DOCUMENT RESUME

ED 077 310 HE 003 993

AUTHOR	Simpson, M. G.; And Others
TITLE	Planning University Development.
INSTITUTION	Organisation for Economic Cooperation and Development, Paris (France). Centre for Educational Research and Innovation.
PUB DATE	72
NOTE	135p.; Studies in Institutional Management in Higher Education
AVAILABLE FROM	OECD Publications Center, Suite 1207, 1750 Pennsylvania Avenue, N.W., Washington, D.C. 20006 ($3.50)
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Admission Criteria; *Cost Effectiveness; *Educaticnal Economics; *Expenditures; Foreign Countries; *Higher Education; International Education; *Management Systems; Program Descriptions; Program Development; Research Projects; Teacher Salaries; Teaching Load
IDENTIFIERS	*University of Lancaster

ABSTRACT

This document reviews varicus aspects of a research project designed to explore the problems raised by the elaboration, discussion and implementation of major development plans for universities and to improve cost effectiveness. The University of Lancaster was designated as the target for studies. Chapter cne presents an overview of details peculiar to the University of Lancaster including the area of project coverage. Chapter two emphasizes various aspects of student course preference. Chapter three covers the undergraduate, post graduate, and new department teaching loads in addition to the planning of undergraduate admissions. Chapter four reviews the admissions policy in 1972/77. Allocations of funds to the library is discussed in chapter five. Chapter six covers teaching staff salaries while chapter seven reviews expenditures in departments. Chapter eight emphasizes the allocation of departmental room space and chapter nine reviews the implementation of research results. Appendices include related research material and an index. (MJM)

Centre for Educational Research and Innovation (CERI)

STUDIES IN INSTITUTIONAL MANAGEMENT IN HIGHER EDUCATION

UNIVERSITY OF LANCASTER

PLANNING UNIVERSITY DEVELOPMENT

Project Leader :
M.G. Simpson, Ph.D., Professor of Operational Research

Team Members :
Department of Operational Research
D. Falcon
Kau Ah Keng
R.N. Kennedy
D.H. Noble
J.M. Norman

University Finance Officer
H.F. White

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
1972

The Organisation for Economic Co-operation and Development (OECD), which was set up under a Convention signed in Paris on 14th December, 1960, provides that the OECD shall promote policies designed:

- *to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;*
- *to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development;*
- *to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obl*

The Members of OECD are: Australia, A Finland, France, the Federal Republic of Germ Japan, Luxembourg, the Netherlands, Norway, P Turkey, the United Kingdom and the United Stat

The Centre for Educational Research and Innovation was created in June 1968 by the Council of the Organisation for Economic Co-operation and Development for an initial period of three years, with the help of grants from the Ford Foundation and the Royal Dutch Shell Group of Companies. In May 1971, the Council decided that the Centre should continue its work for a period of five years as from 1st January, 1972.

The main objectives of the Centre are as follows:

- *to promote and support the development of research activities in education and undertake such research activities where appropriate;*
- *to promote and support pilot experiments with a view to introducing and testing innovations in the educational system;*
- *to promote the development of co-operation between Member countries in the field of educational research and innovation.*

The Centre functions within the Organisation for Economic Co-operation and Development in accordance with the decisions of the Council of the Organisation, under the authority of the Secretary-General. It is supervised by a Governing Board composed of one national expert in its field of competence from each of the countries participating in its programme of work.

The opinions expressed and arguments employed in this publication are the responsibility of the authors and do not necessarily represent those of the OECD.

PREFACE

In CERI's Programme on Institutional Management in Higher Education, eight universities were brought together to set up teams within their institutions to work on their respective pre-selected problem areas.[1] These teams have worked over varying lengths of time, none of which exceeded two years. The results of their work, together with the results of the in-house research of the Secretariat was presented before a wide audience of university executives and managers and Government representatives from the OECD Member countries at an Evaluation Conference held in Paris on 2nd-5th November 1971.

The Programme's work has now produced analyses of the major problem areas of university management and the general directions in which solutions to these problems must be sought. By concentrating the effort in selected university environments the approaches developed may not have the attraction of generality, but this has been more than offset by the demonstration of concrete ways of tackling the specific problems of university management.

This effort represents significant contributions in, at least, four areas:

First, conscious of the fact that universities have become major consumers of financial resources, it has been possible to indicate methods for evaluating the requirements of resources and their costs not only for the university as a whole but especially for its different components. This has involved the use of the budget as a planning tool by linking the expenditures, as far as possible, to the

---

1) These universities are the Free University of Berlin, University of Bradford, University of Copenhagen, Chalmers University of Technology, Gothenburg, University of Lancaster, University of Nijmegen, University of Novi Sad, Université de Paris X-Nanterre. The University of Copenhagen project was, however, carried out by a team from the Technical University of Denmark.

objectives of the programmes for which these expenditures have been incurred.

Second, it has been possible to demonstrate the costs and the consequences of different decisions concerning selected university matters both for current operations and for expansion, in order that policy-makers may choose desired courses of action. Such an approach offers an opportunity for effectively reducing the arbitrariness of decisions concerning the allocation of resources, and thereby improving the general efficiency of operations.

Third, from early in the development of the programme it was found that the basic information requirement for university-wide management was either lacking or was too dispersed among various bodies for its effective utilisation by decision-makers. It was possible, in the programme, to carry out pilot exercises not only to determine information availability and requirements, but also to propose the creation of an information base within the university geared to the needs of the decision-makers.

Four, computer-based mathematical techniques and models have been constructed and tested to demonstrate their potential usefulness in providing a range of results quickly and efficiently, not only for the specific problems of the university for which they were constructed, but also for similar problems in a large number of different universities.

The studies carried out so far have clearly demonstrated that despite great diversity of environment in which the university functions and the variety in the pattern of their organisation, they nevertheless share common problems which can be tackled through inter-institutional/international effort.

The present study was a result of the Project launched in March 1970, during the first phase of the Programme, and was jointly sponsored by the Organisation for Economic Co-operation and Development's Centre for Educational Research and Innovation and by the United Kingdom Department of Education and Science. The purpose of the project was:

"i) to explore the problems raised by the elaboration, discussion and implementation of major development plans for universities, and

ii) to improve cost effectiveness".

The report prepared by the Lancaster University team directed by Professor M.G. Simpson takes a comprehensive view of the University. Such elements as teaching loads, staff requirements, admission policy, expenditures within departments and the library are examined in the various chapters. It is worth noting that the implementation work on the results of the analyses will be continued by the University in the future within the context of planning the expansion of the University for the quinquennium 1972-1977.

Acknowledgement must be given to Dr. C.F. Carter, the Vice-Chancellor of the University, who as Chairman of Senate and of the Development Committee of the University has occupied a central role in fashioning the development plan, and who has taken a direct interest in the work of the project as well as CERI's in-house activities in this field.

The members of the Department of Operational Research participating in the project were:

M. Simpson (Project Leader),
D. Falcon,
Kau Ah Keng,
R. N. Kennedy,
D.H. Noble
and J.M. Norman

Mr. H.F. White was the University Finance Officer contributing to the work

Dr. Abdul G. Khan was the staff member responsible for the CERI Programme on Institutional Management in Higher Education, and as such has played an overall co-ordinating role for the whole Programme. He was assisted by Mr. Paul M. LeVasseur.

CONTENTS

Chapter 1

OVERVIEW

Introduction

This programme, concerned with the shaping of a university for a five-year period, was not a "closed form" research project. Nor was the series of individual studies described in this report the outcome of a formal plan of campaign, in which the total research pattern was specified initially and adhered to. It was rather the result of a dynamic process carried out over a period of some twenty months during which the Lancaster Development plan for 1972-77 was largely formulated. Many individuals and bodies were involved in this development and the project team contributed as and when they were able.

There were certainly some easily identifiable pieces of research which could be specified early on and which were pursued throughout the course of the project. But the precise ways in which these were to be used, amendments which might be necessary and the requirements of new areas of work could clearly not be identified beforehand.

Thus the process of this research matches the general philosophy adopted at Lancaster for this work - that the facilities of a joint Operational Research/Administration project team should be made available within the University to contribute to, and to exercise an influence on, the planning work as an on-going activity. But before describing the study in detail, and its effect on the quinquennial development process, its context must be established.

The Academic Shape and Style of the University of Lancaster

The following section, taken from the University Prospectus, indicates the range of studies available in 1970/71.

All first degree courses at Lancaster, in science as well as in arts, are designed to lead to the degree of Bachelor of Arts with Honours*. They normally last three years, with the exception of the

---

* Other than courses leading to the B.Ed. degree.

Table 1.1: Range of studies at Lancaster

Natural Sciences (Board of Studies A)	Biological Sciences Chemistry Environmental Sciences Physics
Mathematics, technology and business studies (Board of Studies B)	Behaviour in Organisations Commercial Systems Studies (in Dept. of Systems Engineering) Computer Studies Engineering Financial Control Marketing Mathematics Operational Research Systems Engineering
Social, historical and philosophical studies (Board of Studies C)	Economics Education History Philosophy Politics Religious Studies Sociology
Language, literature and area studies (Board of Studies D)	Classics Czechoslovak Studies English French Studies Russian and Soviet Studies

following which last four: Engineering, French Studies, Russian and Soviet Studies (for those who have not studied Russian to the standard required for the three-year course), History and Russian (for those who have not studied Russian to the standard required for the three-year course), English and French Studies, Latin and French Studies.

The course structure for first degrees at Lancaster provides flexibility, by ensuring that wherever possible qualified students have a choice between two or more different major courses after their first year of study; sufficient depth, by allowing considerable specialisation in a major subject or a group of combined major subjects; balance, by the inclusion in schemes of study either of a minor course closely related to the major interest or of at least one other major course in combination; and breadth, by providing opportunities for students to take a course which gives insight into a subject and method of thought different from their major interests.

All courses leading to the B.A. include a three-subject Part I in the first year, with Part II taken over a further two (or three) years.

The University recognises that various fields may profitably be studied together and a number of combined major courses have therefore been established. In designing these courses, the aim has been to extend the range of specialisation possible in the later years of the course but at the same time to retain the rigour and discipline of the course concentrated upon a single major subject.

The major fields of study available were in 1970/71 divided into four related groups. Each of these was controlled by a Board of Studies which is responsible for the regulation of the Schemes of Study governing the major fields in its group and for the admission of undergraduates to Part II studies in those fields. Some combined major courses are controlled jointly by two Boards of Studies.

The above is mainly concerned with the undergraduate degrees. But, Lancaster, like most other universities has a substantial post-graduate activity. In particular, one-year "taught" Masters courses are highly developed and many departments run substantial programmes of this type. Unlike the undergraduate degrees, such Masters programmes are normally the responsibility of individual departments, and the planning of resources for these is a less complex affair than that for the undergraduate programmes with their numerous inter-departmental relationships. Additionally, of course, most departments, and particularly the science departments, have substantial numbers of research students.

Virtually all the subjects listed in the table above match with departments at the University. But as pointed out above, subjects are also grouped together to indicate the Board of Studies structure, which at Lancaster replaces the traditional U.K. division into

Faculties. These Boards of Studies*, though inportant in matters of course development and academic procedures generally, and having an important role to play in the assessment of development plans, do not at Lancaster channel all material between departments and Senate, or the central administration. Departments in fact retain substantial autonomy. Thus in the Lancaster system there are twin structures beneath Senate level which are important in considering and in instituting development plans (i.e. Boards and departments) and both are referred to in some of the studies below.

The Size and Growth Rate at Lancaster

Lancaster is a relatively new and still expanding University. Taking its first students in the academic year 1964/65, Table 1.2 below shows its development to date in terms of student numbers:

Table 1.2: Student Number Trends 1964/1970

	1964	1965	1966	1967	1968	1969	1970
Under-graduate	294	700	1,039	1,233	1,664	2,069	2,440
Graduate	34	69	152	186	310	363	451
Total	328	769	1,191	1,419	1,974	2,432	2,891

The University is expected to continue its growth for several years, the immediate target figure being 5,400 students in 1977.

Another measure of the development of the University is the range of subjects covered - starting with sixteen departments in 1964 it has established one or two new departments in most years until it now has twenty-five departments. It now has reasonably broad coverage of subject matter and degree courses - though there is neither (major) Law nor Medicine, and Engineering has only been set up rather recently.

* In Table 1.1 above only Boards of Studies A-D are mentioned. A further Board (F) has recently been established, effectively splitting the old Board B into the new Boards B and F. There is also a Board of Graduate Studies which is responsible for the regulation of all research studies and the approval of the admission of students to advanced courses; and a Board of Educational Studies which is responsible for approving courses undertaken under the auspices of the School of Education.

In 1970/71 therefore Lancaster is, at least by U.K. standards, a medium-sized and "general" university. It is from this situation that the quinquennial planning exercise was launched - with few obvious academic gaps remaining to be filled and with some departments already at what might be expected to be a viable size.

It should be noted that the "political" pressures of planning in such an expansionist environment are perhaps less extreme than in a steady state or contracting situation. For within universities (and perhaps generally) most people seem to be empire builders at heart, and while the University is increasing in size each department and ancillary activity can expect growth to some degree. Thus there is rather less bickering about parity of treatment and certainly much less than if one department could only grow at the implied expense of another. Thus while the methodology of planning models would seem to be reversible and applicable to both expanding and contracting establishments, the possibility of implementation of such results may well be much affected by the environment in which it is carried out.

The Administrative Structure of the University

Apart from the academic shape and style of the University, the administrative and committee structure is clearly important. Although the governing body of the University is the University Council, the responsibility for the academic life of the University lies mainly with the Senate. A large body, including representatives of departments, Boards of Studies, Colleges and students, it naturally delegates much of its work to smaller committees. The particular committee which most concerns this study is the Development Committee, which consists of the Vice-Chancellor, four members of Senate (representing different segments of the University's academic activities), together with (for some of its business) representatives of Boards of Studies and students. Because of the nature of its business the Academic Registrar and the Finance Officer, as well as the University Secretary, are often present at its meetings.

This committee clearly has a major role to play in formulating development plans - in assessing alternatives and in proposing particular courses of action for Senate decision. The project team, which included one member of the Development Committee and the University Finance Officer, acted sometimes as a "special projects unit" for the Development Committee.

Although Senate has the final responsibility for academic decisions and while the Development Committee plays an essential role in sorting ideas and in formulating policy, departments and Boards of Studies are involved in planning decisions and (later) in implementation. For with departments as the main academic operating units and with Boards of Studies involved in much academic policy formulation, both have to be consulted in setting the academic shape of the University.

Finally, with respect to functions within the University which are of not a strictly academic nature, the colleges have an important role to play - either individually or through the Committee of Colleges. There are currently six colleges at Lancaster, and two more are at an advanced stage of planning. The colleges are intended to provide the main focus for the social life of the University, and the system of student government is centred on them. The colleges are also concerned with the welfare of students and control their general discipline in non-academic matters. The governing bodies of the colleges are the College Syndicates, which are committees of Senate. Syndicates have complete freedom to discuss and put forward proposals on any matter of University policy. Figures 1.1 and 1.2 attempt to illustrate the above points in diagrammatic form.

Quantitative Models - Master or Servant?

The phrase "cost effectiveness" and the background of the members of the project team (Operational Research and Accounting) suggest an "a priori" bias towards the use of quantitative models within this study. Certainly the project team did (and still) do feel that numerical assessments are invaluable in such work. But it was never envisaged that the whole development process could be manipulated algebraically and, in some sense, an "optimal" solution or plan generated. For in planning the development of a university, any attempt to replace the whole of the planning process by algebraic relationships would have to specify some means of measuring in quantitative terms the "output" of a university. One would in fact be forced to compare (in some way) all the various outputs of a university on the same basis. Thus degrees awarded (weighted by class?), the quality of research and the other potential benefits of a university would all have to be measured in some common terms. Clearly some of these are exceedingly difficult to measure at all in any quantifiable way, let alone to relate one to another.

Figure 1.1 Relationships Between Principal Bodies Involved in the Planning Process.

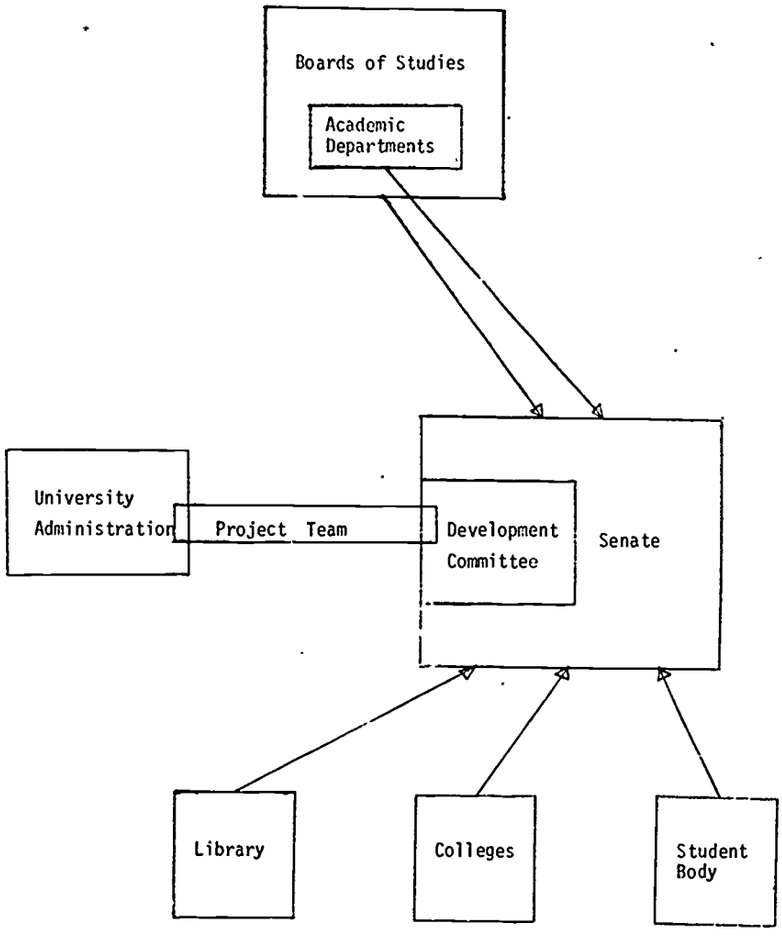
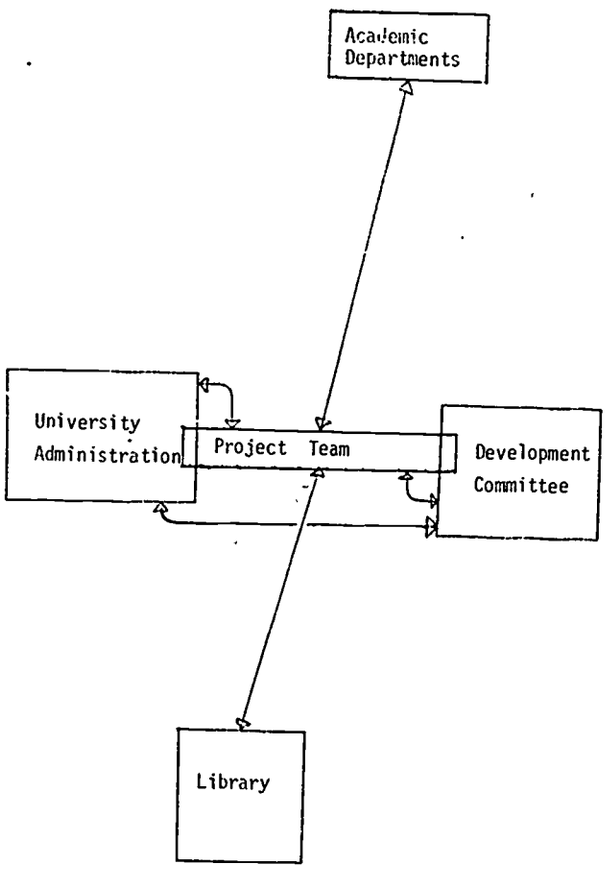


Figure 1.2 Major Information Flows Affecting the Project Team



If this were not sufficient hazard, one would also be forced to specify some particular criterion to be maximised in developmental planning. But where should one look for such a criterion of effectiveness? Perhaps cost per degree awarded? But this is clearly inappropriate, for it would immediately spell death for most science departments. There seems in fact, to be no single and appropriate measure of effectiveness.

Thus in studying university developmental problems, a completely formal approach is not feasible, and methods must be generated to cope in some way both with the various outputs from a university and with many measures of effectiveness. Thus modelling cannot "take over" the planning process, but the approach adopted was based on the hypothesis that by making as explicit as possible the logistical implications of developmental plans, the planning process can be improved.

There have, of course, been many examples, both in universities and elsewhere, of planning decisions involving highly subjective matters being taken with little or no real reference made to the quantifiable aspects. In fact the existence of the former is often used as an excuse to ignore the latter - surely a most unfortunate attitude. There is no suggestion in this study that the merits of various courses should be judged solely by quantitative aspects, but rather that the relative merits of one course rather than another should primarily reflect the academic judgements of those best in a position to make them. Nevertheless, those who are responsible for applying resources to courses should be aware of the implications of these decisions. Indeed, the central theme of the work was to study the consequences of alternative plans so that those making the decisions were (and are) as fully aware of these implications as possible.

Thus although the study may demonstrate that one course is much more expensive in the use of resources than another, it may well happen that the first either has such academic merit that it is nevertheless preferred, or perhaps it may fit better with the other resource constraints existing within the University - of space availability or of the interaction with other courses. All these judgements should in our view involve academics - but the quantifiable aspects should also be taken into account.

Hopefully therefore, the numerical bias has been tempered with a realisation of the limitation of such approaches and the knowledge that very important factors in the total equation cannot be satisfactorily quantified. The next two sections, summarising the

development of the quinquennial plan, indicated where the use of such models has been particularly beneficial and where subjective judgements have still dominated the planning decisions.

Quinquennial Planning - General Framework

Forward planning for U.K. universities is carried out within a quinquennial framework in which three main stages are involved.

(1) There are discussions within each university as to what development would be desirable both in aggregate and relatively within each discipline. Proposals are then made to the autonomous University Grants Committee (UGC)*, together with financial estimates and justification for each proposed new development.

(2) The UGC states student "targets" (for a few broad categories) and allots a block grant for each year of the quinquennium. It may also indicate that some developments are supported, and that others have not been taken into account in establishing the grant; but on some issues no guidance will be given.

(3) The plans of each university are restructured to take account of the UGC decisions, and subsequently minor modifications are made year by year through the quinquennium.

The timing of this research project matched the major part of the preparatory period for the quinquennium covering the academic years 1972/73 to 1976/77 (i.e. from October 1972 to October 1977). Thus the study was concerned with preparing data and research results to be embedded into the planning for the 1972/77 quinquennium and a number of ad hoc projects arising during the course of this period.

From the University's point of view one of the aims of the study was to see to what extent it was possible to ease any "last-minute" planning problems which might arise, for example, at the time of the quinquennial settlement itself (stages 2 and 3 above). For the time scale of the negotiations and discussions within the University Grants Committee and between the UGC and the Government means that quinquennial settlements may be announced rather late, leaving little time for careful reconsideration of plans. (Indeed, in the current

* For the benefit of readers who are not familiar with the organisation and operation of the British University Grants Committee, Appendix 6 gives a short account of the working of that Committee.

quinquennium and in the one being considered in this project the five-year pattern has been replaced by a "one plus four" year pattern - the first year being a holding year related to the previous quinquennium, while the remaining four cover the development period within each university.)

With these time delays there is great pressure within any university to appraise the settlement once it is announced and to finalise internal policy so that any new developments may be pursued without delay. For naturally the academic year introduces major time "steps" into the planning schedule and it may be necessary to take decisions very quickly if the current four-year period is not to be in effect reduced to three! There is therefore a danger of important decisions being taken quickly without being sufficiently considered because of this time pressure; and this is clearly much more critical if the settlement suggests a substantially different level or form of development than had been proposed by the university initially in its submission to the UGC (stage 1 above).

It was thus considered desirable not only to prepare the most appropriate initial submission, but also to have the ability to adapt the developmental plans rapidly according to circumstance. As mentioned above some modification is required continuously to take changes from year to year into account, but again the nature of the quinquennial process makes this much more pressing at the time of the settlement.

Preparing the UGC Submission - The Area of the Project Coverage

The formal terms of reference for the project are shown in Appendix 1. But it is the purpose of this section of the report to elaborate on the context within which the project was carried out and the method of approach adopted.

The formal timetable for the 1972/77 quinquennial planning process can be summarised as:

Mid-1970 - UGC letter of guidance on the form of the quinquennial submission, indicating initial targets as to student numbers for 1976/77, by Arts and Science.

Autumn 1971 - The University sends the submission to the UGC indicating the forms of development proposed, the corresponding student numbers and including cost estimates.

Late 1971	- The UGC informs the University of the recurrent grant allocation for 1972/73, based on 1971/72 levels of expenditure.
Late 1972	- The UGC announces the recurrent grant allocation for Lancaster for 1973/77 plus some comments on individual areas of development proposed and possibly further or revised suggestions as to student numbers.
Late 1972/ Early 1973	- The University revises its plans in the light of the UGC's settlement and institutes specific areas of development.

This process in itself introduces one important factor - the detailed growth pattern projected during the years 1972/77. For most new developments and significant growth must wait till after the settlement is announced. Apart from minimal calculated risks, little can be initiated in 1972/73, and in so far as levels of recurrent grant in 1972/73 will match those of 1971/72 the University population (in student terms) is necessarily held at much the same level. As explained in some detail later this makes smooth growth (even if this could be defined satisfactorily) rather difficult to sustain and the relative advantage of alternative growth profiles were studied in some detail. (Chapter 4.)

