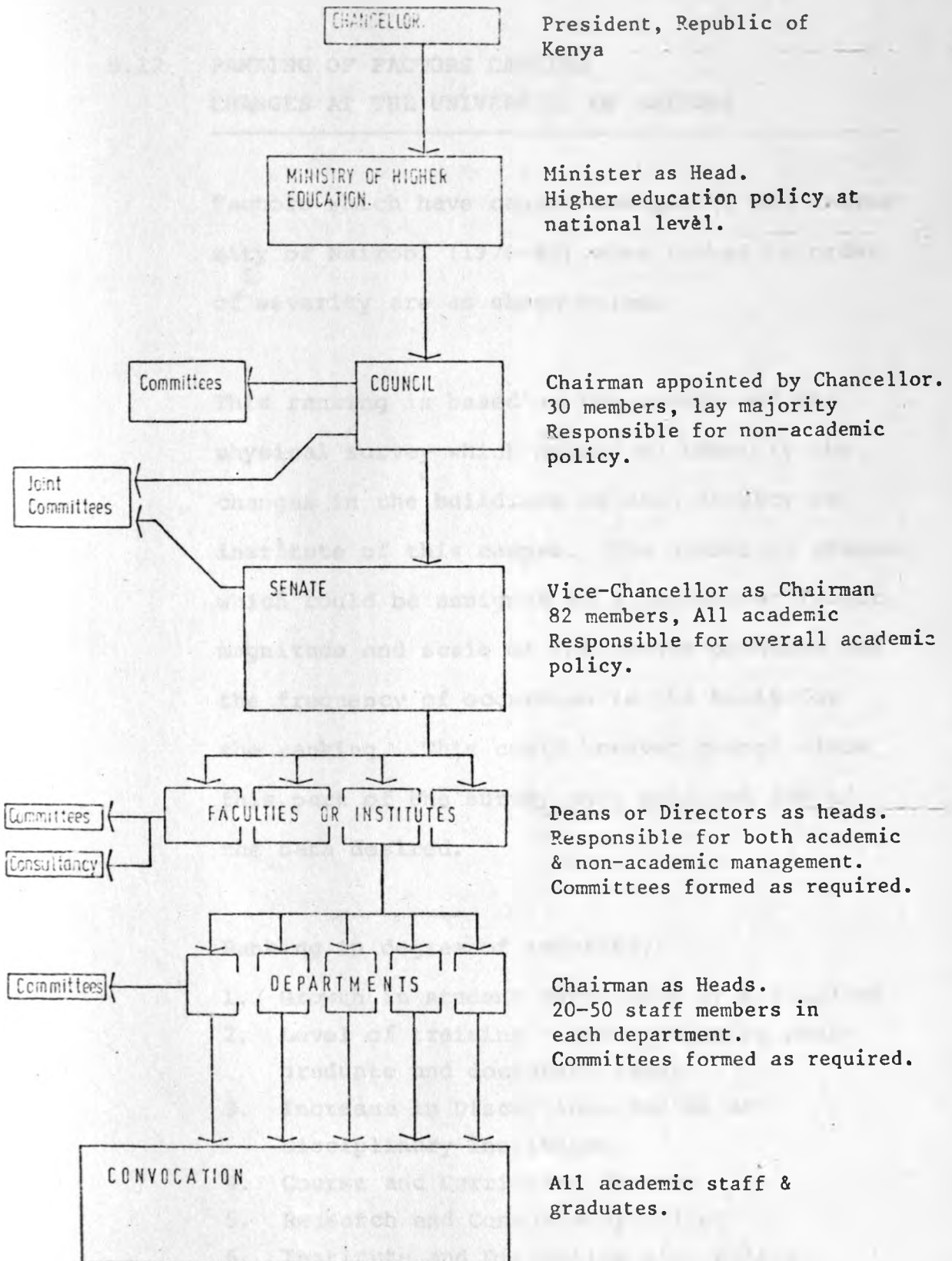


Fig. 5.11.1

Institutional Structure as exists at the University of Nairobi, 1981/82.

5.12 RANKING OF FACTORS CAUSING CHANGES AT THE UNIVERSITY OF NAIROBI

Factors which have caused changes at the University of Nairobi (1970-82) when ranked in order of severity are as shown below.

This ranking is based on the results of the physical survey which helped to identify the changes in the buildings of each faculty or institute of this campus. The number of changes which could be assigned to a particular factor, magnitude and scale of the change produced and the frequency of occurrence is the basis for the ranking. This could however change since this part of the survey only produced 50% of the data desired.

Ranking in degree of severity:-

1. Growth in student enrollment by discipline
2. Level of training - undergraduate, post-graduate and doctorate level
3. Increase in Disciplines and Inter-Disciplinary Institutes
4. Course and Curricular Changes
5. Research and Consultancy Policy
6. Institute and Discipline Size Policy
7. Increase in Academic and support staff

Factors which have not varied considerably over the period 1970-82 and thus have caused

negligible changes are,

- Full-time, part-time work/study courses
- Methods and trends of teaching/learning
- Financial sources and programming
- Institutional Structure

5.13 INTERNATIONAL RANKING OF FACTORS OF
CHANGE

Factors of expected changes in Universities according to a world-wide survey conducted through the auspices of UNESCO³, of which University of Nairobi was not a sample, ranks as,

Source: Onushkin V.G. et al.
Planning the Development of Universities
I & II, UNESCO - Paris 1973

Ranking of expected changes by importance

- 1 Increasing the volume and sources of financing.
- 2 Expanding facilities.
- 3 Changing the curriculum to fit changing needs.
- 4 Expanding numbers of teaching and research staff.
- 5 Changing the structure to fit changing needs.
- 6 Increasing student applications.
- 7 Increasing student enrollment
- 8 Improving the quality of teaching and research staff.
- 9 Increasing the number of student applications relative to the number of places available.
- 10 Narrowing the gap between distribution of graduates by field and manpower needs
- 11 Improving the quality of incoming students
- 12 Increasing refresher course offerings
- 13 Responding to the demand for continuing education for persons in all walks of life.
- 14 Increasing the participation of students in university governance.

Ranking of changes in probable order of realization

- 1-2 Improving the quality of teaching and research staff.
- 1-2 Increasing the participation of students in university governance
- 3 Changing the curriculum to fit changing needs
- 4 Expanding the number of teaching and research staff.
- 5 Changing the structure to fit changing needs
- 6 Increasing refresher courses offerings
- 7 Increasing student application
- 8 Improving the quality of incoming students
- 9 Changing the amount and type of research within the university.
- 10 Narrowing the gap between distribution of graduates by field and manpower needs.
- 11 Increasing student enrollment
- 12 Expanding facilities
- 13 Responding to the demand for continuing education for persons in all walks of life
- 14 Increasing the number of student applications relative to the number of places available.

The differences in the ranking of factors between those of the University of Nairobi and the world-wide survey can be explained as,

- The U.O.N. is a growing institution with present enrollment at 8000. The world-wide survey samples had an average enrollment of 12,000.
- The U.O.N. has been operating as the sole university in Kenya for 12 years. The survey samples had average operational periods of 50 years and were part of a larger university system comprising several institutions.
- The U.O.N. has devoted its efforts to train its local staff and research and consultancy have not reached a level where they make extensive demands on the facilities.
- Courses and curricula changes have resulted from the need to make them more appropriate to national development needs at the U.O.N. as 65% of the samples from the world-wide survey were from developed countries.
- Enrollment at the U.O.N. has been predominantly full-time with no change in emphasis to part-time or refresher courses.

FOOTNOTES

¹UNESCO/Architectural Press, Planning Standards for Higher Education Facilities pp 38-41 (Paris, 1975).

²University of Nairobi, Academic Calendars 1970-1982 (Nairobi: University Press)

³V.G. Onushkin et al, Planning the Development of Universities Vol. I & II pp 105-138 (Paris: UNESCO/Architectural Press 1973).

6. TYPES OF CHANGES IN PHYSICAL FACILITIES

6.1 DEFINITION

The term change in this study is the adaptation of the built form or envelope of a higher education facility to changing user needs or habits.

Types of changes.

These changes can be quantitative as addition of new floorspace or additional services. Qualitative changes such as internal re-organization of rooms or equipment for higher level of teaching/learning or redistribution of services without any physical additions, is a more difficult change to identify and often occurs more frequently.

6.2 FACTORS AND METHODS USED FOR CLASSIFYING CHANGES

Method

The nature, scale and frequency of modification, addition or replacement the built form has to undergo is the primary method used in classifying changes.

Factors

This method can be resolved into four distinct factors which determine the classification of changes:

- Frequency of the changes
- Components in the built form affected by changes.
- Cost of conversion, addition or replacement during change.
- Adaptability of the components affected to the new uses.

6.2.1 Frequency

Most higher education buildings have a life expectancy of 200 years plus. However the frequency of change may be as short as 0-3 years in such areas as workstation layouts or as long as 60 years plus in the main built enclosure. The first users, instrumental in the design of the building, will probably retire or change institutions within the first 12 years

increasing the chances of changes to the physical plant.

Survey
difficulties

Difficulties in determining the change periods at the University of Nairobi were,

- 30% of the buildings are older than 15 years.
- inadequate records exist of the space utilization, re-organization within the establishment beyond 3 years.
- available records show quantitative changes with the qualitative being impossible to sufficiently determine through survey, due to the high staff changeover rate.

Change
frequency
adopted

The change frequency defined by the IPPS/RIBA conference of 1969¹ has been adopted in this study and is set out as (refer 6.3),

- Frequent/Often (0-3 years)
- Occasional (3-7 years)
- Infrequent (7-20 years)
- Seldom (20 years +)
- Rare or Never (60 years +)

6.2.2 Components

Components of the built form which are affected by changes can also be associated to the frequency of changes. This was determined through the understudy of the changes which occurred at the University of Nairobi, though insufficient data prevented the absolute confirmation of this.

These can be identified as,

- Frequent/Often: workstation & equipment layout.
- Occasional : services distribution
- Infrequent : space partitioning
- Seldom : provision of services & replacement of services plants.
- Rare or Never : superstructure + built enclosure.

6.2.3 Costs :

The cost incurred in the conversion or modification of the physical plant also influences the classification. Most components can be modified more economically if planned or designed for modification initially.

A built enclosure which is capable of receiving a multitude of internal activities by the user would be ideal, but only feasible if the changes

Cost Indices of Higher Educational Spaces relative to the cost of one classroom space (classroom = 1.00)

Source: ²Planning Standards for Higher Education Facilities
UNESCO/Architectural Press, 1979.

ROOM TYPE	COST INDICES	ROOM TYPE	COST INDICES
<u>Lecture Theatre</u>			
- " " with demonstration bench	2.20	- measuring room (no climate control)	1.57
- " " without	2.20	- measuring room (climate control)	2.35
- " " special types	2.20	- measuring room (climate control, vibration free)	2.50
- Large assembly/meeting hall	2.20	- engine testing stand	2.50
<u>Seminar rooms training room, group work room</u>			
	1.00	- kilns	2.50
<u>Student work rooms</u>			
- student work room	1.00	- optical lab. (up to 750 kg/m ³ , natural ventilation, not serviced)	1.57
- drawing room with simple tables	1.00	- optical lab. (up to 750 kg/m ³ , mechanical ventilation, serviced)	2.35
- drawing room with drawing machines	1.00	- optical lab. above 750 kg/m ³	2.50
<u>Instruction/Language Laboratories²</u>			
(time tabled, larger groups)		- armoured room	2.35
- instructional room, microscope room	2.35	- physics lab. (natural ventilation, up to 750 kg/m ³ , not serviced)	1.57
- language laboratory	2.35	- physics lab. (mechanical ventilation, up to 750 kg/m ³ , serviced)	2.35
<u>Intensive practical work</u>			
(time tabled, small groups)		- physics lab. (above 750 kg/m ³)	2.50
- practical work with experimental set-ups	2.35	- radio active work room (light protection)	2.35
- anatomical dissection	2.35	- radio active work room (heavy protection)	2.50
- other practical work	2.35	- aerodynamics, hydrodynamics (upto 750 kg/m ³)	2.35
<u>Longterm practical work, work places for students, experimental work</u>			
	2.35	- aerodynamics, hydrodynamics (above 750 kg/m ³)	2.50
<u>Teaching and demonstration arrangements, preparation, and ancillary areas for A1 - A6:</u>			
- teaching and demonstration arrangements	1.00	- applied chemistry (natural ventilation, up to 750 kg/m ³ , not serviced)	1.57
- preparation for A1 - A6	1.57	- applied chemistry (mechanical ventilation, up to 750 kg/m ³ , serviced)	2.35
- material distribution	1.00	- applied chemistry (above 750 kg/m ³)	2.50
<u>Desk-type working places for staff, drawing places, sitting and conference rooms</u>			
- desk-type work place with conference	1.00	- vacuum technical lab.	2.35
- desk-type work place without conference	1.00	- balance room	2.35
- dictation cubicle	1.00	- centrifuge room	2.35
- desk-type work place with experimental work place	1.00	- other places for experimental work	2.35
- desk-type work place with archives	1.00	<u>Experimental halls technical schools</u>	
- desk-type work place with non-public library	1.00	- experiment halls	2.35
- drawing offices not for use by students	1.00	- heavy laboratories	2.50
- sitting and conference rooms, etc.	1.00	<u>Library</u>	
<u>Ancillary Areas</u>			
- experimental work room for arts	1.00	<u>Book shelves areas (and journals)</u>	
- acoustical experiments (up to 750 kg/m ³)	1.57	- library b (books not in store)	1.00
- acoustical experiments (above 750 kg/m ³)	2.35	- bookstorage	1.00
- bacteriology, biochemistry, biology lab. (mechanical ventilation, not serviced)	2.35	<u>Library ancillary</u>	
- bacteriology, biochemistry, biology lab. (mechanical ventilation, serviced)	2.35	- public catalogue	1.00
- chemistry lab. (up to 750 kg/m ³)	1.57	- exhibition area	2.20
- chemistry lab. (up to 750 kg/m ³) mechanical ventilation, serviced)	2.35	- book lending	2.20
- chemistry lab. (above 750 kg/m ³ , mechanical ventilation, serviced)	2.50	<u>Reading places</u>	
- electr. microscope, Rontgen (up to 750 kg/m ³)	2.35	- reading places	1.00
- electr. microscope, Rontgen (above 750 kg/m ³)	2.50	- reading places with bookshelves areas	1.00
- electr. eng. lab. (up to 750 kg/m ³)	2.35	- conference room	1.00
- electr. eng. lab. (above 750 kg/m ³)	2.50	- microfilm reading place	1.00
- plant cultivation etc.	2.35	- individual work room	1.00
- surveying, special room (no climatic control)	1.57	<u>Computer Centre (all)</u>	
- surveying, special room (climatic control)	2.35		1.57
- high voltage lab. (up to 3m high, up to 750 kg/m ³)	2.35	<u>Animal experiment labs., Animal house (all)</u>	
- high voltage lab. (up to 3m high, above 750 kg/m ³)	2.50	(large animals, small animals, aquaria, labs, etc.)	1.57
- high voltage lab. (over 3m high)	2.50	<u>Workshops (all)</u>	
- climate control room (up to 750 kg/m ³)	2.35	(glass blowing, mechanical, electronics, electrical engineering, woodwork, plastics)	2.35
- climate control room (above 750 kg/m ³)	2.50	<u>Stores, Collections, Archives</u>	
- crystallization room	2.35	- Archives	1.00
- illumination eng. - measuring (over 3m high)	2.50	- General Stores	1.57
- metallurgy room	1.57	- Collections	1.00
		- Cold room	2.50
		- Animal food room	1.00
		<u>Reproduction, photography, printing</u>	
		- Photo lab	1.57
		- Printing	2.35

can be economically effected by the users. This means components and systems which lend themselves to easy replacement, modification or addition.

UNESCO
cost
indices

To classify changes the costs incurred during conversion, addition or replacement are as developed by UNESCO.² These are relative capital cost indices of various higher educational spaces, relative to the cost of one classroom (classroom cost index = 1.00) which is the least expensive space. Table 6.2.3 lists these cost indices.

6.2.4 Adaptability :

Severity
of
components
affected

When a change occurs, the components of the built fabric affected, are a measure of the magnitude and scale of the change.

These components can be grouped into three distinct types,

- Primary : foundations, superstructure, stairs, walling, glazing etc.
- Secondary : services, plants such as boilers, electricity, water/drainage mains, PABX etc.
- Tertiary : distribution of above services partitioning, activity distribution, workstation/equipment layout etc.

The adaptability of these components from their previous use to new use is crucial in reducing the cost incurred and the number of components affected during change.

...

...

- 1. ...
- 2. ...
- 3. ...
- 4. ...

...

- ...
- ...
- ...
- ...
- ...

6.3. CLASSIFICATION

As mentioned earlier, it was difficult to classify changes (refer 6.2.1) at the University of Nairobi mainly because of insufficient data and the institution's buildings being relatively new.

Classification
adopted

However a classification developed in the 'IPPS/RIBA Conference 1969: The design of Physics Buildings¹," was tested with the data available at the U.O.N. and adopted as an acceptable classification in this study. The tests were conducted on the basis of the four main factors namely,

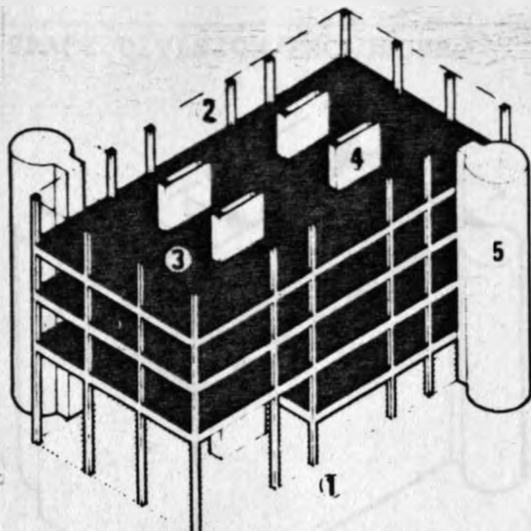
- Frequency of Change
- Components affected
- Cost incurred
- Adaptability to changes

Classification

This classification can be defined by change prediction as,

- Never : 60 yrs + fixed
- Seldom : 20 yrs + fixed
- Infrequent : 7 - 20 yrs
- Occasional : 3 - 7 yrs
- Frequent/Often: 0 - 3 yrs.

SUPER STRUCTURE/SUB-STRUCTURE

CHANGE
PREDICTION

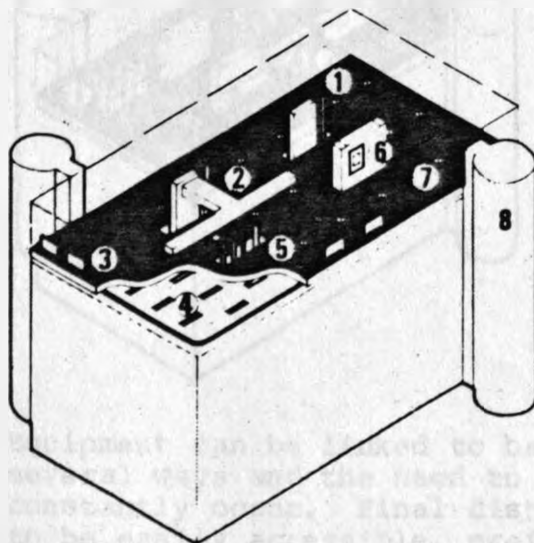
never
60 yr + fixed

- 1 foundations
- 2 columns
- 3 floors
- 4 vertical ducts
- 5 vertical circulation

The main structure is usually expected to last without change for the lifetime of the building. A standard floor loading and a uniform ceiling height will allow normal work to take place anywhere on upper floors, with usually large or heavy work being restricted to the ground floor.

Working areas can be kept clear by grouping vertical circulation. Vertical service ducts serve areas whose size is determined by gravity drainage within the floor/ceiling zone. Adequate provision should be made for additions of floor-space upto a pre-determined limit.

SERVICES PROVISION/PLANT

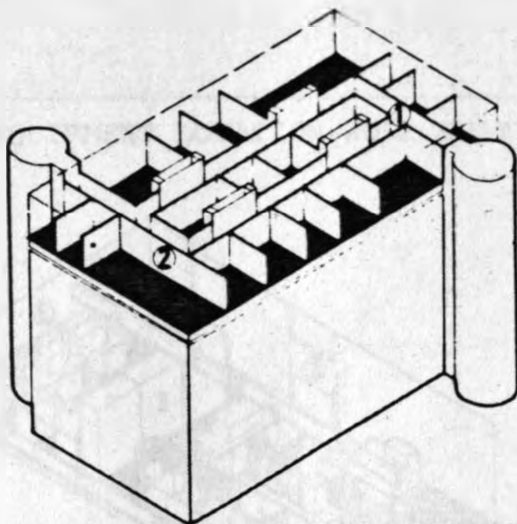
CHANGE
PREDICTION

seldom
20yr+ fixed

- 1 drainage - riser
- 2 ventilation - branch
- 3 heating - outlet
- 4 lighting - outlet
- 5 water - riser
- 6 electricity - riser
- 7 floor hole
- 8 sanitation

Certain sections of the main distributed services are seldom changed. They may, with the renewal of some parts, last the life of the building. It is recognized that some over provision may be necessary at the start, but space can be left in ducts for the insertion of additional services later. Environmental services are arranged to allow alternative partition lay layouts.

SPACE DIVISION/ENCLOSURE

CHANGE
PREDICTION

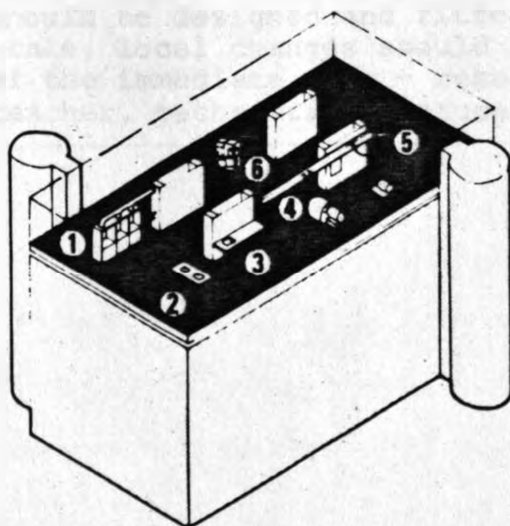
infrequent 7-20 yrs

1 corridors

2 partitions

It is predicted that some partitions may need to be moved every 7 to 20 years as a result of changes in types of activity. Sometimes users can exchange rooms rather than move partitions, but the additional cost and inconvenience of refitting the rooms has to be considered in either case.

SERVICES DISTRIBUTION

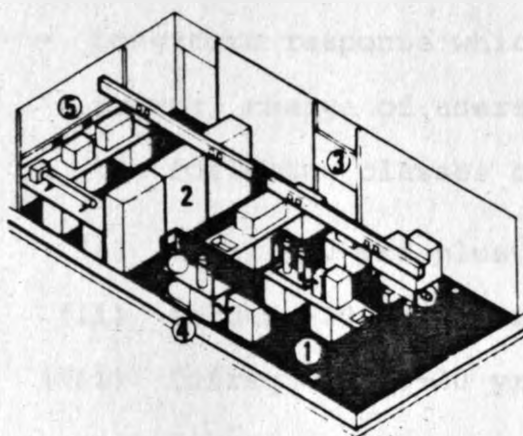
CHANGE
PREDICTION

occasional 3-7 yrs

1 fume extract -
duct2 drainage -
floor hole3 water -
spine / duct4 cooling water -
boom5 electricity -
slung wire6 vacuum -
mobile pack

Equipment can be linked to basic services in several ways and the need to make changes will constantly occur. Final distribution runs need to be easily accessible, preferably from the lab, which draws upon them.