But the planning process within the University covered a longer period than the formal timetable above. In fact in 1969 ideas for new areas of development, either within existing disciplines or implying the establishment of new departments, were canvassed and discussed extensively throughout the University. And in early 1970 the views of departments were sought on what in their view constituted desirable developments within their own departments - mainly in terms of staff and students. This latter exercise was carried out in the context of a hypothetical total student population for the University in 1976/77, and departments were invited to say whether they would like to have "their share" of the implied development or a rather different rate. Perhaps not surprisingly in retrospect, the total bids by departments substantially exceeded the planning targets - with virtually all departments wanting at least their share of the total expansion and some making cases for significantly more than this. Some of this is doubtless due to empire building, while other cases arose where adequate coverage of the subject or the attainment of a viable size for groups of academic staff within a discipline were

clearly important. But it is also possible that the internal university logistics system may have contributed to some extent. For apart from the very early years, the authorisation of new staff appointments to departments has been fairly strictly calculated on the basis of staff-student ratios - with weightings for graduate students based on the UGC "resource weights" then in use. (This is discussed more fully in Chapters 3 and 4.) These calculations have been carried out annually and apart from special cases of small and newly established departments have been a major factor in determining departmental growth rates. Thus for departments wishing to have more academic staff for one reason or another it has been necessary to increase student loads. This may well have been taken into account by some at least in making their bids for future students numbers*. But at this stage, suffice it to say that the Development Committee was faced with numerous proposals for developments and pressures for expansion beyond those which one could reasonably expect to be authorised.

During this period, the major part of the research study was put under way - the development of teaching load models for the courses and teaching methods currently being used at Lancaster. This work is described fully in Chapter 5. The main purpose of these studies was to see to what extent the current student weighting procedures were justified, to evaluate changes in course structures and to establish the most appropriate relationships between staff and student numbers to assist whatever system of control was later to be adopted. This work continued through most of the period of the project, covering nine departments in all, and it has been the basis of determining "consistent" student numbers by departments throughout the quinquennium.

Also at this stage of the project the first attempts were made to grapple with some of the elusive "service" activities within the University. Prime among these was the library, representing a very significant proportion of the total University expenditure (as is

---

* As described later, this staffing policy does of course also have the effect that the academic shape of the University cannot be precisely specified by Senate or indeed by anybody else, but is at least partly the result of free choice by students, of departmental pressures on this choice, and of statistical calculations. This has now led to changes in the planning rationale for staff allocation procedures proposed for the next quinquennium.

clearly desirable in a new university and one not within easy reach of existing major libraries). This work is described in Chapter 5 and indicates the contribution which specific numerical model-building can make in one of the more difficult areas of "cost effectiveness" within universities - not of course that the problem of determining how much should be allocated to a library can be "solved" in any way, but the work has shed some light on this problem and hopefully has enabled discussion of the allocation of expenditure to take place more rationally. A less extensive but still important study conducted at much the same period was on the level of secretarial and administrative staff within departments as described in Chapter 7.

During the summer of 1970 the Development Committee sifted the suggestions for further development and reduced the student number bids to fit the target numbers suggested by the UGC. But at this stage no overall cost estimates were generated. Possible areas for new development (within existing departments or otherwise), student numbers by subject groups, and total library funding were topics discussed at a Senate conference in September 1970. With some modifications to the student numbers and some further sifting of the possible areas for development, these were then referred to Boards of Studies for their views - not only on the balance between different Boards of Studies but also on the relative merits of the various developments within their own fields of interest.

In so far as this Senate conference was a distinct and important stage in the generation of the development plan, it must be pointed out that only relatively straightforward statistical manipulation was used for the "student number" estimates - to supplement the largely subjective views from many individuals within the University. But the library models developed played an important part in the discussion. And immediately following the Senate conference the choice of development profile throughout the quinquennium (see Chapter 4) was considered by the Development Committee and Senate - the formulation by the research team undoubtedly had a significant influence on the growth profile selected.

During the final months of 1970 the work of the research team continued mainly on the study of further teaching departments in order to develop the detailed teaching models. The range of departments chosen was deliberately made as representative of the total University as possible - with different disciplines represented and a particular study of a newly established department. The results of this work were not only embedded in the total study but had immediate applications

to some problems facing individual departments. For example, one department was considering changing its methods of teaching and the models were able to provide some useful indications of the implications of such changes.

Work also continued in the similar areas of the study of student wastage rates and of the tendency of students to switch from one intended major course to another (particularly at the Part I/Part II interface)*, and similarly their choice of minor subjects. All of these factors clearly have an effect on the total distribution of teaching loads corresponding to a given intake of undergraduate students initially registered for various of the Lancaster degree courses. In combination with the previous work on the growth of the total student population expected over the quinquennium, this work would then be expected to lead to estimates of student numbers by year, by course - and associated with the teaching loads model, corresponding "fair" staff numbers by year, by department.

In December 1970 the University Grants Committee moderated the target student number figure somewhat and raised it from the 4,850 previously suggested to a new target of 5,400 students. This meant the numbers which had been used for the overall planning aspects had to be revised somewhat, but no changes in method were incorporated at that stage. But the most important new concept introduced at this period of the planning process was that of the "balance of studies". As mentioned above the staff allocation procedures within Lancaster had previously depended almost entirely on the number of students for whom they had teaching responsibilities. But the rationale behind the quinquennial planning being carried out was that Senate should be able to exercise some real control on the academic shape of the University. There are clearly various ways in which the academic shape might be defined but the number of staff by discipline was felt to be at least as good a measure as any other. The suggestion was therefore made (initially within the Development Committee) that staff numbers by discipline should be nominated for each year across the quinquennium and it would then be up to departments to ensure that they controlled their own teaching load to what they regarded as reasonable limits. This would involve not only their control of the intake procedure for new undergraduate students (and graduates too, of course) but also the ways in which departments might have some influence in the choice of minor courses and in the switching

* Part I is examined separately.

of students from one intended course to another. And in so far as some departments might have been bringing pressure to bear in order to keep their number of students as high as possible, this should clearly be diminished. There are clearly some difficulties in this for no-one would wish to inhibit reasonable freedom of choice for the students, but it was nevertheless felt that it was highly desirable that Senate should indeed be able to have better control over the creature which it was aiming to create. Partly to avoid the problems of restricting student choice and also because of the difficulty of forecasting in any precise manner for a period up to five years ahead, the idea of an unallocated pool of potential staff was also suggested. Thus some 90 per cent of the total staff numbers expected to be available* in the last year of the quinquennium (and a somewhat higher percentage in the earlier years) would be allocated between departments and the reserve left for meeting unforeseen demands and for taking the pressures off departments which, hopefully through no fault of their own, did in fact find themselves under severe teaching pressure. It is clearly not reasonable effectively to give departments specific numbers of staff, and for them then to take as few students as they wish, but the feeling was that significant pressure should be maintained in order to keep the shape as planned initially. Thus Senate would be rather reluctant to create additional posts within departments if they felt that any increase in teaching load had been caused partly by the department itself - and at the same time departments' teaching staff numbers would only be reduced if it seemed that the teaching loads were really getting unreasonably low. (The precise form of the "control" mechanism has yet to be finalised.)

This is clearly a very major change, and the new concept provoked much discussion at Development Committee, at Senate, at Boards of Studies and within departments. Not only the principle itself, but later on in the process, the numbers of staff by departments were the source of much discussion and it was not until May 1971 that the final numbers of staff by department, by year throughout the quinquennium were agreed. Because of the "reserve pool", the staff numbers by department are given in terms of ranges - the "minimum", and "minimum + 20%" - implying that some departments might be held at the lower end while others might take up twice their "normal" share of the reserve pool.

---

* i.e. "required" to give acceptable staff-student ratios overall.

Clearly the change of policy in this respect does not imply that the previous work on teaching models was inappropriate, for some mechanisms to determine the teaching load are still needed. But it was clear that the change in policy might moderate the switching possibilities of students and indeed perhaps their choice of minor subjects. So work on these aspects has continued. At this same period other work on teaching load models was being developed elsewhere. Both the UGC and the Vice-Chancellors' committee are studying this problem and although the results are not yet published it is understood that their estimates of graduate student weightings for teaching loads are likely to be significantly lower than the previous UGC resource weights - previously used at Lancaster for staff allocation purposes; whereas our work suggests that the effort put into graduate course work at Lancaster is very similar indeed to the UGC resource weightings. This is discussed more fully in Chapter 3, but it is perhaps not surprising that the effort devoted to graduates matches fairly closely the "rewards" which had been given under the previous Lancaster staff allocation procedure.

The development of this new policy and the decisions taken on the future shape of the University illustrate the dichotomy running throughout this study of the role of subjective and of quantitative contributions. In deciding the staff numbers, subjective aspects included the feelings about the relative strengths of disciplines not only within the U.K. generally but also within the departments at Lancaster; but these were supplemented by a study on the statistics of applications rates for places at Lancaster (and trends in these rates) and in the apparent availability of jobs for graduates of various disciplines. Certainly no formal model was used but many pieces of information, both subjective and quantitative, were taken together in this particular work.

But the analysis stemming from the change in policy relied upon the quantitative models to a marked degree. For the reversal from the previous student-staff policy to the new staff-student policies meant that essentially the teaching load models had to be "stood on their heads" to determine numbers of students by discipline which would be consistent with "fair" teaching loads within each department. Although there were some uncertainties now in the weights which should be used for graduate teaching in particular, the models were used for this process, as is described more fully in Chapter 4 which represents the end point of the largest study within the project.

The new policy of planning outlined above is one example of the attempts to delegate to departments more of the responsibility for running their own affairs. Thus rather than rely largely on Boards of Studies and on the central administration to generate the teaching loads that they are required to meet, the implied suggestion in the new policy is that departments should have more influence on the way in which they spread their teaching facilities between the various options open to them, e.g. to encourage minor courses (at the expense of "major" students) or not - and to determine their own "teaching loads" to some degree. A similar exercise in possible delegation is that represented by the study of administrative staff within departments outlined in Chapter 7. This in fact was carried out rather earlier in the study. But early in 1971 a study on the possibilities of introducing additional "virement" into departments was pursued. If this had in fact been successful the departments would have had more opportunity of controlling their expenditures on various activities than is possible at the moment. But as pointed out in Chapter 7 this did not in fact prove to be acceptable to Senate.

Virtually all the project is concerned with the issue of recurrent expenditure, though a major factor in university planning is the provision of new buildings. It so happens that at Lancaster rather a small amount of new building is expected during the next quinquennium but one particular building did come under some study from the project team. This is described fairly fully in Chapter 8, and concerns the problem of how best to allocate the total space between the set of departments planned to occupy the building. The familiar difficulty arises of uncertainty in the number of staff expected by department - i.e. precisely which figure within the staff number range should be taken as the planning base. Yet the methodology of the architectural profession, particularly when building to the fine cost limits required in university building, calls for such precise estimates - and small changes may have significant effects on design.

Finally, in spring and summer of 1971 the cost estimates were prepared for the UGC submission. As discussed in Chapter 9 both the areas which were the subject of detailed study within the project and the other cost headings which were not so studied were included in the form of simple cost models. This is to enable not only the submission to be put into an appropriate form for the UGC but to provide the foundations for the future work which will be carried out in 1971 and 1972 in providing the facility to moderate the plans in the light of the UGC settlement itself in late 1972.

Chapter 2

UNDERGRADUATE COURSE PREFERENCE

The Course Structure

All first degree courses at Lancaster are designed to lead to the degree of Bachelor of Arts and, with the exceptions of Engineering and courses including French or Russian as a major, they last for three years. Each course is divided into Part I and Part II. Part I occupies the first year and consists of three subjects of equal weight. A student's choice of Part I subjects conforms to rules stated in the University prospectus which relate an undergraduate's choice of Part I subjects to his intended major field in Part II. Each first-year undergraduate may be assumed to spend $\frac{1}{3}$ of his year with each of the departments in which he has chosen to read his Part I subjects, and we may assign $\frac{1}{3}$ of the load of each first-year student to each of these three departments.

A student is allowed to proceed to Part II if he passes all three papers in the Part I examinations, one of which is in his proposed major subject, and in which he must obtain a relatively high mark compared to the required pass mark in his other two papers. Part II occupies the remaining two years, in which a student is not restricted to a single major subject (e.g. Economics), but may read two major subjects as a combined major (e.g. Economics and Politics) or even three, as a triple major (e.g. Economics, Mathematics and Operational Research). In addition to the major courses to be followed, a student is required to read other minor courses, the number and length of which will depend on the type of major chosen. Generally, a Part II science student will have to follow a one-year minor course in his second year. An arts student taking a single major will typically read a one-year minor in his second year and a two-year minor in both his second and third years. Part II final examinations (with minor exceptions) consist of nine units; a unit being examined partly by class or practical work or other "course work assessment", and partly by a formal "finals" paper. A science major may typically take eight papers in his major subject and one paper in his minor; an arts major may typically take six papers in his major subject, two papers in his two-year minor and one paper in his one-year minor. It thus seems reasonable to assign a weighting of $\frac{2}{9}$ to a minor course

lasting one academic session, implying that a second or third-year student spends $\frac{2}{9}$ of his year on such a minor course. These weights are also consistent with the teaching hours given in the respective major and minor courses. Using such weights as a basis, a complete Part II weighting system can be shown as follows:

Table 2.1: Student weights

Type of Major	Major	2nd Year Arts		2nd Year Science	
		2-yr Minor	1-yr Minor	Major	1-yr Minor
Single	$\frac{5}{9}$	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{7}{9}$	$\frac{2}{9}$
Combined	$\frac{7}{18}$ each	-	$\frac{2}{9}$	$\frac{7}{18}$ each	$\frac{2}{9}$
Triple	$\frac{1}{3}$ each	-	-	$\frac{1}{3}$ each	-
Type of Major	Major	3rd Year Arts		3rd Year Science	
		2-yr Minor	1-yr Minor	Major	1-yr Minor
Single	$\frac{7}{9}$	$\frac{2}{9}$	-	$\frac{9}{9}$	-
Combined	$\frac{1}{2}$ each	-	-	$\frac{1}{2}$ each	-
Triple	$\frac{1}{3}$ each	-	-	$\frac{1}{3}$ each	-

Using this weighting system, the teaching load of each department can be measured in terms of "student equivalents", so that the total load for all departments measured in student equivalents is equal to the number of students actually at the University.

Course Switching and Wastage

Although students are required to state their provisional choice of major when they apply to the University, these choices are not binding. Students are still allowed to change their intended major when entering Part II provided their Part I examination performance qualifies them to do so. For instance, a student who intended to major in Politics when he entered the University may decide to major in Economics instead when entering Part II. He is usually allowed to

switch if he can satisfy the requirements for him to major in Economics, in particular that he has passed Part 1 Economics with at least a "majorable" mark.

There are a number of reasons why a student may decide to switch from his provisional choice after one year of study. Some possible ones are:

(1) he may have developed new interest in another subject field;

(2) he may find himself more competent in another field;

(3) he may be attracted to a new major field which has just been offered;

(4) he may have been uncertain as to where his interest lay when admitted to the University;

(5) he may have applied to do a subject where competition for places was not great in order to get easy admission and to switch later.

During the first year and between the first and second years of the undergraduate degree course a small percentage of the Part I students either fail Part I or withdraw voluntarily from the course. Based on the 1968 and 1969 entry figures, the mean wastage is about 9 per cent: clearly this may vary from year to year and from one department to another, and wastage was indeed rather high in those years.

Students who pass Part I will then carry on to do their Part II. It is at this stage that any switching of major subject will normally occur. Since there is no examination between year 2 and year 3, student wastage at this stage is negligible. Thus, the pattern of student switching becomes a very important factor in estimating the Part II teaching load.

Based on the 1968 and 1969 entry data, we were able to construct two switching matrices. A switching matrix (S_{ij}) indicates the proportion of first year students who intended to major in Department i but switched to Department j in their second year. Each of the elements of the switching matrix is calculated by:

$$S_{ij} = \frac{A_{ij}}{A_i} \quad \text{where}$$

A_i = number of students who intended to major in Department i and passed Part I (i.e. after wastage has been taken off).

A_{ij} = number of students who intended to major in Department i at admission but switched to Department j when entering Part II.

and $\sum_j A_{ij} = A_{i.}$

Switching can be substantial. As an illustration, the following table shows the percentage of Part II students who opted to follow their provisional choice of major. Although it is not possible to generalise as the sample is small, some points do emerge. For instance, there is relatively little switching in the science departments, with the notable exceptions of Mathematics and Operational Research. Of the arts departments, Philosophy has a switching rate significantly higher than the average.

Table 2.2: Proportion of students who did not switch their intended major between Part I and Part II*

Department of Intended Major	Year of Entry	
	1968	1969
Biological Sciences	.91	.95
Chemistry	.92	.79
Computer Studies	-	.83
Engineering	-	.75
Environmental Sciences	.75	.72
Mathematics	.42	.51
Physics	.84	.82
Financial Control	-	.83
Operational Research	.25	.00
Economics	.66	.68
Politics	.68	.61
Sociology	-	.69
History	.73	.59
Philosophy	.32	.28
Religious Studies	.70	.75
English	.75	.76
French	.75	.74
Russian	.90	.89
Classics	.84	.80

* For the complete switching matrices, see Appendix 2.

In this process of switching, some departments will have more students "switch in" than "switch out" while others will have just the contrary. Thus, some will gain students relative to others and others will lose, with a significant effect on the planning process as a whole, especially with regard to the balance of studies and staff and facilities requirements. In particular, given unrestricted student choice, it would be possible for some departments to end up with more students than they could properly teach. Also, excessive switching may unfavourably affect the balance of studies desired by the University.

The coefficients in a switching matrix may change owing to changes in student course preferences or with the introduction of new departments and new courses. Evidently, within limits, students should be given the opportunity to follow their own choice of major subject. Nevertheless, some controlling device may be desirable in order to achieve a balance of studies and to avoid departments becoming overloaded. With a fixed staff-student ratio, if a department is allocated a certain number of members of staff but accepts more students than the ratio implies, the average teaching load on each of its members of staff will increase. Thus, a department may feel constrained to limit the number of students it will take, although some of the effects of switching behaviour may be taken account of by giving some departments more staff.

Minor Course Preference

Switching and wastage are not the only factors in determining the effective teaching load. The remaining factor is student choice of minor courses.

Taking 1969/70 and 1970/71 data, we have calculated, in Tables 2.3 and 2.4, the proportion of total students majoring in each department (or "major equivalents") and, given the current course preference, the proportion of the total teaching load in each department, using the weights of Table 2.1. We counted a combined major student as half a student in each of his major departments, and a triple major student as one third of a student in each of his three departments.

Table 2.3: Distribution of major equivalent students and workload 1969/70

Departments	First Year		Second Year		Third Year	
	% of Intending Major Equiv.	% of workload	% of Actual Major Equiv.	% of workload	% of Actual Major Equiv.	% of workload
Biol. Sc.	5.5	2.6	4.7	7.0	5.1	5.1
Chemistry	6.4	4.0	6.3	5.5	4.8	4.8
Comp. St.	5.4	-	2.2	2.6	-	-
Engineering	1.2	2.0	-	-	-	-
Env. Sc.	4.0	3.9	2.9	2.0	3.4	3.5
Maths	3.8	15.6	4.0	4.1	5.1	5.3
Physics	5.5	3.5	4.5	4.6	5.7	5.8
Pln. Control	2.1	-	-	0.3	-	-
O.R.	0.6	-	0.3	1.4	0.3	0.7
Economics	11.6	9.8	11.5	7.8	11.8	10.4
Politics	7.2	9.5	12.6	10.2	12.8	13.0
Sociology	1.7	5.8	-	-	-	-
History	12.1	11.1	16.2	14.4	17.1	16.8
Philosophy	4.4	9.6	4.8	5.5	3.7	4.6
Rel. Studies	3.7	3.9	3.0	4.6	2.4	2.6
English	14.2	9.4	14.5	10.7	18.9	16.5
French	8.1	5.1	8.8	6.7	6.4	5.9
Russian	1.4	0.8	1.9	2.5	1.1	1.2
Classics	1.1	3.4	1.8	3.6	1.3	2.7
P.A./Music	-	-	-	0.5	-	-
Education	-	-	-	-	-	-
Marketing	-	-	-	2.5	-	1.2
Law	-	-	-	1.9	-	-
H. Arch	-	-	-	1.7	-	-
Total	100	100	100	100	100	100

Table 2.4: Distribution of major equivalent students and workload - 1970/71

Departments	First Year		Second Year		Third Year	
	% of Intending Major Equiv.	% of workload	% of Actual Major Equiv.	% of workload	% of Actual Major Equiv.	% of workload
Biol. Sc.	6.8	2.6	5.9	8.0	5.0	5.0
Chemistry	6.3	4.5	5.0	4.8	6.4	6.4
Comp. St.	4.3	4.9	6.2	5.3	2.5	2.5
Engineering	2.4	1.7	1.4	1.4	-	-
Env. Sc.	5.3	3.6	2.8	2.2	2.9	2.9
Maths.	4.7	15.9	3.0	2.9	4.0	4.0
Physics	7.1	4.2	5.1	5.2	4.2	4.2
Fin. Control	3.3	-	2.4	2.5	-	0.7
O.R.	0.5	-	0.0	1.3	0.3	0.4
Economics	10.4	8.8	11.8	8.3	11.7	10.0
Politics	7.1	8.6	8.7	8.4	13.0	12.8
Sociology	2.8	7.7	4.6	5.6	-	-
History	10.1	9.2	13.0	11.6	16.0	15.6
Philosophy	4.1	7.9	2.5	2.9	4.8	5.6
Rel. Studies	3.0	3.0	4.4	5.2	3.2	3.2
English	12.0	8.0	14.6	9.9	15.0	13.6
French	6.8	4.0	6.5	4.8	7.7	7.5
Russian	1.9	3.1	1.1	1.7	1.5	1.3
Classics	1.1	2.3	1.1	3.8	1.8	2.9
P.A./Music	-	-	-	1.7	-	-
Education	-	-	-	0.6	-	-
Marketing	-	-	-	0.6	-	1.4
Law	-	-	-	1.5	-	-
H. Arch	-	-	-	1.8	-	-
Total	100	100	100	100	100	100

Some observations can be made:

(1) The two tables portray a broadly similar distribution of percentages of student numbers and workload across all departments except that Engineering, Financial Control and Sociology were not offered as Part II major subjects in 1969/70. Slightly more than 8 per cent of the Part II students in 1970/71 chose to major in these subjects, resulting possibly in a reduction of major students in other departments, notably Politics and Philosophy, as compared to 1969/70 figures.

(2) There are many differences between the percentages of major equivalent student numbers and workloads. In Part I, although a relatively small percentage of students intend to major in Mathematics, the actual workload of the Department of Mathematics is relatively high, owing to the large amount of "service" teaching it does. Other departments such as Sociology and Philosophy appear to be attractive to first-year students, indicated by their relatively high Part I workloads compared to the percentages of intending majors. In Part II, the differences in the percentages of actual major equivalents and workload become less significant especially in the final year.

(3) Since loads do not vary over departments strictly according to major equivalent student numbers, we may construct a relative load index α to show the difference between workload and student numbers. We have

$$\alpha = \frac{\text{per cent of workload}}{\text{per cent of major equivalent students}}$$

We can compute α values for different years of studies and for different departments. Generally α's vary greatly among departments for the first and second years but less so for the third year.

It is clear that it would not be fair to allocate teaching staff solely according to the number of students intending to major in each department (the major equivalents). Some account must be taken of service teaching and minor course preference, and it is to take such account that the α values have been computed: their use in the quinquennial staff planning exercise is described later in Chapter 4.

Chapter 3

TEACHING LOADS

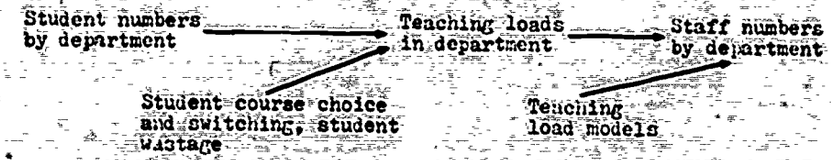
Purpose of Work

For a given method of teaching, how great is the load on the members of staff in a department caused by a given mix of undergraduate and graduate students? How we have tried to answer this question is described in this chapter, but first, let us explain why we need to answer it.

Suppose that in each year of the next quinquennium we know how many undergraduates and how many graduate students will enter the University. This itself is not very easy to define, as there are many categories of students - some studying part-time, some studying away from the University (in France, for example), some from American universities spending their junior year at Lancaster, and so on. Given these intakes of students, we can, by estimating wastage rates (due to withdrawals and failures), estimate the number of students, by year of study, in each year of the quinquennium. Also, by estimating switching rates (changes of degree course by students who enter the University to take a degree in one subject but in fact take a degree in another) we can estimate the number of students intending to take degrees (to "major") in each subject. Next, by estimating the extent of the demands made on each department of the University by students majoring in another we can estimate the load in each department. All this we described in the last chapter. Finally, knowing the projected load in each department, we need to compute the required numbers of staff in each department in each year of the quinquennium; or, to use the reverse method now proposed, we need to compute what load (of a given "mix") can be carried by a given number of members of staff, as suggested in the following paragraphs. It is to carry out this last step that we need to answer the question of teaching loads.