 EQUIPMENT LOCATION/WORK STATIONS


 CHANGE
 PREDICTION

frequent / often 0-3yrs

- 1 bench
- 2 storage
- 3 display
- 4 rig
- 5 work zone

This represents the effect on the layout of furniture, storage and services of the introduction of a research work zone into a teaching laboratory. It is desirable that the lab should be designed and fitted out so that small scale, local changes should be within the control of the immediate user - research worker, teacher, technician or student.

Broader
Classification

The response of the built spaces may also be categorized in a broader context of time and components affected into,

- Long-term response which accommodates growth, change of users and involves the following classes of changes,
 - (i) Never, 60 yrs plus
 - (ii) Seldom, 20 yrs + fixed
 - (iii) Infrequent, 7-20 yrs.

- Short-term response which occurs more frequently accommodating the matamorphic growth of disciplines and involves the classes of changes,
 - (i) Occasional 3-7 yrs.
 - (ii) Frequent/Often 0-3 yrs.

Summary of
Effects on
U.O.N.

The summary of the effects on the facilities of the University of Nairobi by these factors of change identified are shown in table 6.4.1.

Table 6.4.1
Effects on the components of the physical facilities of the University
of Nairobi by the factors which cause changes.

FACTOR

GROWTH. STUDENT POPULATION BY DISCIP.
LEVEL OF EDUCATION - UG, P.G. & DOC.
INCREASE. DISCIPLINES/INTER-DISCIP.
CHANGE. COURSE, CURRICULLA
CHANGE. RESEARCH, CONSULTANCY . . .
CHANGE. INSTITUTE / DISCP. SIZE
INCREASE. ACAD. & SUPPORT STAFF

FULL TIME/PART TIME COURSES
METHODS, TRENDS, TEACH/LEARNING.
FINANCIAL SOURCES, PROGRAMMING
INSTITUTIONAL STRUCTURE.

FOOTNOTES

¹UNESCO/Architectural Press, Planning Buildings and Facilities for Higher Education, pp 86-89, (Paris, 1975).

²UNESCO/Architectural Press, Planning Standards for Higher Education Facilities, pp. 307, (Paris, 1975).

7. RESPONSE TO FACTORS OF CHANGE

Architectural
response

Having identified the factors which bring about changes in the built envelope of an institution, and studying the changes they produce, prototypical design solutions were sought. Each factor is analysed individually and architectural design mechanisms defined in concept. This is to enable future designers to incorporate the necessary level of flexibility initially, at the conceptual stage of design synthesis and eventually to detail design of work-stations and spaces.

Factor of
growth

The architectural mechanisms for each factor of change also showed that growth is an important and inevitable phenomenon to be accommodated.

Effects

Growth if uncontrolled or, not planned for initially, can often result in chaos by the

destruction of the inherent order of the constituent parts, that which enables comprehension to the observer. Another result may be the 'choking' of the system at certain point in use and hampering farther expansion and diversification.

System of
planning

Thus a system of planning should be adopted at the outset which accommodates growth in pre-defined directions, i.e. accepts additions at the open ends or completion through using space set aside for expansion.

The planning of built spaces should also permit growth by addition of more spaces, or upgrading of existing spaces for higher level of study.

Optimum
planning
system

The basic systems of planning were studied with a view to selection of the optimum, for higher education facilities.

The systems studied are;

- Nuclear : planning around a point
- Axial : planning along a line
- Branching : planning along intersecting lines
- Segmental : planning in linked segments.

FACTOR

: A system of planning to accommodate growth!

CHANGE PREDICTION

- never 60 yr+ occasional 3-7 yrs.
- seldom 20 yrs+ frequent/often 0-3 yrs.
- infrequent 7-20 yrs.

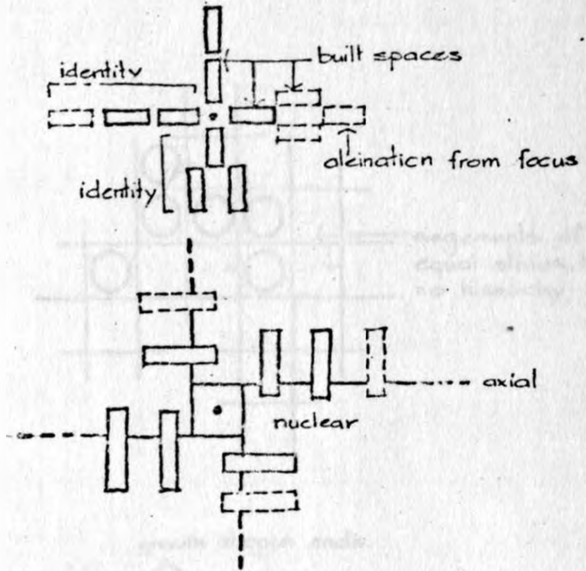
7.0 RESPONSE

Nuclear:-

The nuclear arrangement has a limit to the size of users, any growth beyond which weakens the arrangement and alienation to the peripheral elements occurs.

Identity to individual users sharing the facility is limited.

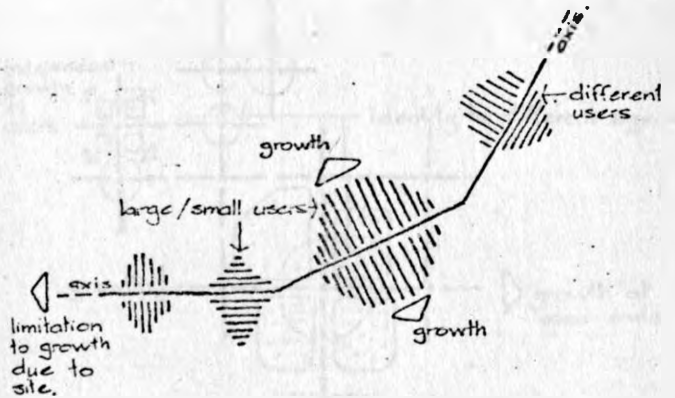
For the arrangement to function beyond the limit, other organizational patterns have to be combined.



Axial:-

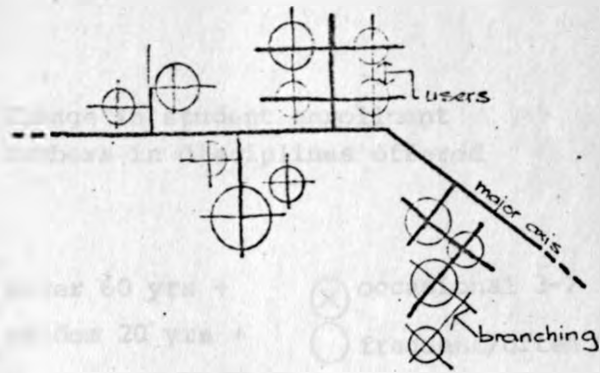
The axial system limits growth of users in two directions, but expresses a clearer identity to individual users.

However its ability to house more users is limited and relies on the combination of a branching system



Branching:-

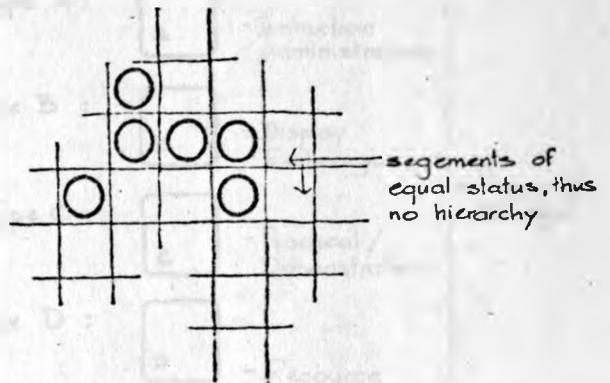
The branching arrangement accommodates more users by allowing other systems on its branches while maintaining the hierarchy of the main axis. A cohesive element such as this axis is essential in bonding together the diverse users or disciplines, but the bond being weak, encourages territorial attitudes and discourages sharing of facilities.



Segmental:-

The segmental system is capable of growth by addition to the open ends and completion within sectors.

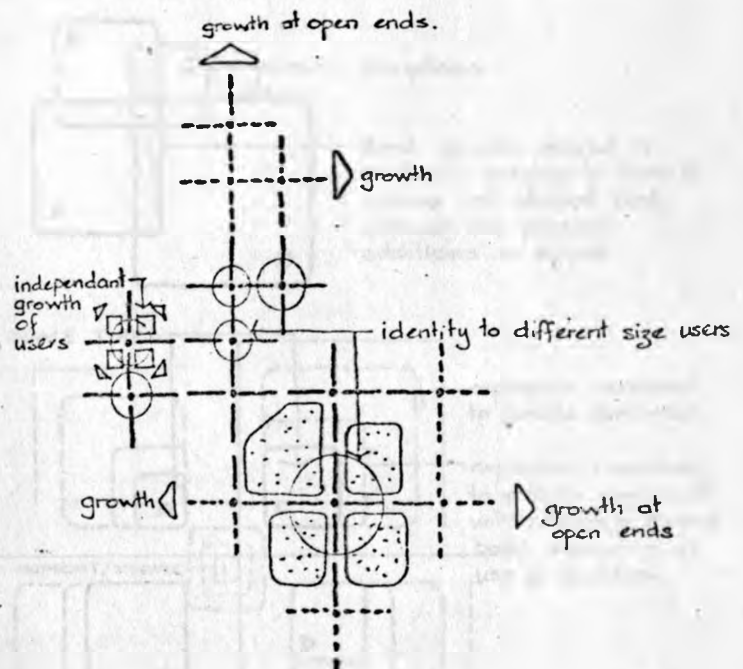
No hierarchy of any part is imminent with the result that it is the ideal system to encourage interaction and abandon territorial attitudes. However this also makes identity of individual users difficult except when confined to a complete sector.



A combination of segmental and nuclear planning is recommended as the most suitable for higher education facilities as it affords growth, encourages interaction, abandoning territories and the nuclear combination gives a sense of identity to the users within a system. A user may grow and expand around the nucleus, such as the intersection of circulation, by using up the adjoining sectors.

Since the segments show no hierarchy, a larger user may be accommodated by identifying adjoining segments around a particular nucleus to provide a larger facility yet maintaining and enhancing the inherent order. Should need arise for a reversal with time, the segments could be made to identify themselves around the other adjoining nuclei to accommodate smaller or splinter users such as inter-disciplinary research or consultancy institutes.

This principle is further elaborated in 9.3.1 - Conceptual approach for Flexibility.



hierarchy of constituent elements determined by the users with potential to change with time. users may grow or shrink maintaining the inherent order after each re-organization.

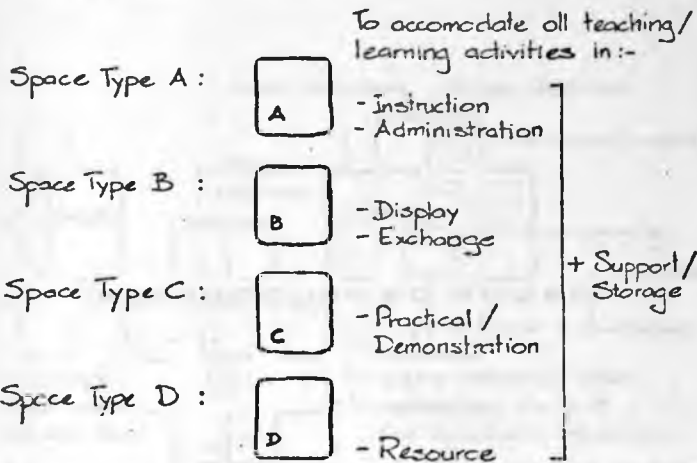
FACTOR : Change in student enrollment numbers in disciplines offered

CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

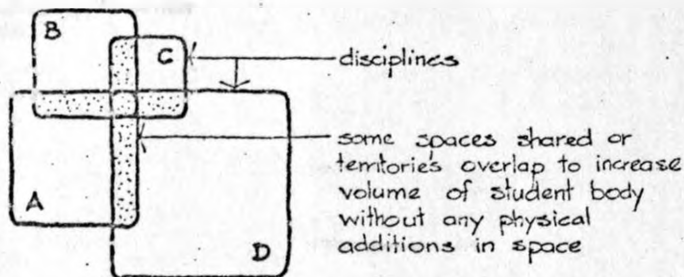
7.1 RESPONSE :

Development of spaces or types of spaces which can house more than one activity in the optimum room performance conditions.

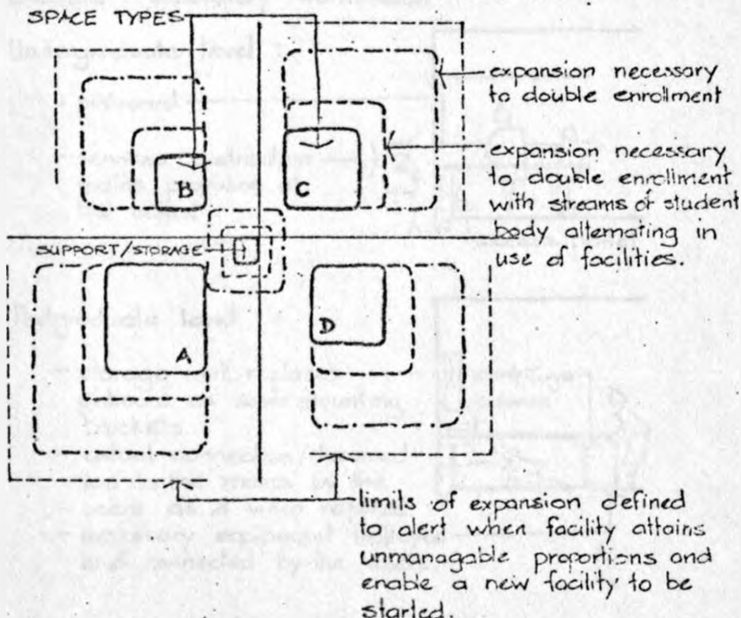
This is possible by grouping activities with common room performance requirements to produce categories. A space type with the necessary room performance requirements can be developed to accommodate all the activities in a category.



This enables disciplines to share certain spaces as the demand for more space is rarely encountered at the same time. Spaces which accommodate more activities help this as opposed to purpose built for particular disciplines.



Enrollment may also be increased by having 2-streams of student body alternating in the use of facilities, when the resultant expansion is lesser and the utilization rates of spaces increased.



The maximum limits in expansion should be defined to alert when a facility attains unmanageable proportions, to enable new facilities to complement its role. The limits should also consider the metamorphical changes that disciplines undergo and be able to accommodate that element of expansion.

FACTOR : Distribution of Student Population at undergraduate, postgraduate and doctorate level

CHANGE PREDICTION : never 60 yrs +. occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

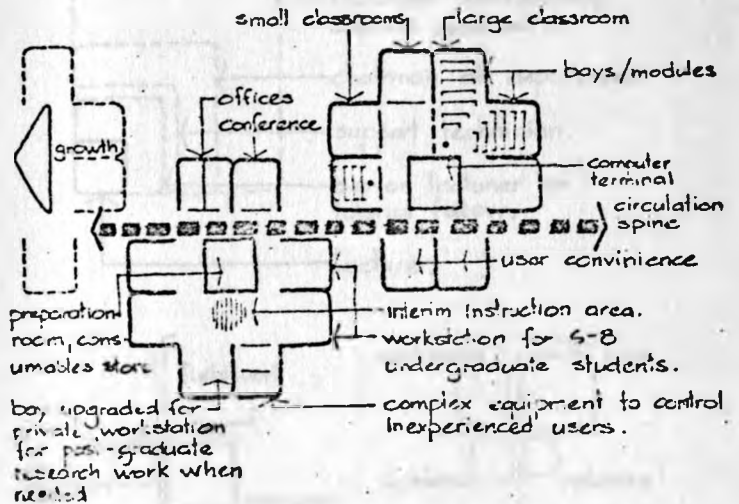
7.2 RESPONSE :

Spaces should be available in modules or bays with the potential of adding new modules as and when necessary upto a pre-defined limit.

These bays or modules should be designed for undergraduate needs with the potential of upgrading to provide the more complex post-graduate workstations by merely trolleying in the necessary equipment by the users.

This enables the facilities to efficiently cope with the intermittent demand for postgraduate workstations.

Bays or modules should also be capable of accommodating the necessary support/storage spaces, such as prep rooms, cold storage, co-ordinator's office etc

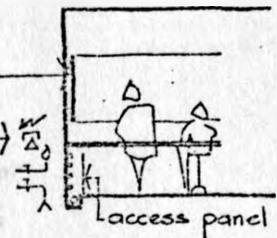


Services accommodation (ducts, plant rooms etc) should be provided from the outset with the distribution mains for gas, electricity, plumbing/drainage etc. These mains should be capable of receiving connection or disconnection in bays by the users rather than rely on specialized skill from outside. To facilitate this, the mains should have connection outlets at acceptable runs with distribution to the actual equipment by flexible tubing or wiring to enable change by users or as in the case of upgrading workstations for postgraduate research, connection of more complex equipment should be possible.

Example : Laboratory workstation

Undergraduate level :

- pinboard
- services distribution mains provided at the outset



Postgraduate level :

- storage unit replaces pinboard on same mounting brackets.
- actual connection/disconnection to the mains by the users as & when required
- necessary equipment trolleyed in & connected by the users.



FACTOR

Change in the staff : student ratio
and the calibre of staff

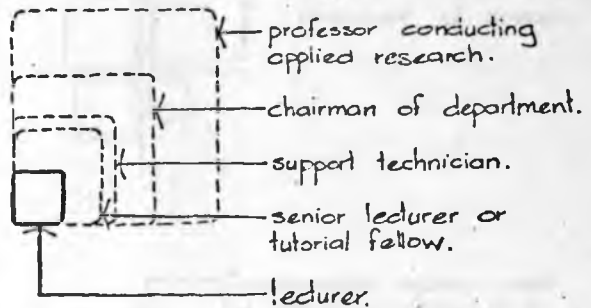
CHANGE PREDICTION

- never 60 yrs +
- seldom 20 yrs +
- infrequent, 7-20 yrs
- occasional 3-7 yrs
- frequent/often 0-3 yrs

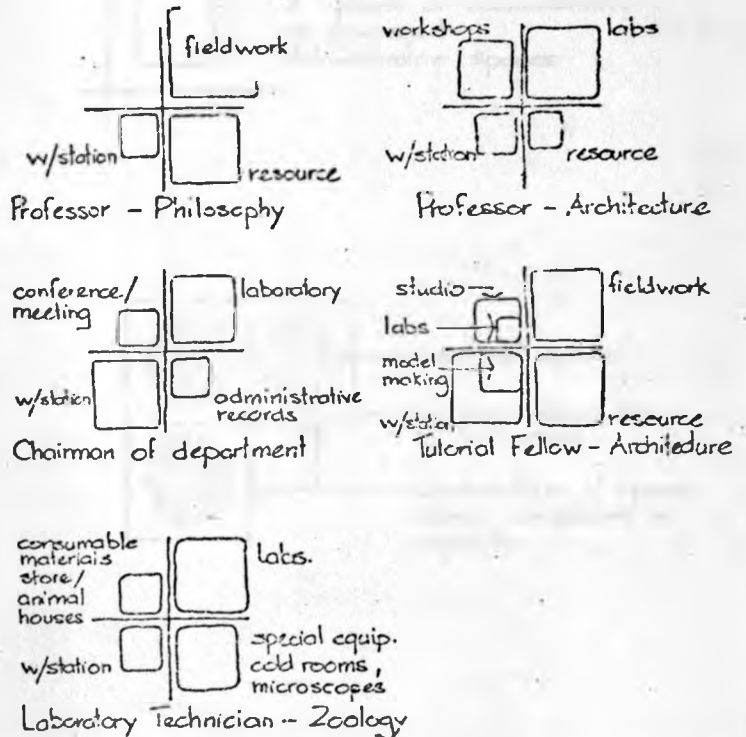
7.3 RESPONSE

Increase in staff accommodation is usually associated with increase in student enrollment to maintain acceptable ratios, the space requirements of both being adjusted at the same time. However, the nature of the space required depends on the calibre of staff.

Variation of requirements in size & complexity:



To develop a norm is impossible as each case has to be evaluated individually, requirements varying considerably.



To develop a response to all these diverse requirements is difficult.

Two essential design parameters to accommodate this diversity are:-

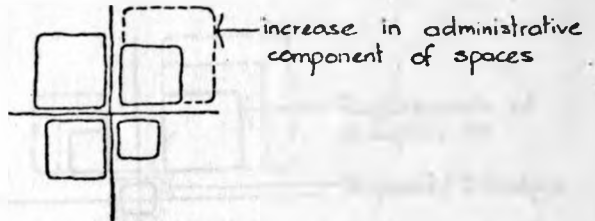
- potential of growth and reorganization of internal spaces should be possible e.g. demountable partitioning.
- workstations should be capable of upgrading for more complex use to cope with the intermittent demand for specialized use such as audio-visual material preparation.

FACTOR : Full-time, part-time work/study courses

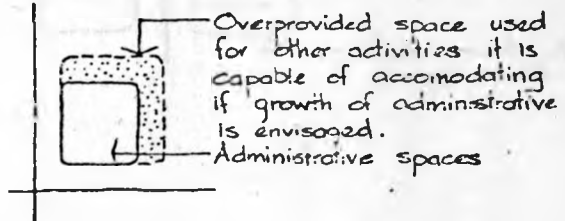
CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.4 RESPONSE

The size of the administrative component of the physical facilities is dependent on the programming of courses. Administrative space increases if both types of courses - full time and part time run simultaneously as assessment becomes more complex.



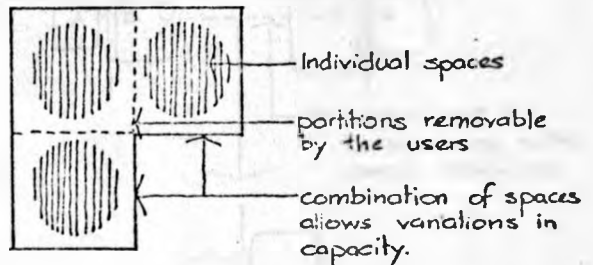
A space type which can accommodate other activities in addition would be advantageous as it could be used for other purposes if overprovided initially.



Spaces available in smaller capacities which can be combined to function as one space whenever necessary are advantageous.

The change should be effected by the users.

This enables exams and joint classes to be conducted for different types of courses.