It would be natural to show the theme of the last paragraph in a diagram like the following:

Figure 3.1: The relationship between student numbers and staff requirements



The logic indicated in Figure 3.1 is how we first envisaged our work being embedded in the planning and control processes. However, as is explained in Chapter 1, during the course of the project, the planning rationale at Lancaster has been altered. In the past student admission quotas were set for departments, and the allocation of staff to departments followed directly from the consequent student load by the application of a fixed staff-student ratio across all departments.

What now comes first (that is, what is decided first) are the numbers of members of staff in each year planned for each department. Given the numbers of postgraduate students in each department, and the load they cause on members of staff (part of the answer to our question on teaching loads) we can estimate the effective numbers of members of staff in each department available for undergraduate teaching. Finally, with a knowledge of student minor course preference and major course switching, the numbers of undergraduates to be admitted to each department in the next quinquennium (grossed up to allow for wastage) can be determined, on the assumption that student choice of courses is free. Once these numbers are published, it is for each department to decide whether the numbers of students wishing to switch to a major in the department or to minor in it should be limited.

Undergraduate Teaching Loads

All of this depends on our ability to estimate wastage, switching and course preference, on the one hand, and teaching loads on the other. The first set of factors can be studied historically, by determining how many students have dropped out in the past and their pattern of course switching and minor course preference. The second factor has been the subject, at Lancaster, of an empirical study.

Of the twenty-five teaching departments now at Lancaster we studied nine in some detail: Operational Research, Biological Sciences, Physics, Engineering and Financial Control (which we shall identify, though not necessarily in order, as S1 to S5), and Classics, English, Politics and French (identified as A1 to A4, again not necessarily in order). The procedure we used varied from one department to another: for one department we sent a questionnaire to each member of staff, in others we had discussions with the administrative officer, followed by discussions with individual staff members; in one department already using a sophisticated method of staff allocation, we were able to compare the existing system with our own formal approach. In all cases, we had discussions with the head of department and with individual members of staff, and scrutinised such information as was available in prospectuses, departmental lists and timetables.

Leaving aside all time spent on college activities, University and departmental administration, and examinations, we conjecture that for any department, the undergraduate teaching load in any one year of studies can be roughly described by an expression of the following form:

$$L = \ell(1+p) + c\left(\left[\frac{N}{n}\right] + \frac{m}{2}\right)\left(1+\frac{q}{s}\right) + Nr + \text{any load due to practicals or language laboratory work}$$

where L = teaching load

ℓ = number of lectures

p = preparation time per lecture

c = number of seminar sessions per course

N = number of student/course combinations

n = number of students in a seminar group

m = number of courses run

q = preparation time/seminar week/member of staff

s = number of seminar sessions in a course/seminar week/member of staff

r = "post-mortem" time per student per course

$[x]$ = largest whole number not exceeding x.

The expression for the total teaching load in a department (measured in hours) has three parts, apart from the special load of practicals or laboratory sessions. The first concerns lectures given

and the time spent directly on preparation for them. It was often difficult for members of staff to distinguish between personal research time and time spent preparing a course of lectures, since normally members of staff gave lectures on topics on which they had previously carried out research. It was also suggested that the time taken to prepare a one-hour lecture was less for a repeated lecture than for one given its first performance. It was found helpful to invite members of staff to compute the average preparation time over the first four years of a lecture series: thus estimates of preparation times per lecture in the first four years of its being given of (say) 10, 4, 1, 1, would be counted as an average of 4 hours.

The second part concerns seminars, tutorials, and problem classes. Almost all undergraduate courses at Lancaster are based on a lecture course backed up by (usually) either a weekly or a fortnightly series of tutorials, with small groups of students, at which difficulties can be ironed out. Material for such tutorials is prepared beforehand by the member of staff who takes them. We have supposed that he takes q hours for each session, and he may take (say) s sessions on the same seminar topic. Thus each seminar group causes a number of hours of teaching load equal to:

$$c\left(1 + \frac{q}{s}\right)$$

where c is the number of sessions attended by the group, and $1 + \frac{q}{s}$ represents one hour for the actual session, and q hours of preparation divided by the s groups on average taken by each member of staff. The number of seminar groups is approximately given by:

$$\left[\frac{N}{n}\right] + \frac{m}{2},$$

since if n is the number of students in each seminar group, then for a lecture/seminar series i attended by N_i students there will be:

$$\left[\frac{N_i - 1}{n}\right] + 1$$

groups and thus altogether:

$$\sum_i \left[\frac{N_i - 1}{n}\right] + m \doteq \left[\frac{N}{n}\right] + \frac{m}{2} \text{ groups.}$$

The third part we have described loosely as "post-mortem time", in which we include all other time spent with students on academic

work or on marking work submitted during a course. There was some difficulty in distinguishing post-mortem time from preparation time when work was done on seminar preparation resulting from questions asked by students during a previous seminar. This has been treated as post-mortem time - the amount of time involved is quite small.

This formula was found to apply to all three years of study, in the sense that staff members generally thought that the assumptions implicit in the formula were reasonable; the difficulty they had was in estimating the values of the variables.

The use of this formula in an arts department resulted in the following table of teaching load:

Table 3.1: Teaching load in hours for a (not necessarily typical) arts department

	Lectures	Seminars	Post-mortem	Total
1st year	300	1,800	645	2,745
2nd year	720	4,050	3,510	8,280
3rd year	880	3,960	1,830	6,670
Total	1,900	9,810	5,985	17,695

Not much more than 10 per cent of the total is concerned with lectures, about 55 per cent with seminars and their preparation and 35 per cent with post-mortem time.

The accuracy of such figures depends on the accuracy of the figures they are based on, some of which are known (number of students, number of courses, number of seminars) and some of which have had to be estimated (p, q, r, s). Of the four estimated variables, s can be estimated reasonably accurately, though with difficulty, and variations in p make relatively little difference to the total load.

It is quite possible that inviting members of staff to estimate the times taken on various activities may have resulted in over-estimation of those parameters: lecturers are unlikely to have given replies which would show them as not working intensively, and this qualification needs to be borne in mind when interpreting the results.

Taking values which were generally recognised as reasonable in the departments, we were able to produce two graphs, one relating to Part I teaching loads and the other to Part II (Figures 3.2 and 3.3). The two straight lines have been fitted by eye.

The intercept of 350 hours of the Part I line relates to time

PART I

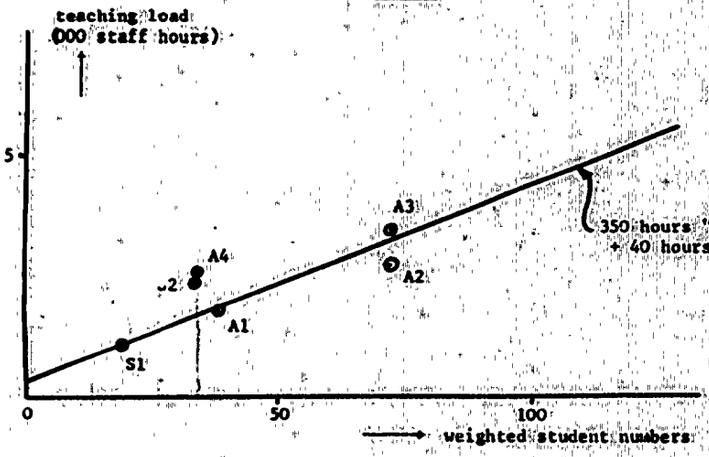


Figure 3.2

PART II

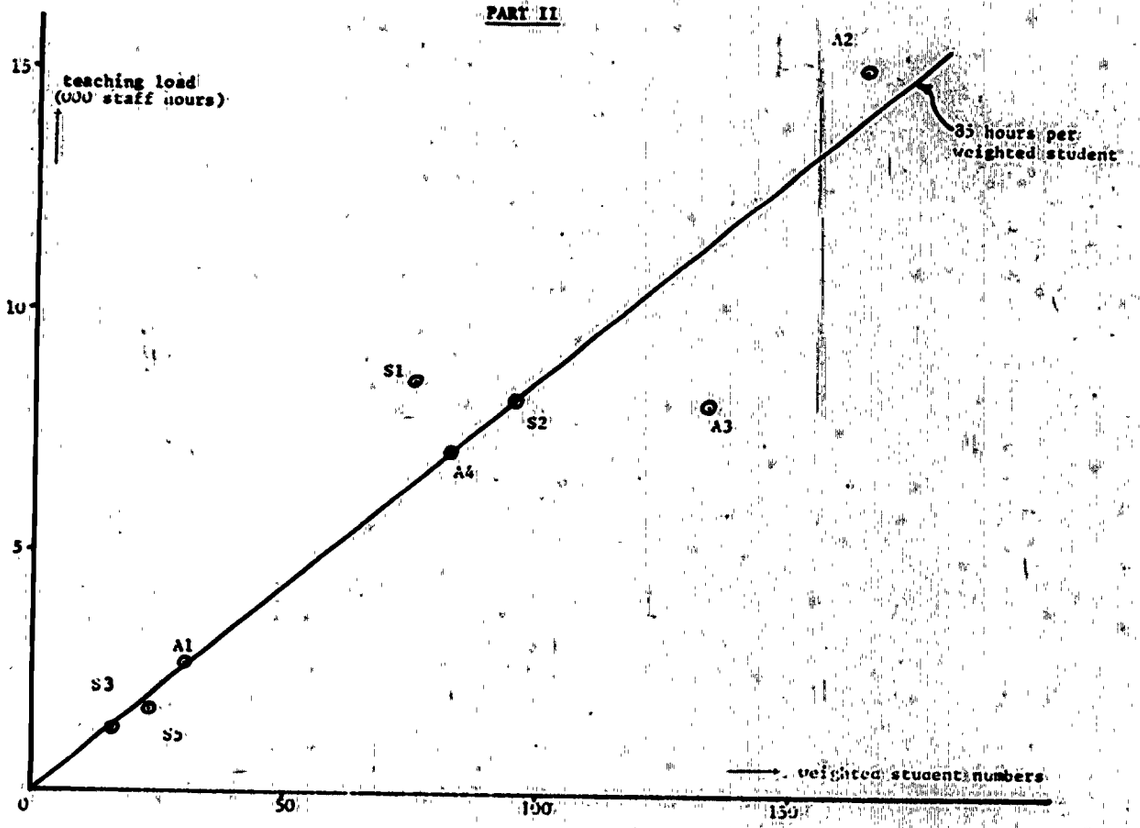


Figure 3.3

taken preparing for and actually giving lectures: estimates of this time varied from 250 to 450 hours. If it were thought better to have no "overhead" then a line showing (say) 45 hours per weighted student instead of 40 might seem a more reasonable fit. S2 and A4 are well above the line: this may be because of their extensive practical classes and language laboratory sessions, for S2 alone it may be because of the way teaching loads are shared equitably among members of staff under the department's own loading formulae.

Considering the variety of departments considered, and the variety of people involved in the data collection, the small spread about the fitted line in the Part II graph is remarkable. There is no intercept and hence no "overhead": all types of classes, including lectures, are smaller in Part II than in Part I. The slope of the line corresponds to a load of 85 hours per weighted student.

The total teaching load resulting from an undergraduate over the three years of his course is thus 45 (say) + 85 + 85 = 215 hours, and the average load per year about 72 hours. $\frac{45}{72} = 0.6$ and $\frac{85}{72} = 1.2$ are thus the suggested weights for Part I and Part II students.

If staff requirements are based on the formulae:

$$L_1 = 45N_1 \quad \text{for each department}$$

$$L_2 = 85N_2 ,$$

and assuming that each member of staff can be allocated 900 hours of teaching load, then we can compute staff requirements for any student intake profile over (say) the next seven years. A crude justification for the figure of 900 hours is that it is equivalent to 30 hours attributable time in each of the thirty weeks of three ten-week terms. It is also consistent with estimates of the average total time spent by members of staff on teaching and directly associated work which we calculated from the teaching load data. Suppose we consider the profile below, derived according to criteria discussed in more detail later, in which a balance has been kept between gradual growth in the student population and gradual growth in first-year intake. The staff requirements for this student profile are given in the last line of table 3.2.

The staff requirements and the student population have been drawn, in Figure 3.4, on scales such that 180 staff has the same ordinate as 2,272 students. It is easily seen that as intakes increase (from Year 4 onwards) the staff requirements lag behind owing to the relatively small load for each Part I student, giving an implicit

Table 3.2: Student numbers and staff requirements

Year	70/71	71/72	72/73	73/74	74/75	75/76	76/77
Total Intake:							
1st Year	858	810	810	1,079	1,450	1,650	1,700
2nd Year	711	776	734	734	980	1,317	1,498
3rd Year	703	711	776	734	734	980	1,317
All year total	2,272	2,297	2,320	2,547	3,164	3,947	4,515
Number on Part I	858	810	810	1,079	1,450	1,650	1,700
Number on Part II	1,414	1,487	1,510	1,468	1,714	2,297	2,815
Staff on Part I	43	42	42	54	73	83	85
Staff on Part II	134	140	143	139	162	217	266
Staff total requirement	177	182	185	193	235	300	351

reserve of staff compared to a staff-student ratio computed on a basis of equality over students in all three years of study.

That a Part I student made only half the demand on staff time of a Part II student was not anticipated before the study, and we therefore tried to verify this by means of a student survey.

A questionnaire was sent during the Spring Term to 20 undergraduates in each year of study, asking (in effect) for a copy of their individual timetables, together with an estimate of the number of students attending each session. 35 completed proformas were returned, a response rate of about 60 per cent.

The following table shows the average number of lectures and seminars (or tutorials) attended, and the median group size. Practical classes and language laboratories have been excluded.

If it is true that Part I undergraduates are less demanding of staff time than Part II undergraduates, then we would expect to find evidence of this in the table. It is clear that the lecture load is much less in Part I than in Part II: even though the average number of lectures attended in the third year is less than the average number attended in the first year, the average number of students attending a lecture is smaller still. However, lectures account for a small proportion of a member of staff's teaching load.

Figure 3.4

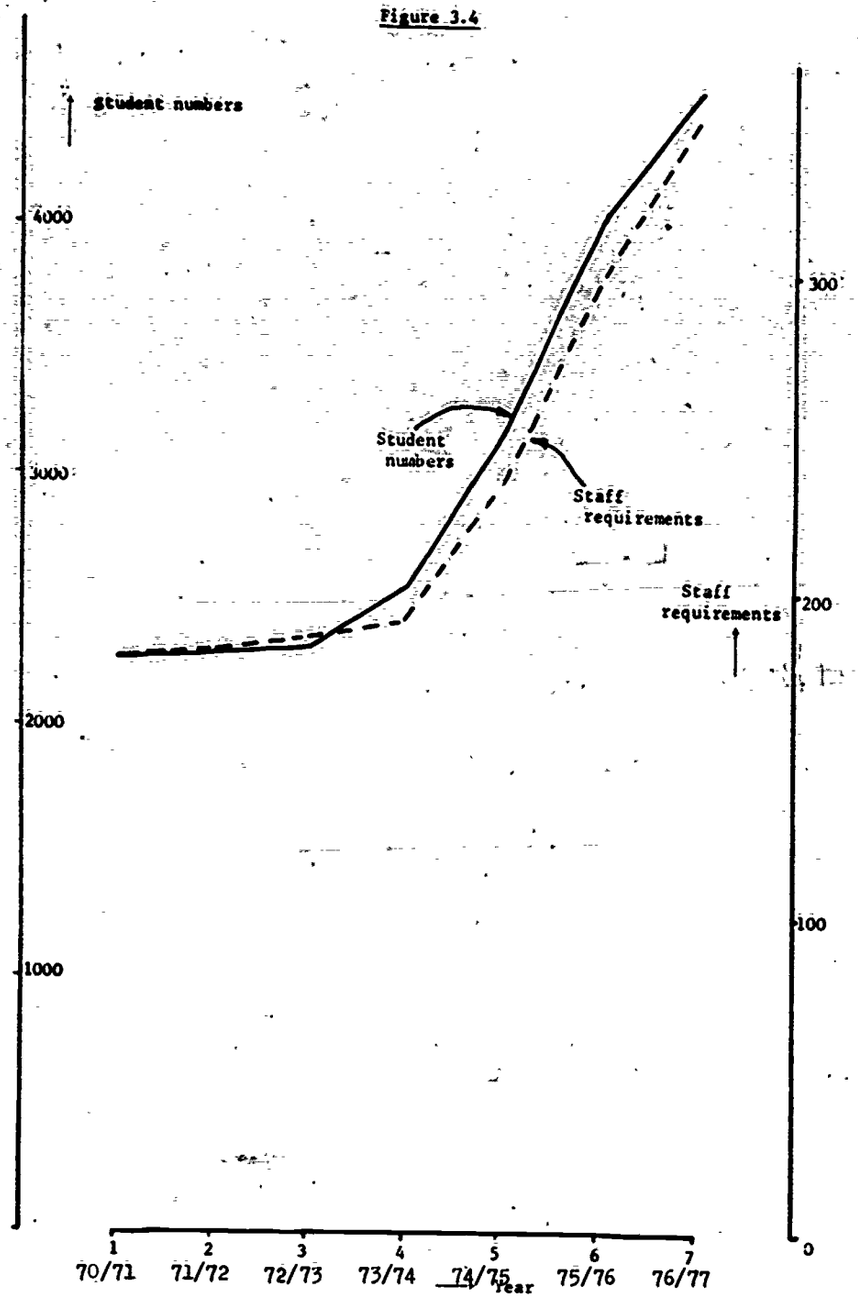

Student numbers
4000
3000
2000
1000
Student numbers
Staff requirements
Staff requirements
300
200
100
0
1 70/71
2 71/72
3 72/73
4 73/74
5 74/75
6 75/76
7 76/77
Year

Table 3.3: Numbers of lectures and seminars attended per week by undergraduates

Year of study	Lectures		Seminars/tutorials		Responses
	Average number attended	Median group size	Average number attended	Median group size	
1st	7	100	5	10	10
2nd	7 or 8	40	4	8 or 9	11
3rd	4	30	4 or 5	7	14

In our analysis, we took the load due to giving and preparing seminars as (roughly):

$$\frac{N}{n}(1 + \frac{q}{s})$$

where

N = number of students

n = group size

q = preparation time for a seminar topic

s = average number of seminars on the same topic taken by a member of staff.

Table 3.3 gives estimates of n, and the average number of seminar sessions attended by each student. Thus the total number of seminars held in a week for Part I for N_1 students is estimated by $\frac{5N_1}{10} = \frac{N_1}{2}$. Similarly, the total number of seminars held in a week for N_2 Part II students is roughly $\frac{N_2}{2}$. Thus the proportional load of a Part I to a Part II student is given approximately by the expression:

$$(1 + \frac{q_1}{s_1})/(1 + \frac{q_2}{s_2}) .$$

It seems reasonable to take $s_2 = 1$ as there is very little duplication of seminars in Part II, and $q_1 = q_2$ (= q say) as there seems no reason to assume that the seminar itself is more or less difficult to prepare. To give an indication of the possible Part I/ Part II seminar preparation ratio, we therefore compute values of the foregoing expression for various values of q and s_1, thus:

Table 3.4: Relative Part I/Part II seminar loads

s_1 \ q	2	3	4	5
2	.7	.6	.6	.6
3	.6	.5	.5	.4

It can be seen that for quite a wide range of values of q and s_1, the load due to preparing and giving seminars in Part I is more or less about half what it is in Part II.

Even at this early stage of the analysis, some useful assistance could be given at a departmental level to those planning new courses. For example, in one arts department, it was proposed to give twice as many seminars in Part I but fewer lectures. We were able to give an estimate of the change in staff work load which would result. We estimated that it would rise from 2,745 to 2,945 hours - the department had felt that the effect of its new plans would be "a slight increase" in the teaching load. Again, a formal structure could help in spreading the teaching load within a department "fairly". It is probably true that preparation time for senior members of staff is generally less than that for junior members; indeed we sometimes suspected that an individual's estimates of p and q might be more a measure of his experience than of his industry. Fair loads need not necessarily be equal but a formal model of teaching loads could help to spread a department's teaching load among its members fairly.

Postgraduate Teaching Loads

Various attempts were made to derive weights for postgraduate students, with varying success. One attempt was made concurrently with the undergraduate teaching load study.

Staff members we talked to in all four arts departments thought that 30-40 hours was a reasonable estimate of the teaching load of a postgraduate research student. If we take 40 hours then the appropriate weight is 0.6 relative to the average undergraduate weight of 1.0.

The net teaching load of a postgraduate research student in science or business studies is more difficult to estimate: there was considerable variation between departments: the smallest teaching

load in a department was 240 hours, and the biggest considerably more. Such figures are difficult to interpret, since they do not take account of the contribution to teaching made by research students.

The teaching load due to postgraduate students taking courses is also difficult to estimate: it is certainly variable, as Figure 3.5 shows. The straight line representing an average load of 260 hours per student has been drawn as a guide. Possibly there may be a difference between the arts departments on the one hand and the science departments on the other.

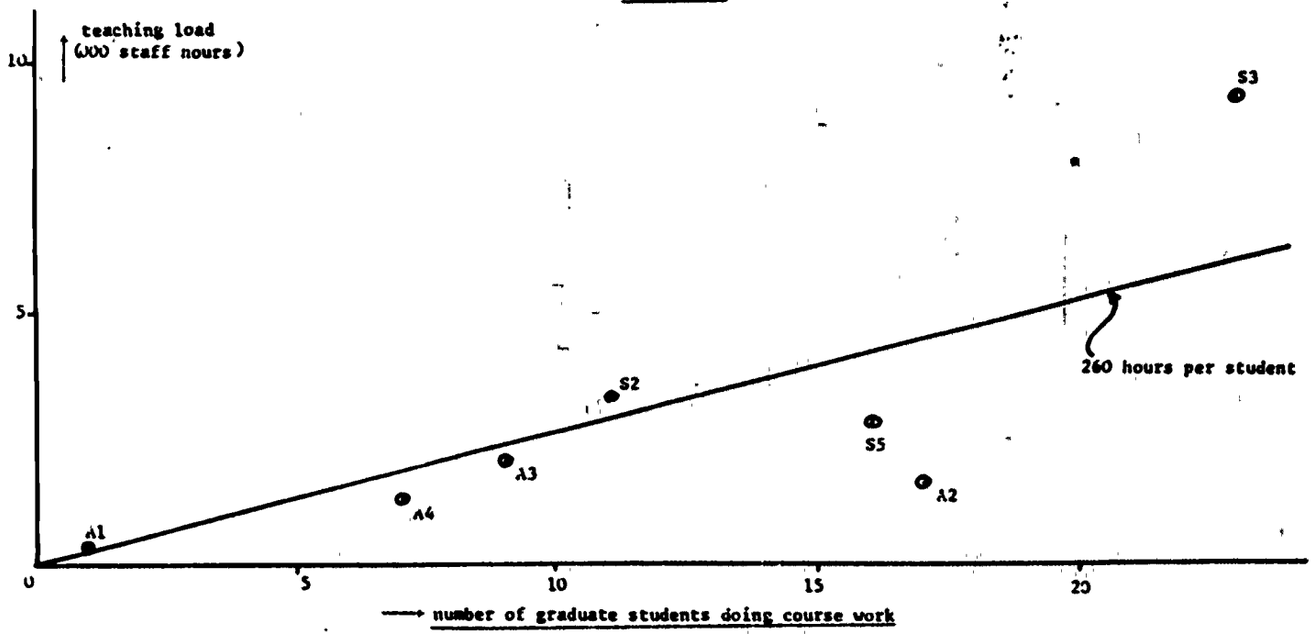
There are grounds for discounting some of the points because they are special cases: S2 because it is in part supported by UGC earmarked "pump-priming" funds and S3 because it is in part supported by outside earnings. If this were done, then the appropriate line would be much flatter.

In addition to these grounds for treating the data with caution, it is known that the postgraduate weights which might be appropriate to the data in the graphs are different from the weights implied by staff returns to a "Use of Time" survey carried out by the Committee of Vice-Chancellors and Principals in the same period. Nevertheless, the data do represent the allocation of resources felt to be appropriate by departments: they are, we believe, honest assessments of the perceived graduate course loads. All these remarks emphasise the value of sensitivity analyses on the effects of different postgraduate weightings on departmental loads.

In the past, though not as a measure of relative teaching load, the University Grants Committee has used a weight of 2 for an arts postgraduate and 3 for a science postgraduate, relative to a weight of 1 for an undergraduate. These are the weights which have been used at Lancaster. Until recently, departments at Lancaster have been grouped in four Boards of Studies with Board A including the science departments, Board B the business and technology departments (including Mathematics and Economics), Board C social studies and Board D language and area studies.

In accordance with the so-called "UGC norms" suppose we weight postgraduate students in Boards C and D by a factor of 2, and then determine appropriate weights for Board A and Board B to compare them with the norms, our object being to check whether the actual staffing matches the allocation policy determined by UGC norms. We might expect the appropriate weight for Board A to be 3 and that for Board B between 2 and 3.

Figure 3.5


teaching load
(000 staff hours)
10
5
0
5
10
15
20
S3
S2
S5
A3
A4
A2
A1
260 hours per student
number of graduate students doing course work

If the weights for Boards A, B, C and D are a, b, c and d (c = d = 2 in this case) and N is the total number of weighted students at the University, then:

N = number of undergraduates + a x number of postgraduates in Board A
+ b x number of postgraduates in Board B
+ c x number of postgraduates in Board C
+ d x number of postgraduates in Board D

and if there are M staff, we can define $w = \frac{N}{M}$ as the staff-student ratio.