FACTOR

Restructuring to accommodate changes in Disciplines and Inter-disciplinary institutes

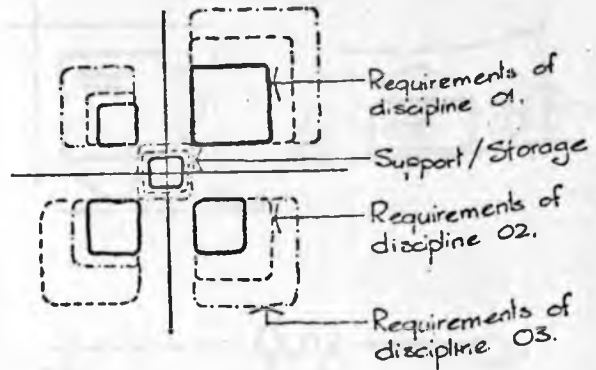
CHANGE PREDICTION

- never 60 yrs +
- occasional 3-7 yrs
- seldom 20 yrs +
- frequent/often 0-3 yrs
- infrequent 7-20 yrs

7.5 RESPONSES

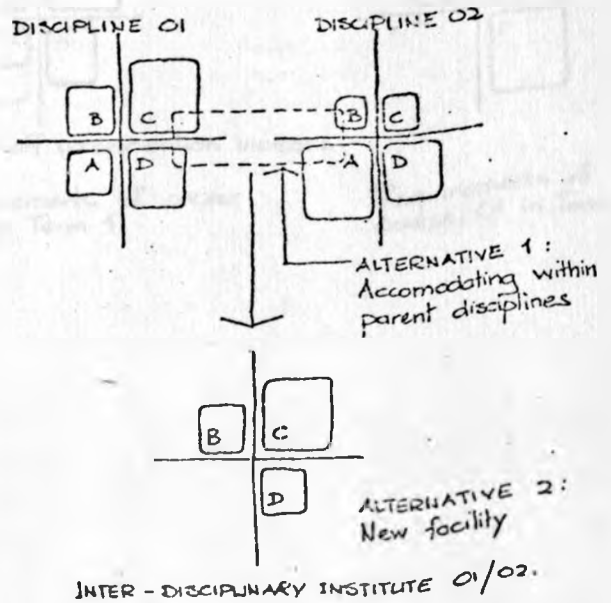
At national policy level, if the role of an institute changes then the disciplines offered change, resulting in spaces specifically designed for previous users being forced upon new users.

The system of space types gives flexibility in that only the proportion of the space types needed, changes whenever the user changes, as user requirements differ.



The spatial needs of any inter-disciplinary institute should be identified in terms of immediate and eventual. If the eventual needs cannot be accommodated in the facilities of parent disciplines then a new facility, accessible to the parent disciplines, is recommended.

The requirements of an inter-disciplinary institute may be similar or absolutely different from the parent disciplines. If different, the system of space types enables the parent discipline to house the new discipline by increasing the proportion of necessary space type only.

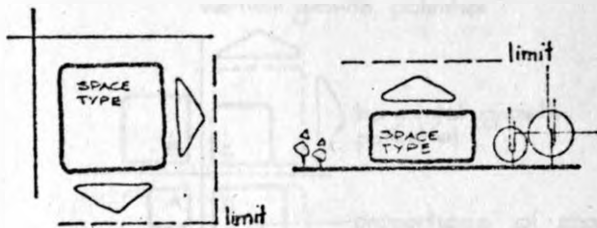


FACTOR : Course & Curriculum Changes

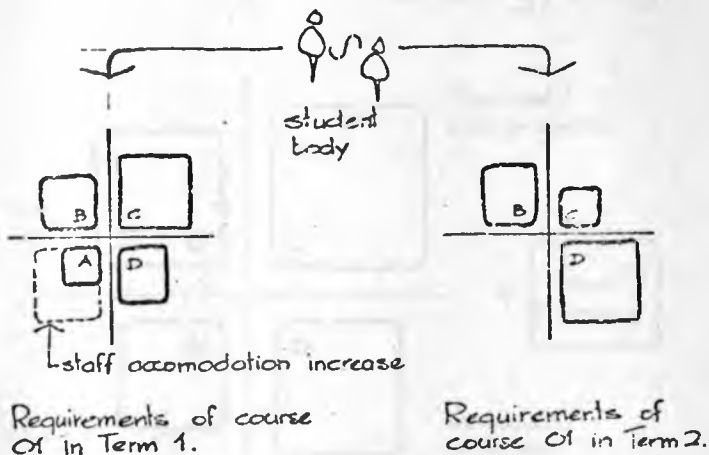
CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.6 RESPONSE

A system of planning that allows growth upto a pre-defined limit as the demand for spaces of different types varies with shorter courses increasing in duration or becoming courses with greater weighting.



Requirements of a course may vary over time in one academic session, a student body divided and alternating in the use of facilities is a possible solution. This however will require increased staff numbers and accommodation for them.

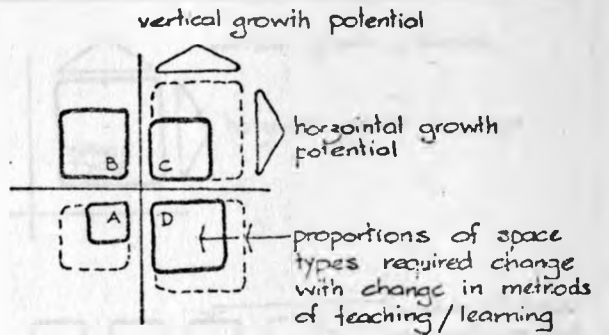


FACTOR : Change in methods & trends of teaching/learning

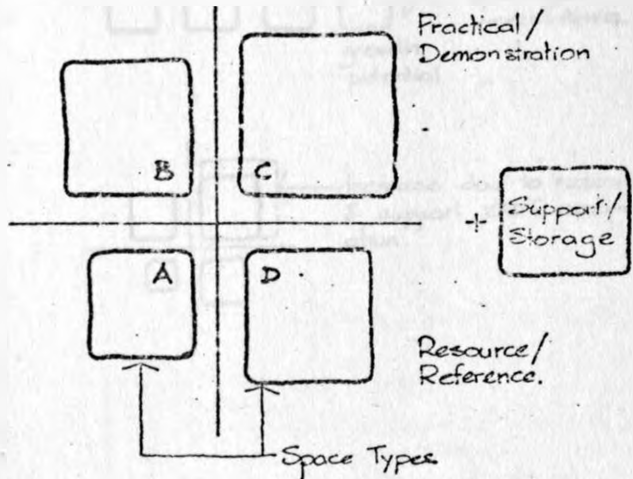
CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.7 RESPONSE :

As teaching/learning methods develop, the proportion of space types they require change, e.g. a change of emphasis from theoretical to practical teaching/learning results in need for more practical/demonstration space.



Potential of internal re-organization to accommodate new requirements by having space types capable of accommodating a range of activities as opposed to purpose built.

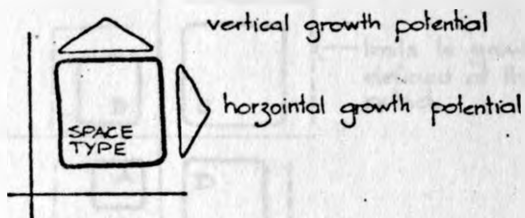


FACTOR : Change in research & consultancy policy

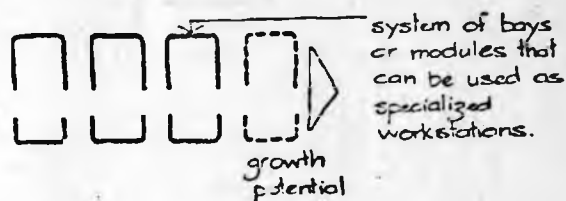
CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.8 RESPONSE

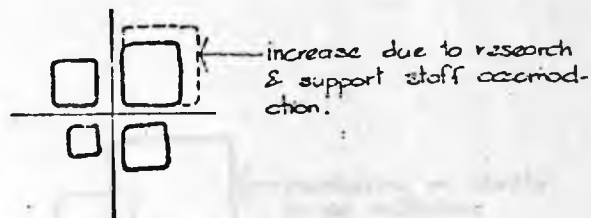
As research and consultancy usually evolves after a discipline is established, the potential of a built system to grow to accommodate these activities should be planned for.



The demand for research and consultancy spaces is intermittent, thus if bays or modules could be upgraded to house the additional equipment and staff, then better utilization of facilities is achieved.



When the research and consultancy begins on a permanent basis, which is usually well after having built and used the facility, then an increase of research and support staff is inevitable.



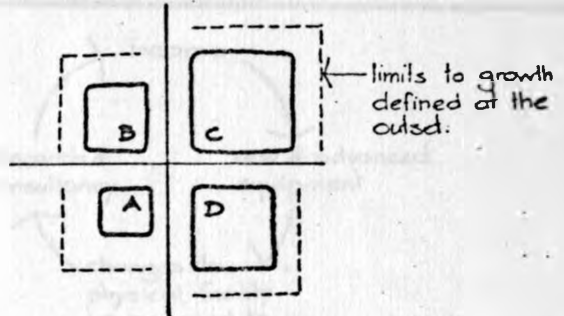
FACTOR : Institute & discipline size policy

CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.9 RESPONSE

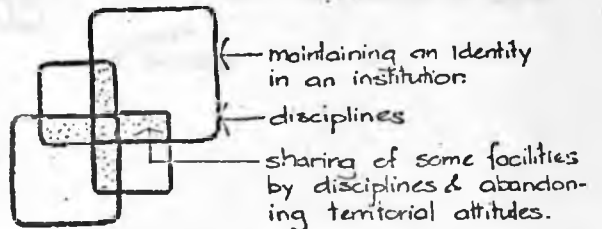
An institute's or discipline's maximum growth limits should be defined at the outset with any revisions to this in consideration of:

- maximum enrollment limits
- inter-disciplinary needs
- ratio of staff to student and the calibre of staff.
- mode of courses offered
- course and curriculum changes
- teaching/learning methods
- research and consultancy policy.



This aids in maintaining a facility in manageable proportions and alerts when a new facility should be started to compliment the role of the existing one.

Planning should enable the sharing of facilities and the abandoning of territorial attitudes by disciplines yet be able to maintain an identity in the institute.



FACTOR : Financial sources & programming .

CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

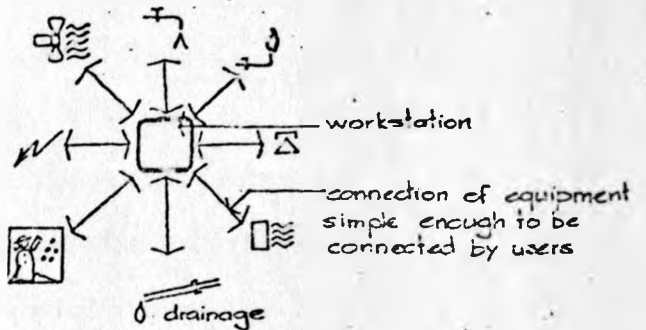
7.10 RESPONSE :

When sources of finances increase new equipment has to be accommodated.

Services distribution should be provided at the outset to cope with the additional load and allow easy connection/disconnection especially when required intermittently.



Programming of higher education at national level such as the incorporation of pre-university education into the tertiary system has the effect of increasing the volume of student body and the response is the same as 7.1.



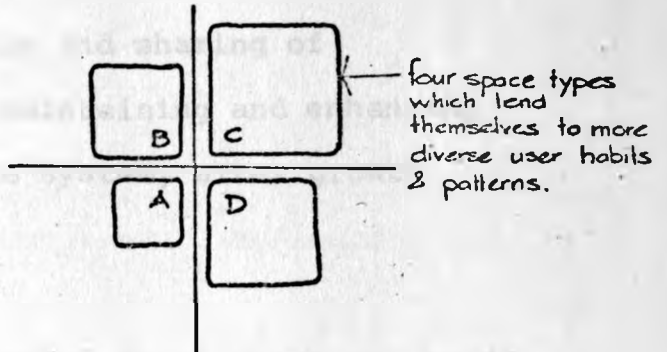
FACTOR : Institutional Structure

CHANGE PREDICTION : never 60 yrs + occasional 3-7 yrs
 seldom 20 yrs + frequent/often 0-3 yrs
 infrequent 7-20 yrs

7.11 RESPONSE

Changes in institutional structure result in re-structuring of an institution for more effective results.

A system of space types capable of a range of activities aids in allowing more diverse activities as well as upgrading potential for deeper level of study into a field.



In conclusion, the main architectural mechanisms to develop a facility that demonstrates flexibility to the factors which cause changes are,

- The selection of a system of planning that permits growth of individual users interaction and sharing of facilities yet maintaining and enhancing the order of the system, after growth takes place.

- Development of Space Types which are built spaces that can accommodate a range of activities and are planned in modules. This is done by grouping spaces by common room performance requirements to produce four distinct space types from the physical survey data of the University of Nairobi. The modules are also capable of connection to additional modules for more space or may be upgraded by the users for higher depth of study or research into a field.

FOOTNOTES

¹

A. Papageorgiu, Continuity and Change, pp 54-57
(London: Pall Mall Press, 1971)

¹

B. Virani, "Principles of Growth in Architectural Form", thesis University of Ahmedabad, India, 1972.

¹

V. Dudhaiya, "Evaluation of the Grid as an Organization Principle in Architecture", thesis University of Ahmedabad, India, 1975.

8. FOUR SPACE TYPES DERIVED FROM GROUPING ROOM PERFORMANCE REQUIREMENTS

8.1 METHOD EMPLOYED.

Use of Survey.

The physical survey/inspection of University of Nairobi facilities was used to identify all the activities which have to be housed in a higher education facility. It also enabled their room performance requirements to be identified which when grouped, according to common requirements, showed that all these activities could be housed in six distinct space types as in table 8.1.1.

Six Space Types

Four Space Types

Further adjustment of the room performance showed that these space types could be reduced to four distinct types:

Room Performance Adjustments

Space Type 01 and 06 could be combined by the following adjustments:

X

							UTILIZATION RATE STAFF, STUDENT RATIO
	PLUMBING/ DRAINAGE	COMMUNICATIONS GAS	VENTILATION optimum type	ACCOUSTIC	ILLUMINATION	REMARKS	
	low for SERIES 205	-	natur	cell, natur creat	natur + artf.	Blackout necessarly where A.V. used.	35-60 1:40
	low	low	mech	wall cell, creat-	Artf. specia + black- out		20 1:150
	high	mod	natur + fume extrac:	-	natur + mod artf.	Air condition- ing for series 650	25-55 1:12
	-	-	natur	cell, creat	artf. high specia		18 1:15
	high	low	natur	cell, creat	mid natur + mod		30 -
	-	COMM. MOD.	natur	cell creat	mod natur + mod artf.		60 -

- floors to be level with maximum permissible load of 500 Kgm/sq. meter.
- minimum structural span to be increased to 7.0 meters.
- partitioning to be demountable with modules of 1.0 - 1.2 meters.

Space types 03 and 05 could be combined by the following adjustments:

- minimum structural plan of $(4.8 \times 2 = 9.6)$ meters.
- some of the partitions (approximately 30%) should be permanent to accommodate the service mains distribution with the remainder of the partitions to be demountable to enable different size areas and work-stations.
- provision of clearly defined and uninterrupted service distribution routes with the mains for all services at the outset. The actual connection to these mains should be possible as and when required. The mains should be such as to enable connection along the perimeter as well as central to spaces.

Four Space
Types

Thus four distinct Space Types were derived from grouping according to common room performance requirements.

These are defined in table 8.1.2 as;

ELECTRICAL	PLUMBING/ DRAINAGE	COMMUNICATIONS GAS	VENTILATION optimum type	ACCOUSTIC	ILLUMINATION	REMARKS	UTILIZATION RATE STAFF, STUDENT RATIO
	-	comm mod.	natur	ceil treat	mod natur + mod	ext encls well defined & perman with mod int flexib in layout & use	35-60 1:40
	low	low	mech	wall + ceil + treat	Artf. special + black- out		20 1:150
	high	high	natur + local- ized fume extract	ceil + treat	high natur + mod artf.	Air condition- ing for series 650 All services runs at outset with actual connection by users when necessary.	25-55 1:12
	-	comm, low	natur	ceil treat	high artf + natur	large spaces sense of cohesion & flow highly flexible int layout & use.	18 1:15

8.2 CAPITAL COST COMPARISON OF TWO ALTERNATIVE GROUPINGS

Method of Comparing

The four space type alternative obviously has the advantage of being more flexible though it is more expensive to construct than spaces which are purpose built. In order to determine the difference an exercise comparing the capital costs of constructing the two alternatives, (the four and six space types) was conducted on an arbitrarily chosen Department of Geography in the following manner;

- The spaces being used by the department in the academic sessions 1976/77 and four years later in 1981/82 were determined.
- The capital cost of producing these spaces for the sessions 1976/77 and 1981/82 respectively were determined.
- The capital costs were then calculated using the relative cost indices as developed by UNESCO in Planning Standards for Higher Education (see 6.2) .

Results

These calculations and their results are shown in table 8.2.1

 Summary Results:

Space Types 01-06:-

Capital Cost	1976/77	2093
--------------	---------	------

Capital Cost	1981/82	2877
--------------	---------	------

Space Types A - D:-

Capital Cost	1976/77	2218
--------------	---------	------

Capital Cost	1981/82	2802
--------------	---------	------

With the Four Space Type alternative the capital cost at the outset, i.e. 1976/77 session, is higher by 6% than the other alternative, since a certain amount of over-provision is inherent. The 'loss' however over a period as short as four years is recovered since the provision of the requirements of 1981/82 session cost less with more flexible spaces.

In conclusion, all higher education activities can be comfortably housed in four distinct types of spaces.

A prototype facility using these four space types is developed to demonstrate the level of flexibility possible using this method of planning in chapter 9.

TABLE 8.2.1

Department of Geography:
Academic Facilities Requirements 1976 - 1982

Department of Geography: Academic Facilities requirements during:-

Space Types 01-06: Academic Session 1976/77					Space Types A-D: Academic Session 1976/77				
Space Type	Code/Sub-Category	Total Floor Area (m ²)	Relative Cost Factor	Capital Cost	Space Type	Code Sub-Category	Total Floor Area (m ²)	Relative Cost Factor	Capital Cost
01	105(x2)	120	1.0	120	A	105(x2)	120	1.0	120
	205(x2)	120	1.0	120		205(x2)	120	1.0	120
02	310(x1)	200	2.2	440		505(x2)	120	1.0	120
						510(x2)	20	1.0	20
03	210(x2)	200	2.35	470		640(x2)	160	1.0	160
	220(x1)	30	1.57	48		over-provide	100	1.0	100
	625(x1)	120	2.35	282	B	310(x2)	200	2.2	440
	420(x1)	100	1.5	150		C	210(x2)	200	2.35
04	405(x1)	100	1.0	100	220(x2)		30	1.57	48
					625(x1)		120	2.00	240
05	605(x1)	40	1.57	63	420(x1)		100	2.00	200
					605(x1)	40	2.00	80	
06	505(x2)	120	1.0	120	D	405(x1)	100	1.00	100
	510(x2)	20	1.0	20					
	640(x2)	160	1.0	160					
Total Capital Cost (Units)				2093	Total Capital Cost (Units)				2218

Space Types 01-06: Academic Session 1981/82					Space Types A-D: Academic Session 1981/82				
Existing since 76/77				1993	Existing since 76/77				2018
01	205(x1)	60	1.0	60	A	205(x1)	60	1.0	60
	110(x1)	200	2.2	440		505(x4)	80	overprovision 76/77-	
03	225(x1)	100	1.57	157		515(x1)	30	1.0	30
						645(x1)	20	overprov. 76/77	
04	415(x1)	50	1.0	50	a	110(x1)	200	2.2	440
05	635(x1)	30	1.57	47	C	635(x1)	30	1.57	47
						225(x1)	100	1.57	157
06	505(x4)	80	1.0	80	D	415(x1)	50	1.0	50
	515(x1)	30	1.0	30					
	645(x1)	20	1.0	20					
Total Capital Cost (Units)				2877	Total Capital Cost (Units)				2802

In space types 01-06, if type 06 were over-provided in 76/77, it would not be utilized for its purpose until 81/82 session when 130 sq.m. of it is necessary. This would mean that this more purpose built space would remain idle or be utilized at below optimum conditions till then.

In contrast if space A which can accommodate a greater variety of activities is overprovided by 100 sq.m. in 76/77, then the capital cost in 81/82 for activities 205, 505, 515 and 645 would be negligible as the reorganization would be internal. The utilization however, of this space in the period 1976-82, would be poor, but being capable of greater flexibility house more in optimum conditions.

8.3 DESIGN PARAMETERS FOR FLEXIBILITY IN THE FOUR SPACE TYPES

In order to make a space capable of housing more activities in optimum conditions than is presently possible, the following design parameters have been considered.

Determining Parameters

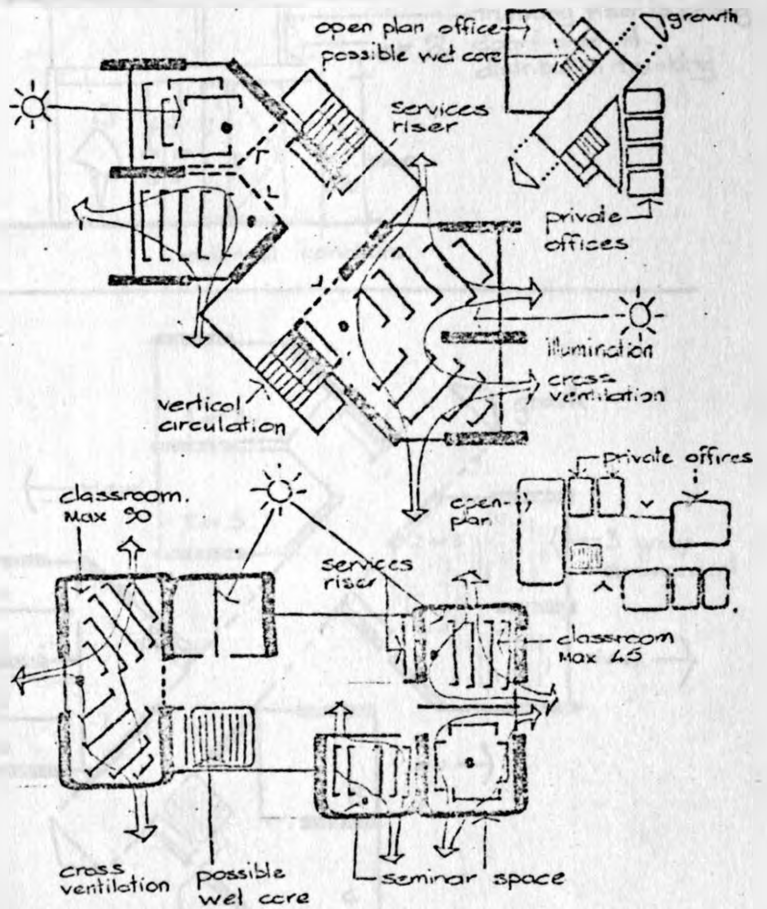
These parameters were identified through the physical survey which showed the changes the physical plant of the University of Nairobi had undergone in the period 1970-1982. Understanding the factors which caused the changes and analysing the response the users brought about to cope, showed the main shortcomings of the existing facilities.

The possible architectural flexibility to overcome these shortcomings for each of the four SPACE TYPES developed is recommended as follows.