Table 3.5: Staff and students at end-December 1970

Board	Postgraduate* students	Undergraduate students	Staff
A	109½	487	67
B	210	497	106
C	140	835	89
D	41	472	52
Total	500½	2,291	314

Table 3.5 gives staff, postgraduate and undergraduate students in each Board of Studies at end-December 1970. We thus have:

$$67w = 487 + 109\tfrac{1}{2}a$$
$$106w = 497 + 210b$$
$$89w = 835 + 140c$$
$$52w = 472 + 41d.$$

We have supposed that c = d = 2. Adding the third and fourth equations together, we obtain as an estimate of w,

$$w = \frac{1307 + 181 \times 2}{141} = \frac{1669}{141} \doteq 12.$$

* Part-time postgraduate students have been counted as ½.

In Board A, we may estimate the implicit postgraduate weighting using this estimated value of w = 12, by

$$a = \frac{67 \times 12 - 487}{109\frac{1}{2}} = \frac{317}{109\frac{1}{2}} \doteq 3$$

which does indeed agree with the UGC norm.

In Board B, with a similar calculation, we obtain

$$b = \frac{106 \times 12 - 497}{210} = \frac{775}{210} \doteq 3\frac{1}{4}$$

which is higher even than the UGC norm for science postgraduates. The reason for this is that some of the departments in Board B, particularly those concerned with business studies (Operational Research, Systems Engineering and others) carry out practical projects with staff-student teams which need relatively intensive staff involvement and consequently a more favourable staff-student ratio which has been maintained in part by income earned from the projects.

It seems likely that in the near future, the Development Committee may decide that the weights for postgraduate students used up to now are too high. The appropriate weight for an arts postgraduate has been suggested as equal to that for an undergraduate*. With the same data, we can compute appropriate weights, implicit in present staff numbers, for each Board of Studies. Suppose that in Board D the appropriate postgraduate weighting is 1, so that w is estimated by $\frac{472 + 41}{52} \doteq 10$.

Then $a = \frac{670 - 487}{109\frac{1}{2}} \doteq 1.67$

and $b = \frac{1060 - 497}{210} \doteq 2.68$.

It does not seem feasible (for reasons of campus politics, if nothing else) to weight business postgraduate students heavier than science postgraduate students, so we may weight them both at 2:1 thus:

---

* This is of course only one of an infinite number of possible weightings, but it seems not unreasonable that a postgraduate student in an arts department should be weighted the same as an undergraduate.

Table 3.6: "Estimated" and actual staff at end-December 1970

(i) Board	(ii) Under-graduates	(iii) Weighted Post-graduates	(iv) Total Weighted Students	(v)=(iv)÷10 Estimated Staff at 10:1 ratio	(vi) Actual Staff
A	487	219	706	71	67
B	497	420	917	92	106
C	835	140	975	98	89
D	472	41	513	51	52
Total	2,291	820	3,111	312	314

The reasonableness of taking a weight of 2 for postgraduate students in science and business departments is partly checked by noting that with w = 10 and c = 1, the equation for Board C is approximately satisfied, and that the weighted staff-student ratio ($3111 \div 314$) turns out to be very nearly equal to 10.

Planning Undergraduate Admissions

Let us see how these results could be used in planning the development of departments. We take it that we are given the number of staff in each department both now and at the end of the quinquennium, an estimated total of 522 at Lancaster in 1976/77. Such numbers, under the new policy, are a clear indication of the way in which the University is desired to develop. They imply a notional "reserve" of staff to be used to reinforce departments which are seen during the quinquennium to be overloaded, or which it is desired to develop. Suppose also that we are given the number of equivalent postgraduate students in each department currently at the University and the proposed numbers of postgraduate students in each department at the end of the quinquennium. Given a possible distribution of postgraduate students by Boards of Studies thus:

Table 3.7: Possible postgraduate students in 1976/77

Board A	190	560
B	370	
C	270	
D	50	
	880	

conforming to a graduate/undergraduate ratio of 16 per cent in a postulated university of 5,400 students at the end of the quinquennium, we can compute the staff-student ratio w as

$$w = \frac{4520 + 880 + 560}{522} = 11.42.$$

Thus the number of members of staff required to teach these postgraduate students $= \frac{880 + 560}{11.42} = 126$. The numbers of staff in each department available for teaching undergraduates can be found by subtracting the numbers required for postgraduate students from the proposed minimal staff allocations at the end of the quinquennium. These staff numbers may be multiplied by 11.42 to give the numbers of equivalent students which can be dealt with by each department. It is at this point that the α-values discussed in the previous chapter can be used. Strictly, if we expect N_i students majoring in Department i to give rise to a load $N_i\alpha_{ij}$ in Department j, then to convert the teaching load in each department in terms of equivalent students (say N_i) to equivalent students majoring in that department (N_i) we need to solve the following equations (one for each department):

$$\sum_i N_i\alpha_{ij} = N_j.$$

Bearing in mind the uncertainty of the α_{ij} values, solving such a system of linear equations seems unnecessarily cumbersome and we have instead adopted the procedure of dividing each N_i by its corresponding α_i to compute an estimate of N_i, and then normalising to ensure that the sum of the N_i is equal to the sum of the N_i. In any case, if there are any constraints on the number of students permitted to major or minor in any department, it is at this point that allowance must be made. Using these N_i, for each year of study, as estimates of undergraduate numbers at the end of the quinquennium, a profile of undergraduate numbers can be produced taking account of the constraints on smoothed intakes and smoothed student growth. The way this is done is described in the next chapter.

Teaching Loads in New Departments

The remark above (page 43) that as intakes increase, staff requirements lag behind student numbers owing to the relatively small load for each Part I student, does not hold in the first few years of a department's existence. This section looks at the workload of

a new department. Usually, in a new department, staff are not allocated on a strict staff-student basis, and indeed many departments begin with very few students, believing that this will involve them in less work. However, the marginal load per student in the first few years is the same as in the steady state, and if a staff-student ratio were strictly imposed it would in fact be more efficient in staff time to have high intakes, provided that adequate facilities were available.

The previous workload model had the form:

$$\bar{L} = \ell(1 + p) + c\left\{\left[\frac{N}{n}\right] + \frac{m}{2}\right\}(1 + \frac{q}{s}) + Nr + \text{any load due to practicals or language laboratory work.}$$

As an approximation, let us take the load associated with seminars as proportional to the number of equivalent students, and suppose also that the number of hours of practicals u has associated with it preparation time ut. Then writing Nk as an approximation to $c\left\{\left[\frac{N}{n}\right] + \frac{m}{2}\right\}(1 + \frac{q}{s}) + Nr$, we have:

$$\bar{L} = \ell(1 + p) + Nk + u(1 + t).$$

This is assumed to hold separately (i.e. with different parameter values) for each year of study. In a particular technology department at Lancaster, the only difference in parameter values concerns k, and we may write:

$$\bar{L} = \ell(1 + p) + N_I k_I + N_{II} k_{II}) + u(1 + t)$$

where the suffixes I and II denote Part I and Part II respectively.

What characterises a new department as regards teaching load is that lectures and practical sessions have to be prepared ab initio; there is no backlog of lecture material and prepared practical material to draw on. Suppose therefore we let $\ell^{(i)}$ be the number of lectures being given for the i^{th} time, and $p^{(i)}$ be the average number of hours required to prepare such a lecture, with $u^{(i)}$ and $t^{(i)}$ defined similarly. Then:

$$L = \Sigma_1 \ell^{(i)}(1 + p^{(i)}) + (N_I k_I + N_{II} k_{II}) + {}_i u^{(i)}(1 + t^{(i)}).$$

The coefficients $p^{(i)}$ and $t^{(i)}$ are the workloads associated with one hour of lectures and one hour of practical sessions. It is a

commonplace that lectures and practicals being given for the first time take more time in preparation than those for the second time. However, considerable revision and preparation are still needed for the second delivery, and (so it is thought in this department) only on the third delivery has an equilibrium been reached, beyond which the workload changes very little. Typically a department might run lecture courses and practical courses for about four years before new lecturers and new courses replace the old ones. This re-cycling takes place all the time in a department which has reached a steady state but not in a very young department.

As an illustration, we give below details of the teaching load for the technology department at Lancaster already referred to. Some of the parameter values are known (for example, the number of Part I students in Year 1) but most are either estimated or have been agreed as reasonable by members of staff of the department.

Parameter Values in a New Department

$k_I = 15$ and $k_{II} = 45$ are known, and Tables 3.8a and 3.8b give values for the new parameters.

Table 3.8a

i	1	2	3	4
$p^{(i)}$	9	5	$2\frac{1}{2}$	$2\frac{1}{2}$
$t^{(i)}$	5	$2\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$

Using the data above, the workload can be computed to give Table 3.8b.

The table as shown implies that it is possible to split lecture and practical courses so that in the steady state, there is a constant workload related to the introduction of new courses: there are many ways of splitting the courses, one of them is shown in Table 3.9, a and b, in which the suffixes indicate for how many years the course has been given. If such course-splitting is not possible, then irregularity in new course workload is inevitable, and will be even more pronounced in the first few years of a department's life.

Table 3.8b

Year	1	2	3	4	5	steady state
N_I	20	40	80	100	120	145
N_{II}	0	12	32	50	70	105
(1)	90	300	300	200	200	200
(2)		90	300	300	200	200
(3)			90	200	200	200
(4)				90	200	200
(1)	60	230	230	130	130	130
(2)		60	230	230	130	130
(3)			60	130	230	130
(4)				30	30	130

Table 3.9a: Lectures and practical classes in a new department

	Year	1	2	3	4	5
Year of Study	1	90^1	90^2	90^3	90^4	100^1
lectures	2		300^1	300^2	150^1	150^2
					200^3	200^4
	3			300^1	300^2	200^3
					50	50^2
						100^1
practicals	1	60^1	60^2	60^3	30^4	30^1
					30^1	30^2
	2		230^1	230^2	100^1	100^1
					130^3	100^2
						30^4
	3			230^1	230^2	230^3

Figure 3.6

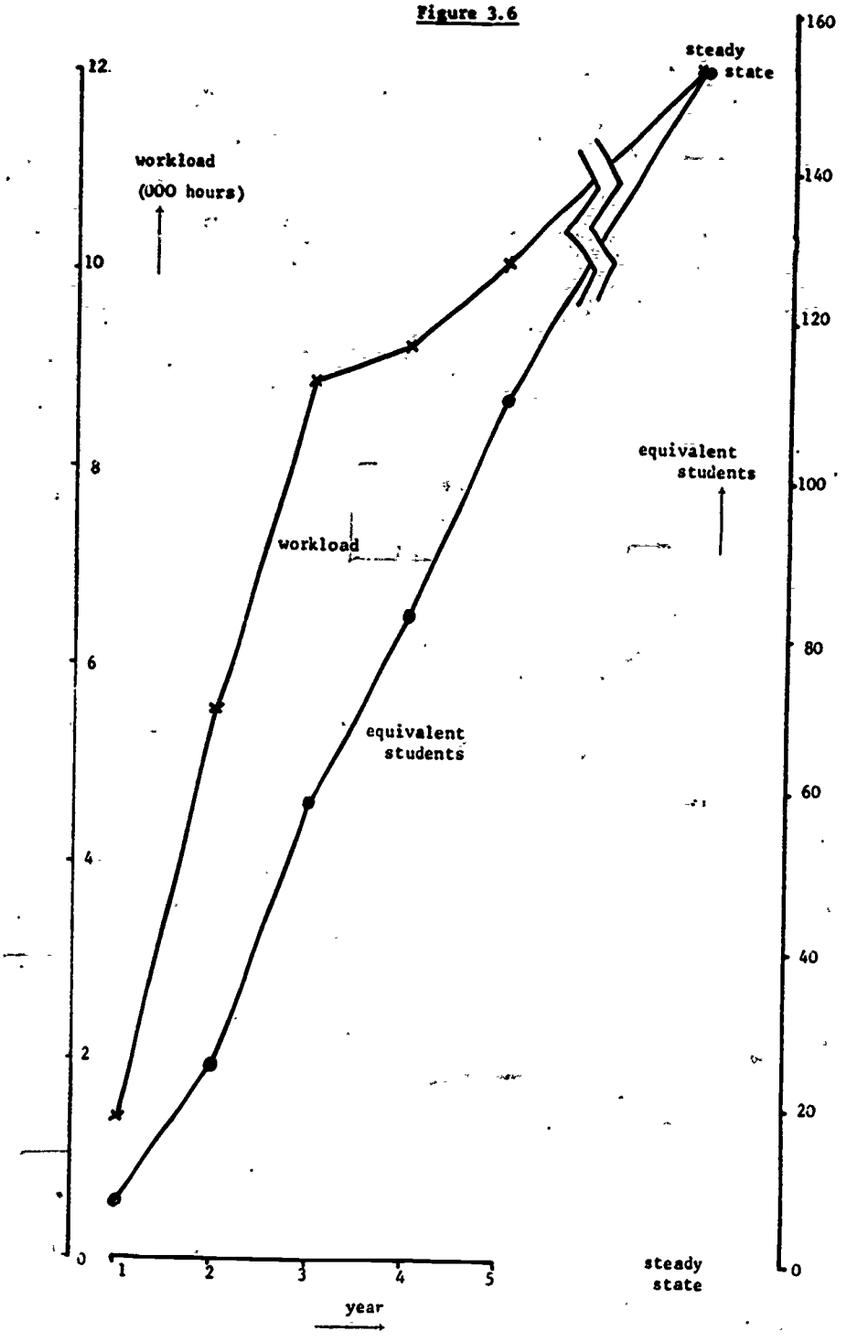

steady state
workload
(000 hours)
12
10
8
6
4
2
0
160
140
120
100
80
60
40
20
0
equivalent students
workload
equivalent students
1
2
3
4
5
year
steady state

Table 3.9b: The resulting teaching load can be computed as:

Year	1	2	3	4	5	steady state
L	1,410	5,590	8,880	9,240	10,115	12,065

Values for load (L) and equivalent student numbers ($\frac{1}{3}N_I + N_{II}$) are plotted in Figure 3.6. The lag of student numbers behind workload is noteworthy. It should be remarked that the workload does not include research or administrative work: it is often alleged that during the first few years of a new department, the workload on members of staff is such that they have very little time for research.

Since the preparation for a course precedes its delivery by some time, it may be realistic in practice to smooth the workload and bring it forward. It is the practice of departments to have staff before students because of this and other preparatory work. It is clear from Figure 3.6 that unless members of staff are appointed an appreciable time before the arrival of students, a strict application of a staff-student ratio would unfairly penalise new departments. For a new department at Lancaster, numerical estimates were made of the amount of resources needed above those called for by the overall University staff-student ratio.

Chapter 4

ADMISSIONS POLICY IN 1972/77

The General Growth Pattern

This chapter describes how, given proposed undergraduate student numbers in each department at the end of the quinquennium, undergraduate intakes can be planned to satisfy various criteria. That this really is a problem is not immediately obvious: a linear interpolation rule, with undergraduate intakes rising by the same amount each year, and total undergraduate numbers in consequence (since the B.A. is a three-year course) rising by three times that amount seems on the face of it an entirely reasonable admission programme. The reason that it is not lies in the way the quinquennial planning system works.

The next quinquennium covers the five years 1972 to 1977. In the last year of the current quinquennium (1971/72) each university must "balance its books", that is, it must spend no more than its income from the University Grants Committee. On top of this, the U.K. in general, and universities in particular, are currently suffering from the effects of inflation. Together, these two factors ensure that undergraduate numbers must stay roughly constant in 1971/72, compared to 1970/71.

The full settlement for the next quinquennium will be announced around November 1972, at which time each university will know its income from the UGC for the next five years. November 1972 is already part way through the first year of the next quinquennium, and it therefore seems prudent (on account of the anticipated cash flow) not to plan for significant expansion in 1972/73. The year 1972/73 must be a "holding" year, with little if any increase in student numbers, unless a real risk is taken on the form of the final settlement - and many universities "guessed wrong" last time! For the remaining four years of the quinquennium, however, it seems reasonable to plan the expansion in undergraduate numbers which has been suggested by the University Grants Committee and accepted by the University (more or less a doubling in size) in accordance with two criteria:

1) to make increases in total student population as smooth as possible,

2) to make increases in total student intake as smooth as possible.

The reason for the first criterion is mainly that increases in total student numbers give rise to corresponding requirements for facilities, especially residential accommodation. The assumption is that steady increases in the student population are easier to deal with than intermittent, relatively large increases. The reason for the second criterion is in part related to that for the first: some facilities for first-year students are already fully loaded (e.g. lecture accommodation for certain Part I courses is already so strained that further increases might mean a radical change in the way the courses are taught). Another reason is one of treating intending entrants, and particularly school leavers, fairly. It seems right that increases in student intakes should not be subject to large changes since this could mean that those attempting entrance to the University one year would be unfairly penalised in comparison with those attempting entrance in the next. Something can be done to smooth the effect of such changes by offering deferred admission, and this solution may have other benefits to the intending student, but it seems unlikely that it will be itself sufficient to take up the effects of large fluctuations in student intakes.

There seem in consequence to be two strategies:

(1) to have student numbers still accelerating fast over the last three years of the quinquennium. This would enable a smoother build-up in intake numbers, but could cause major transitional problems in the overlap from Quinquennium 1972/77 to the following Quinquennium 1977/82, especially if 1977/78 is again a holding year, like 1972/73.

(2) to accelerate as hard as possible in mid-quinquennium and then level out. This would cause significant unevenness in student intake numbers, and large imbalances between Part I and Part II. student numbers. It would, however, make the University less vulnerable to discomfort in another holding phase in 1976/78 than would Strategy (1).

For each of the two growth profiles in these two strategies, two levels of student intakes in the next two years were explored:

(1) The financial difficulties at the end of the current quinquennium have made it unlikely that the previously planned intake of 790

in 1971/72 can be significantly exceeded. A further 790 in 1972/73 would keep total undergraduate population about constant.

(2) If inflation were to be met from the University's own resources, and if the University wished to "squeeze" no further, (e.g. to maintain the current teaching loads and staff-student ratio) then the same expenditure per student in constant value terms would be implied. If inflation were to run at 10 per cent over the next two years, and if half of this had to be met by reductions in student numbers, then total student population would have to be reduced by about 5 per cent in each of the next two years. Intakes of around 670 in each year would achieve this. Happily, it appears unlikely that the Government will leave universities to absorb inflation at anything like a 10 per cent rate: so this second intake strategy is probably redundant.

There are thus four cases, combining the two intake strategies in 1973/77 and the two intake levels in 1971/73. We have numbered the four cases from 1 to 4, thus:

(1) intake 670 in 1971/73, gradual increases in 1973/77
(2) intake 790 in 1971/73, gradual increases in 1973/77
(3) intake 670 in 1971/73, rapid increases and then levelling off 1973/77
(4) intake 790 in 1971/73, rapid increases and then levelling off 1973/77.

For each of the cases the remaining flexibility in intakes has been used to meet the two criteria as closely as possible.

Past data were used to estimate switches in students' intended majors and loss rates (as described in Chapter 2). These were used to calculate Part II undergraduate numbers in terms of equivalent students. When changes from current to future intakes were significant, they were smoothed as much as possible in accordance with the two criteria. When reductions were inevitable across the whole University, they were applied equally.

The most important results were produced in the form of graphs (Figures 4.1 and 4.2) which were presented at a meeting of the University's Development Committee when a decision was made on the most preferred pattern of growth. Finally, the student profile shown as Case 4 was chosen, corresponding to sustained intakes in 1971/72

Figure 4.1

Undergraduate Student intake over the next quinquennium

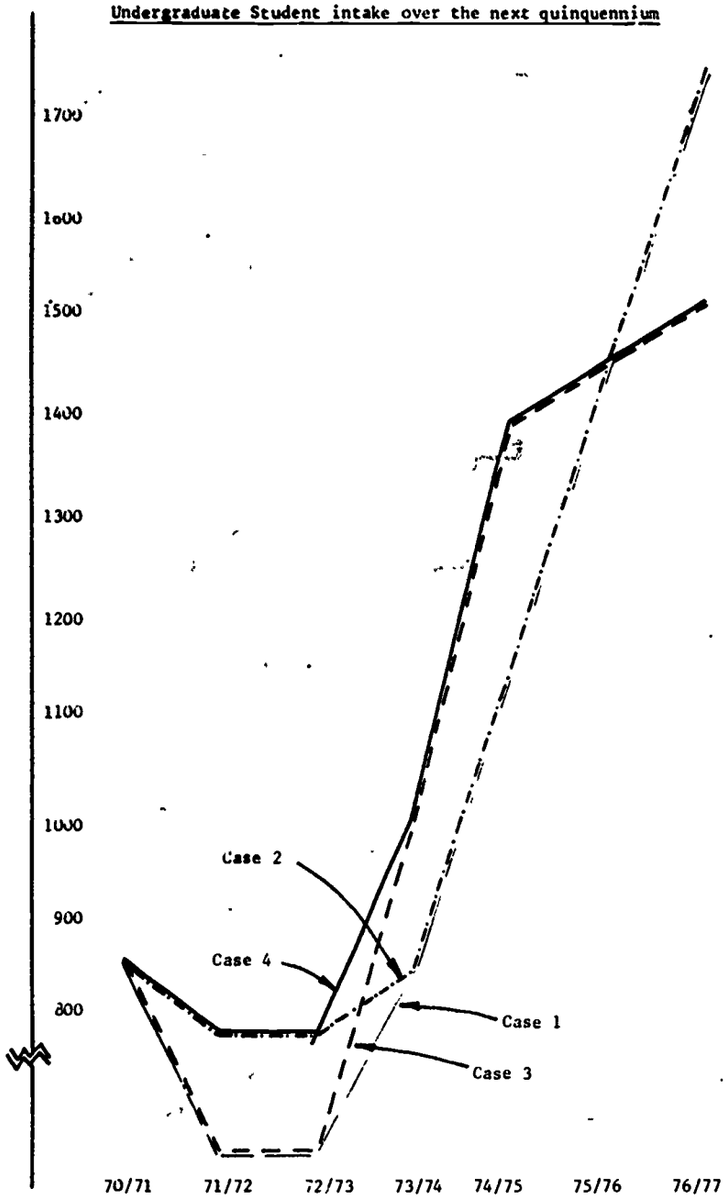
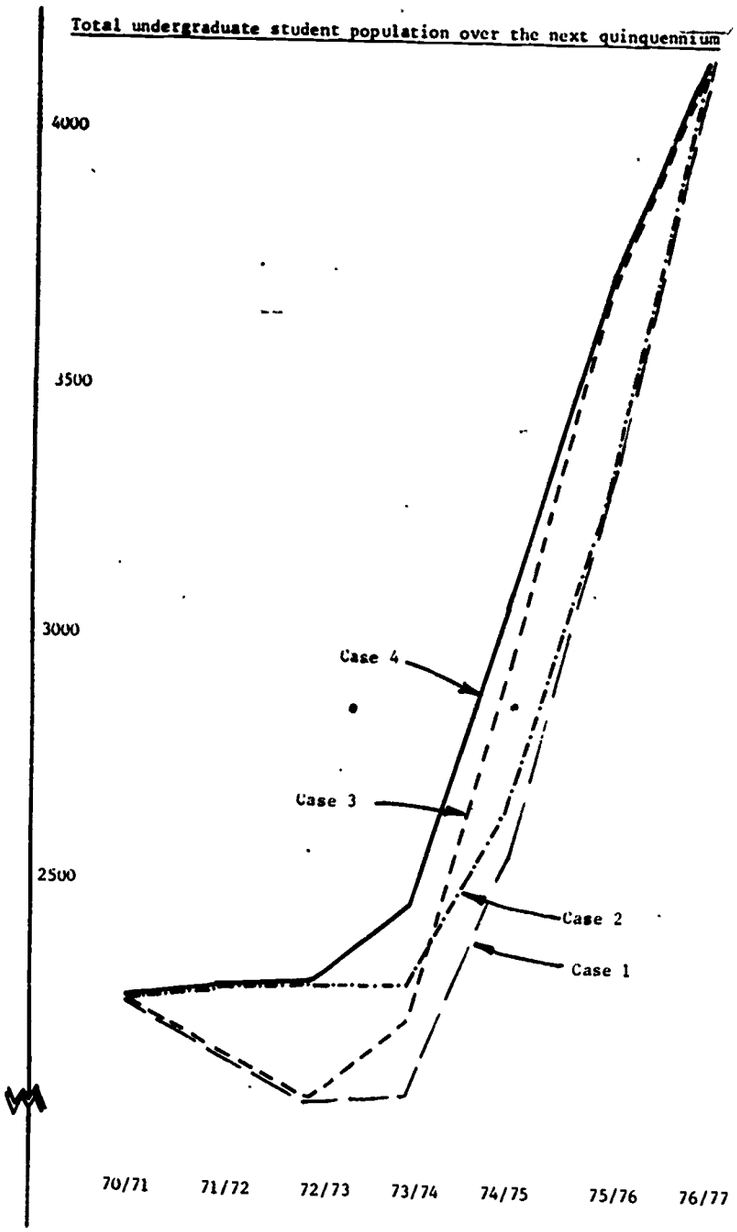


Figure 4.2


Total undergraduate student population over the next quinquennium
4000
3500
3000
2500
Case 4
Case 3
Case 2
Case 1
70/71
71/72
72/73
73/74
74/75
75/76
76/77

and 1972/73, and fast growth in student intakes in 1973/74 and 1974/75, tailing off a little in 1975/76 and 1976/77. The choice of this profile implied (at the time) a commitment (among other things) to a worsening staff-student ratio in the next two years, and greater pressure on accommodation (relative to Cases 1-3) in the middle of the quinquennium.

After the presentation of this material, the University agreed to plan to increase its undergraduate numbers from 4,150 to 4,520. One consequence of the earlier presentation to the Development Committee was that agreement was soon reached on a student profile comparable to Case 4 but ending in 1976/77 with the newly proposed total undergraduate numbers.

A Computer Programme to Compute Admissions

The Development Committee were also shown the proposed development of student numbers in each department corresponding to each of the four cases. These numbers were produced by a computer programme "Quinqnos" whose outline is as follows. The main loop of the programme may be represented:

The data (box 1) comprise:

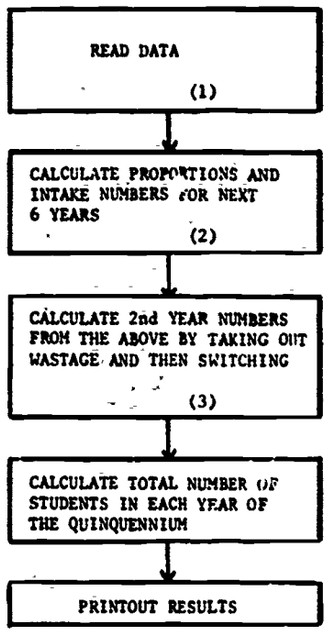
a) Present numbers of major equivalents by department for each year of study.
b) Vector of wastage fractions by department.
c) Switching matrix.
d) Planned numbers over the next two years by department.
e) First-year intakes over the next six years.
f) Planned student numbers for the seventh year by department.

In box 2, the programme works out the way in which the proportions of undergraduates in each department would change over the next seven years in order to reach the planned target, and then converts these to numbers for each department's intake.

In box 3, the first-year figures for each department have the appropriate wastage fractions removed and are then multiplied by the switching factors to give the following year's second-year structure.

The programme smooths out year to year fluctuations in the balance of studies, as represented by the ratio of the number of (equivalent) students taking science courses to the number of

Figure 4.3 Flow chart for computer program "Quinqnos"



(equivalent) students taking arts courses. The Development Committee's plans implied an increase in the proportion of science students and the programme ensures that the rate at which this increase takes place will be consistent with the increase in total student numbers implicit in the preferred student growth profile.

The programme was used in conjunction with the planning of undergraduate admissions, described in Chapter 3. On each run the results were printed in four main sections and, as an illustration, a sample from each section, relating to one of the arts departments, is shown in Table 4.1. The figures shown are based on the 1970/71 course preference structure. Given current student numbers in the

department and planned student numbers at the end of the quinquennium, the preferred total student growth profile gave the major student equivalents shown in Table A. This table and the one beneath it are based on the assumption that no course switching is allowed, i.e. that a student reads the major course which he intended to read on admission to the University. The second table shows teaching loads and staff requirements in terms of equivalent students. Postgraduate student numbers are shown changing linearly from their current figure to the estimated number in 1976/77. Staff numbers were calculated on the basis of the 1:11.42 staff-student ratio derived in Chapter 3. It will be seen that except for third-year students, this department is a net loser, in that the load of its own students doing courses in other departments is much greater than that of students from other departments doing its own courses.

The third table again shows major student equivalents, this time assuming switching is maintained at present levels. Naturally, first-year intakes are unchanged, but it can be seen that this department is also a net loser of major equivalent students, i.e. that students intending to major in it on admission tend to change their minds. Similar remarks may be made about Table D as were made about Table B. The effects of losses through switching are apparent.

One result of the analysis has been that it enables us to estimate bounds on the effect of the new policy on computing student numbers described in Chapter 2. In 1969 and 1970, a student at the end of the first year who wished to change his major and was qualified by his Part I results to take his new major could do so. Thus the 1969 and 1970 switching matrices used in the programme relate to times when students had considerable freedom in their choice of major. Staff were then allocated to departments on the basis of the resulting load.

Under the new system, it may be that not every student who wishes to change his major and is qualified to do so will be allowed to (because the department in which he would like to major might become overloaded). Thus the two pairs of tables (A, B and C, D) represent two bounds on the forecast operation of the proposed system; first with no switching allowed at all, and secondly with complete freedom to switch. The number of students who want to, are qualified to and are permitted to switch under the new system would probably be somewhere between the two extremes, though precise forecasts of the effect of the new policy on switching would clearly be exceedingly hazardous.

The Determination of an Admission Policy

Results like those shown in Table 4.1 are the culmination of the teaching loads study described in Chapter 3 and the work on course switching, course preference, and wastage described in Chapter 2. These results are in effect one link in an iterative chain, as shown in Figure 4.4. This chart is an expansion of the simple diagram shown in Figure 3.1.

Table 4.1: Sample printout from computer-programme "Quinance"

A: Major equivalents: no switching

1st Yr. Nos.	58	61	61	84	113	128	123
2nd Yr. Nos.	46	51	55	53	74	99	112
3rd Yr. Nos.	63	46	51	53	53	74	99
Staff (UG)	15	13	14	16	19	25	29

B: Teaching loads: no switching

1st Yr. Total	34	36	36	52	74	84	85
2nd Yr. Total	34	37	39	39	54	77	87
3rd Yr. Total	60	46	51	53	53	75	106
All Yr. Total	128	119	126	144	181	236	278
Staff (UG)	12	11	11	12	15	20	25
PG Nos.	16	16	16	16	15	15	15
Staff (UG+PG)	13	12	13	14	16	22	26

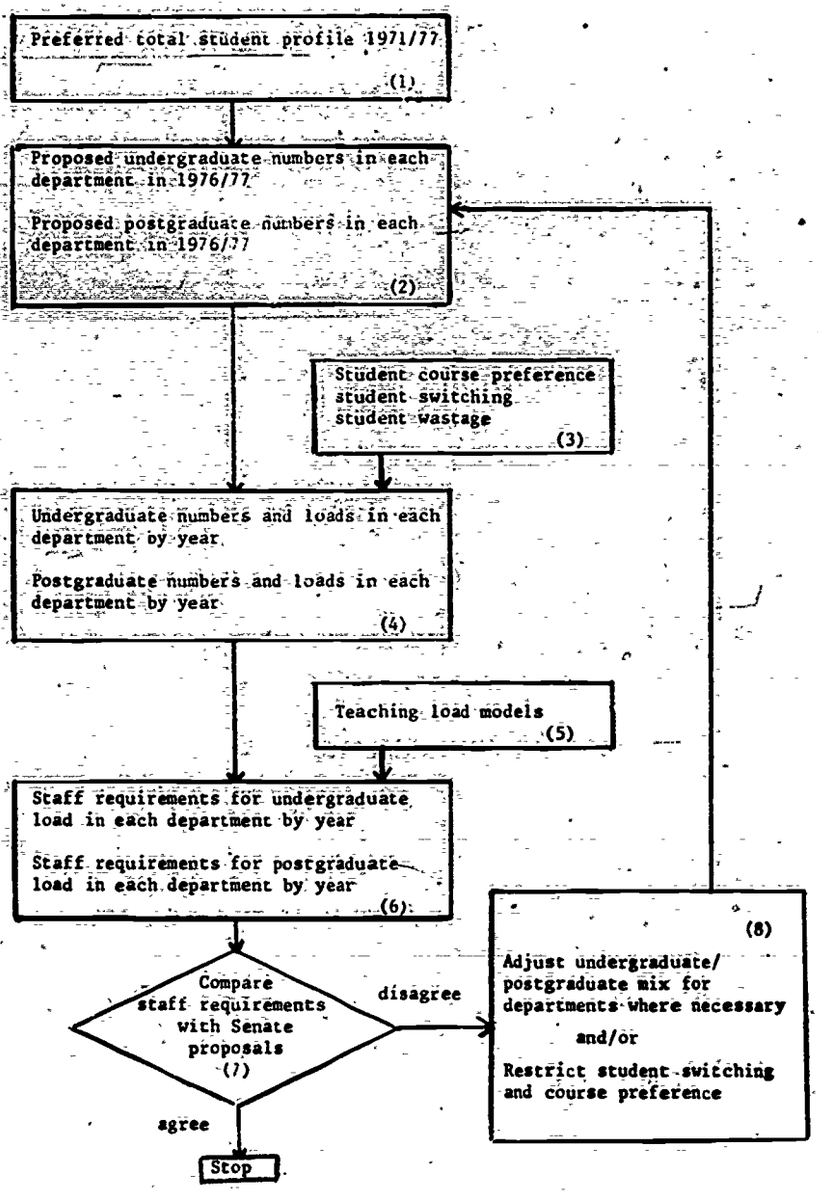
C: Major equivalents: switching

1st Yr. Nos.	58	61	61	84	113	128	123
2nd Yr. Nos.	46	44	45	45	61	82	92
3rd Yr. Nos.	63	46	44	45	45	61	82
Staff (UG)	15	13	13	14	17	22	25

D: Teaching loads: switching

1st Yr. Total	34	36	36	52	74	84	85
2nd Yr. Total	34	32	33	33	46	63	72
3rd Yr. Total	60	46	45	45	45	63	87
All Yr. Total	128	114	114	130	165	210	244
Staff (UG)	12	10	10	11	13	18	21
PG Nos.	16	16	16	16	15	15	15
Staff (UG+PG)	13	11	11	12	15	19	22

Figure 4.4 An iterative procedure to determine student admissions



In box 1, the preferred total student profile is input to the computer. In box 2, proposed undergraduate and postgraduate numbers (based initially on reasonable forecasts), for each department in the last year of the quinquennium, are also input. In Box 3, student course preference, switching and wastage are applied to box 1 and box 2 to give undergraduate and postgraduate numbers and loads, by department, for each year of the quinquennium. In box 5, the results of the teaching load study are applied to the departmental student numbers and loads of box 4 to give staff requirements for undergraduate and postgraduate loads by department, again for each year of the quinquennium. These staffing requirements (box 6) can then be compared with the proposed staffing figure put forward by Senate (box 7), and if the figures do not agree (box 8), adjustments can be made to the numbers of undergraduate and postgraduate students in departments or student switching and course preference can be restricted. The cycle is then re-entered at box 2, and repeated until a sufficiently close agreement is reached.

At this point, based on:

- the preferred total student profile in 1971/77
- the proposed undergraduate and postgraduate student numbers in each department in 1976/77 (adjusted if necessary)
- estimated student wastage, course preference and switching (restricted where necessary)
- the results of the teaching load models

we have produced the desired schedule of:

- planned undergraduate and postgraduate student admissions in 1971/77, consistent with the proposed minimal numbers of members of staff in each department in each year.

We emphasise the dependence of the results on the parameter values we have taken. If teaching methods were to change, the relative Part I/Part II student weights might also change. The Development Committee may well request further results based on different ways of weighting postgraduate students. There are two points here: first, that results such as these need to be the object of a sensitivity analysis to determine the stability of the results in the face of variations in parameter values, and second, that there needs to be a continual up-dating of the parameter values. The second point alone would be a worthwhile reason for continuing the activities of the project team. An extensive sensitivity analysis is currently under way.

Chapter 5

ALLOCATION OF FUNDS TO THE LIBRARY

Introduction

This chapter describes work which is designed to assist the decision: How much should be allocated for recurrent library expenditure? The work entailed the construction of a model which computes the disaggregation of a given total budget amongst different expenditure heads, and so demonstrates the level of overall funding necessary to attain specified levels of service.

Much of this report is concerned with the direct teaching/learning process as carried out by academic departments. In addition to these activities, any university maintains a number of "central services", all of which contribute in some way to its overall performance.

The principal central services are shown in Table 5.1.

Table 5.1: Principal central services

Administration
Library
Computer
Audio-Visual Aids
Buildings and Grounds Maintenance
Residence and Catering Facilities
Recreational Facilities

The problems of preparing a budget estimate for a central service depend very much on the particular service under consideration. The maintenance of buildings and grounds is simple to cost, given the standards of heating, cleaning etc. which are to be maintained. Nor is it very difficult to estimate savings that can accrue from a reduction in, say, cleaning standards. On the other hand, given that the university population is reasonably satisfied with the standards attained, there is no cogent reason why more money should be spent on improving service.

However, when one considers the University Library, such simplistic comments do not hold. The university population is rarely

happy with the level of service a library is able to give, since there are many demands for service which are not satisfied, in addition to which library management is convinced that there is a large latent demand. Also libraries in universities have to do more than attempt to satisfy immediate demand. They bear a responsibility for building a collection of journals and books, and a retrieval system, which will be available for future users, and there is thus no point at which the marginal value of spending money on the library becomes zero. However, there is clearly a point at which this marginal value is less than that which would accrue from spending the money elsewhere in the university, and value judgements have to be made in determining appropriate resource allocations. Obviously research of the nature described in this study can only assist such value judgements, and cannot replace them.

Organisation of the Lancaster University Library

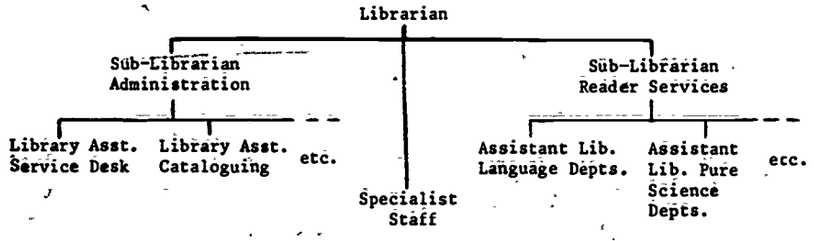
There are no significant departmental libraries at Lancaster. All books, periodicals and other bibliographic material are housed in two buildings, one of which is temporary accommodation to be vacated when all teaching departments are on the main site. The library is under the control of the University Librarian, with two sub-librarians responsible for reader services and administration respectively. A number of assistant librarians maintain close contacts with readers by assisting with all facets of library use from the selection of new books to the conduct of detailed literature searches. Routine library work such as book ordering and cataloguing, arranging inter-library loans, issuing material to readers, etc. is performed by trained library assistants, who in turn are helped by untrained juniors. In addition specialist staff are employed for binding, photographic and print work, the development of computer based systems in libraries, and research into library management.

Library Expenditure Model

Library expenditure has been traditionally presented under the following heads:

Staff
Books
Serials (i.e. periodicals)
Binding
Sundries.

Figure 5.1



A model has been developed, which shows for a given total library budget, the most likely breakdown between these heads. Figure 5.2 illustrates the model, and the following sections detail its principal features.

(1) Staff

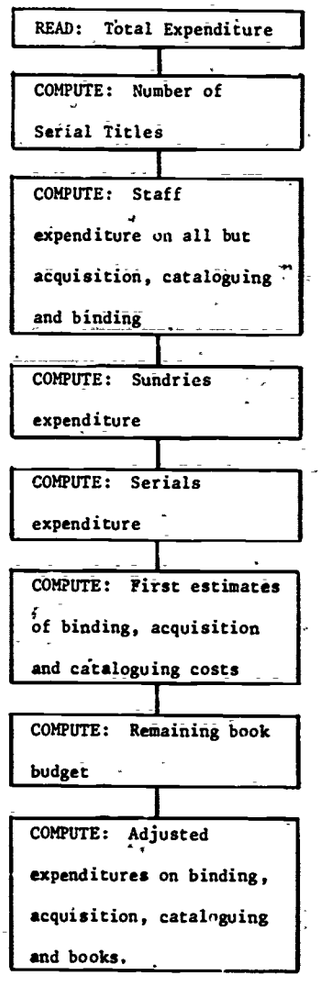
The previous section on library organisation outlined the main categories of staff in the library. With the growth of the library that is envisaged, the librarian foresees the need for a third sub-librarian before the end of the next quinquennium. Assistant librarians have in the past been recruited so that each has served four academic departments.

Although the number of academic departments is not to expand greatly over the next quinquennium, the size and scope of existing departments will certainly increase. Thus to maintain present service levels to departments it is estimated that ten assistant librarians will be needed to service thirty departments by 1976/77. Senior and junior library assistants perform a number of functions:

Service desk (i.e. issues, returns and general enquiries)
Inter-library loans
Acquisitions
Cataloguing
Serials (i.e. ordering, receiving, etc.)
Official publications.

The number of staff needed to man the service desks will depend partly on the number of issues that occur. This in turn depends upon the number of users, and the number of issues per user. The number

Figure 5.2



of potential users is known, as the student population up to 1976/77 has already been determined. The number of issues per user is a statistic which was stable prior to a major change in loan policy, since when it rose by some 30 per cent, and shows signs of further increase. However, the number of service desk staff cannot be expected to grow linearly with issues indefinitely. The present supervisor of the service desk can envisage doubling the throughput of issues with a 50 per cent increase in staff. Sensitivity analysis described later

indicates this estimate is not critical. Trained library assistants perform a supervisory role for the service desk, so increases in staff will be at the junior level. The number of inter-library loans that need to be processed is expected to increase linearly. The present staff level is assumed to be correct for present work loads, so the extra staff needed, again at the junior level, can be estimated. The levels of activity in the acquisition and cataloguing sections depend entirely upon the number of books bought. Thus the size of the book budget is reflected in the number of staff estimated for these sections. Extra acquisition staff will be at the junior level, but for cataloguing, the additional staff will have to match the present ratio of senior to junior staff. The staff who will process serials are similarly estimated on the basis of the number of serials that will be bought. Again extra staff will be at the junior level. At present one senior library assistant takes care of Official Publications (i.e. Government documents) and preparing material for binding. Although the number of serials that will need binding is to increase, the saving in effort by introducing an internal bindery is expected to compensate, so that one person will still be sufficient for the combined load. The cost of the systems analyst and photographic and support staff such as programmers, secretaries etc. are included under this head.

(2) Binding

The library has recently opened its own bindery, which has a given capacity. When this capacity is exceeded, extra binding can be contracted out, or the bindery can have its capacity increased. As the smallest increase feasible involves employing two extra staff, there is a level of extra work below which it is cheaper to contract work out, and above which the extra internal capacity is economically justified. The model computes the number of items that will need binding in a given year, which depends upon the number of serials and paperback books bought by the library. The model then determines the least cost method of binding this number of items.

(3) Sundries

This expenditure head covers such items as stationery, telephones, travel etc. In the past it has amounted to less than ten per cent of library expenditure, and no detailed analysis has been attempted. Estimates of future expenditure have been made by fitting

a regression line between past expenditures (corrected for inflation) and student numbers, and using the line to extrapolate the cost in conjunction with the agreed future student numbers.

(4) Serials and Books

These are grouped together here because of the way in which funds for serial and book purchase are controlled at Lancaster. Once an order is placed for a serial the librarian is most reluctant to cancel the order, library policy being to hold consecutive copies of serials as far as possible. Thus a decision to order a new journal commits expenditure into the future. The library divides its book budget between teaching departments according to a formula agreed by the Library Committee. Departments are permitted to use some of their allocation for purchasing serials, a limit being imposed in recognition of the commitment of future funds. In order to estimate binding costs accurately it is necessary to estimate the number of serials that will be purchased. A linear extrapolation of serial titles is incorporated in the model and sensitivity analysis indicates this is a justifiable simplification. The cost of serials at current prices is then computed, and the amount of money remaining to be spent on books, after all other expenditures are met, is found. Using current book prices this budget implies that a certain number of books will be bought in a given year. Appropriate adjustments are then made to the book budget to allow for the extra cost of staff who will be needed to acquire, catalogue and bind the books, together with extra binding costs.

(5) Validation of the Model

In developing any model one is concerned that the structure is correct, and that the parameter estimates used are sufficiently accurate. Since this is a simple model, and since the librarian was involved in its development, the question of detailed validation of structure does not arise. However, there are a considerable number of parameters in the model and the values of these parameters were initially estimated by the most appropriate means. In testing the model it was necessary to isolate those parameters to which a small change would result in a significant change in the output of the model. A sensitivity analysis was performed on twenty variables, and it was found that six of these were sufficiently sensitive to require further investigation. These variables are listed in Table 5.2.

Table 5.2: Sensitive variables in the library model

- Average book price
- Average serial price
- Number of serials taken } decision variables
- Number of books taken }
- Work rate in cataloguing section
- Staff salaries

In the case of book prices a detailed survey of the cost of the last 1,500 books bought was made. The results of this survey enable an average book price to be calculated, together with a confidence interval. A similar survey was made of serial prices, and the staff salary model described in Chapter 6 was utilised to estimate the salary costs of senior library staff.

Interpretation and Use of Model

The model was programmed to enable the sensitivity analysis to be performed, and to allow the comparison of a number of alternative budgets to be made rapidly. Various attempts were made to present the resulting information in ways that could be easily interpreted by decision makers, i.e. the Librarian, Library Committee, Development Committee and Senate. Table 5.3 shows a typical comparison of cost information that was presented, and Figure 5.3 illustrates the information graphically.

Table 5.3: Alternative library budgets

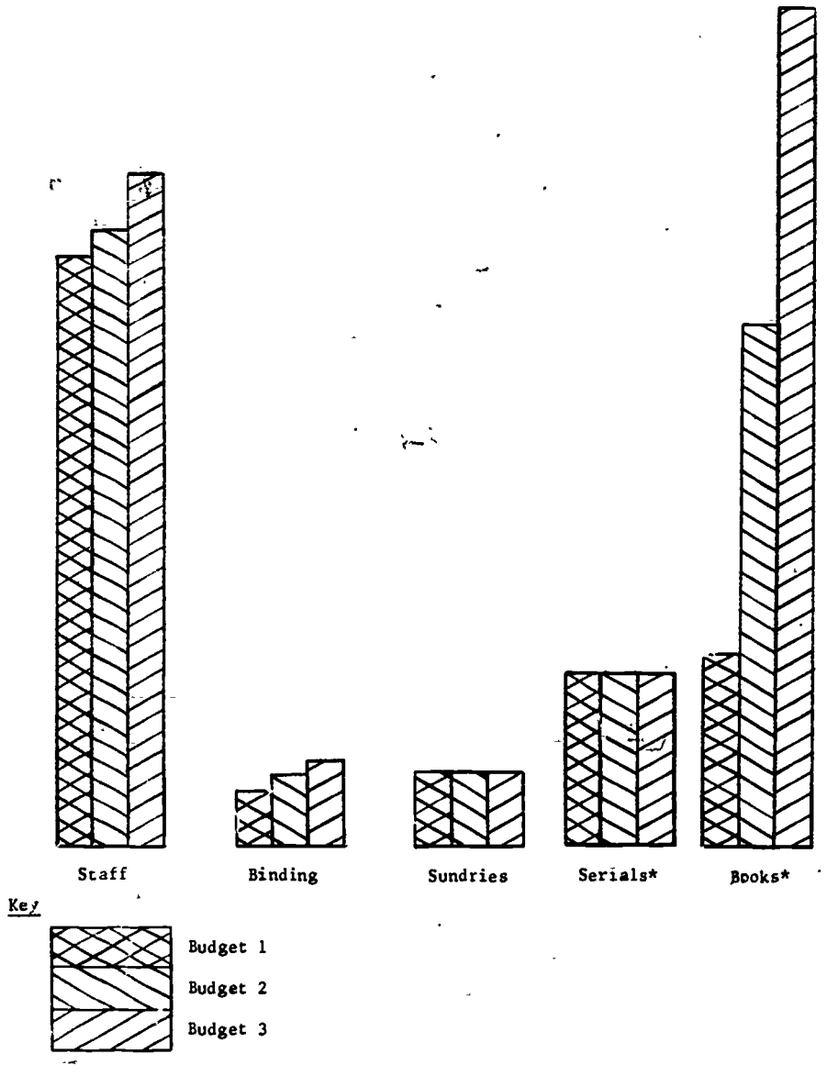
	Staff	Binding	Sundries	Serials*	Books*	Total
Budget 1	121.1	12.7	15.6	34.7	35.7	219.8
Budget 2	125.0	15.2	15.6	34.7	105.7	296.2
Budget 3	135.8	17.1	15.6	34.7	169.4	372.6

All figures are in £1,000s.

* The model does not indicate the exact split of funds between books and serials that might occur.

When such information was presented, care was taken to point out where misinterpretation could occur. This is particularly crucial in the case of book and serial prices. All the estimates produced

FIGURE 5.3 ALTERNATIVE LIBRARY BUDGETS



* The model does not indicate the exact split of funds between books and serials that might occur.

by the model are at 1970/71 prices, to conform with UGC requirements for the completion of quinquennial estimates. However, the rate of increase in book and serial prices is particularly high, so a nominal book budget prepared for 1976/77 has to be corrected to indicate the equivalent purchasing power of such a budget, should the inflationary trends continue. This problem is further complicated since, as Lancaster spends more on library facilities than the national average, supplementation resulting from the Tress-Brown Index of University costs will always be insufficient. Similarly for staff costs, the estimates are prepared under the assumption that should national agreements alter salary scales, the library would receive appropriate supplementation.

Results from the model have been presented to a number of meetings, and have served as bases for discussion. The first such meeting was of the Development Committee in September 1970, when a paper was being prepared for a Senate Conference outlining initial quinquennial plans. At this stage the decision was taken that the library would continue to spend in the region of 9 per cent of estimated total university expenditure. In February 1971 the Library Committee received detailed estimates and provided valuable feedback to the research team. The budgets were presented as in Table 5.3 and the Library Committee took the opportunity of discussing the level of book purchase that they felt would be desirable in 1976/77. These recommendations were then incorporated into the model, so that instead of a total budget being used as the starting point, the desired book budget was input to the model, and the necessary total budget computed. A later Library Committee meeting in June 1971 approved these estimates, which were then sent to the Development Committee for incorporation in the quinquennial submission.