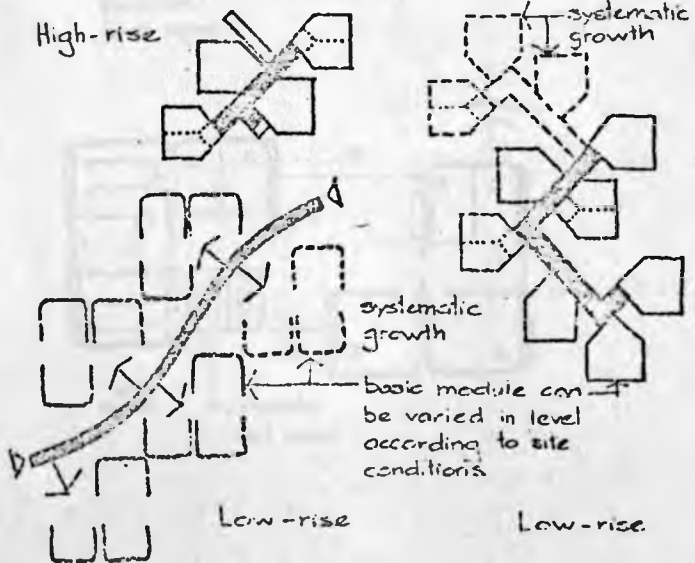
SPACE TYPE A
Instruction/Admin

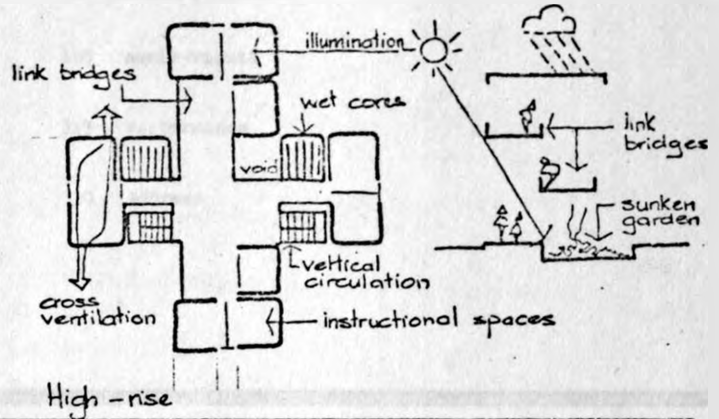
- 105 Classrooms
- 205 Special Classrooms
- 305 Seminar Rooms
- 505 Offices
- 510 Secretary/Typist/Reception
- 515 Conference
- 640 Consumable Materials Store
- 645 Administrative Records

- Spaces available in different capacities for larger groups initially, specializing into smaller groups which are instructed separately in later years.
- Sub-division into private or open-plan office possible
- Adequate permanent ventilation when used for audio-visual display. (black-out necessary)
- Minimal services distribution if used as special classrooms for geology, sewing, typing etc.

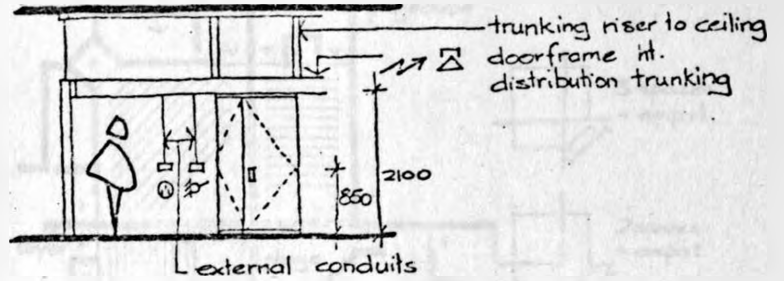


- Basic module adaptable to varying site conditions
 - gradient
 - low/high rise neighbourhood
 - systematic growth possible.





- Electrical and communication service, distribution should be such as to allow constant relocation of switchgear and instruments



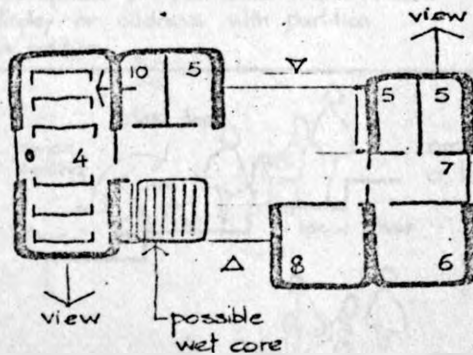
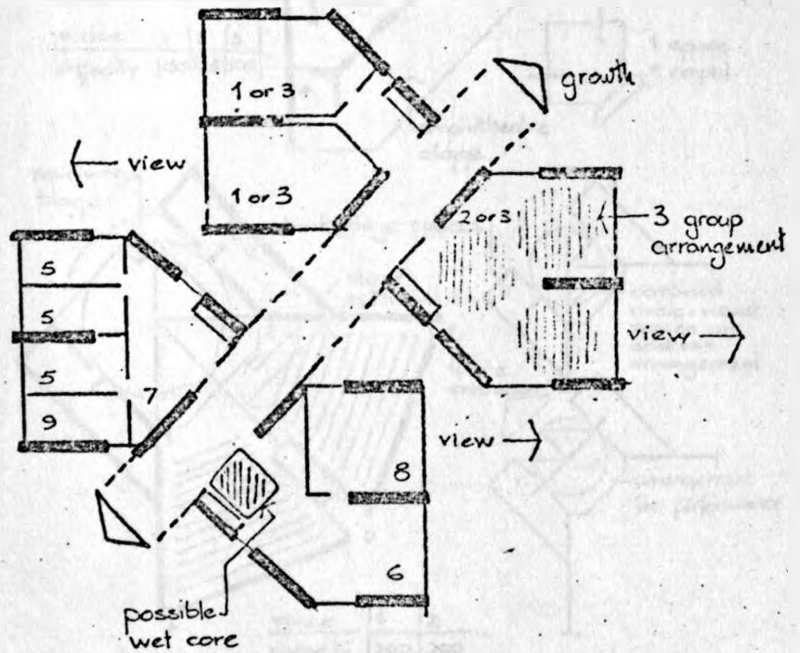
Possible Uses:

- Instruction

1. Class max 20
2. Class max 50
3. Seminar room
4. Special Classroom

- Administrative/Support

5. Office
6. Open plan office
7. Sec/Typist/Reception
8. Conference
9. Admin Records
10. Consumable Materials Store



SPACE TYPE B

Exchange/Instruction

110 Lecture Theatre

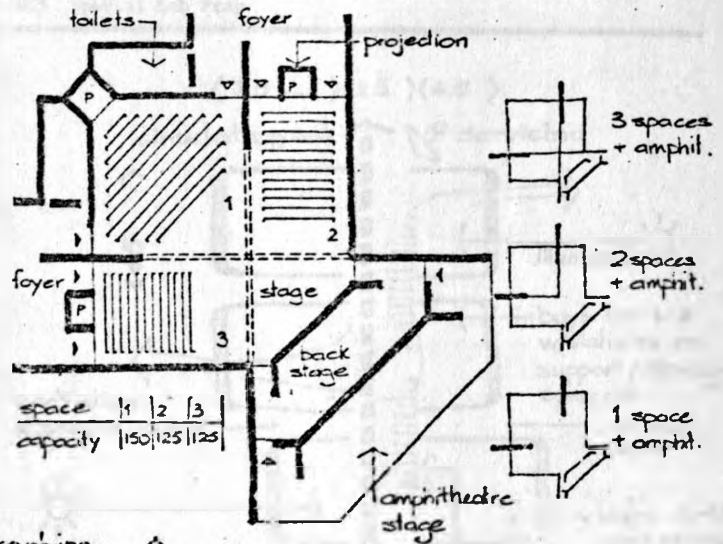
310 Audio-Visual

315 Performance

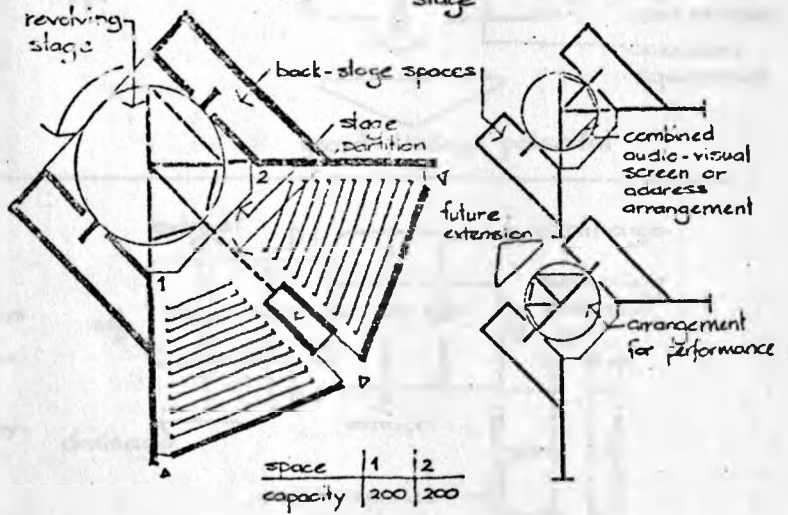
320 Address

- Spaces available in smaller capacities or sizes, yet be combined to function as one for large gatherings, an advantage to overcome low present utilization rate of 20%

- Ability to house both a performance and an audio-visual display an advantage for flexible use



space	1	2	3
capacity	150	125	125



space	1	2
capacity	200	200

Arrangement for individual audio-visual display or address with partition in position.

Various stage settings

- Furniture movement/storage for lecture or performance should be easily effected by users to enable more flexibility in use.



arrangement during a lecture

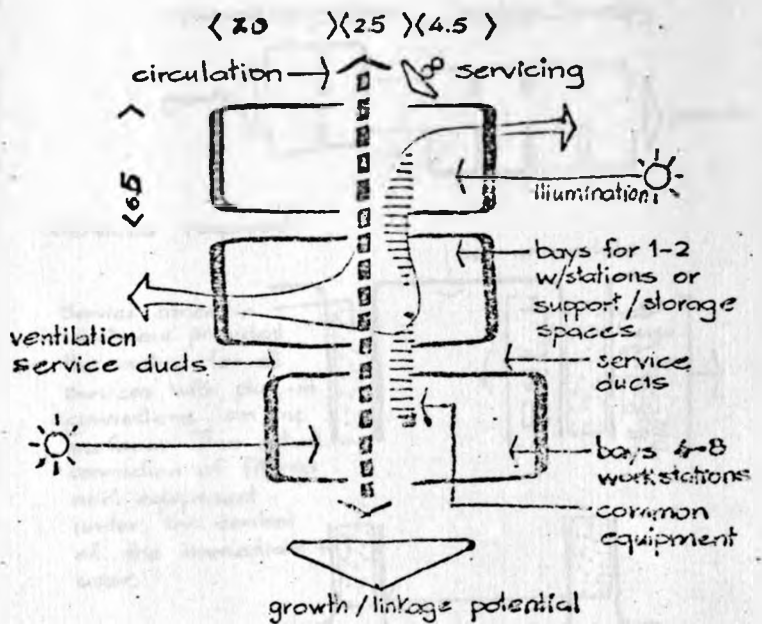


arrangement during a performance / address.

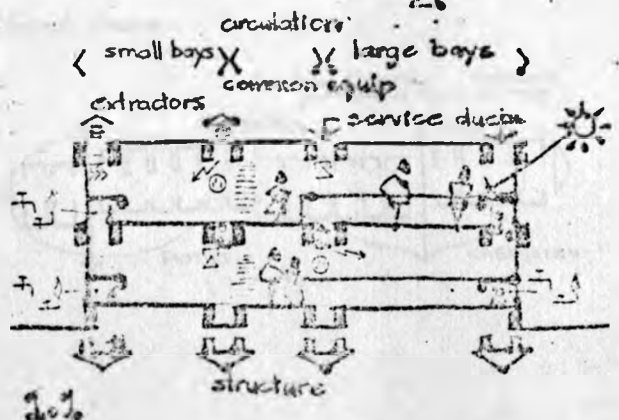
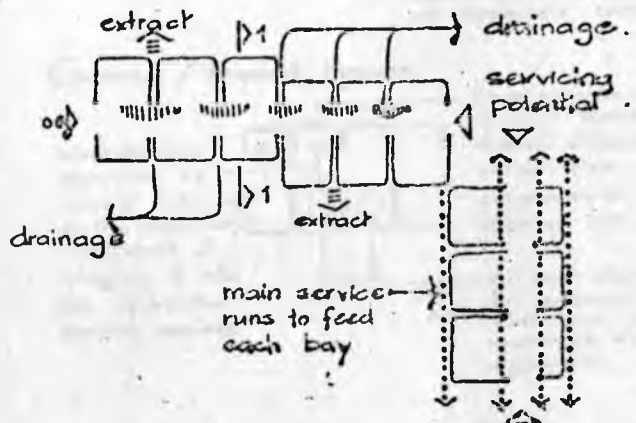
SPACE TYPE C
Practical/Demo

210 Class Laboratory	620 Controlled Factor Storage or W/Station
215 Individual Laboratory	625 Photolab
220 Laboratory Prep	630 Radio-Active Source
225 Special Lab	635 W/Shop Prep
235 Health Convalescence	650 Computer Unit
240 Health Diagnostic	
245 Workshops	
250 Individual Workshops	
420 Data Bank	
520 Special Office	
610 Laboratory Prep	
615 Special Lab Prep	

- Ability to function with more than 1 tutor conducting different course or demonstration in separate bays.
- Higher utilization possible than present 25-55%
- Sensitive equipment readily accessible yet use can be supervised or controlled
- Bays of work/stations may be upgraded for research work by merely moving necessary equipment
- More efficient layouts can be effected by the users
- Common equipment readily accessible
- Group work easier when equipment scarce



- Services distribution allows feed into or omission of bays with ease
- Possibility of conversion of bays into specialized support spaces such as darkrooms, radio-active sources etc.
- Possibility of conversion of bay bays into controlled factor workstations or storage such as cold rooms, experimental animal storage or lathe or vibration beds, paint shops etc.

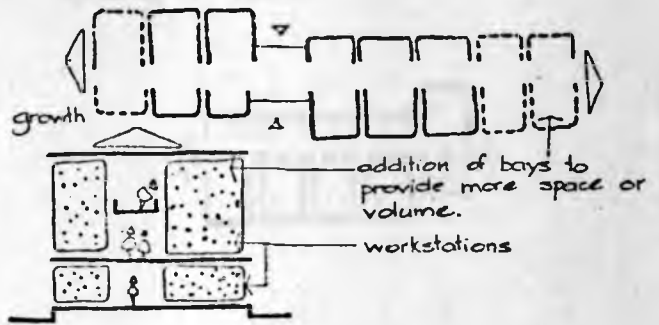


615 610 520 420 250 245 240 235 225 220 215 210

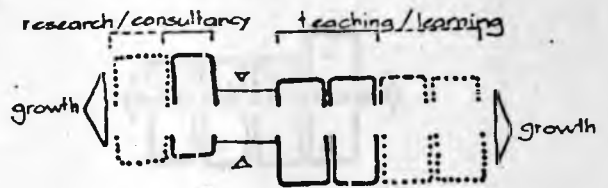
The initial requirements of users and any subsequent changes in these in terms of practical demonstration spaces and relevant support spaces can only vary in,

- Space or volume of enclosure
- Change in the balance between teaching/learning and research/consultancy.
- Types of services required
- Equipment needed
- Allocation of areas to courses within a discipline or user
- Complete change of user.

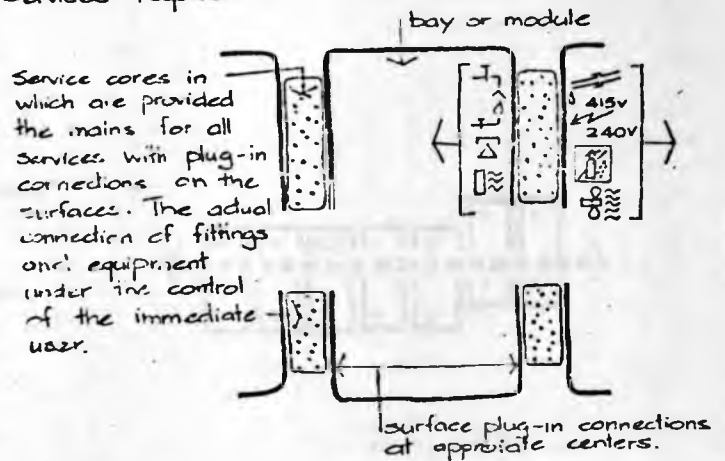
All these variations in needs can be accommodated by planning spaces in modules or bays into which service mains are provided at the outset with plug-in connections under the control of the immediate user.



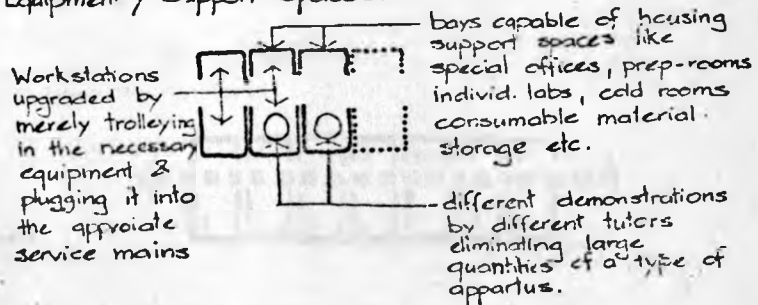
Teaching / Learning and Research / Consultancy Spaces:



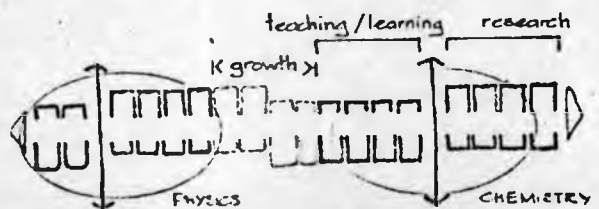
Services required:



Equipment / Support Spaces:



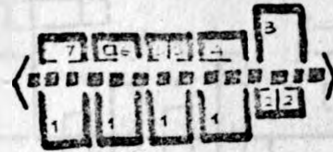
Different Users:



Change of Users :

210. Zoology Lab.

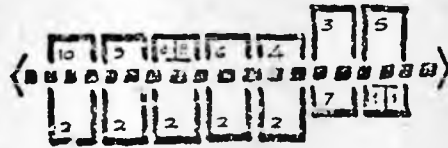
1. Workstations for 8 offices
2. Offices
3. Tutorials, references, demonstrations
4. Prep room/technician
5. Consumable materials store
6. Cold room
7. Individual lab (1-3 work stations) for research.

245. Metal Workshop
(as support/space to Engineering)

1. Workstations for 8
2. Forge, Brazing, Soldering or Casting.
3. Lathe
4. Consumable Materials Store
5. Painting
6. Tools
7. Technician Prep. Room
8. Office

240. Health Diagnostic/Treatment
(Dental Clinic)

1. Offices
2. Bays with 2 dental chairs each.
3. Radiology Room
4. Photographic dark room
5. Tutorials, Reference, Demonstrations
6. Sterilization
7. Research Lab.
8. Toilets
9. Dental Workshops
10. Waiting/Reception

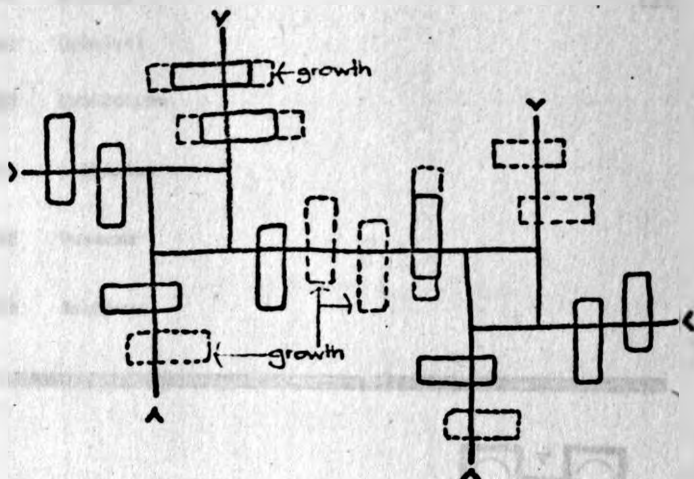


650. Computer Unit

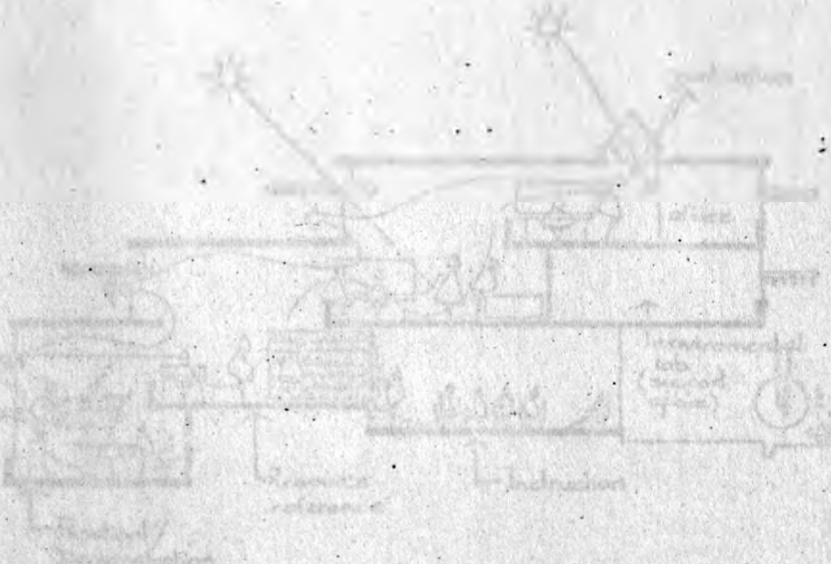
1. Main Computer Units.
(different makes)
2. Information Keyboard panels
3. Key-punch machines
4. Offices
5. Reception
6. Programming
7. Tutorials/Instructions
8. Temperature control plant
9. Transformer.



Clusters or bays of modules which constitute a practical/demonstration space should be planned on site to maintain an inherent order after growth. This systematic growth should be possible to aid comprehension to an observer or user.



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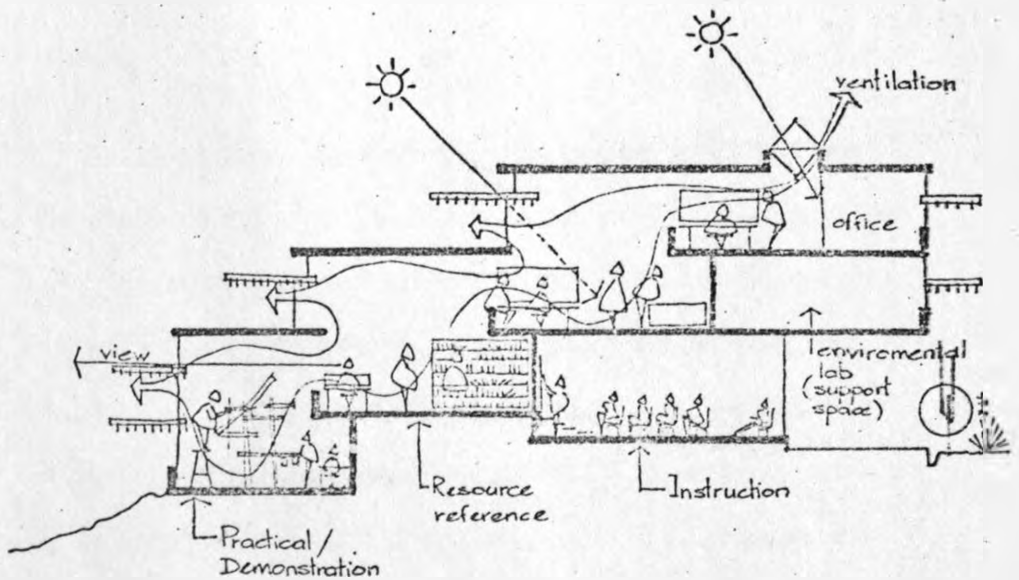
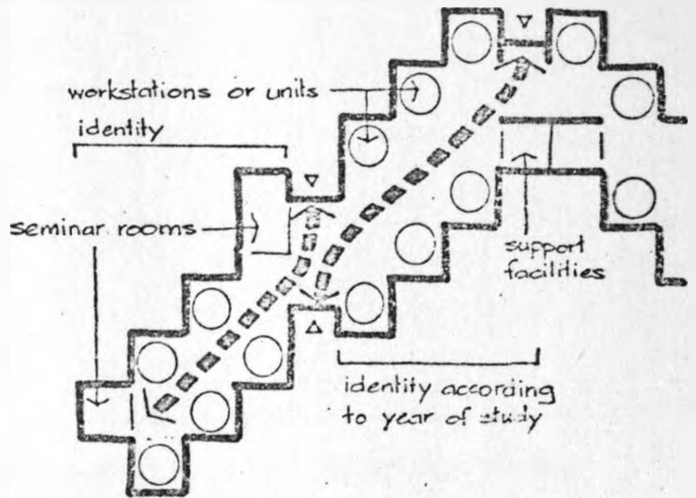


Resource/Exchange

230	Studios
260	Gymnasia
325	Exhibition
405	Libraries
410	Museums
415	Archives

- Large spaces which are capable of division into small 'units or stations' maintaining identity with total space yet offering adequate privacy. These stations can be individual workstations as in architectural studios; cataloguing, lending departments as in libraries; or separation of exhibits by year of study for annual exhibitions or public open days

- Sub-division should be flexible and effected by the users as changes in user patterns may be as frequent as 3-4 times in an academic session



FOOTNOTES

¹UNESCO/Architectural Press, Planning Standards for Higher Education Facilities, pp. 307 (Paris: UNESCO/Architectural Press, 1975).

The physical survey of the existing University of Nairobi revealed the changes higher education buildings undergo and defined possible architectural mechanisms to accommodate these changes.

To demonstrate and evaluate these mechanisms in this study, an addition to the buildings at the Chiromo Campus of the University of Nairobi is proposed. The users of this proposed facility are identified from the immediate development plans to house five disciplines in more permanent and adequate buildings, as the present are congested and impeding on the growth of the others.

9 PROTOTYPE FACILITY DEVELOPED FROM FOUR SPACE TYPES

The physical survey of the existing University of Nairobi revealed the changes higher education buildings undergo and defined possible architectural mechanisms to accommodate these changes.

To demonstrate and evaluate these mechanisms in this study, an addition to the buildings at the Chiromo Campus of the University of Nairobi is proposed. The users of this proposed facility are identified from the immediate development plans to house five disciplines¹ in more permanent and adequate buildings, as the present are congested and impinging on the growth of the others.

A single complex adjoining the present, is proposed to house all the five users with adequate flexibility for their metamorphic growth, additional occupiers and even the possibility of a complete change of users. The five initial users are:-

USER 01: School of Environmental Studies

USER 02: School of Journalism

USER 03: Population Studies & Research Institute

USER 04: Institute for Development Studies

USER 05: Institute of African Studies.

9.1 THE NEEDS

The needs of the five initial users were identified in terms of the four Space Types developed. This, as later demonstrated, enabled flexibility to accommodate complete change of users and similar buildings to cater for all the diverse requirements.

Factors which cause change were also investigated in context of the eventual needs of these users.

This data is compiled in a manner to suggest to future implementers the data necessary in compiling an architectural design brief for a flexible higher education facility.

9.1.1 USER 01:
School of Environmental Studies

Course:	Initial	- 2 year, full-time postgraduate course leading to a degree B.A. (Env. Sci).	
	Eventual	- frequent seminars, conferences or workshops involving staff, students and outside participants as an exchange method of teaching.	
Enrollment	Initial	- 12 full-time students per year	
	Eventual	- 18 full-time students per year. 30 participants in each refresher course.	
Staff	Initial	Academic	Support
	Eventual	2 x Lecturers	1 x Prac/Demo Space Tech.

Related Disciplines/
Spaces

Frequent

- Geology
- Chemistry
- Land Development
- Planning (DURP)
- Government
- Business Admin.
- Economics
- Geography
- Sociology
- Agriculture
- Forestry

Environmental
Studies

Service Courses
offered to:
Develop. Studies
African Studies
Population Studies

Intermittent

- Botany
- Zoology
- Med. Physiology
- Biochemistry
- Engineering
- History
- Commerce
- Law

Research/
Consultancy

- | | |
|----------|---|
| Initial | - Academic research expected in curriculum mainly of data compilation and processing. Consultancy limited to existing academic staff using individual work-stations. |
| Eventual | - Applied research of level to resolve practical issues with aids such as computers and test equipment hired or borrowed for short periods of use in multipurpose Practical/Demonstration space. This space should be able to accommodate lab or w/shop type activities but demand for either will be intermittent. |

Space Requirements.

SPACE TYPE		Instruction/Administration	Area (sq meters)
SPACE TYPE A	Initial	2 x 105 Classrooms (divisible into 4 small units)	160
		5 x 505 Offices	80
		1 x 510 Sec/Typist/Reception	16
		1 x 640 Consumable Materials Store)	16
		1 x 645 Administrative Records)	
		1 x 105 Classroom (for refresher courses: to be shared with use 03)	80
	Eventual	2 x 505 Offices	32
	Sub-Total	384	
SPACE TYPE B		Exchange/Instruction	
	Initial	Nil	-
	Eventual	1 x 320 Address (seminars, w/shops, conferences, shared with user 03)	-
	Sub-Total	-	
SPACE TYPE C	Initial	Practical/Demonstration	
		1 x 215 Individual Lab	100
	1 x 250 Individual W/Shop	100	
	Eventual	1 x 520 Special Offices	18
	Sub-Total	218	
SPACE TYPE D		Resource/Exchange	
	Initial	1 x 405 Library	120
	Eventual	1 x 420 Data Bank (Computer Terminal)	-

Total Floor Area

Initial
Eventual

672
32
640

9.1.2 USER 02:
School of Journalism

Course	Initial	- 1 yr full-time study postgraduate course leading to a diploma - 4 term course with 3 terms instruction & final term involving research dissertation.	
	Eventual	- 4-8 wk. refresher or advanced courses mainly to outside participants. - evening classes to be offered.	
Enrollment	Initial	- 40 full time students	
	Eventual	- 80 full time students - 15-20 participants in refresher courses - 15-20 participants in evening courses	
Staff	Initial	Academic	Support
		1 x Director 2 x Snr. Lecturers 2 x Lecturers 1 x Tutorial Fellow	1 x Photolab Tech. 1 x Recording Studio Tech. 2 x Lithographic W/Shop 1 x Admin. Assistant
	Eventual	2 x Lecturers Staff to Student Ratio - 1 : 8	
Related Disciplines/Spaces	Frequent		Intermittent
	- Languages Input		- Broadcasting Studios - Mass media - Advertising Consultancy
		<div style="border: 1px solid black; padding: 5px; display: inline-block;">School of Journalism</div> ↓ Services courses offered to: all	
Research/Consultancy	Initial	- Academic research as expected in curriculum only	
	Eventual	- developments into new communication techniques - consultancy work to possible state run communication media.	

Space Requirements

SPACE TYPE A	Instruction/Admin	Area (sq meters)
Initial	2 x 105 Classrooms (divisible into 4 small units)	160
	6 x 505 Offices	96
	1 x 510 Secretary/Typist/Reception	16
	1 x 640 Consumable Materials Store)	16
	1 x 645 Admin. Records)	
	1 x 205 Special Class	80
Eventual	2 x 505 Offices	32
	Sub-Total	400
SPACE TYPE B	Exchange/Instruction	
Initial	2 x 310 Audio-visual (capacity 80x2) (to be shared with all other users)	160
Eventual		-
	Sub-Total	160
SPACE TYPE C	Practical/Demo	
Initial	3 x 520 Special Office	54
	1 x 245 W/Shop Lithographic	150
	1 x 225 Special Lab (Recording Studio)) 100
	1 x 615 Special Lab Prep. (Control)) 100
	1 x 625 Photolab	100
Eventual	nil	-
	Sub-Total	404
SPACE TYPE D	Resource/Exchange	
Initial	- Main Chiromo Library	-
Eventual	- ditto -	-
Total Floor Area :	Initial	932
	Eventual	32
		964

9.1.3 USER 03:

Population Studies & Research Institute

Course	Initial	- 2 year full-time postgraduate course to produce advanced level demographers. - 1 year - coursework involving 8 subjects from a choice of 17 - Year 2 - research work & thesis - Doctorate level of study available.
	Eventual	- Nil
Enrollment	Initial	- 25 full time students - maximum 2 doctorate candidates though this enrollment is intermittent.
	Eventual	- 40 full time students
Staff	Initial	Academic 1 x Director 3 x Visiting Professors 3 x Lecturers 2 x Tutorial Fellows
		Support 1 x Administrative Asst. 1 x Typist/Receptionist
Related Disciplines:	Frequent	Maths Statistics Economics Geography
		<div style="border: 1px solid black; padding: 5px; display: inline-block;">Population Studies & Research</div> ↓ Service courses to: Sociology
	Intermittent	Computer Unit
Research/Consultancy	Initial	- Frequently commissioned by Government to undertake studies which are advisory in policy making. Commissions however are intermittent.
	Eventual	- ditto -

Space Requirements

			Area (sq. meters)
SPACE TYPE A		Instruction/Admin/Support	
	Initial	3 x 105 Classrooms (capacity 40)	120
		3 x 105 Classrooms (capacity 40)	120
		10 x 5505 Offices	160
		1 x 510 Sec/Typist/Reception	16
		1 x 640 Consumables Materials Store)	32
		1 x 645 Administration Records)	
	Eventual	Nil	-
		Sub-Total	328
SPACE TYPE B		Exchange/Instruction	
	Initial	1 x 320 Address (capacity 100 x 2) (shared with user 01,04,05)	240
	Eventual	Nil	-
		Sub-Total	240
SPACE TYPE C		Practical/Demo/Support	
	Initial	1 x 245 (Lithographic) shared with other users	-
	Eventual	Nil	-
SPACE TYPE D		Resource/Exchange	
	Initial	Nil	-
Total Floor Area	Initial		568
	Eventual		568

9.1.5 USER 05:

Institute of African Studies

Course	Initial	- Collection & documentation of material culture and preparation for display.	
		- Postgraduate research & service teaching only.	
	Eventual	- Nil	
Enrollment	Initial	- No student enrollment, only postgraduate research.	
	Eventual	- ditto -	
Staff	Initial	Academic	
		Support	
		1 x Director	
		1 x Snr. Research Fellow	1 x Sec/Typist
		3 x Research Fellows	1 x Snr. Technician
	5 x Junior Research Fellows		
	Eventual	2 x Snr. Research Fellows	

Related Disciplines/
Spaces

Frequent

Development Studies
Museum
Archives
Design
Fine Art
History
Literature
Philosophy
Religious Studies
Architecture
British Institute
in East Africa

African
Studiesservice courses
to:to mainly
frequent users

Intermittent

All other
departments

Research/ Consultancy	Initial	- Research & consultancy dependent on staff initiative and funds availability.
	Eventual	- More emphasis on applied research & publication.

Space Requirements:

SPACE TYPE A	Instruction/Administration		Area (sq meters)
Initial	10 x 505	Offices	160
	1 x 510	Sec/Typist/Reception	16
	1 x 645	Admin Records	16
	1 x 640	Consumable Materials St.	
Eventual	2 x 505	Offices	32
		Sub-Total	224
SPACE TYPE B	Exchange/Instruction		
Initial	1 x 320	Address (shared with user 01,02,04 & 05)	-
	1 x 310	Audio-Visual (shared with user 02)	-
Eventual	Nil		-
		Sub-Total	-
SPACE TYPE C	Practical/Demonstration		
Initial	1 x 225	Special Lab (Restoration)	100
Eventual	Nil		-
		Sub-Total	100
SPACE TYPE D	Resource/Exchange		
Initial	1 x 405	Library	100
	1 x 415	Archives	200
	1 x 325	Exhibition	200
Eventual	Nil		-
		Sub-Total	500
Total Floor Area		Initial	792
		Eventual	32
			824

9.2 THE SITE

The site was selected from one of the several available for the University's growth within the City of Nairobi. At present, on the site is the Chiromo Campus most of which was built in the late sixties with continual additions to it.







The part to be developed is approximately 20 hectares of lush green vegetation and many indigenous trees which complement the well developed botanical gardens. The land slopes steadily down to the two seasonal rivers which bound the site on two sides. Nearly all of the five initial users are presently located at the Main Campus, which is about 10 minutes walking distance away from the Chiromo Campus. This also houses the arts and engineering disciplines and the administration of the entire University.

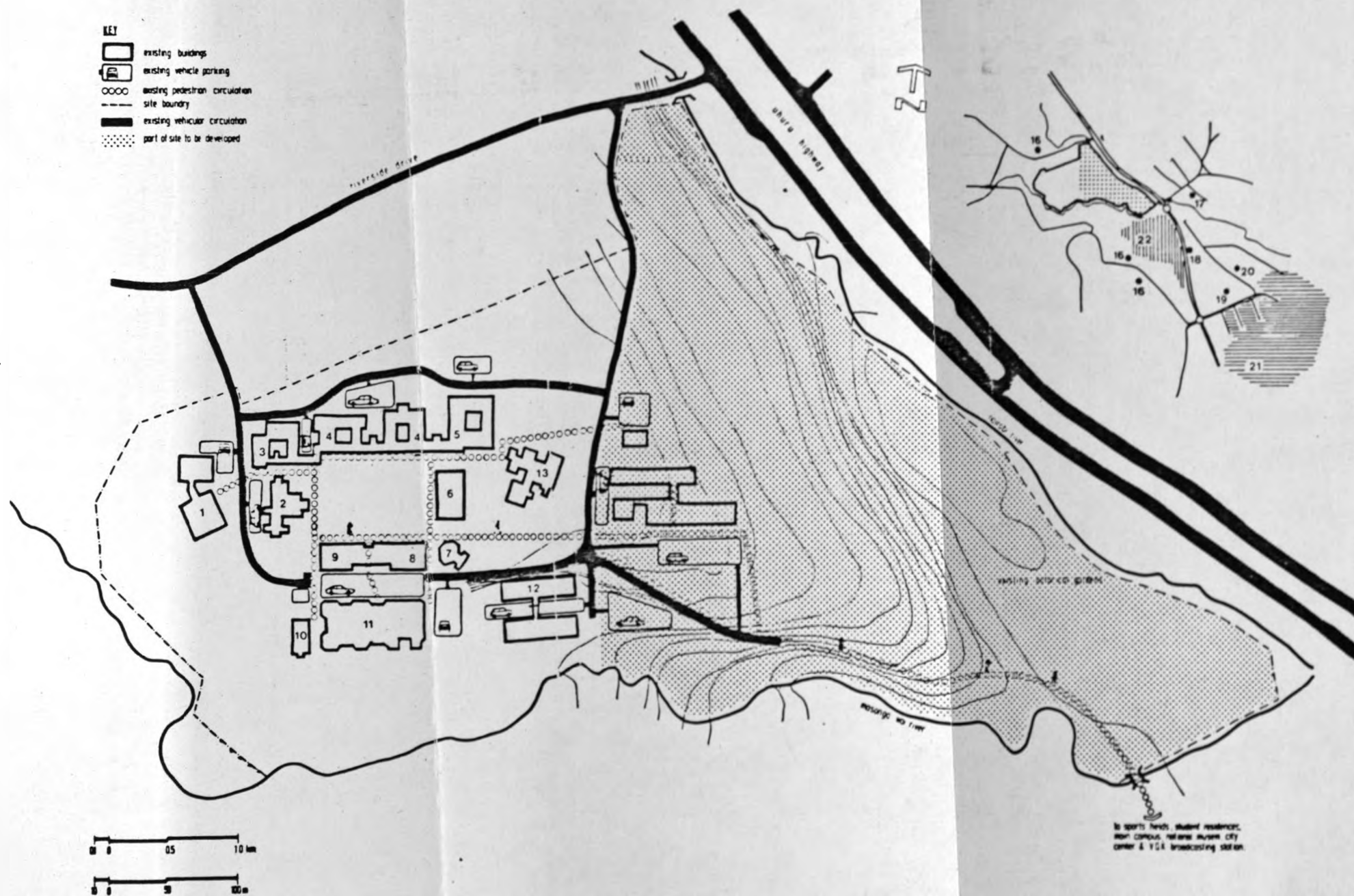
9.2 THE SITE

Site Plan & Location Plan.

LEGEND

- 1. Library
- 2. Cafeteria
- 3. Human Anatomy
- 4. Veterinary pre-clinical
- 5. Bio-Chemistry
- 6. Entomology & Agriculture
- 7. Lecture Theatres
- 8. Botany
- 9. Zoology
- 10. Gecaga Institute of Comparative Endocrinology
- 11. Physical Sciences Complex
- *12. International Centre for Insect Physiology & Ecology
- *13. British Institute of Eastern Africa
- 14. Computer Centre
- 15. Chemistry, Physics, Geology, Maths & Meteorology
- 16. Student Halls of Residence
- *17. National Museum
- *18. Voice of Kenya (V.O.K.) broadcasting station
- 19. Main Campus
- 20. Engineering Faculty
- *21. City Centre - Nairobi
- 22. Sports Fields

- KEY
-  existing buildings
 -  existing vehicle parking
 -  existing pedestrian circulation
 -  site boundary
 -  existing vehicular circulation
 -  part of site to be developed



*Not part of the University of Nairobi.



[The text in this section is extremely faint and illegible. It appears to be a list or a series of entries, possibly describing the features shown in the map. The text is arranged in vertical columns.]

9.3 THE FACILITY

9.3.1 Conceptual Design Approach for Flexibility.

9.3.2 Proposed Site Layout.

9.3.3 Proposed Pedestrian Promenades.

2.1 THE FACILITY

2.1.1 Conceptual Design Approach for Facility

2.1.2 Proposed Site Layout

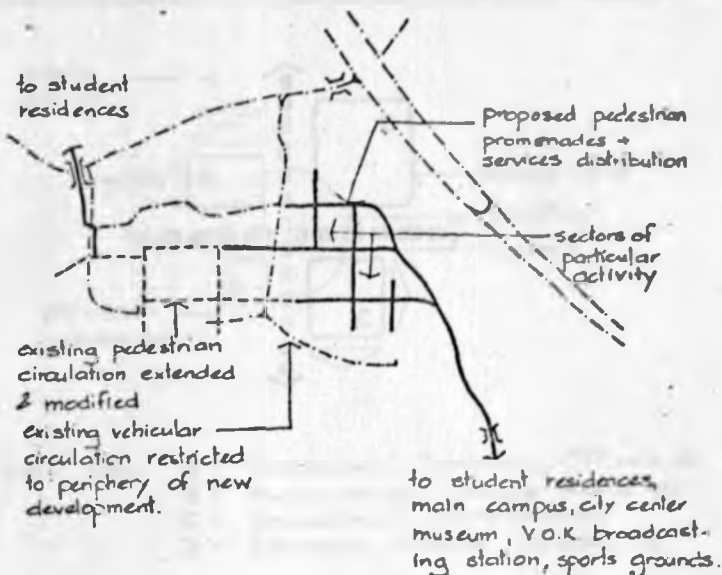
2.1.3 Proposed Pedestrian Arrangement

9.3.1 CONCEPTUAL DESIGN APPROACH FOR FLEXIBILITY

The constraints of an already established pedestrian and vehicular circulation serving the existing is extended and modified to serve the new requirements.

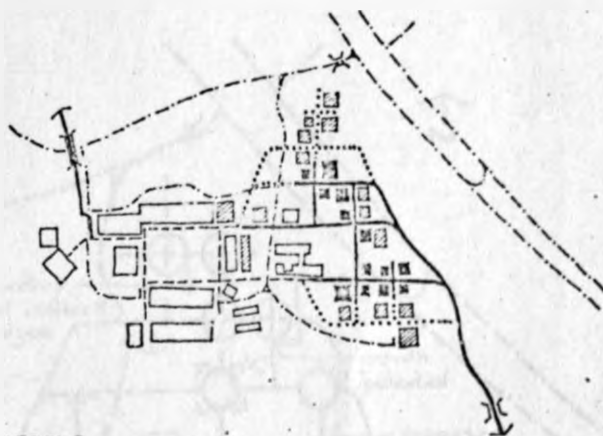
Pedestrian promenades which define the site into sectors of particular activity on which the space types developed are planned. These promenades also distribute the service mains to the built areas of the sectors.

Vehicular circulation in the new development is restricted to the periphery using the existing network.



The pedestrian promenades also bond the existing and the new into a complex where growth may occur by completion or addition to the open ends.

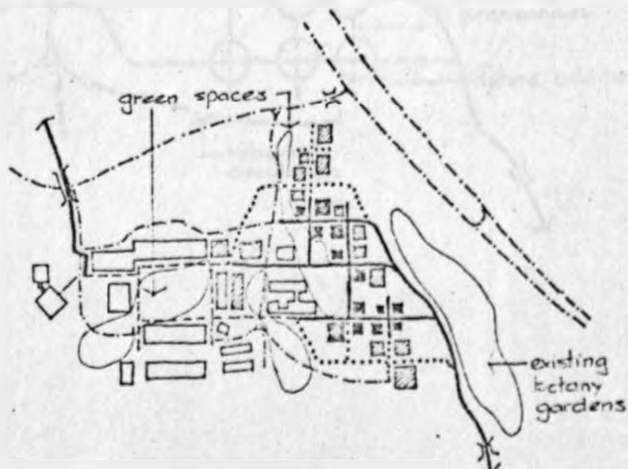
A system is thus established in which comprehension of the constituent parts is inherent whenever change or growth occurs.



LEGEND

- existing
- proposed
- ▨ future additions
- existing
- proposed
- future additions

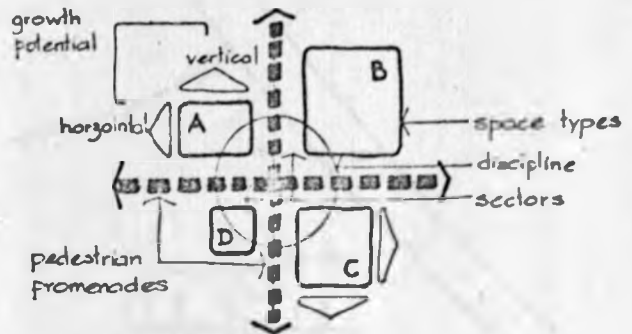
Green spaces flow through sectors defining courts or outdoor retreat spaces around which academic activities function. These are to be landscaped in living forms giving the impression of vastness to an eventually tight packed low rise system of planning of the built spaces.



Disciplines are centered around junctions or nodes of circulation combining various proportions of the adjoining sectors into a facility for that particular discipline.