It is envisaged that further use will be made of the model in the event that some reallocation of funds is necessary when the UGC settlement is announced.

Chapter 6

TEACHING STAFF SALARIES

Introduction

This chapter describes a simulation model which predicts the future cost of staff salaries. The model can also be used to investigate the effect of changes in staffing policy.

In British universities permanent teaching staff are appointed to one of the following positions:

Professor
Reader
Senior Lecturer
Lecturer.

At Lancaster the title Reader is conferred on some senior lecturers to recognise research ability, but in general as far as the level of seniority and responsibility are concerned, and in salary terms, the titles are equivalent*. For the remainder of this chapter senior lecturers should be taken to include readers.

Professors are appointed at fixed salaries. There is a minimum professorial salary, and for any university the UGC recurrent grant is calculated on the basis that the average professorial salary is of a certain value. The UGC also imposes a limit of 35 per cent on the percentage of staff who can be appointed professors or senior lecturers at any time. Non-professorial appointments are made on two salary scales. The scale for senior lecturers has nine points, although the ninth point is not automatically attained. Lecturers are appointed to a fifteen point scale, with an efficiency bar operating at the eighth point. In normal circumstances a lecturer (senior lecturer) progresses by one point on the scale each year. At Lancaster the Academic Promotions Committee can sanction faster progression up the scale, and can also promote lecturers to senior lecturer posts. There is no formula by which a new appointee has his salary automatically fixed, but data obtained at Lancaster indicate a strong correlation between initial salary and age/academic qualifications.

---

* This is the most common U.K. practice, but in some U.K. universities only the title "Reader" is used, replacing senior lecturer completely.

Staff salary costs amount to some 38 per cent of present recurrent expenditure, so there is ample reason why as full an understanding as possible of the effects of University growth on these costs should be sought. A simulation model which embodies the salary scale structure has been developed, and is being used to project salary costs to 1976/77.

Simulation Model

The model used to represent the process of staff movement is of a type known as Markov Models. The basic premise upon which such models are built is that an entity can be in one of a number of states at a given point in time. At regular intervals state changes occur, and the probability of an entity changing from one state to another needs to be known for every pairing of states. Appendix 3 shows the possible transitions that can be made in the model. The transition probabilities depend only upon the state the entity is in immediately prior to the state change, and do not depend upon the previous history of state changes that have occurred to the particular entity. This simplification, necessary for computational expedience, must be closely examined in any application of Markov Models. In this particular application the entities referred to above are teaching staff, the states are points on salary scales.

Figure 6.1

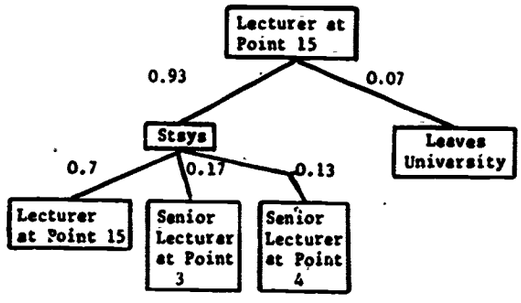


Figure 6.1 shows a typical set of transitions possible in a state change, together with transition probabilities. In reality, the probability that a lecturer at point 15 is promoted to senior lecturer might depend upon how long he has been at that point. If he has been there for ten years, he is clearly unlikely to receive promotion, while if he has been there only one year he may have to wait a little longer. The model developed is unable to recognise these degrees of complexity, and data are not available in sufficient detail to create any such model.

The basic data inputs to the model are the number of staff at the various levels in 1970/71, and the total number of teaching staff over the whole quinquennium. Using an initial estimate of staff numbers by department over the quinquennium the number of professors in the University was estimated. Given the total number of posts, and the number of professors in any year, there is an upper bound on the number of senior lectureships that can be filled in that year, due to the 35 per cent limit mentioned above. The model simulates reality by performing the following three stages consecutively:

1. The numbers of staff at each level who will leave in a given year are estimated.
2. Staff who remain are either promoted to positions vacated or newly created at the level above, or move up the salary scale they are already on, unless already at the top of the scale.
3. New staff are introduced to the system to fill the remaining posts.

Figure 6.2 illustrates the main facets of the model.

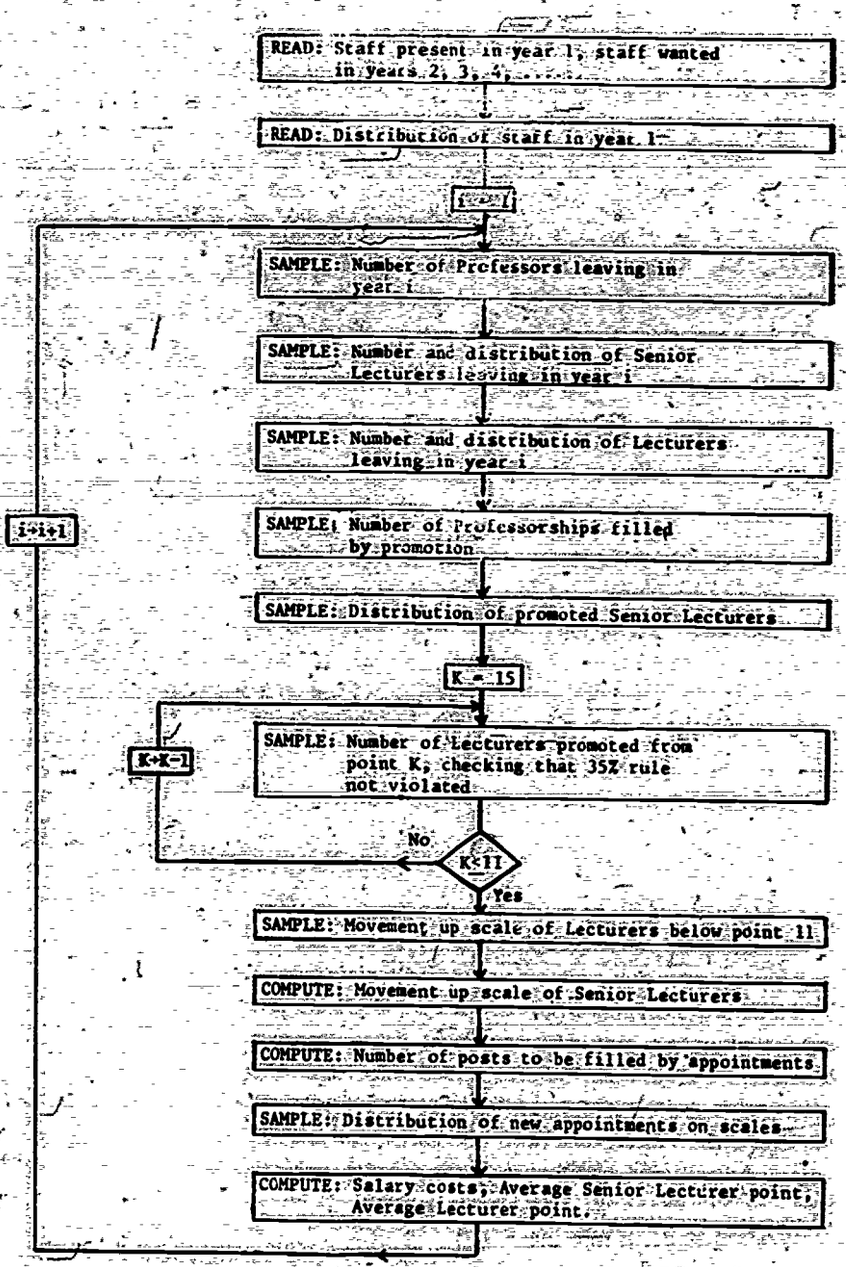
Each of these stages will now be considered in greater detail:

(1) Exit of staff from the University

Staff leave the University for two reasons: to retire, or to take posts elsewhere. Retirements, being age correlated, can be easily forecast from current staff records. However, very few staff will reach retirement age at Lancaster during the next quinquennium*, so this part of the model deals only with the estimating resignations. In the absence of sufficient data permitting a more detailed analysis,

* A consequence of the University's relative youth as an institution.

Figure 6.2


READ: Staff present in year 1, staff wanted in years 2, 3, 4, ...
READ: Distribution of staff in year 1
i = 1
SAMPLE: Number of Professors leaving in year i
SAMPLE: Number and distribution of Senior Lecturers leaving in year i
SAMPLE: Number and distribution of Lecturers leaving in year i
i=i+1
SAMPLE: Number of Professorships filled by promotion
SAMPLE: Distribution of promoted Senior Lecturers
K = 15
K=K-1
SAMPLE: Number of Lecturers promoted from point K, checking that 35% rule not violated
No
K=11
Yes
SAMPLE: Movement up scale of Lecturers below point 11
COMPUTE: Movement up scale of Senior Lecturers
COMPUTE: Number of posts to be filled by appointments
SAMPLE: Distribution of new appointments on scales
COMPUTE: Salary costs, Average Senior Lecturer point, Average Lecturer point.

it is assumed that a constant proportion of staff at each grade will resign each year. So the model uses a sampling routine to estimate how many professors, senior lecturers and lecturers will resign each year. Having arrived at these estimates it is necessary to determine from which points on the lecturer and senior lecturer scales the departures will occur. Departures of staff in the past are distributed across the scales in a certain way. But these distributions will reflect the distributions of all staff on scales as well as any inherent biases towards leaving from particular points on the scales. So the model, in determining from which points staff are to leave, combines the long run distribution of departures with the actual distribution of staff posts at that point in time.

(2) Movement of staff that stay

The preceding section described how the model computes the number of staff that leave the University in a given year. This information is combined with the number of new posts created by the expansion of the University to indicate how many new appointments are needed at each level.

For professorial and senior lecturer posts, these appointments can come from within the University. The bulk of the professorial appointments over the next quinquennium will be second and third chairs within existing departments. For such chairs in the past, a particular percentage have come from within. It is assumed that the same proportion will be true for future appointments, and that these people will come from the top three points of the senior lecturer scale, as has also been true of virtually all promotions to chairs in the past. The data available show no bias towards promotions coming more frequently from point 9, rather than 8, or 8 rather than 7, so the model determines with equal likelihood from which of these three points the senior lecturer is promoted. This contrasts with promotions from lecturers to senior lecturers, where there is a bias towards the higher points on the scale providing promotions. The promotion of senior lecturers generates further senior lecturer posts to be filled, and these are added to those produced by departures and expansion. To determine how many of these posts are filled by existing lecturers, it is noted that nearly all promotions to senior lecturer have come from points 12, 13, 14 and 15 on the lecturer scale (i.e. the top 4 points). The model considers in turn each lecturer at point 15, and determines by a sampling process whether or not the lecturer is to be promoted, and if so, to which point on the senior

lecturer scale. The sampling process reflects the proportion of lecturers at point 15 who have been promoted in the past, it being assumed that a similar proportion will be promoted in the future. The model then sequentially performs a similar process on lecturers at points 14, 13, and 12, moving lecturers who are not promoted to higher points on the scale in accordance with past data. During this stage a record is kept of the number of promotions from lecturer to senior lecturer, and a constant check is kept that the number of posts available is not exceeded. Should all these posts be filled by promotion before the model has considered all the lecturers at point 12 and above, any promotion which the sampling process calls for is not allowed, and movement to a higher point on the lecturer scale is specified. This explains why lecturers at point 15 are considered for promotion before those at point 14 etc.

As with promotions from senior lecturer to professor, promotions from lecturer to senior lecturer create more posts on the lower scale, so the number of new lectureships to be filled is updated by the model.

Lecturers on points 1 to 11 are next considered. Past data indicates that of the various possible changes (viz: "stay the same", "move up one point", "move up two points", etc.), the only two changes that are significant for our purposes are "move up one point" and "move up two points". (It is noted in passing that past data signify that the existence of the bar on the lecturer scale has no significant effect upon movements up the scale.) The model determines for each lecturer on points 1 to 11 whether one or two steps are to be made. This is again done by a sampling process reflecting past data.

The model then moves senior lecturers who have not been promoted up their scale. Past data indicate that moves of more than one point are very rare, so the model moves all senior lecturers at point 1 to point 2 etc. Again it is noted that past data do not indicate that the eighth point on the senior lecturer scale is effectively used as a terminal or holding point.

(3) Appointment of new staff

The previous two sections, together with information on new posts created by expansion, determine how many new staff need to be appointed at each level. It is assumed that the distribution of appointments across the scales in the past will be representative of future appointments. The model uses these distributions and sampling.

procedures to allocate new staff to the scales. This can be done in two ways. All non-professorial posts can be grouped together, and a sampling routine used to allocate a new staff post to either a point on the senior lecturer scale, or a point on the lecturer scale. The other alternative is to set quotas of senior lectureships and lectureships, with the 35 per cent rule being the constraining factor, and use sampling procedures to allocate posts to particular scale points. The reason for these two options in the model is that the method of recruitment to posts in reality is difficult to describe precisely. The majority of posts are defined as being either for a lecturer or for a senior lecturer. However, there are occasions when a lectureship cannot be filled, but a senior post can, and vice versa. The two options on recruitment are built into the model to represent limits within which the real life situation lies, and are controlled by altering a parameter.

Testing of Model

The comments made earlier in this chapter on the structure of Markov Models indicated that numerous simplifications are incorporated in this model. The extent to which such simplifications are acceptable depends upon the purposes to which such a model is put. It would clearly be hazardous to use the model to forecast the career path of an individual member of the teaching staff; the model was never intended for such purposes, but will be used for forecasting the aggregated salary costs of a total body of staff approaching six hundred in number by 1977. Thus the performance of the model must be judged with its purpose in mind. Preliminary tests have been carried out, using the model to determine the average points on the senior lecturer and lecturer scales for staff in 1971/72, and comparing these results with the actual staff positions on the scales. There is still potential error not due to shortcomings of the model, since there are still, at the time of writing, some three dozen posts to be filled, and estimates have been made of the points on the scales at which these appointments will occur. Table 6.1 shows the results of these comparisons.

When the vacant posts are filled these comparisons will be updated, and if the suggestion of bias remains further investigations will be necessary. In addition to the model being validated by monitoring its performance, it is being subjected to detailed sensitivity analyses to isolate those parameters which need to be most accurately estimated.

Table 6.1: Preliminary results from simulation model

	Average Points on Scales 1971/72	
	Senior Lecturer	Lecturer
Model Prediction	5.0	7.3
Actual*	5.2	7.5

* This includes estimates of some 10 per cent of posts.

Chapter 7

EXPENDITURES IN DEPARTMENTS

Introduction

This chapter deals with those expenditures under the control of teaching departments. At Lancaster a Departmental Allocation is granted to each department; out of which, expenditures against the following items are met:

Administrative and secretarial staff salaries
Technical staff salaries
Consumable materials
Travel, post, stationery etc.

Expenditure on teaching staff is not controlled by departments, so in the past there has been little opportunity for departments to capitalise on savings under this head, although some instances have occurred when teaching assistants have been paid with money saved by someone taking a sabbatical with less than full pay.

In this chapter two studies are described; the first outlines a scheme which was designed to allow departments greater flexibility in their allocation of resources whilst at the same time reflecting their needs for central services. The second is a study which assists the process of determining departmental allocations by assessing the funds necessary for administrative and secretarial assistance.

A Scheme for Departmental Virement

The following paper was prepared by the research team, and after meeting the approval of the Development Committee was put to Senate.

Departmental budgeting in the next quinquennium

(1) The Development Committee propose that from 1st July 1972 the present departmental budgeting scheme should be changed to allow limited virement between the budget head for academic salaries and what is at present regarded as the departmental allocation. The proposed change would also allow for a charging system for central academic services (excluding the library) so that

departments would be aware of the cost of these services and could influence their growth.

(2) The allocation of resources would (as now) be related to student load. For practical purposes an agreed estimated student load for each department would be used although if there were any major variations the budgets could be altered in the following year's allocation. Ignoring minor variations on the student load would recognise the fact that departments need to plan ahead for staff recruitment and other purposes and that they are not always able to respond quickly to unforeseen changes in student numbers.

(3) The main elements of academic department expense - excluding library and accommodation - are shown below and it is suggested that these be grouped into four budget heads.

Elements of Cost	Budget Head
Academic (Teaching) Salaries	Academic Salaries
Technicians Salaries Clerical and other Departmental Admin. Salaries	Departmental Salaries
Consumables Other Departmental Expenses	Other Departmental Expenses
Computer Audio Visual Aids Nuffield Theatre	Central Services

The budget for academic salaries at departmental level would not be in cash but would be expressed in terms of weighted staff units - the weights would reflect the required proportion of senior to junior staff. All other cost elements would be budgeted in cash.

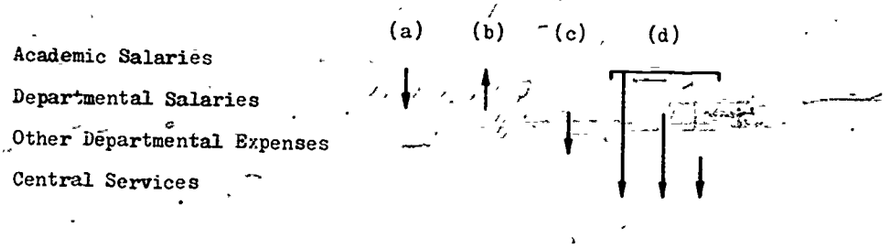
(4) The budget originally approved by Development Committee would hopefully represent a normal departmental deployment and although virement would be allowed from this point there would need to be some rules to stop abnormal development that could perhaps place a heavy contingent liability on the University. These rules would be in three forms:

i) A definition of the budget heads between which virement is allowed.

ii) A limit on the amount (in cash or staff units) that can be transferred between budget heads.

iii) The evaluation of the staff units transferred.

(5) The proposals for the allowable transfers are shown in the following table. The arrows show the direction of the permitted transfer of resources:



a) The staff unit in this transfer would be evaluated in terms of the average technicians or clerical salary so that the saving of one lecturer could not produce a number of clerks, the total staff (academic and departmental) would remain about the same.

b) The staff unit would be evaluated in terms of the average academic staff cost.

c) There would need to be a relatively low total limit on this transfer to avoid the possibility of a department using staff vacancies to lead to undue extravagance on other departmental expenses.

d) These transfers would normally be in the direction indicated but transfers in the reverse direction would be allowed if a special case were agreed by the Development Committee. A strict control on the transfers out of the Central Service budget would be required to avoid the possibility of the University having to finance a central service that could not quickly contract as well as using the money for other departmental purposes.

(6) Although, if it is approved, the revised budgeting method would not come into operation until July 1972, it is proposed that the central service charging should be introduced notionally from

July 1971. This would give a year's experience of costs and usage before incorporating this type of expenditure into the departmental budgets proper.

(7) Carry forward of overspent or underspent allocations at each year end would continue to be allowed on the budget heads expressed in cash values although forced virement may be necessary to avoid accumulating compensating over and underspendings within a department.

(8) The main advantage to departments would be the ability to transfer resources to or from the academic salary vote. The early stages of such a scheme would need a close control by the Development Committee but it may be possible after a time to relax this detailed control.

In the event, the scheme was not accepted by Senate, so, in the immediate future at least, the present system of departmental budgeting will continue.

Administrative Services

The central administration at Lancaster University is complemented by administrative and secretarial staff in departments. University policy has been that, if departments so desire, the routine administrative load on academic staff should be minimised.

The "obvious" way to tackle the problem of determining appropriate assistance is to do a detailed work analysis, specifying all the administrative tasks and estimating the required staffing. A study of such scope was felt to be unnecessarily detailed, so the concept of a supply/demand regression line was introduced. On the supply side of the equation there are the following grades:

	Supply Points
Administrative Officer	6
Senior Clerk & Clerk/Secretary	3
Junior Clerk & Shorthand Typist	2

The supply points allocated to these grades are in proportion to their average salaries. This allows departments freedom in deciding the balance of assistance they will employ. For example, a department "justifying" six points could have either an administrative officer, or two secretaries, or three shorthand typists.

Demand points for the following grades of other staff were determined by performing regression analyses on existing data, omitting those departments which, for reasons of embryonic size or external fundings, were clearly atypical.

	Demand Points
Professors (full-time)	1.5
Readers, Senior Lecturers	0.75
Lecturers, Project Officers	
Part-time Professors	0.25
Research Officers	
Technical Staff	0.15

Such analysis is clearly based upon the assumption that the existing staffing levels were generally correct. Although this could well be a false assumption, the introduction of a control policy such as this has merit in itself, it certainly helps to create parity of treatment.

Further Developments

In preparing the quinquennial submission, estimates are needed for the expenditures dealt with in this chapter. The administrative services model is being embedded in these estimates and needs to be complemented by similar studies on technical staff and consumable materials, items which account for significant funds in science and technology departments.

Chapter 8

THE ALLOCATION OF DEPARTMENTAL ROOM SPACE

The Problem

There are many "spatial" problems within universities - the capacities and relative positions of laboratories and lecture theatres and the ever-pressing difficulties of rooms for teaching staff, particularly where tutorial teaching is practised. But the problem tackled in this project is the common one of the conflict between trying to provide "custom-built" accommodation, while maintaining "flexibility" should the planned use require any modification. In expanding organisations, such as the University of Lancaster, a coupled difficulty is the uncertain and changing space requirements of departments increasing in size.

Most of the non-laboratory teaching accommodation at Lancaster is provided within the college buildings. These are each substantial in size, and can readily accommodate the largest departments. Apart from any constraints imposed by colleges against "domination" by one or two departments, this space can be essentially occupied by any non-laboratory department; and although departments may have to move en bloc from time to time, this system provides much flexibility in allowing more space to be made available to departments as they expand*. Thus a few years ago, six or seven departments were located in any one college - while the norm is now three or four.

But the next substantial block of non-laboratory teaching space to be built at Lancaster is not within a college but a special "Arts teaching" building, planned to house Economics, Computer Studies and four of the other Business School departments This is unique at Lancaster, in being scheduled beforehand for occupation by specific non-laboratory departments - and for convenience (though not accurately) it will be referred to as the "Business School". In this building, the problem of department expansion is being partly met by building in separate phases in the customary manner, while between phases, any "spare" accommodation can be used temporarily by staff

* It is assumed here that for operational reasons, most departments wish to keep all their staff rooms grouped together - this is in fact true of nearly all departments in Lancaster at present.

from other departments.

The provision of this building naturally implies nominal allocations of space to the various departments and thence allows for special purpose accommodation. Though special purpose accommodation can certainly be beneficial, we wish to ensure that its provision does not inhibit flexibility in space allocation. And although ranges for staff numbers are set in quinquennial plan, the variations within the ranges are not insignificant. It is with this aspect of space allocation and any interaction on building design that this study is concerned. The methodology is clearly transferable to similar planning problems in other contexts; but the long "planning lead-time", and the increased uncertainties in requirements are perhaps as significant within university building as anywhere, while the difficulties of getting departments to surrender space previously allocated to others more heavily pressed are well-known - and often surrounded by mysteries of "academic requirements"!

The "Business School" is to house six departments: Operational Research, Economics, Computer Studies, Behaviour in Organisations, Marketing and Financial Control (referred to subsequently as B1 to B6, not necessarily in order). There is already an outline plan for the building which defines its shape and the total floor space. The objective is, knowing the forecast number of staff and graduate students, to allocate the room space to each department within the building, and to locate any "special purpose" rooms, so as to provide the greatest flexibility in accommodating the departments - whatever their actual expansion rates.

Background Information

The building is to be of three storeys, with two entrances - one off the main pedestrian spine of the University, and the other adjacent to a car park*. The ground floor must contain space for a small computer, all lecture theatres, and the centralised facilities. Also there must be room for computer terminals above the computer. Three of the departments concerned are strongly undergraduate based (B1, B4 and B6) and it is desirable to have these close to the "spine" access. To minimise noise and internal traffic within the building, the two largest of these departments should be placed so that under-

* See Figure 8.1.

graduate movements through other departments are minimised. Similarly, it is also desirable to have the central facilities (e.g. conference room, reception) near the car park entrance. Academic staff rooms in department B6 will mostly be 240 square feet because of tutorial group sizes, but for the rest of the departments, 200 square feet will be the norm. The outline plan was devised to meet all these considerations, as Figure 8.1 illustrates. In particular, the differential room sizes can be accommodated by the provision of one "block" of rather wider span than the remainder. The plan also affords much opportunity for alternative allocations - clearly the task might have been much more difficult!

Apart from "service" facilities there are four types of accommodation required:

(1) Specialist teaching accommodation (e.g. computer, lecture theatres, demonstration rooms).

(2) Non-academic staff rooms (e.g. research staff, computer programmers, administrative and secretarial staff).

(3) Academic staff rooms.

(4) Graduate student work rooms*.

Information has been provided by the departments for categories (1) and (2) and it is not likely that the estimates of requirements for these will be far wrong. (Any discrepancies here can be dealt with fairly easily, as is later explained).

The problem therefore becomes one of allocating the numbers of rooms of types (3) and (4) to the departments, to provide greatest flexibility.

Room Allocation

The total number of rooms available for academic staff and graduate students, having satisfied the initial considerations and allocated the space for non-academic staff and specialist teaching, is as follows:

---

* It is the practice at Lancaster to provide as much graduate work room accommodation in departments as possible, for those who do not have sleeping and living accommodation on campus. This is space which might alternatively be provided in the library.