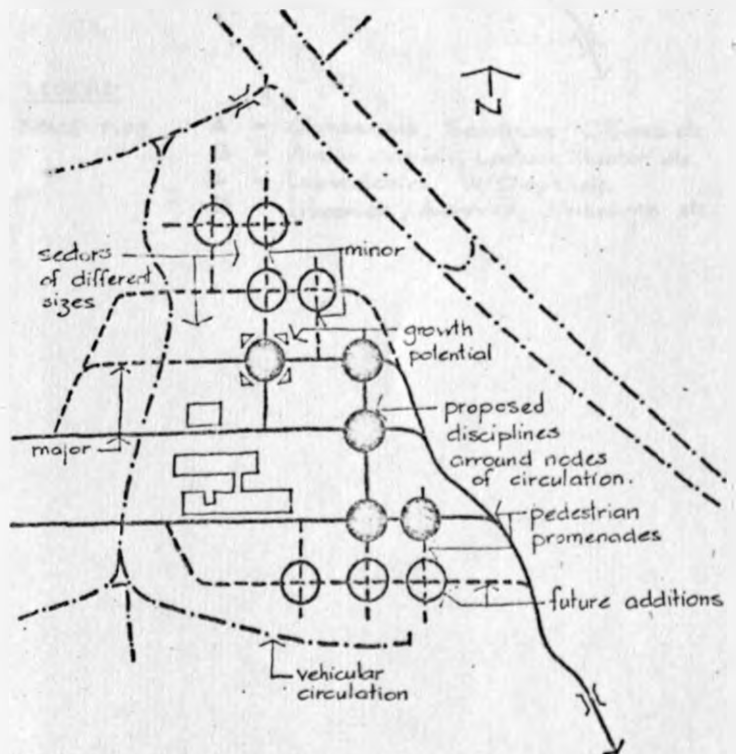
The built spaces which house the discipline are planned within the framework of the four SPACE TYPES developed, each capable of accommodating a range of activities. This enables a new user to utilize the facility by merely changing the proportions of the four space types present.

Growth of each space type is also possible within the system.



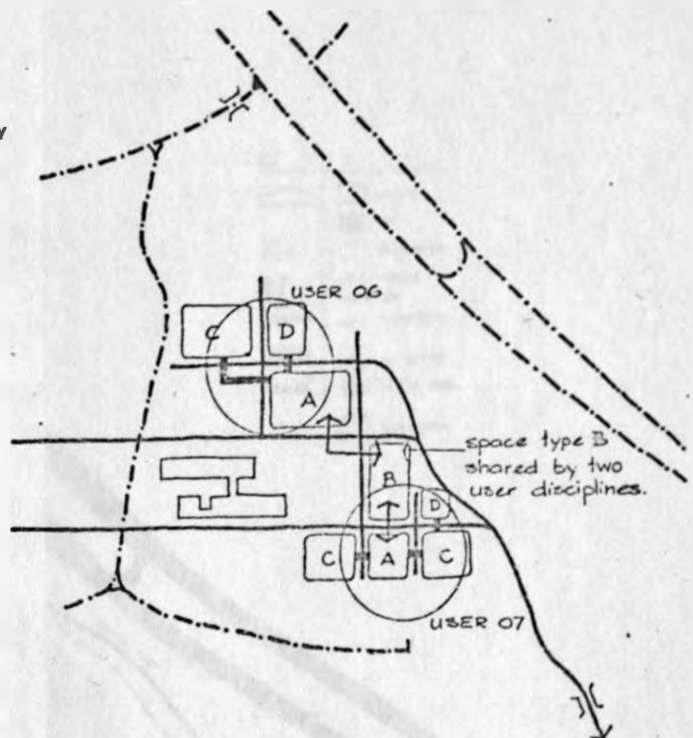
SPACE TYPE: A - Classrooms, Seminars, Offices etc.
 B - Audio-Visual, Lecture Theater etc.
 C - Laboratories, Workshops etc.
 D - Libraries, Archives, Museums etc.

The discipline may expand and grow at will around this node, have a unique identity within the system, yet is bonded to the system through the cohesive element of pedestrian walkways. This helps to reduce territorial attitudes by disciplines and enables better utilization of available spaces. The nodes may occur at any intersection of the major and minor promenades. The rigid major promenades (east-west) arise out of need to link with the existing and distribute activities over the whole site. The less rigid minor promenades (north-south) intersect and define sectors of varying sizes as necessary for the system.



A system is thus established which efficiently copes with the needs of small disciplines, accommodates growth within them and accommodates new disciplines or interdisciplinary institutes at the open ends.

Should two larger disciplines be forced upon this system, it is capable of coping and still maintains the order established.



LEGEND

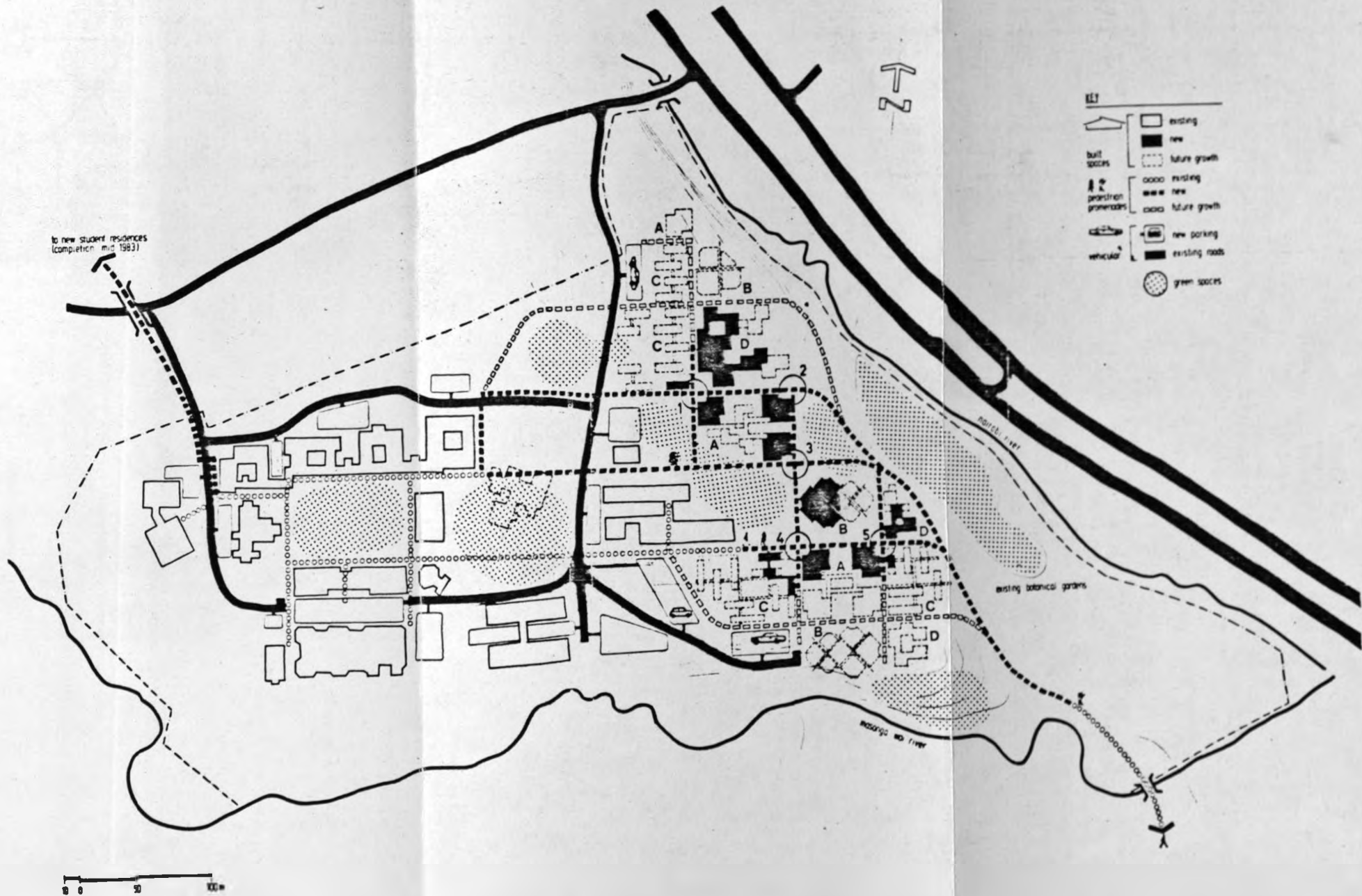
SPACE TYPE

- A - Classrooms, Seminars, Offices etc
- B - Audio-Visual, Lecture Theater etc
- C - Laboratories, W/Shops etc.
- D - Libraries, Archives, Museums etc.

LEGEND

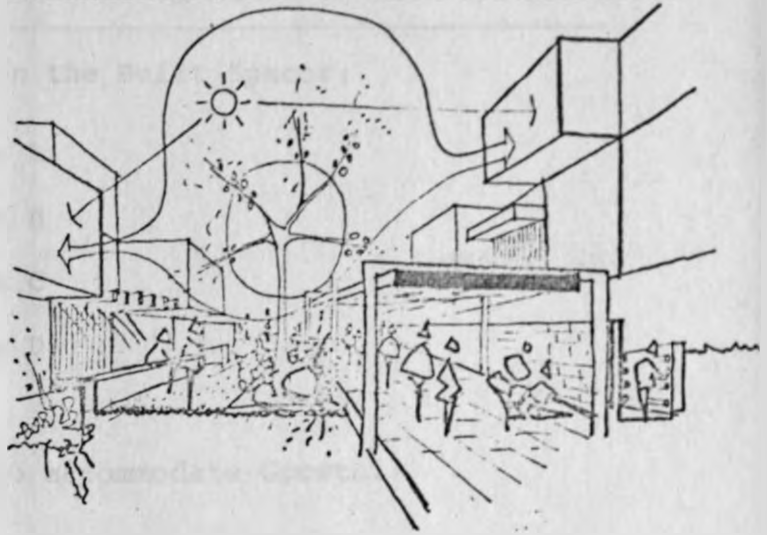
- 1. Institute of African Studies
- 2. Institute for Development Studies
- 3. Population Studies & Research Institute
- 4. School of Journalism
- 5. School of Environmental Studies.

- A. Space Type A)
- B. Space Type B)
- C. Space Type C) refer to 9.4.1
- D. Space Type D)

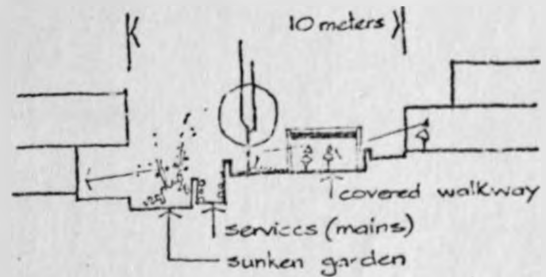


9.3.3 PROPOSED PEDESTRIAN PROMENADES

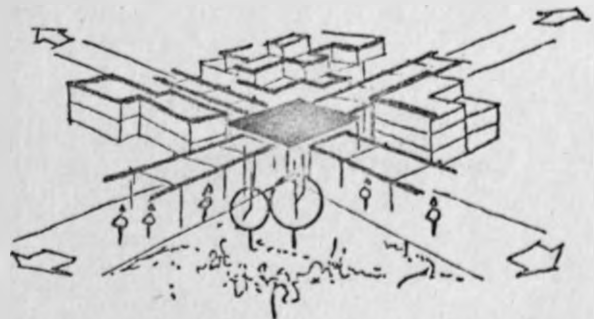
The proposed pedestrian promenades do not only feed the built spaces with the vital user circulation and services but also act as open spaces which permit the basic human requirements of light and ventilation into the tight-packed enclosed spaces.



The issue of privacy of the built spaces from that of the walkways is resolved by varying levels of the walkways and the adjoining built spaces or by changing the position of the walkway in the 1.0 metre pedestrian reserve between built spaces.



Each intersection or node gives the observer the sense of having arrived at a place through variation in the enclosure (roof covering) materials used, different designs for the spaces and landscaping for the node. This also eliminates the monotony of rigid linear walkways and gives the feeling of cohesiveness to the adjoining built spaces around the node which make up a micro-complex for a particular discipline or user.



9.4 DEMONSTRATION OF FLEXIBILITY

9.4.1 Flexibility in the Built Spaces:

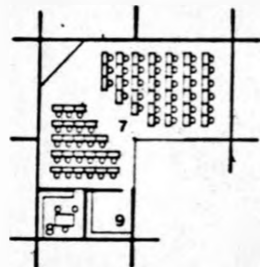
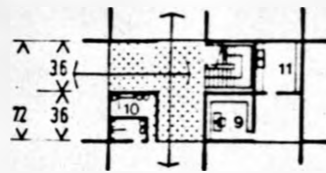
- Space Type A
- Space Type B
- Space Type C
- Space Type D

9.4.2 Flexibility to accommodate Growth.

9.4.3 Flexibility to Change of Users.

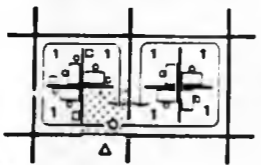
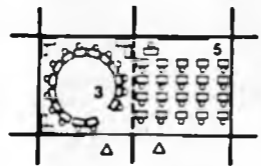
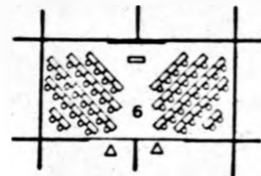
LEGEND

1. 505 Office
2. 510 Sec/Typist/
Reception
3. 515 Conference
4. 305 Seminars
5. 105 Classroom (capa-
city 20)
6. 105 Classroom (capa-
city 52)
7. 205 Typing Classroom
(capacity 54)
8. 520 Special Office
9. 640 Cons. Mats. Store
10. - Toilets
11. - Cleaners



< 36 x 36 x 36 x 36 >

< 72 x 72 >

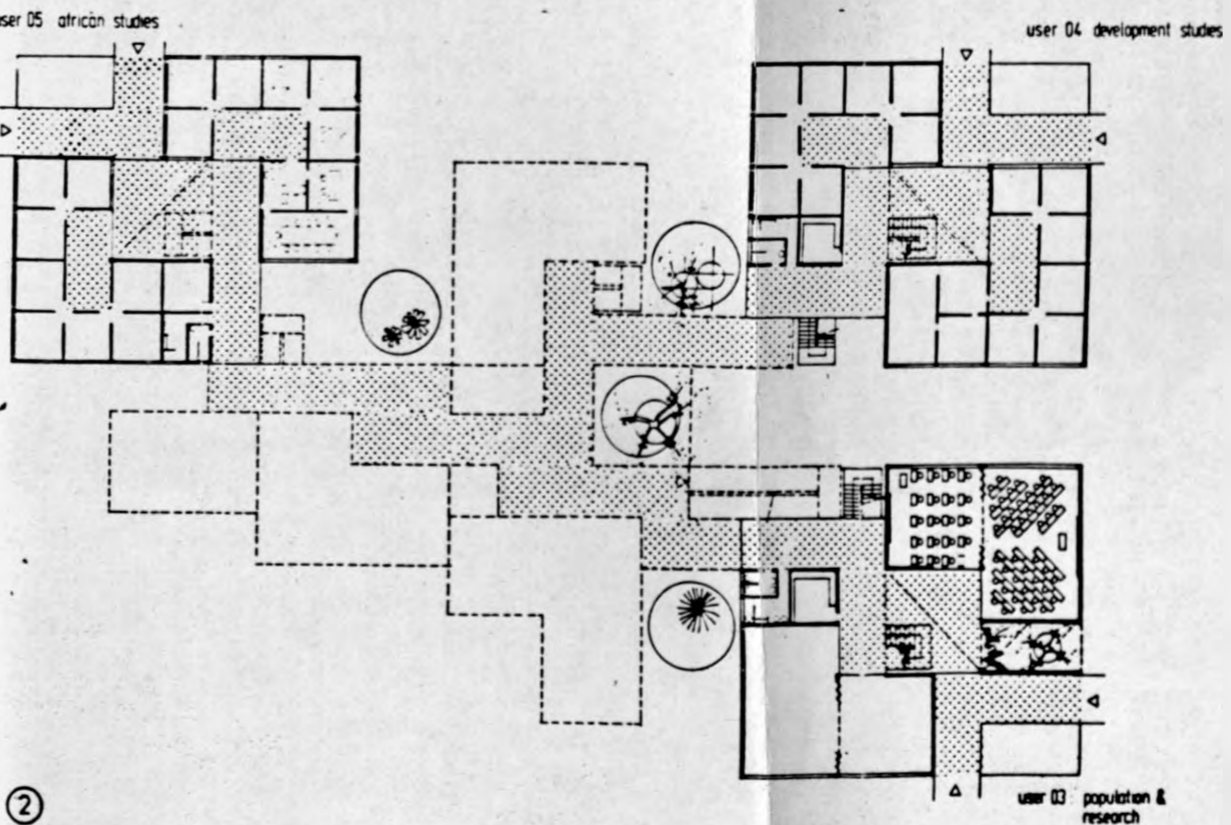
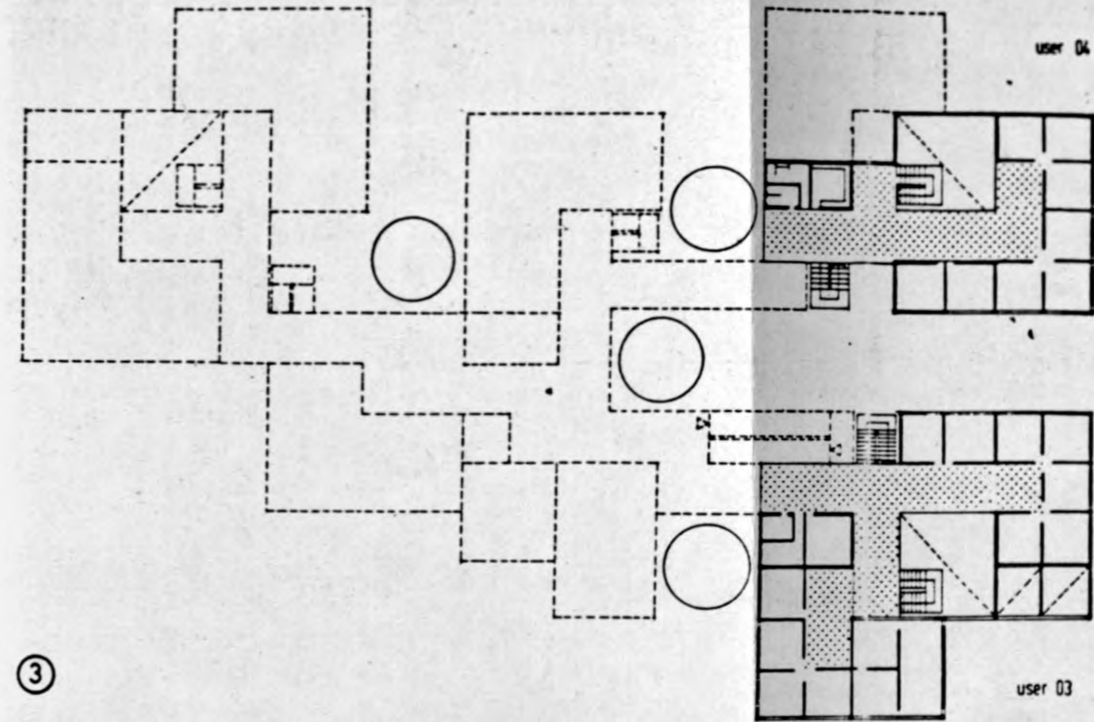


1 A module of planning which accommodates the entire range of activities, including circulation and utilities, either as a single unit or when combined.

2 Ground Floor Plan:
Possible layout using basic module and its combination to produce space which has a sense of identity for the three users, yet is a part of the system. Growth possible by repetition of the module along pre-defined directions to maintain comprehensibility.

3 Upper Floor Plan:
- ditto -

①

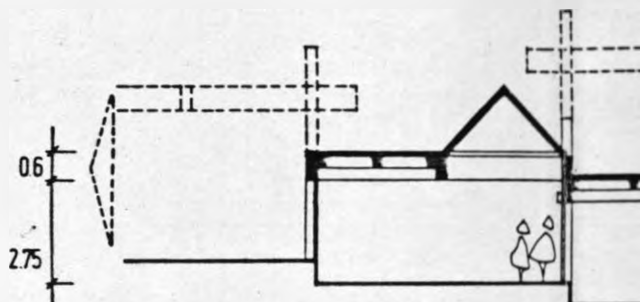


②

① & ②

The basic module encloses space with in-situ cast concrete framework stub columns and beams to allow additional connection when necessary. The levels of the module may be varied to suit site gradients with the possibility of stacking them on each other. Into this framework can be plugged in pre-cast concrete decking as floor and roof or openings such as roof-lights, glazing or solid elements such as concrete blockwork. The flexibility in the openings avoids solar heat gain and direct sunlight for different orientations by introducing the sun-shading or 'solid' elements, as appropriate. Internally the partitioning is demountable to provide private work stations or when removed and fitted with mechanized partitioning, the division of spaces to give varying capacity

Services distribution is mainly electrical and communication is ideal at doorframe height to enable uninterrupted openings without moving the distribution trunking.

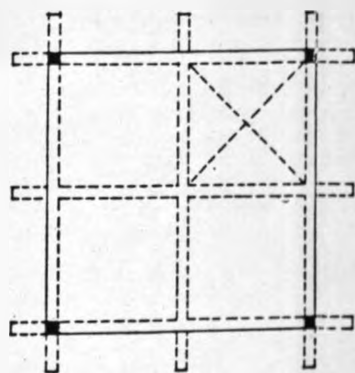


36 * 36

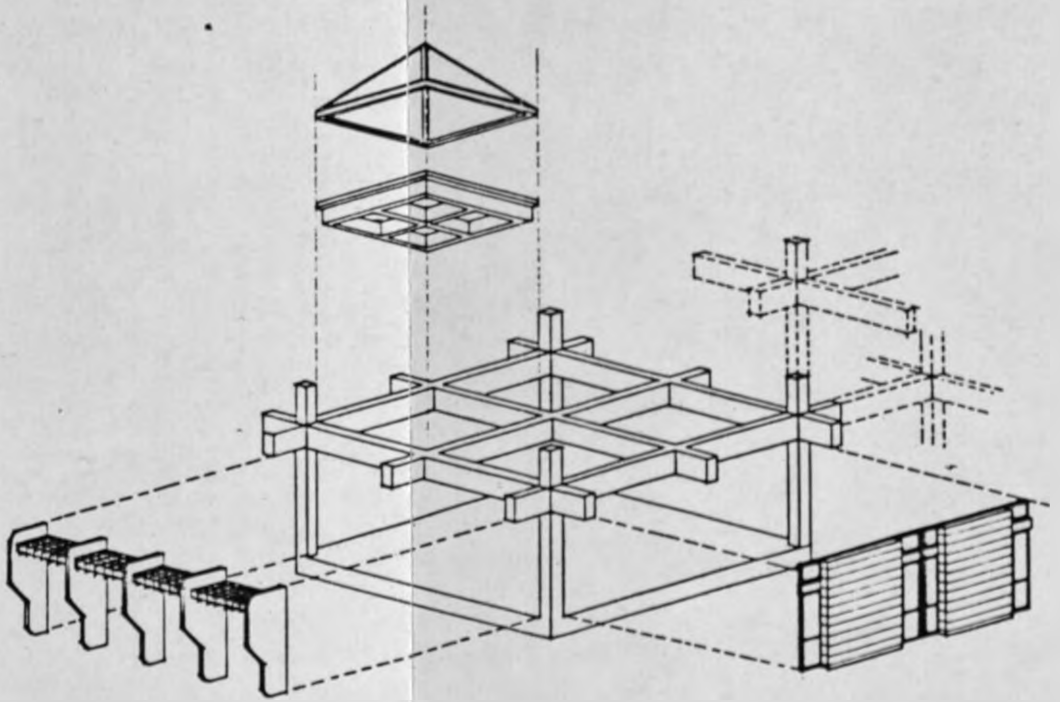
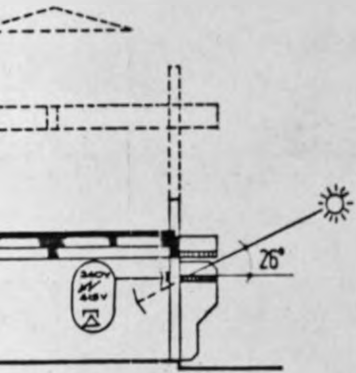
36

36

36



①



②

FLEXIBILITY IN THE BUILT SPACES.