200 sq.ft. Rooms	240 sq.ft. Rooms	100 sq.ft.* Rooms	175,150 280 sq.ft. Rooms
105	30	7	1 each

Considering both the 240 square foot rooms and those of 200 square feet as being equivalent "academic staff-rooms" (and provided the 240 square foot rooms are allocated to B6 as far as practicable) we have the equivalent of about 141½ "standard" rooms. (i.e. 105 + 30 + 3½ + 3 (approx.)).

The "ranges" of academic staff numbers (and comparable estimates of graduate student numbers) for each department for 1976/77 are shown in Table 8.1 below.

Table 8.1: Estimates of staff and graduate student numbers within the "Business School"

Department	Staff Numbers Range	Graduate Student Numbers
B1	20-24	20
B2	20-24	70
B3	11-13	40
B4	17-20	30
B5	15-18	70
B6	32-38	30

Approximately seven graduate students can be effectively accommodated within a "standard" room, but not all postgraduates will be given study room accommodation (see footnote on page).

The expected number of staff is 126 (i.e. mean of the estimated ranges) and the expected number of graduate students is 260. Hence the number of standard rooms likely to be available for graduate accommodation is 141½ - 126 = 15½**. This is equivalent to about 17 graduates per room though, of course, in real physical terms only seven graduates will be using each room, and the others will require alternative accommodation elsewhere.

---

* These rooms, intended for users in groups (2) and (4) are referred to as "½ rooms" in the analysis below. At the current stage in design, adjacent "½ rooms" could be rescheduled to standard rooms if desirable.

** Though if all departments attained "maximum" staff levels, only 4½ rooms would be available for graduate students.

Stating the objective in a non-mathematical way, we wish to allocate the rooms so as to minimise the expected number of changes necessary. Appendix 4 deals with the mathematical treatment of this, but (expectedly) the resulting number of rooms is equal to the "average" staff expectation plus the number of graduate rooms assessed at one per 17 graduates.

Table 8.2: "Optimal" room allocations by department

Department	Room Allocation
B1	23
B2	26
B3	14½
B4	20½
B5	20½
B6	37

As noted before, as many as possible of the rooms allocated to B6 should be of 240 square feet.

Flexibility

Having decided on the number of rooms to allocate to each department, the departments should be located so that errors in forecasts can be accommodated as well as possible. This is a matter of ensuring that every department can expand or contract without inconvenience. We think of "inconvenience" as meaning any of:

(1) No department should have just one or two rooms on a different floor from the bulk of its accommodation.

(2) No department should be split into two parts by another department occupying space within its own "boundary".

(3) No department should expand into the specialist teaching/facility areas of another.

(4) No department shall have "common" circulation space within its "boundary".

Therefore a "good" interface between departments is one which is not inconvenient on any of the above criteria, and provides ample room on either side for movement (i.e. either department has sufficient

opportunity to expand into rooms originally and nominally allocated to the other). Preferably, all such interfaces would be in areas of 200 square feet room accommodation, and for overall flexibility, every department should have at least one "good" interface.

Starting from an initial allocation of space to departments, the interfaces were assessed as indicated above; this was facilitated by a purely abstract representation of the spatial relationship between departments, which made the degree of flexibility and the implications of changes more readily apparent*.

Simple inspection and modifications to the space allocations then enabled a layout to be identified which offers sufficient flexibility and satisfies (1) to (4) above.

It has therefore been possible to make recommendations about the location of (nominal) departmental space and in particular of special purpose rooms associated with individual departments. The layout recommended is shown in Figures 8.1 to 8.3, indicating where the departments are to be placed; the interfaces are marked.

When the building is ready for occupation, reallocation can take place if necessary on the basis of actual staff and student numbers. Hopefully, the provisions made here will be adequate to cover all reasonable forecast errors and in particular the special purpose accommodation provided should be conveniently located for each department.

Figures 8.1, 8.2 and 8.3

These are schematic diagrams of the Ground, First and Second Floors of the Business School showing the locations of the departments. Dashed lines represent interfaces between departments. Interfaces are labelled as G, if they are "good" interfaces, or with a small bracketed letter for others. The poorer interfaces are described below:

Ground Floor

(a) This interface is adjacent to the main pedestrian entrance to the building, and is inconvenient on criterion (4).

(b), (c) and (d). These interfaces, all with the Central Facilities area, are inflexible because the size of this area is fixed.

* See Figure A4.1 in Appendix 4.

1st Floor (e) This is adjacent to the computer terminals, and a stairway (criteria (3), (4), (2)).

2nd Floor (f) Implies expansion across circulation space (criterion (4)).

Expansion of departments into accommodation upstairs or downstairs is regarded as undesirable (criterion (1)), and hence no interface between departments on different floors is marked; but some departments necessarily occupy space on more than one floor.

Figure 8.1: Ground Floor

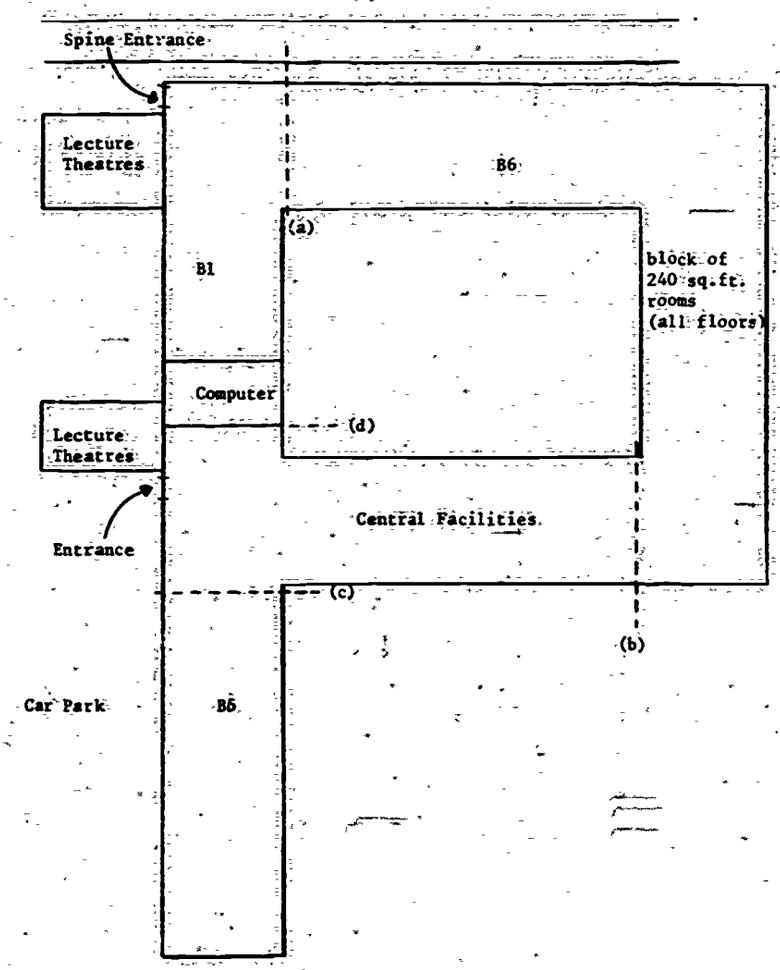


Figure 8.2: First Floor

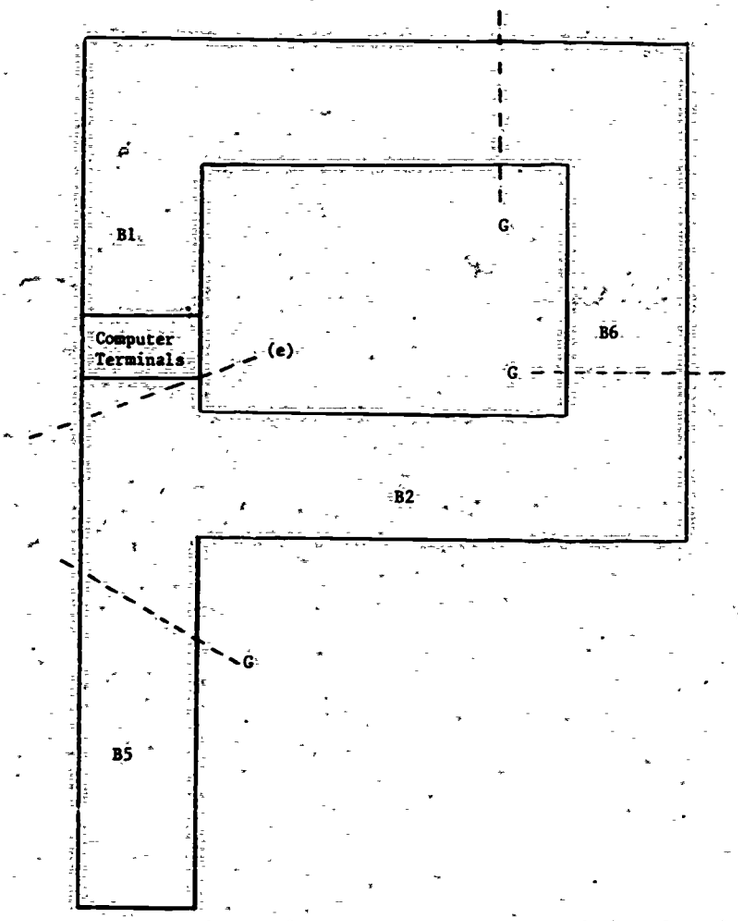
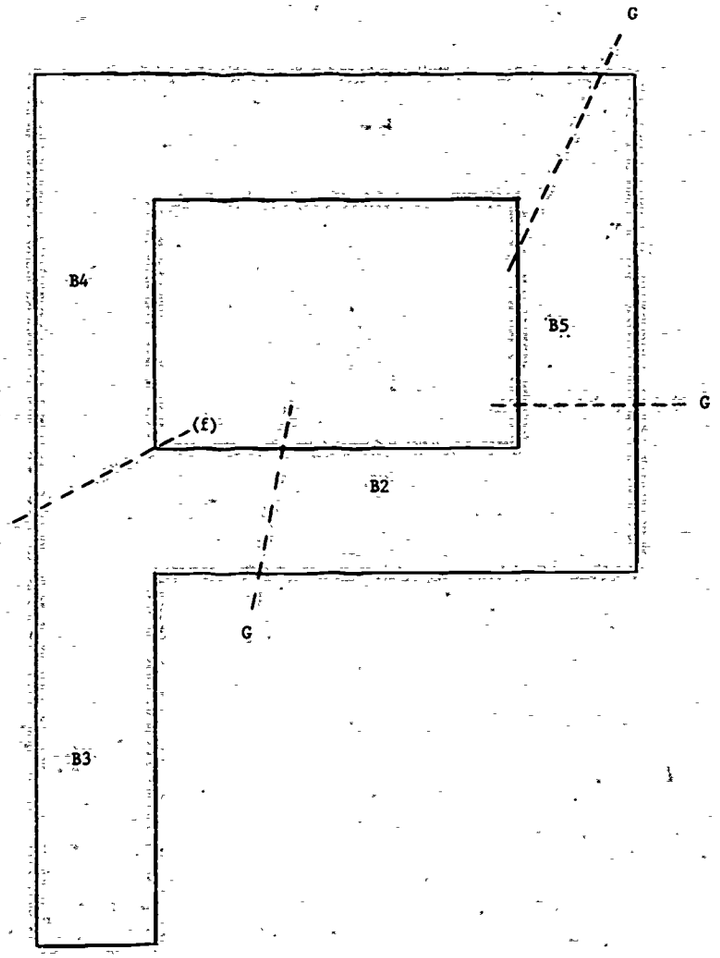


Figure 8.3: Second Floor



Chapter 9

FURTHER WORK

Introduction

In order that maximum benefit be gained from the work described in this report, it is planned that the activities of at least part of the research team will be extended beyond the formal contract period. As is stated in the terms of reference, one of the aims of the study was "to explore the problems raised by implementation". While the implementation of the work proceeded as opportunity arose, perhaps the major test will arise when the settlement is announced in late 1972. For until then, the size of the budget available will not be known, so that discussions on its division between departments and other activities are somewhat hypothetical. It is not clear to what extent this (potential) artificiality will have affected the receptiveness within the University to the results of the research - but there will be no question of artificiality when the funding for 1973-77 is finally announced. Thus it would clearly be irresponsible not to pursue the work at least until late 1972/early 1973 and we intend to do so. As has been indicated throughout the report, the key points in the quinquennial planning process are:

(1) The submission of quinquennial estimates in late 1971

(2) The settlement announcements in late 1972.

The sections below are keyed to these two dates.

Preparation of Submission

Appendix 5 shows the principal forms that need to be completed. In assisting the Finance Officer in preparing the financial estimates required, the research team will continue the formulation of general relationships between costs and various input variables. These relationships will then be subjected to sensitivity tests so that those items for which uncertainty is particularly important can be isolated and subjected to more detailed investigation.

One factor to be explored is the level of (central) administration cost to be expected. In this, reference will be made to an

earlier study carried out within the Operational Research Department concerning, inter alia, the trends in Lancaster's administration costs compared with those in other U.K. universities*. Of particular interest then was the joint effect of institutional youth and relatively small size. Though these factors are clearly rather less important now, much of the analysis remains relevant, and the total cost involved is not insignificant.

Period Between Submission and Announcement of Grant

During this stage the general relationships mentioned above, together with results already described in this report, and supplemented by further studies as the need arises, will be incorporated in computer programmes. Such programmes will be able to compute the consequences implicit in alternative planning targets (i.e. student number totals) and overall budgets. Thus variations in likely forms of the settlement will need to be estimated, so that a portfolio of alternative reactions can be explored.

In addition to fixing these main parameters the UGC will probably indicate the priorities they place on the various developments proposed in the Lancaster submission. Thus in addition to being able to cope with a range of alternatives on the two main parameters, the programmes developed will need to be able to handle a variety of subject mixes. Further statistics on the relative applications for the various courses at Lancaster, and initial indications of the effect of the new staff allocation policy on course choice and switching may provide further insight into some of the uncertainties implicit in the whole process.

In addition, study will be made of the most effective means of presenting planning information to decision makers. In an area where it is easy to generate vast quantities of data, it is vital that the user should be able to extract his needs with minimum difficulty.

This is relevant not only to the quinquennial planning process, but also to the continual control of functions within the University. In this period, therefore, the derivation and presentation of data for the settlement stage will be the main concern, but hopefully additional data will be obtained on the wider information systems requirements within the University - particularly with respect to

* Blakeman, E.T. A University Cost Model for Lancaster. Unpublished dissertation - University of Lancaster. 1969.

admissions and staffing policies, and possibly on budgeting for individual departments and other cost centres.

The study has of course already provided some empirical evidence on this - in particular the library analysis. But further exploration is required, and both speed of response and data volume are important. In this respect it is planned to explore the potential of time-sharing computers. The technical facilities are about to become available at Lancaster, and if programmes can be operated in this way, strategies suggested in Development Committee (or elsewhere) could be explored via the programmes immediately.

Period after Announcement of Grant

Once the UGC announces the grant and planning target to the University the final phase of planning can commence. It is envisaged that the programmes and presentation techniques discussed above will be used by the Development Committee to assist their considerations. And as the last stage of a project, by then extending over a period of some 3½ years, it will finally be possible to assess the real effect of the work.

As implied in Chapter 1, planning for as complex an organisation as a university can have no single preferred path - nor can any plan generated be demonstrated as optimal. And though subjective elements often dominate major choices of action, the work so far justifies the belief that quantitative analysis does have a "creative" as well as a "passive" role to play in deciding the future shape of Lancaster.

Appendix 1

TERMS OF REFERENCE

The project described in this report is one of a set of studies organised by the Centre for Educational Research and Innovation of the OECD into Institutional Management in Higher Education (Joint Project CERI XVII). Under this programme individual projects have been mounted in a number of universities within OECD countries, with the educational authorities of the countries concerned also closely involved.

The project at Lancaster was jointly sponsored by CERI and by the U.K. Department of Education and Science; the formal terms of reference below cover both this project and the closely related programme at the University of Bradford.

1. Purpose of the Project

The purpose of the Project is:

(i) to explore the problems raised by the elaboration, discussion and implementation of major development plans for universities, and

(ii) to improve cost effectiveness.

2. Content of the Project

To this effect the following studies will be undertaken:

(i) the University of Lancaster will carry out research work on cost projections and academic implications for alternative development strategies;

(ii) the University of Bradford will carry out a study of potential economies per student year.

3. Cost Projections and Academic Implications for Alternative Development Strategies

The research work referred to in paragraph 2(i) shall consist of:

(i) basic studies to derive general costs models from each existing and potential department capable of being readily

adapted for changes in student number and in teaching methods;

(ii) a study to determine the appropriate ranges of the outside constraints and feasible development patterns;

(iii) research work to derive cost models for the activities of the central services of the University (central services of computing, administration, library, etc.);

(iv) a study of the structure of the central administration of the University and of the information systems required and of the appropriate decision making mechanisms;

(v) an exploration of the most appropriate ways in which the data generated can be built into the decision making process on development policies.

4. Study of Potential Economies per Student Year

The study referred to in paragraph 2(ii) shall comprise:

(i) a preliminary study of the current costs of producing graduates in different disciplines broken down by major items of expenditure (capital and maintenance costs, salaries, administrative costs, etc.);

(ii) the construction of alternative models corresponding to different sets of assumptions regarding the University's future enrolment policy for new course combinations, staff/student ratios, use of the building, building cost economies, etc.;

(iii) the collection of data in order to assess the variation of costs per unit in relation to increased enrolments;

(iv) the pilot testing of conclusions emerging from the research work referred to in sub-paragraphs (i), (ii) and (iii) above.

Appendix 2

COURSE PREFERENCE DATA

(Basic data used to calculate student numbers in Chapter 2)

APPENDIX A2.1 SWITCHING MATRIX FOR PART I (1968) & PART II (1969) STUDENTS

Depts. as at 1968 October \ Depts. as at 1969 October	Bio. Science	Chemistry	Computer St.	Engineering	Env. Ss.	Mathematics	Physics	Financial C.	O.R.	Economics	Politics	Sociology	History	Philosophy	Rel. St.	English	French	Russian (3)	Russian (4)	Classics
Bio. Science	.91	.03								.03	.03									
Chemistry		.92								.06				.02						
Comp. Studies																				
Engineering																				
Env. Science	.08				.75		.02			.08	.08									
Mathematics			.25		.02	.42			.01	.20	.01			.09						
Physics			.08			.03	.84							.02		.03				
Financial C.																				
O.R.						.18			.23	.47	.06			.06						
Economics						.04				.66	.16		.08	.05			.01			
Politics										.06	.68		.22	.02			.02			
Sociology																				
History										.03	.14		.73	.03		.03	.01			
Philosophy						.03	.01			.03	.12		.16	.32	.06	.19	.03			.05
Rel. St.													.14	.07	.70	.09				
English										.01	.04		.09	.05	.01	.75	.05			
French											.02		.06		.01	.16	.75			
Russian (3)																		1.00		
Russian (4)													.10						.90	
Classics													.03		.03	.03	.07			.84

The figures on the leading diagonal are those given in Table 2 of Chapter 2.

APPENDIX A2.2 SWITCHING MATRIX FOR PART I (1969) & PART II (1970) STUDENTS

Depts. as at 1969 October / Depts as at 1968 October	Bio Science	Chemistry	Comp. St.	Engineering	Environ. Sc.	Mathematics	Physics	Financ. C.	O.R.	Economics	Politics	Sociology	History	Philosophy	Rel. St.	English	French	Russian (3)	Russian (4)	Classics
Bio Science	.95	.03												.02						
Chemistry	.03	.79	.07		.03		.01			.07										
Comp. Studies			.83	.03		.04	.03		.01	.04										
Engineering			.12	.75		.13										.02				
Env. Science	.08	.04			.72		.02	.03		.11										
Mathematics		.04	.13	.02		.51				.22						.04				
Physics		.02	.05	.05			.82	.04		.05				.01						
Financial C.								.83		.17										
O.R.			.08			.19		.27		.46										
Economics			.01			.03		.02		.68	.15		.06	.04		.01				
Politics										.04	.61	.10	.22		.01	.02				
Sociology											.08	.69	.04	.04	.15					
History										.04	.14	.09	.59	.01	.03	.08	.01			.01
Philosophy				.02		.02	.02			.06	.09	.09	.15	.28	.08	.17	.02			
Rel. St.												.07	.10	.04	.75	.04				
English										.01	.01	.03	.12	.01		.76	.05			.01
French										.01	.01	.04	.05			.15	.74			
Russian (3)																		1.00		
Russian (4)											.03		.08						.89	
Classics																.14	.06			.8

APPENDIX A2.3 PERCENTAGE DISTRIBUTION OF PART I SUBJECTS TAKEN 1970/71 (BY MAJOR DEPARTMENTS)

Major Departments	Part I Courses: Biology	Chemistry	Classics	Comp. St.	Czech.	Economics	E. Greek	E. Maths	Engineering	English	Env. Sc.	French	History	Hist. of Sc.	Intro. Maths	Maths	Philosophy	Physics	Politics	Rel. St.	Russian (non-lang.)	Russian	Sociology Cell Biology
Bio Science	1	.78		.07		.02		.51			.21				.15	.12	.03		.01				
Chemistry	.04	1.00		.27		.17		.04			.27	.02			.87	.10	.05		.17				
Comp. St.		.03		1	.03	.38			.03	.05	.05			.05	.22	.57	.13	.05	.14				.27
Engineering		.38							1		.10				.38	.62	.05	.47					
Env. Science	.15	.07		.17		.22		.15			1				.55	.23		.44					.02
Mathematics		.03		.76		.35			.08	.02	.05	.02		.09		1	.35	.13	.01		.02		.08
Physics		.16		.05		.15			.26		.18			.05	.45	.55	.14	1		.01			
Financial C.				.46		1		.37	.07		.02		12		.32	.14	.09		.28		.07		.07
O.R.				.58		1			.06					.15		1			.06				.15
Economics				.04		1		.57	.01	.05	.03	.04	.18	.01	.11	.15	.11		.46				.25
Politics			.02	.02		.30		.06		.14		.02	.62			.02	.27		1	.03	.12	.01	.39
Sociology			.04			.25		.04		.17		.13	.38				.25		.42	.33			1
History			.03		.02	.14		.01		.37		.02	1				.28		.65	.08	.13	.01	.28
Philosophy			.06	.03	.03	.07	.03			.43		.03	.32		.01	.06	1	.04	.43	.21	.01		.18
Rel. St.			.27	.02			.08			.15			.37				.61		.15	1			.35
English			.16		.02	.04	.02			1		.25	.38				.42		.15	.15	.05		.37
French			.17		.23	.07				.53		1	.19				.21		.04	.10	.04		.42
Russian			.20		.60							.40	.20							.40		1	.20
Classics			1		.10	.16				.48		.21	.05				.53		.05	.21			.21

APPENDIX A2.4. PERCENTAGE DISTRIBUTION OF PART I SUBJECTS TAKEN 1969/70 (BY MAJOR DEPARTMENTS)

Part I Courses

Major Departments	Biology	Chemistry	Classics	Comp. St.	Czech.	Economics	E. Greek	E. Maths	Engineering	English	Env. Sc.	French	History	Hist. of Sc.	Intro. Maths	Maths.	Philosophy	Physics	Politics	Rel. St.	Russian (non-Lang.)	Russian	Sociology	Cell Biology
Bio Science	1	.55						.62			.41			.03	.36		.05							
Chemistry	.15	1				.21		.10	.16		.12				.84	.05	.06	.16		.02			.04	.08
Comp. St.		.05				.53			.21	.10	.26	.02	.05		.09	.93	.27	.27	.05	.05			.12	
Engineering						.11			1		.67			.11	.44	.55							.11	
Env. Science	.10	.20				.26		.07	.16		1			.03	.59	.25		.31	.03					
Mathematics	.04	.10				.77			.14	.04	.12	.03	.07	.04	.01	.99	.28	.20	.16				.03	
Physics	.02	.20				.17			.19		.20			.07	.61	.39	.13	1		.02				
Financial C.						1		.44				.06	.06		.44	.12	.06		.63				.19	
O.R.						1			.20	.08	.08				.08	.92	.20	.08	.35					
Economics	.01	.01				1		.61	.01	.02	.06	.05	.22		.14	.12	.18	.03	.55				.01	
Politics			.05			.33		.09		.08		.07	.73			.02	.37		1	.03			.23	
Sociology			.08					.08		.38		.23	.23				.54		.15	.31			1	
History			.10			.14		.04		.27		.05	1				.36		.59	.12			.33	
Philosophy			.06			.15	.03		.03	.45		.06	.35		.08	.10	1	.05	.35	.14			.15	
Rel. St.			.07				.29	.04		.35			.27				.57		.09	1			.32	
English			.23			.02		.01		1		.22	.47		.02		.41		.10	.23		.01	.28	
French	.01		.26			.09	.01	.02		.53		1	.19		.02		.28		.17	.14		.02	.26	
Russian			.18		.55	.09				.27		.46	.09						.09	.09		1	.18	
Classics	.06		.81				.19			.56		.50	.25				.75			.25			.13	

Appendix 3

TRANSITIONS WHICH CAN OCCUR IN THE STAFF SIMULATION MODEL

Note: since resignations can occur from any point, they are not explicitly shown.