SPACE TYPE B - Exchange/Instruction

LEGEND

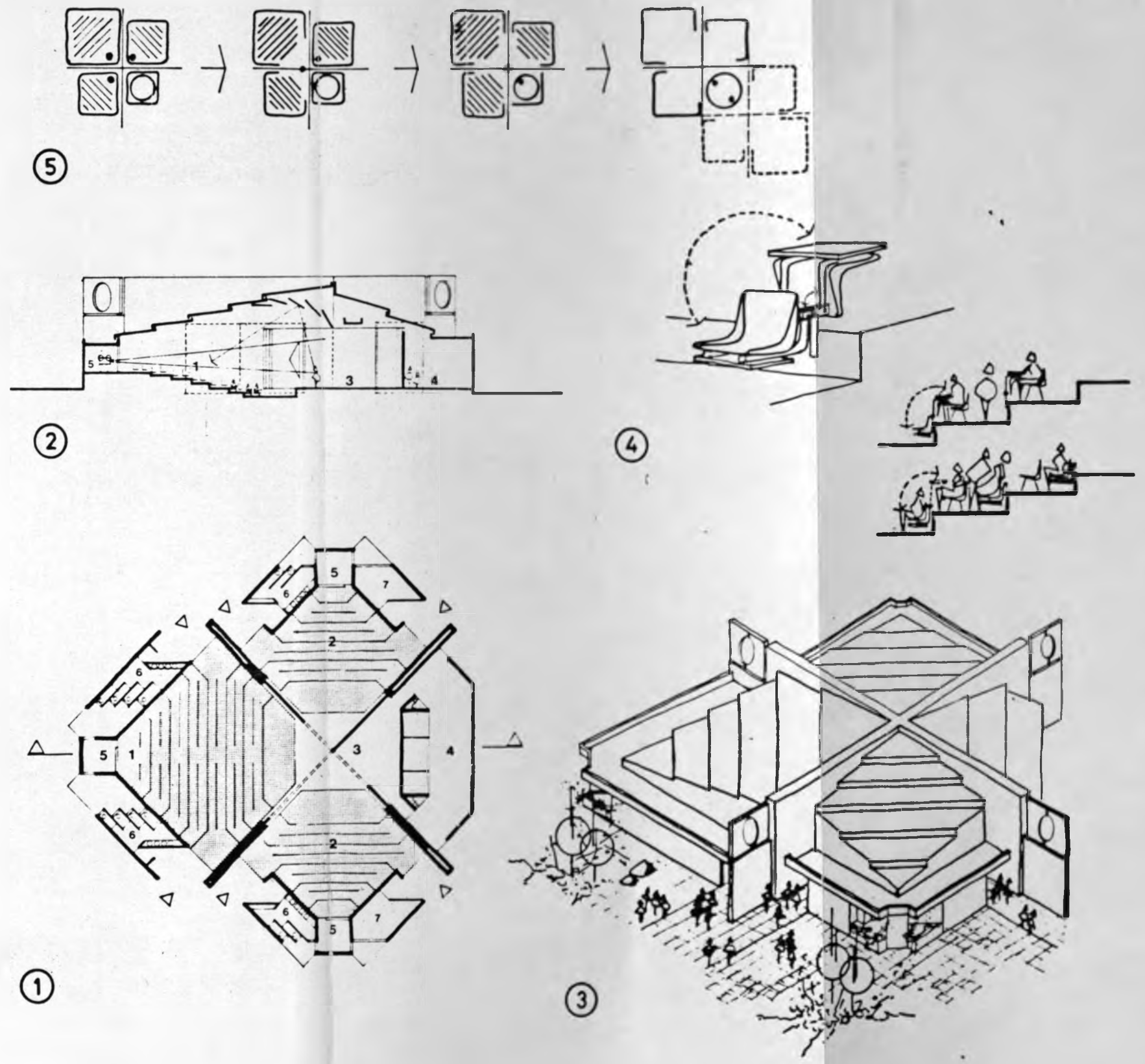
- 1. Auditorium 110 Lectures
310 Audio-Visual
- 2. Auditorium 315 Performance
320 Address
- 3. Stage
- 4. Backstage/Changing
- 5. Projection
- 6. Toilets
- 7. Furniture Storage

- ① Ground Floor Layout
- ② Section
- ③ Aerial View

④ The swing type desk/chair equipment was developed to eliminate the need for moving furniture when the space is used differently. During formal lectures, the equipment is used as a desk with a loose chair to sit on. During performances, addresses or audio-visual displays, the equipment is swung around and used as a chair and together with the loose chair doubles the capacity. The occupant capacities thus produced are:

	desk	chair
1. Auditorium	100	200
2. Auditorium	75	150

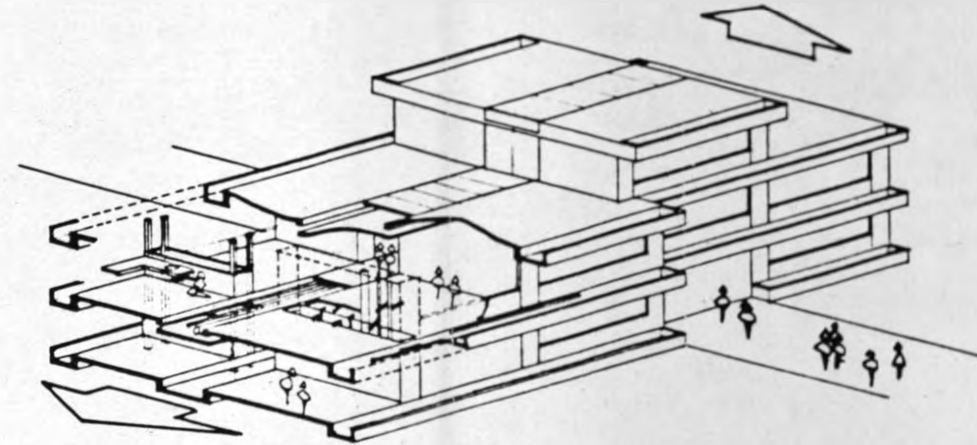
⑤ The three spaces may be combined in pairs or all three to vary the occupant capacity by mechanically moving the massive partitions. A systematic growth is also possible when needed, sharing the same backstage and changing facilities.



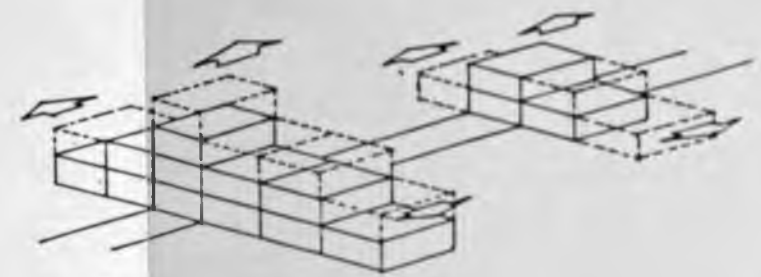
FLEXIBILITY IN THE BUILT SPACES.

SPACE TYPE C - Practical/Demonstration

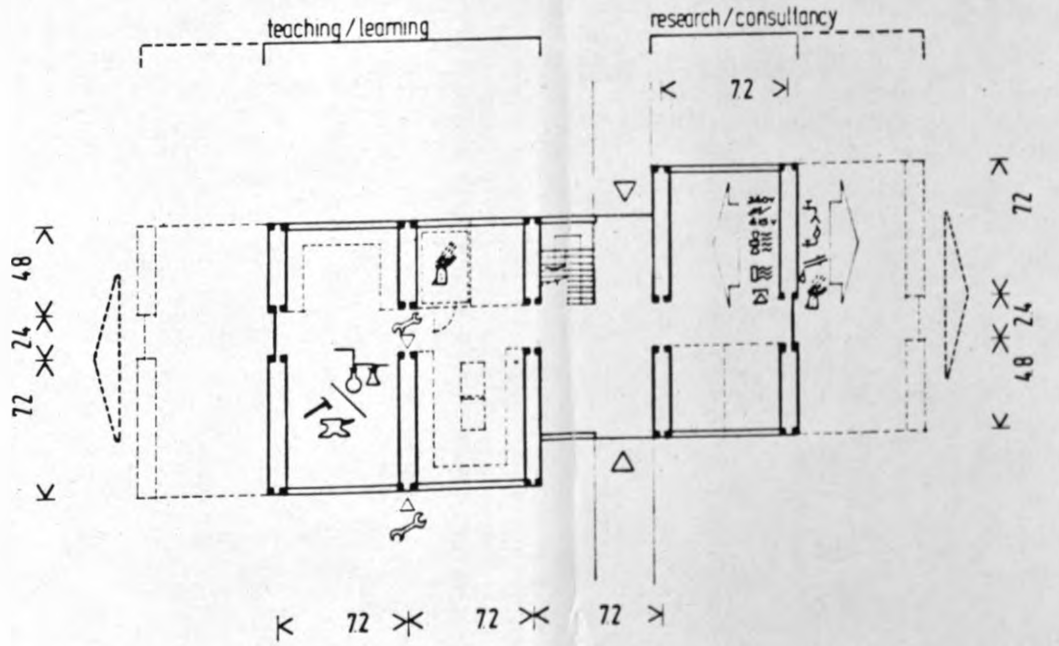
- ① Plan.
Arrangement of bays or modules which are separated by service cores in which are provided the distribution mains of all services. Connections, workstation layouts are under the immediate control of the user.
- ② Isometric.
Stackability of the modules or bays with clearly defined and uninterrupted service routes feeding or omitting bays.
- ③ Growth potential of a typical cluster showing systematic addition of bays and modules both vertically and horizontally.
- ④ Provision of all service mains are done at the outset with the actual provision of equipment and fittings controlled by the immediate user. 'Plug-in' connections to the services are provided at appropriate centres with the actual connections under the control of the user thru flexible hosing or wiring.



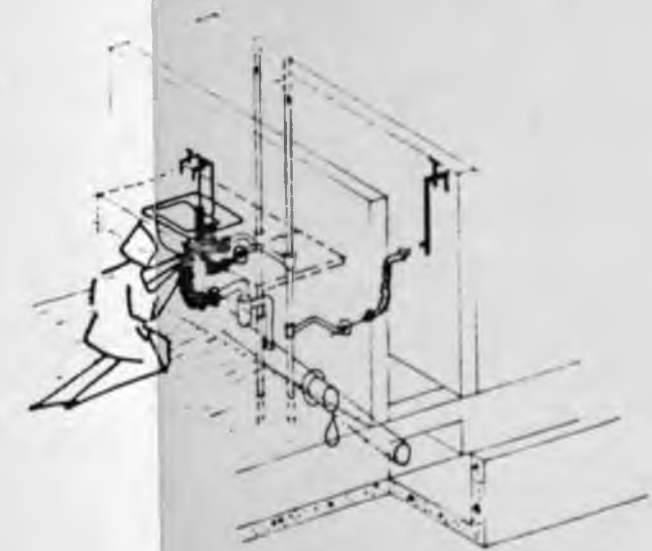
②



③



①



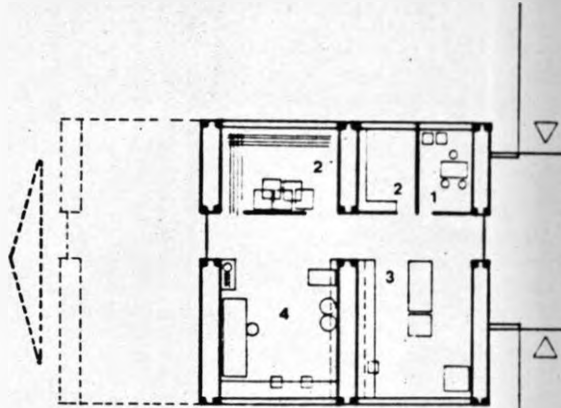
④

In this manner the most efficient work-bench layouts are possible with the potential of continual change.

① ENVIRONMENTAL STUDIES

LEGEND

1. 520 Special Office/
Technician
2. 640 Consumable Materials
Store
3. 215 Individual Lab.
4. 250 Individual
Workshop.



225 restoration lab & w/shop.

② AFRICAN STUDIES

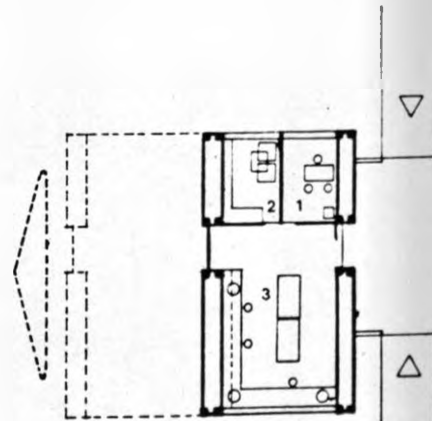
LEGEND

1. 520 Special Office/
Technician
2. 640 Consumables Materials
Store
3. 215 Individual Lab
4. 250 Individual wood/
metal workshop.

②

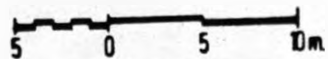
③ JOURNALISM

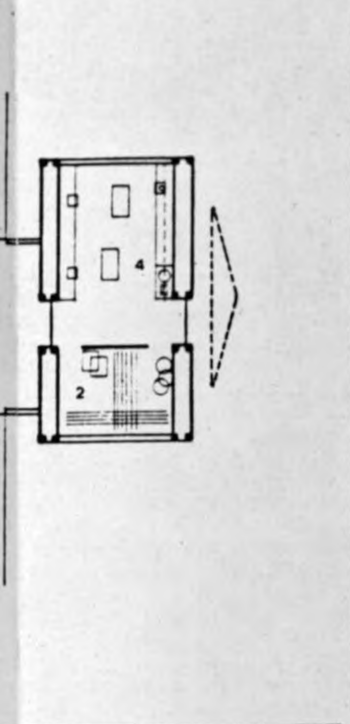
1. 520 Special Office/
Technician
2. 640 Consumable Materials
Store
3. 225 Type setting
4. 250 Xeroxing & binding
5. 250 Printing presses
6. 230 Studio
7. 620 Dark room
8. 620 Dark cubicles
9. 225 Graphic artist +
Studio
10. 620 Radio Teaching Studio
11. 620 Control room
(Radio/T.V.)
12. 225 T.V. editing review
13. 620 T.V. Teaching Studio



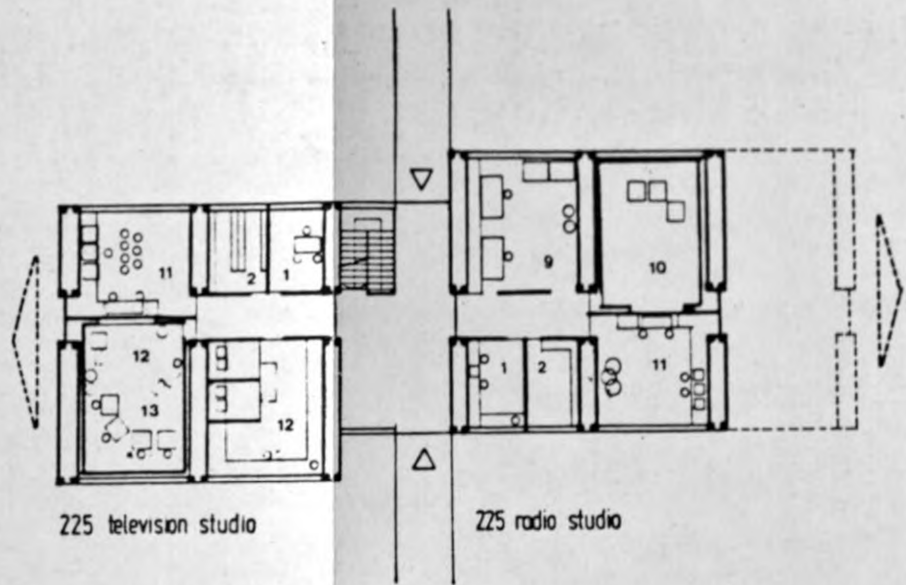
215 individual lab

①



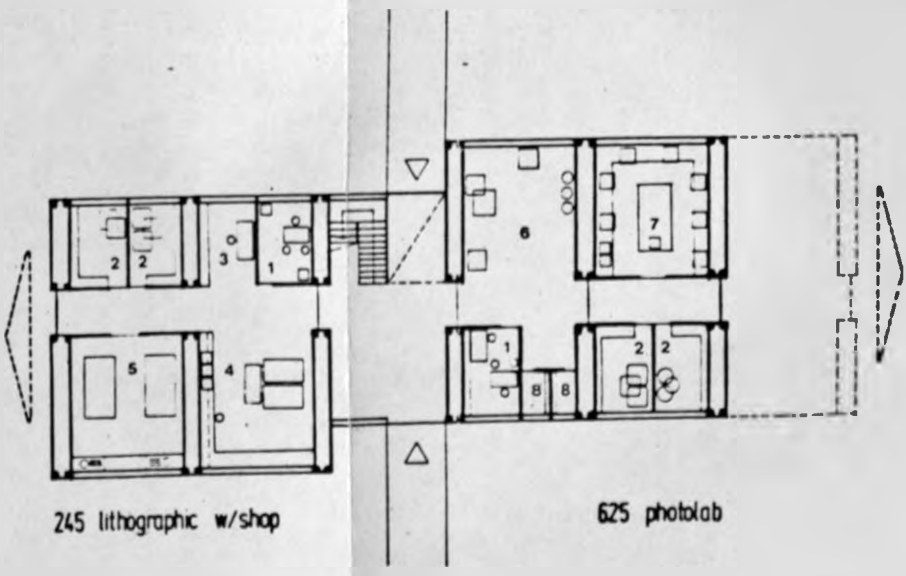
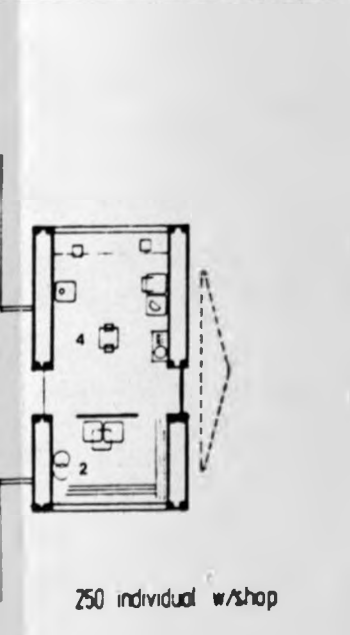


250 individual w/shop



225 television studio

225 radio studio



245 lithographic w/shop

625 photolab

③

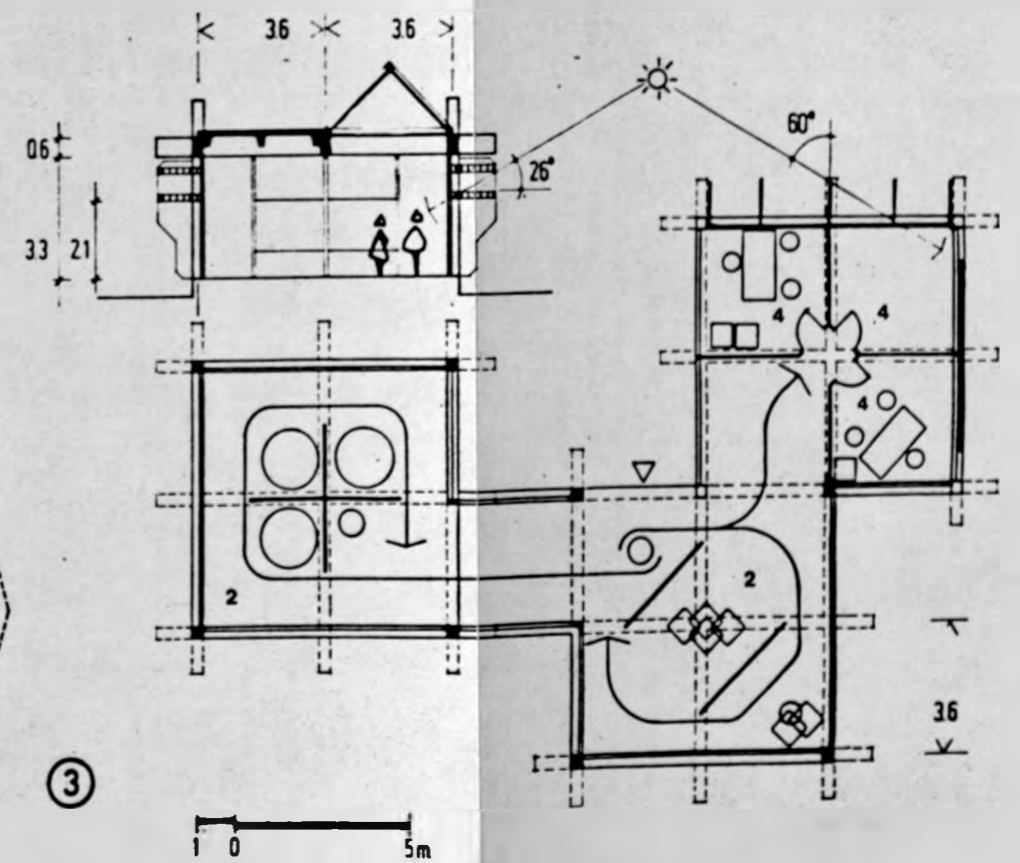
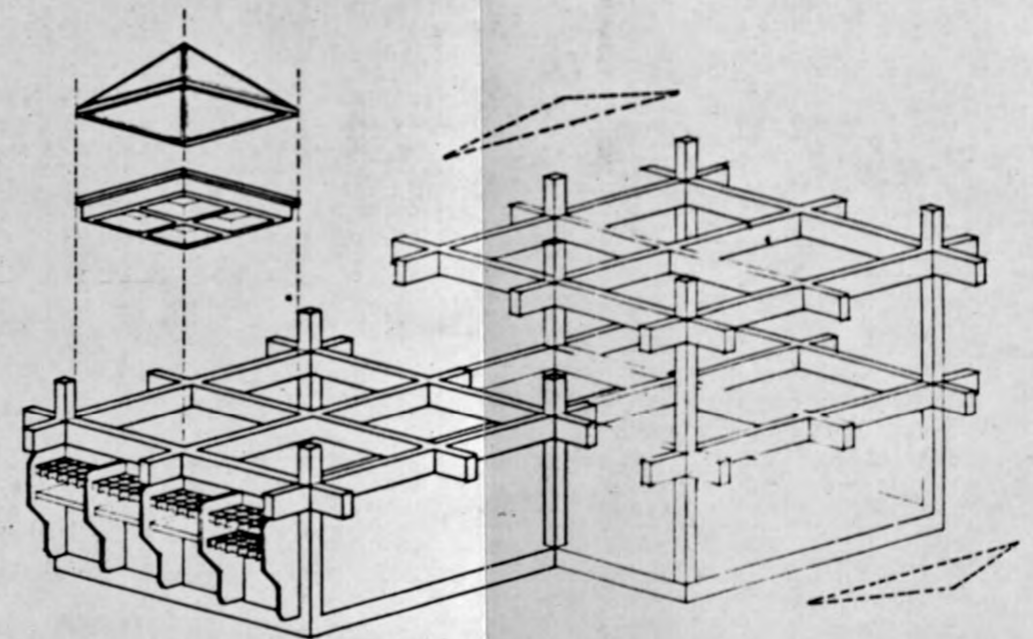
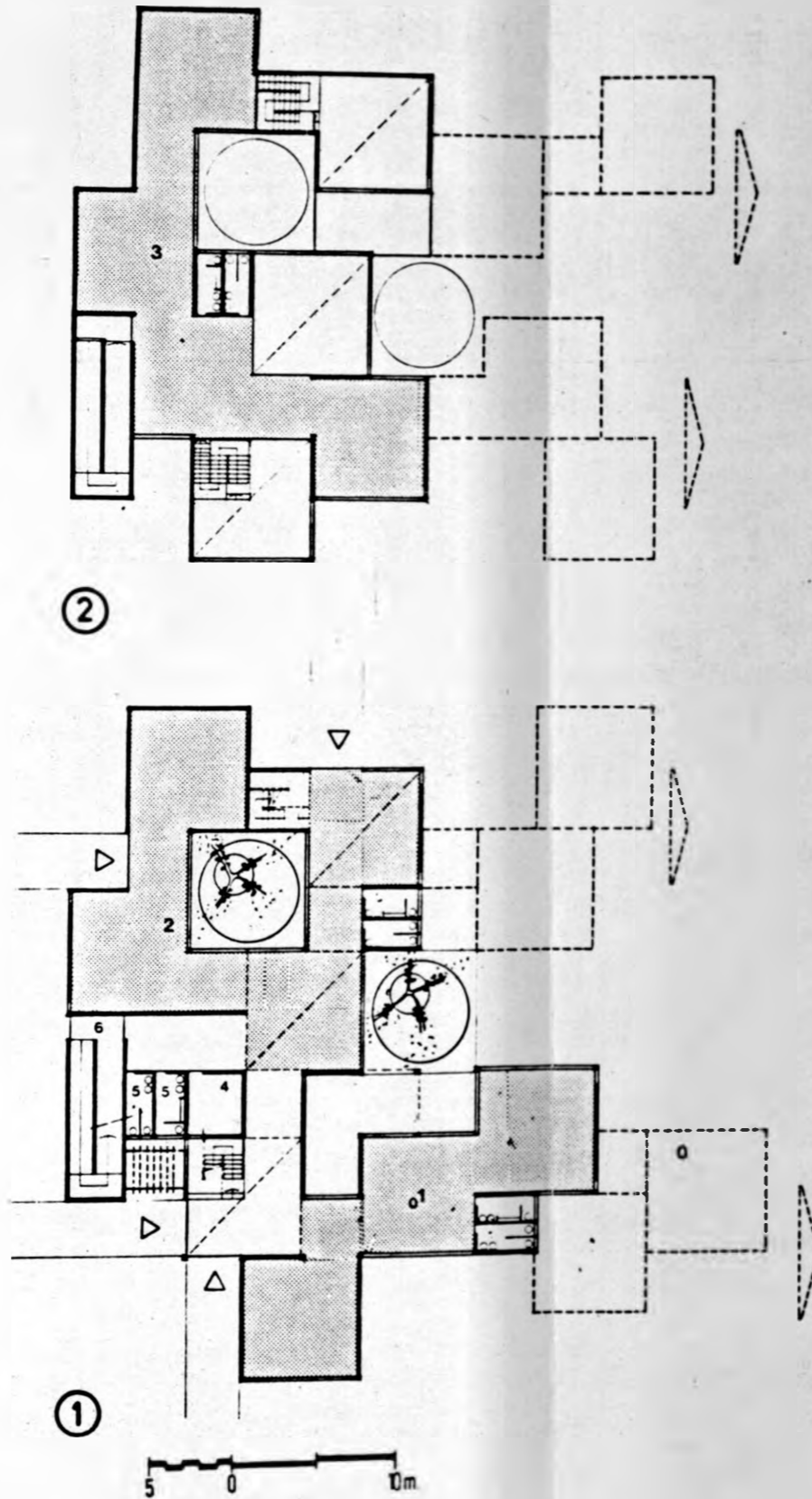
FLEXIBILITY IN THE BUILT SPACES:

SPACE TYPE D

LEGEND

- 1. 405 Library
- 2. 325 Exhibition
- 3. 415 Archives
- 4. Technician
- 5. Toilets
- 6. Ramp.

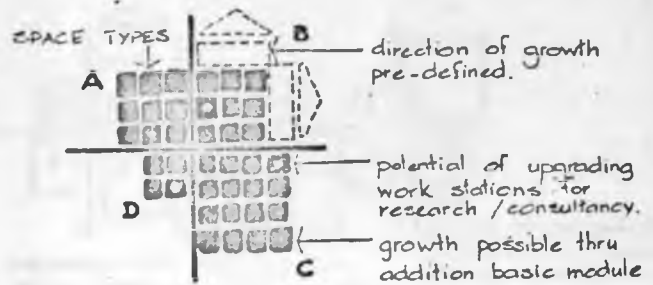
- ① Ground Floor Layout - African Studies.
- ② Upper Floor Layout - African Studies
- ③ Planning according to the basic module with potential of systematic growth by repetition. Though similar to the module of Space Type A, the difference is in ceiling height and floor load capabilities which are higher. The partitioning is demountable where private work stations are located or flexible where displays and exhibits are accommodated.



9.4.2 FLEXIBILITY TO ACCOMMODATE GROWTH.

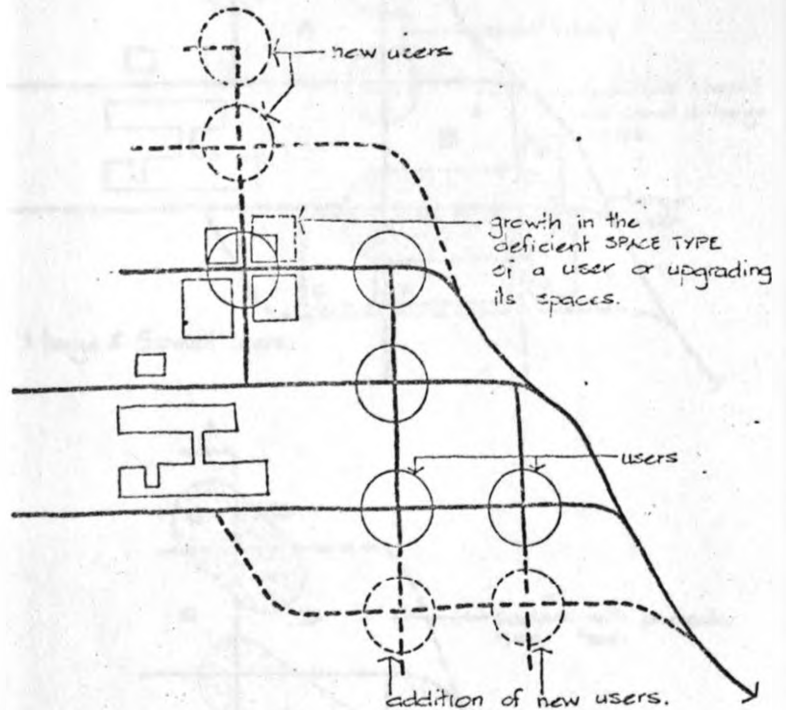
Growth in the built space can be brought about by addition of the basic planning module of each space type (as demonstrated in 9.4.1) or the upgrading of a particular space or module when necessity demands.

In order to maintain comprehension of the constituent parts in the system the directions of growth are pre-defined. This results in enhancing and furthering the inherent order of pedestrian circulation, sectors with different space types, identity of users within the system such that comprehension of the elements is maintained after growth takes place.



The system of planning accommodates growth in the system which is of two main types:-

- Realization of a deficiency by a user and the appropriate addition or upgrading to the relevant space type.
- Addition of new users or splinter users such as inter-disciplinary institutes research/consultancy bodies etc.





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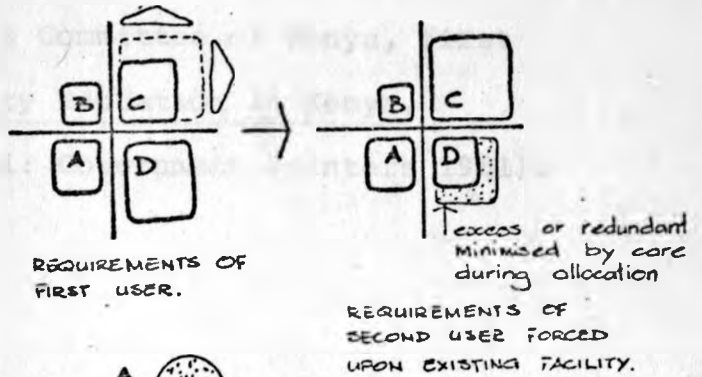


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9.4.3 FLEXIBILITY TO ACCOMMODATE CHANGE OF USERS.

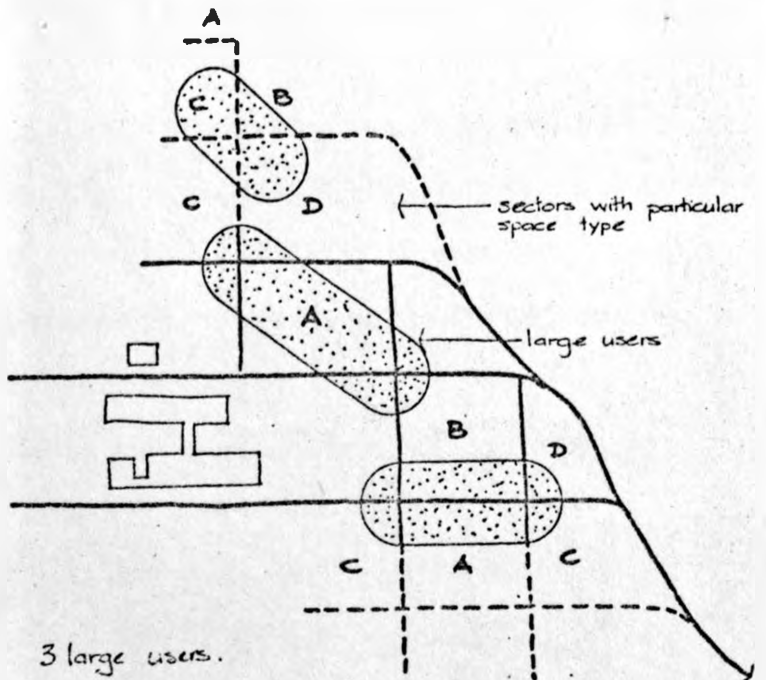
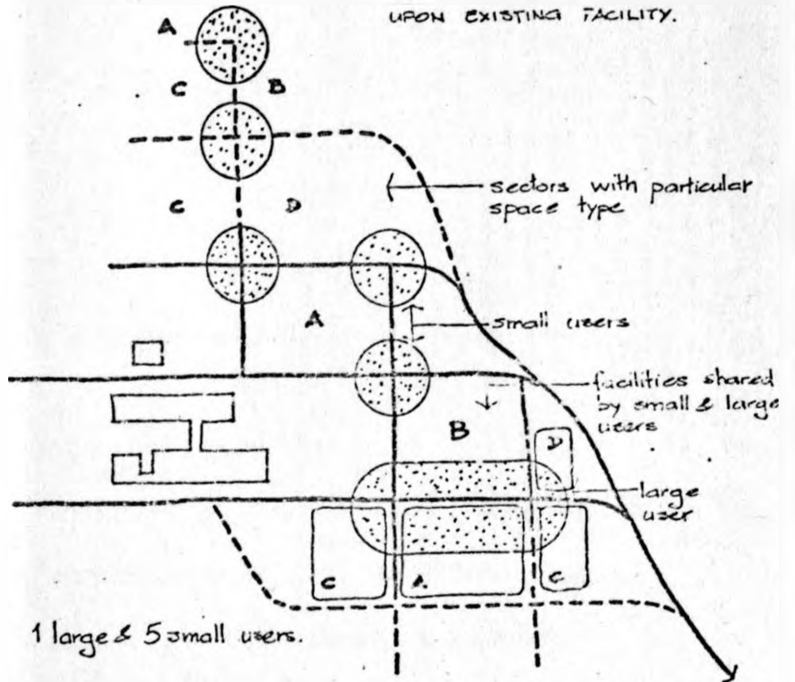
Planning the built spaces in the framework of the four SPACE TYPES enables all the teaching/learning activities at the University of Nairobi to be accommodated. Should a new user be forced upon this facility, it responds by merely changing the proportion of the space types existing. This is possible through the potential of growth of each type.

A new user may however inherit an excess of a particular space type or not need it at all. This can be minimised by careful allocation of facilities to users whenever re-organization occurs.



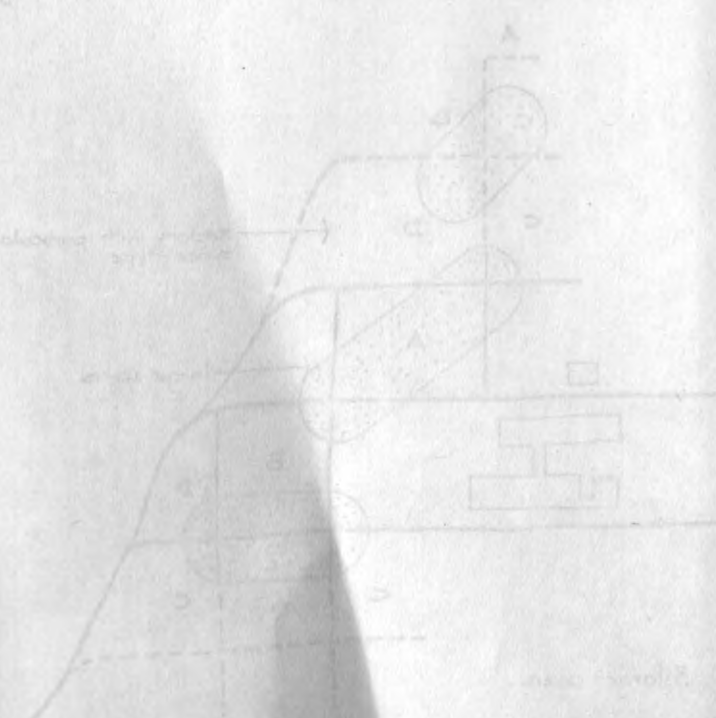
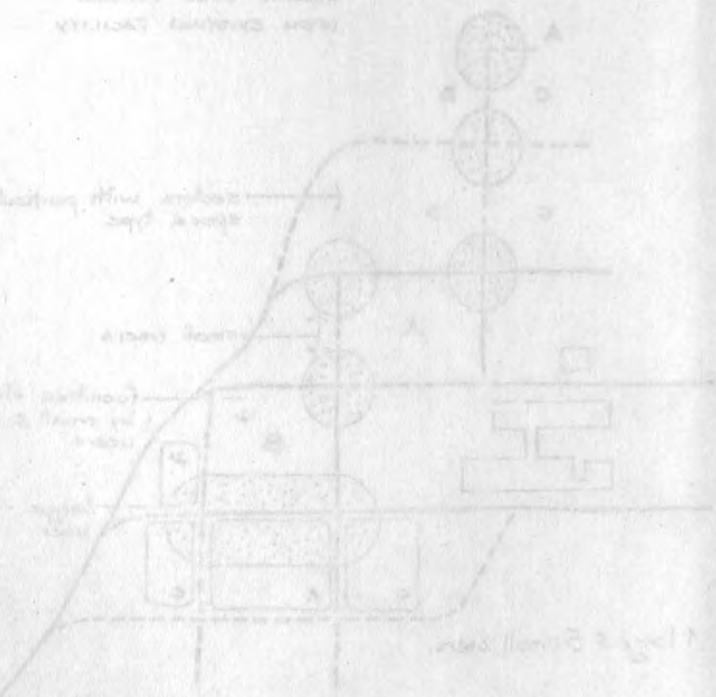
Should larger users (those which require more space than around a single node of circulation) be forced upon the 'system', it responds by easily accommodating yet maintaining the inherent order of circulations, work zones, administration etc. Thus the 'system' is valid for all scales of users as the same facilities are used combining the appropriate space in sectors to house a discipline. Each sector houses one space type

- Space Type A: Classrooms, and administration.
- Space Type B: Lecture Theatres, Audio-Visual & Auditoria.
- Space Type C: Labs, workshops & their support spaces.
- Space Type D: Resource, Archives, Museums etc.





SECTION OF BUILDING
 DIVISION OF PHYSICS
 FROM CHICAGO FACILITY
 ROOMS WITH PARTIAL
 ROOMS WITH PARTIAL
 ROOMS WITH PARTIAL



The following is a description of the building layout shown in the diagrams. The building is divided into several rooms, labeled A, B, C, and D. The layout is shown from two different perspectives: a top-down view and a side view. The top-down view shows the arrangement of rooms and their relative positions. The side view shows the building's profile and the location of the rooms. The diagrams are annotated with various labels and arrows, indicating the location of the rooms and the direction of the path. The text is written in a cursive style and is somewhat difficult to read.

FOOTNOTES

- ¹University Grants Committee of Kenya, first report, University Education in Kenya, pp 32-34 (Nairobi: Government Printers 1981).

10 CONCLUSIONS AND RECOMMENDATIONS

An understanding of the factors which have caused changes at the University of Nairobi and their effects on the physical plant of this institution, is the basis on which the degree of 'response or flexibility' necessary has been determined and recommended in this study.

Time, the external and necessity the internal forces acting on the physical plant compel it to respond, making it vital for this response to be rational and systematic. This rationality and systematized response is the flexibility required and, should be reversible should time and necessity demand.

Invariable
Factors

In consideration of the factors which have been
changed at the level of physical and social
effects on the physical plane of this institution,
the basis on which the degree of response
or flexibility, necessarily, has been determined
and recommended in this study.

Time, the external and necessarily the internal
factors acting on the physical plane, could be so
respond, making it vital for this response to be
external and systematic. This rationality and
systematized response is the flexibility
respondent, should be revealed, should that
and necessarily be so.

External
Factors

Scope of
Response

The span of time in this instance varies from 0 to 60 years plus. This study concludes the architectural design mechanisms necessary to develop a built enclosure which withstands changes over such a span of time coupled with the changing user habits.

Types of
Response

The flexibility required may be divided into two, based on the frequency of change; short-term which is response necessary as frequent as 0-7 years and long term, of frequency of 7-60 years plus.

Short-term

Short-term flexibility involves mainly internal re-organization - partitions, corridors, service mains capacities and feeds to work stations, work bench layouts, storage, work zones etc.

Response
mechanisms

The architectural response or mechanisms which have to be incorporated to produce short-term flexibility are the following:-

- The built enclosure should be planned on the basis of the four SPACE TYPES developed (refer 8.1). This allows easier internal re-organization as each space type is subjected to lesser diversity of uses and thus responds, by accommodating in the optimum the entire range of activities in

The following table shows the results of the study conducted in 1971. This study was conducted in order to determine the necessity for the development of a new type of work which would be suitable for the aged population.

The flexibility requirements are divided into two, based on the frequency of change; short-term with a response necessary as frequent as 0-1 year and long-term, of frequency of 2-10 years or more.

Short-term flexibility involves mainly manual re-orientation - positional, rotational, horizontal, work plane changes and leads to work stations, work bench layout, stairs, work zones etc.

The anthropometrical response of workers which has to be incorporated to produce short-term flexibility are the following:-

The main emphasis should be placed on the basis of the four FEAR types developed in 1971. This allows easier internal re-orientation at each space change and subjected to least diversity of use and the response by anthropometrical data. The main objective is to provide a suitable type of work for the aged population.

its group. The higher initial capital cost of producing these space types is feasible compared to the present purpose-built spaces (refer 8.2).

- Spaces should be designed in modules or bays which may be combined to increase occupant capacity or up-graded or down-graded as and when the depth of teaching, learning, research or consultancy changes.

The spaces should also be planned to express identity at course or discipline level yet be part of an overall system which encourages interaction or sharing of some spaces to achieve better utilization (refer 9.3-site layout).

- Provision of clearly defined and easily accessible service routes should be allowed in the built enclosure together with the services mains at the outset. The actual provision and connection to the mains of equipment and fittings should be under the control of the immediate user - teacher, student, technician or researcher (refer 9.4.1-Space Type C). This involves development in the fields of equipment and fittings such as plug-in connections to service mains, development which is

outside the scope of the architect.

Long-term

Long-term flexibility is response to accommodate the less frequent growth and adaptation to new users. Growth is inevitable as it may arise from scarce resources initially or the discovery of inadequacy or more complex needs with time. A change of user might be forced upon the facilities due to factors such as policy changes at national level, change in institutional structure etc.

Response mechanisms

The architectural mechanisms to incorporate long-term flexibility are;

- A system of overall planning that accommodates growth by addition to the whole or repetition of constituent elements or by completion. The system should maintain comprehension of constituent parts retaining and furthering the order established (refer 9.4.2).

This is essential as additional needs are impossible to predetermine. Limits on the growth and expansion should also be pre-defined, in the context of student enrollment, research consultancy, discipline's metamorphic growth etc.,

to enable users and facilities planners to realize when further expansion is not possible. This maintains a facility in manageable proportions and prompts the need for additional facilities to complement its role in overall higher education objectives.

- Planning the built enclosure in the framework of the design parameters developed for the four SPACE TYPES (refer 8.1). Should a large user be forced upon the facility with differing requirements, the facility responds by merely changing the proportions of the SPACE TYPES present and maintaining the inherent order, since the initial facilities were planned with the potential to grow within the system (refer 9.4.2.).

Specific to
University
of Nairobi

In addition to these general conclusions and recommendations it is proposed that the following recommendations specific to the University of Nairobi, should be adopted.

- A system of future teaching/learning space planning be adopted that allows a sense of identity to the individual disciplines yet bonds it to the overall

system or complex by some of the constituent elements such as pedestrian circulation (refer 9.3-conceptual approach for flexibility). This encourages interaction and exchange between disciplines, essential for any healthy academic environment and abandons territorial attitudes by individuals or disciplines to achieve better utilization of available spaces.

- Scheduling the use of spaces be centralized for groups of users sharing a part of the complex to attain more effective and efficient use of available space.
- Data of changes in facilities be maintained to
 - identify and define directions in which flexibility should be further incorporated into new facilities.
 - data should identify the exact factors which have caused changes.
 - The scale and magnitude of the change should be quantifiable to develop norms for use by future higher educational facilities planners.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved. The document also outlines the various methods and procedures that should be followed to ensure the accuracy and reliability of the records.

In addition, the document provides a detailed explanation of the different types of records that should be maintained, including financial records, inventory records, and customer records. It also discusses the importance of regularly reviewing and updating these records to reflect any changes in the business's operations.

Finally, the document concludes by reiterating the importance of proper record-keeping and encourages all business owners to take the necessary steps to ensure that their records are accurate and up-to-date.

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