Before Transition	After Transition
L.P.1	L.P.2 or L.P.3
L.P.2	L.P.3 or L.P.4
L.P.3	L.P.4 or L.P.5
L.P.4	L.P.5 or L.P.6
L.P.5	L.P.6 or L.P.7
L.P.6	L.P.7 or L.P.8
L.P.7	L.P.8 or L.P.9
L.P.8	L.P.9 or L.P.10
L.P.9	L.P.10 or L.P.11
L.P.10	L.P.11 or L.P.12
L.P.11	L.P.12 or L.P.13
L.P.12	L.P.13 or L.P.14 or S.L.P.1
L.P.13	L.P.14 or L.P.15 or S.L.P.2
L.P.14	L.P.15 or S.L.P.2 or S.L.P.3
L.P.15	L.P.15 or S.L.P.3 or S.L.P.4
S.L.P.1	S.L.P.2
S.L.P.2	S.L.P.3
S.L.P.3	S.L.P.4
S.L.P.4	S.L.P.5
S.L.P.5	S.L.P.6
S.L.P.6	S.L.P.7
S.L.P.7	S.L.P.8 or Professor
S.L.P.8	S.L.P.9 or Professor
S.L.P.9	S.L.P.9 or Professor

Notation - L.P.1 = Point 1 on lecturer scale etc.
S.L.P.1 = Point 1 on Senior Lecturer scale etc.

Appendix 4

ALLOCATION OF DEPARTMENTAL ROOM SPACE

Graduate Student Numbers

Estimated graduate student numbers for each department are given in Table A4.1 below, along with the corresponding number of rooms needed to accommodate them at the (artificial) "norm" of 17 graduates per "standard" room.

Table A4.1

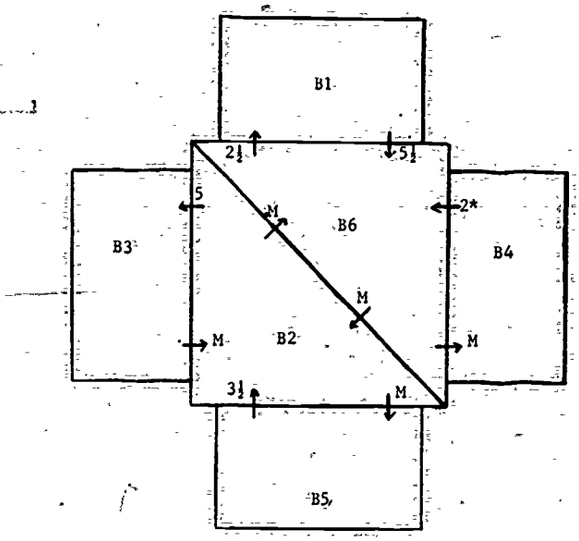
Department	Possible Number of Graduates	Possible Room Requirement for Graduates	Total Room Requirements
B1	20	1	21-25
B2	70	4	24-28
B3	40	2½	13½-15½
B4	30	2	19-22
B5	70	4	19-22
B6	30	2	34-40
		15½	

The last column in the table then gives the total space requirement by department, by combining the preceding column with the academic teaching staff ranges.

Figure A4.1

Spatial Relationships - Flexibility

The diagram below is a purely abstract representation of the relative positions of the departments. Adjacency on this diagram represents a "good" interface. The numbered arrows represent the maximum number of rooms which can be reallocated from a department on one side of the interface to the department on the other, without inconvenience. Thus, "B3 $\xleftarrow{5}$ B2" means department B3 can take, at most, 5 rooms from department B2 before either department suffers any inconvenience.



Notes:

1) "M" denotes that room changes of the maximum feasible requirement can be readily accommodated.
2) "*" denotes that a change of more than two rooms can be made with slight inconvenience.
3) The form of Figure A4.1 is of course dependent both on the building design and the room allocation policy. For any given policy, such a diagram can be created, and used to assess the associated "flexibility". But a different allocation would in general give rise to a different pattern of relationships. The above represents only the allocation which has been considered in detail.

Formulation

Assume probability distributions for the room requirements for each department, so that $f_i(j)$ = probability that department i requires j rooms. Then if j_i^* = number of rooms allocated to department i, a measure of the expected change required is given by

$$F_i(j_i^*) = (1).f(i)(j_i^* + 1) + (2).f_i\ (j_i^* + 2) \ldots\ldots \text{ etc.}$$

or $$F_i(j_i^*) = \sum_{j=j_i^*+1}^{\infty} f_i(j)(j - j_i^*)$$

Now we treat the problem as the minimisation of the sum of the $F_i(j_i^*)$'s subject to the overall room constraint, $\sum_{i=1}^{6} j^*_i \equiv 141\frac{1}{2}$

i.e. Minimise $\sum_{i=1}^{6} F_i(j^*_i)$ such that $\sum_{i=1}^{6} (j^*_i) = 141\frac{1}{2}$

Obviously, if we vary the total number of rooms available, because say, the non-academic staff room forecasts were wrong, the same approach can still be used. Similarly, variations in the expected staff numbers, or in graduate student numbers, can be taken into account. The main problem appears to lie in estimating the values of the probabilities $f_i(j)$. But this is seen to be relatively unimportant when we consider the two cases of uniform and symmetric strongly modal distributions for $f_i(j)$ - for both produce the same results!

Rather than a minimisation using say dynamic programming, a marginal analysis procedure was adopted. This is much faster.

Marginal Analysis

j = number of 200 square foot units

$f_{(j)}$ = probability of demand for j units, for a given department

$F_{(j)} = \sum_{k=j+1}^{\infty} f(k)(k-j)$, the "dislocation" function.

(1) For uniform distributions

Table A4.2 below shows the values of $f_{(j)}$ for each department, to give uniform distributions, and consistent with the figures in Table A4.1; and also the computed values for $F_{(j)}$.

Table A4.2: Values of $f_{(j)}$ & $F_{(j)}$ for uniform distributions

Department							
B1	j	21	22	23	24	25	
	$f_{(j)}$	.2	.2	.2	.2	.2	
	$F_{(j)}$	2.0	1.2	.6	.2	0	
B2	j	24	25	26	27	28	
	$f_{(j)}$	.2	.2	.2	.2	.2	
	$F_{(j)}$	2.0	1.2	.6	.2	0	
B3	j	13½	14½	15½			
	$f_{(j)}$	.33	.33	.33			
	$F_{(j)}$	1.0	.33	0			
B4	j	19	20	21	22		
	$f_{(j)}$	.25	.25	.25	.25		
	$F_{(j)}$	1.5	.75	.25	0		
B5	j	19	20	21	22		
	$f_{(j)}$	.25	.25	.25	.25		
	$F_{(j)}$	1.5	.75	.25	0		
B6	j	34	35	36	37	38	39	40
	$f_{(j)}$	.14	.14	.14	.14	.14	.14	.14
	$F_{(j)}$	2.94	2.10	1.4	.84	.42	.14	0

Table A4.3 below then shows the form of the marginal analysis, the changes in allocation indicated, and the final solution. Thus column (2) shows the marginal <u>increase</u> in $F_{(j)}$ for a 1 room decrease in allocation, and column (4) the corresponding <u>decrease</u> in $F_{(j)}$ for a 1 room increase. Hence if any value in (4) exceeds any value in (2), a change in allocation is desirable; thus the 2nd allocation (column (5)) represents a 1 room switch from B4 to B1 - indicated by +, and also showing that the switch could equally well have been from B5 to B1. In either case, the value of $\Sigma F_{(j)}$ reduces from 3.47 to 3.37.

Columns (5) to (8) correspond precisely to columns (1) to (4) for the revised allocation. Comparison of columns (6) and (8) shows that no further decrease in $\Sigma F_{(j)}$ can be attained, so that this

allocation is optimal (though ++ shows that a switch from B5 to B4 would have no overall effect).

Table A4.3: Marginal analysis results

Dept.	Initial Allocation (1)	margin (2)	$F_{(j^*)}$ (3)	margin (4)	Second Allocation (5)	(6)	$F_{(j^*)}$ (7)	(8)
B1	22	.8	1.2	$.6^{+}$	23	.6	.6	.4
B2	26	.6	0.6	.4	26	.6	.6	.4
B3	14½	.67	0.33	.33	14½	.67	.33	.33
B4	21	$.5^{+}$	0.25	.25	20	.75	.75	$.5^{++}$
B5	21	$.5^{+}$	0.25	.25	21	$.5^{++}$	.25	.25
B6	37	.56	0.84	.42	37	.56	.84	.42
		$\Sigma F_{(j^*)}$	3.47			$\Sigma F_{(j^*)}$	3.37	

(2) For Symmetric Unimodal Distributions

Table A4.4: Values of $f_{(j)}$ & $F_{(j)}$ for symmetric unimodal distributions

Department								
B1	j	21	22	23	24	25		
	$f_{(j)}$	.1	.22	.36	.22	.1		
	$F_{(j)}$	2.0	1.1	.42	.1	0		
B2	j	24	25	26	27	28		
	$f_{(j)}$	.1	.22	.36	.22	.1		
	$F_{(j)}$	2.0	1.1	.42	.1	0		
B3	j	13½	14½	15½				
	$f_{(j)}$	.25	.5	.25				
	$F_{(j)}$	1.0	.25	0				
B4	j	19	20	21	22			
	$f_{(j)}$	.17	.33	.17				
	$F_{(j)}$	1.5	.67	.17	0			
B5	j	19	20	21	22			
	$f_{(j)}$	.17	.33	.33	.17			
	$F_{(j)}$	1.5	.67	.17	0			
B6	j	34	35	36	37	38	39	40
	$f_{(j)}$	.05	.1	.18	.34	.18	.1	.05
	$F_{(j)}$	3.00	2.05	1.2	.53	.2	.05	0

Table A4.5: Marginal analysis results

Dept.	Initial Allocation (1)	Margin (2)	$F_{(j^*)}$ (3)	Margin (4)
B1	23	.68	.42	.32
B2	26	.68	.42	.32
B3	14½	.75	.25	.25
B4	20	.83	.67	.5
B5	21	.5	.17	.17
B6	37	.67	.53	.33
		$\Sigma F_{(j^*)}$	2.56	

In this case, the initial allocation is immediately optimal, but once again B4 and B5 can exchange one room.

On the basis of these calculations the proposed room allocations are therefore:

Department	Allocation
B1	23
B2	26
B3	14½
B4	20½
B5	20½
B6	37

A simple heuristic which would get the same results is: "allocate to each department the mean number of expected staff rooms; and allocate the remaining rooms in proportion to the number of graduate students per department".

But this method would only give appropriate results for symmetric distributions. And while we have no basis for creating skew distributions yet, these may well be required when more information is available. The marginal analysis method, however, will work for any unimodal distribution, and, in extremis, dynamic programming procedures are applicable.

In any event, results from whatever analytical procedure is appropriate would be followed by a "flexibility" assessment as described in Chapter 8.

Appendix 5

THE UGC SUBMISSION

This Appendix contains copies of the principal forms to be filled in by universities in making their submission to the UGC.

(As these are reproductions of the official forms, the numbering of tables and general layout of this Appendix is not consistent with the style followed in the rest of this report.)

TABLE 1

UNIVERSITY/COLLEGE OF

1971-72 £'000s	INCOME	1970-7 £'000s
	Endowments	
	Donations	
	Grants from local authorities	
	Fees - full time courses - home students	
	- overseas students	
	- part-time courses	
	- special and short courses	
	- from Colleges of Education for BEd students	
	Research grants - government	-
	- other	-
	Research contracts - government	-
	- other	-
	Other income for specific purposes - government	-
	- hospital boards	-
	- other	-
	Research Training Support Grant	
	Payments for computer services	
	Surpluses from income and expenditure accounts	
	Other income	
	TOTAL INCOME OTHER THAN UGC GRANTS	

TABLE 2

UNIVERSITY/COLLEGE OF

1971-2 £'000s	EXPENDITURE	1976-77 £'000s
	Administrative	
	Academic Departments	
	Salaries of teaching and research staff	
	Departmental wages	
	Departmental and laboratory expenditure	
	Expenditure from research grants and contracts	- - - -
	Expenditure from other specific income	- - - -
	Libraries	
	General Museums & Observatories	
	Central Computer Maintenance	
	Central Educational Technology Units	
	Other academic services	
	Area Training Organisation	
	Maintenance of Premises	
	General Educational expenditure	
	Student facilities and amenities	
	Miscellaneous expenditure	
	Capital expenditure from income	
	TOTAL	

TABLE 3(1)

UNIVERSITY/COLLEGE OF

EDUCATION

TOTAL DEPARTMENTAL EXPENDITURE

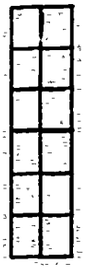
ACADEMIC DEPARTMENTAL EXPENDITURE

	1971-72 £'000s	1976-77 £'000s
Expenditure (£000s)		
Academic and analogous salaries		
Other salaries and wages		
Other departmental expenditure		
TOTAL EXPENDITURE FROM GENERAL INCOME		
Expenditure against research grants and contracts	-	-
Expenditure against other specific income	-	-
TOTAL EXPENDITURE		

	Nos.	Nos.
Student load		
full-time - undergraduate		
- postgraduate - research		
- course (a)		
- course (b)		
part-time - undergraduate		
- postgraduate - research		
- course (a)		
- course (b)		

TABLE 4(1)

UNIVERSITY/COLLEGE OF

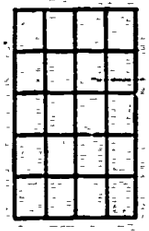


EDUCATION

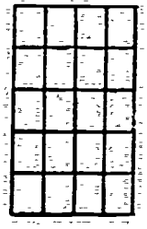
TOTAL FOR SUBJECT GROUP

ACADEMIC STAFF

1971-72



1976-77



Professors

Readers, Senior Lecturers, Lecturers, Assistant Lecturers

Other staff

Total full time staff

Part time staff

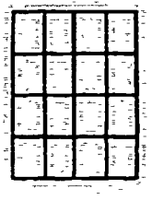
TABLE 5

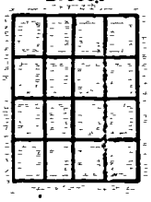
UNIVERSITY/COLLEGE OF

1971-72
£'000s

ADMINISTRATION
Expenditure (£000s)

1976-77
£'000s





Salaries of staff on academic scales

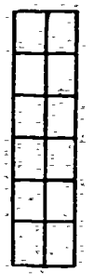
Other salaries and wages

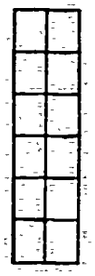
Other expenses

TOTAL

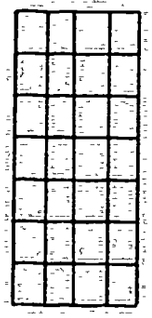
TABLE G

UNIVERSITY/COLLEGE OF





1971-72 £'000s	LIBRARIES	1976-77 £'000s
	Academic and analogous salaries	
	Other salaries and wages	
	Books	
	Periodicals	
	Binding	
	Sundries	
	TOTAL	



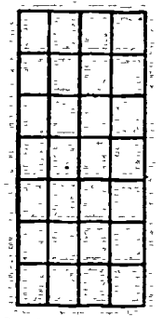
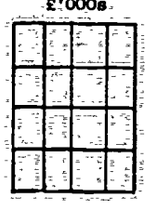


TABLE 7

UNIVERSITY/COLLEGE OF

1971-72 £'000s	GENERAL MUSEUMS & OBSERVATORIES	1976-77 £'000s
	Academic and analogous salaries	
	Other salaries and wages	
	Other expenditure	
	TOTAL	



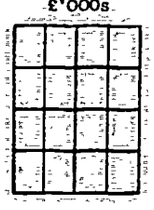
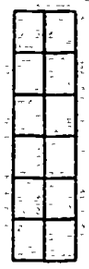
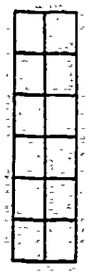


TABLE 8





1971-72 £'000s	MAINTENANCE OF CENTRAL UNIVERSITY COMPUTER	1976-77 £'000s
	Academic and analogous salaries	
	Other salaries and wages	
	Other expenditure	
	TOTAL	

£'000s		
	Grant from Computer Board	

TABLE 9

UNIVERSITY/COLLEGE OF

1971-72 £'000s	CENTRAL EDUCATIONAL TECHNOLOGY UNITS	1976-77 £'000s
	Academic and analogous salaries	
	Other salaries and wages	
	Other expenditure	
	TOTAL	

TABLE 10

UNIVERSITY/COLLEGE OF

AREA TRAINING ORGANISATION (INSTITUTE OF EDUCATION)

	1971-72 £'000s	1976-77 £'000s
Academic and analogous salaries		
Other salaries and wages		
Other expenditure		
TOTAL		

TABLE 11

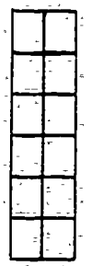
UNIVERSITY/COLLEGE OF

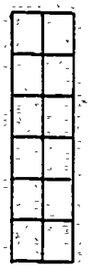
OTHER ACADEMIC SERVICES

	1971-72 £'000s	1976-77 £'000s
Academic and analogous salaries		
Other salaries and wages		
Other expenditure		
TOTAL		

TABLE 12

UNIVERSITY/COLLEGE OF





1971-72 £'000s	MAINTENANCE OF PREMISES	1976-77 £'000s
	Academic and analogous salaries	
	Other salaries and wages	
	Rent	
	Heat, light, water, power and cleaning	
	Ordinary repairs and maintenance	
	TOTAL	

Appendix 6

THE UNIVERSITY GRANTS COMMITTEE

The University Grants Committee was established in July 1919 and was given the task of advising the Government on the financial needs of the universities. Its terms of reference were extended in 1946 and today they read:

"To enquire into the financial needs of university education in Great Britain; to advise the Government as to the application of any grants made by Parliament towards meeting them; to collect, examine and make available information relating to university education throughout the United Kingdom; and to assist, in consultation with the universities and other bodies concerned, the preparation and execution of such plans for the development of the universities as may from time to time be required in order to ensure that they are fully adequate to national needs".

The UGC is not a statutory body, and there is no legislation governing its existence. Its members are appointed by the Secretary of State for Education and Science after consultation with the Secretaries of State for Scotland and Wales. All serve in an individual capacity; none is representative of any particular university, organisation or interest, although collectively their knowledge and experience cover a wide field. Only the Chairman is full-time. There is a part-time Deputy Chairman. Members devote about one-fifth of their time to the Committee's business; otherwise they are actively engaged in their professions. At present, apart from the Chairman and Deputy Chairman, there are 19 full members, of whom 14 are drawn from the universities, two from industry and three from other sectors of education. The Education Departments, other Government Departments and the Research Councils have assessors on the Committee, but these assessors have no responsibility for Committee decisions. The Committee reports to the Secretary of State for Education and Science. Its advice to the Government is confidential.

The Committee is supported by a system of advisory sub-committees, covering a wide range of academic subjects. These sub-committees, the members of which are appointed by the Committee, meet under the chairmanship of a member of the Committee and consist of experts, drawn largely from the universities, in the field concerned. From time to time working parties are set up for a limited period to

consider particular problems.

Why the UGC was established

The universities are independent, self-governing institutions, usually established by charter. They are free to conduct their own affairs, and they are not subject to legislative control or ministerial directive. On the other hand, they depend on the State for the greater part of their funds, and they play an important part in the development of national policies and of the economy.

In this situation, if the normal methods of control of Government expenditure are not to be applied, there is a need for some intermediary between the State and the universities. There has to be some machinery which will enable public funds to flow into the universities without direct governmental intervention and which will reconcile both the interests of the State as paymaster and the requirements of national policy with the proper academic freedom and autonomy of the universities.

The machinery adopted for this purpose, and endorsed by successive governments of all parties, is the UGC.

The Grant System

The UGC grant list covers 45 universities (34 in England, one in Wales and eight in Scotland) and two business schools. The UGC does not give financial aid to the individual colleges of Oxford and Cambridge Universities. The total population of full-time university students was 219,000 at the beginning of the academic year 1969/70.

The UGC prepares the case to the Government periodically for the overall financial needs of the universities, after examining the universities' own estimates and proposals. The total sums to be made available are fixed by the Government, but the UGC decides the allocation of these total sums between the individual universities. The financial assistance provided by the Government to the universities through the UGC covers three broad categories of expenditure: recurrent, non-recurrent and equipment. The UGC is not concerned with grants to individual students or with students' union subscriptions.

(1) Recurrent grants

These are for expenditure on staff salaries, running costs of departments, laboratories, libraries, maintenance of premises and

so on. The total amounts are determined by the Government for periods of five years at a time, and these are allocated between individual universities by the UGC as annual sums (covering the academic year 1st August to 31st July) for each year of the five-year period.

The total amount of grant is not normally increased during the period of quinquennium, except to help meet: (a) costs reflecting major changes in Government policy, for example on the desired rate of expansion in student numbers; (b) the cost of such increases in academic salary scales as are approved by the Government; (c) such claims for rises in prices, on the basis of an index of university costs, as are accepted by the Government after considering representations submitted from time to time by the UGC.

Special earmarked grants are made by the Government (outside the recurrent grant settlement) to cover universities' liability for rates.

(2) Non-recurrent grants

These are for four specific purposes - for financing approved building work, for the purchase of sites and properties, for the payment of professional fees and for the furnishing of buildings. The first of these is by far the greatest in terms of annual expenditure and also largely determines the requirements of the other three. The Government fix the total value of grant-aided building work which may be started within a given financial year (beginning on 1st April). The distribution of university building programmes within the total is decided by the UGC, which is also responsible for controlling standards and costs.

(3) Equipment grants

A new system for awarding grants for the purchase of equipment for teaching and research came into operation on 1st April 1968. Before then grants had been available only for the initial equipping of new accommodation; universities had had to provide for the replacement and renewal of equipment in existing accommodation from their recurrent income. Under the new system, each university is provided with an annual sum of money fixed for a period of years in advance and related in the main to the number of students in the university. Universities are free to accumulate the money in an equipment fund and to deploy it as they think best, both on the replacement of

equipment in existing buildings and on the initial provision for new buildings.

The Planning of University Development

In assessing the financial needs of the universities, the UGC has to take account not only of the plans put forward by the individual universities themselves but of other factors such as the demand from students for university places, national needs for qualified graduates and the likely availability of resources.

The UGC is therefore closely concerned with the pattern of the future size and balance of the universities, in terms both of student numbers and of resources. It is the UGC's responsibility to formulate a broad central strategy of development, for the universities as a whole and for each university within that whole. This involves the UGC in a close and continuing dialogue, on the one hand, with the universities both collectively (through the Committee of Vice-Chancellors and Principals) and individually and, on the other hand, with the Government. It also becomes involved in the collection and analysis of a wide range of statistics about university numbers and costs and in giving universities as clear and positive guidance as possible about the pattern of development envisaged.

In allocating recurrent grants for the 1967-72 quinquennium the UGC gave each university:

(i) a statement of the student numbers (distinguished between undergraduates and postgraduates and between arts-based and science-based students) on which the grant for 1971-72 had been calculated;

(ii) a memorandum of general guidance on the broad picture of university development in the five-year period;

(iii) comments on proposals put forward by the individual university which the UGC wished particularly to encourage or discourage.

University Budgetary Autonomy

Recurrent grants are given in the main as annual block grants, without strings. Each university determines the internal disposition of its grant as a matter of its own budgetary autonomy. This block grant principle is regarded as necessary to ensure a proper degree of freedom to universities in the conduct of their academic affairs

and to avoid the "management" of the universities by the UGC. No attempt therefore is made to lay down in detail from the centre how much of a university's grant should be spent on this or that department, on this or that activity, on teaching or research. (Earmarked grants are occasionally made in order to stimulate a particular development, but they are incorporated in the block grants as soon as possible.)

The freedom of discretion afforded to universities by the block grant principle is qualified in practice by convention. Universities accept that it is the UGC's business to set the general strategy and that, while they are free to plan their own development in the light of their particular circumstances, they have a responsibility for exercising this freedom within the framework of national needs and priorities and in the light of the guidance, general or particular, given to them by the UGC. This is a well-established convention and it is an essential part of the "UGC system". It was summed up in the Memorandum of General Guidance which the UGC issued with the 1967-72 recurrent grants:

"The Committee hopes that universities will find it helpful to have the considerations mentioned in this memorandum before them when they come to decide their own development policies and priorities for the quinquennium. Each university is free to determine the distribution of its annual block grant in the light of the guidance, general and particular, which the Committee has given. It would, however, be in accordance with generally accepted convention that the Committee should be consulted before any major new developments outside the framework set by the universities' quinquennial submissions and the guidance contained in this general memorandum and in the individual allocation letters are undertaken."

Non-recurrent grants are earmarked in the sense that they are given for specific capital projects and cannot be used for a different project except with the consent of the UGC.

Equipment grants are block grants and universities have full discretion to spend them as they wish.

The Way in which the UGC Works

The UGC meets regularly once a month throughout the year, except in August. Special meetings are arranged if necessary. In addition the UGC holds a weekend conference once a year. The UGC has meetings from time to time with the Committee of Vice Chancellors and Principals

and with the Association of University Teachers. It keeps close touch, through its Chairman and Officers, with a wide range of Government Departments, with the Research Councils and with other bodies and committees concerned with developments in higher education.

Vice-Chancellors and other university officers are in constant contact with the Chairman and Officers of the Committee about the day-to-day problems of individual universities. And the UGC, as a Committee, visits each university at least once in each quinquennium. On these visits the Committee has discussions with groups of staff, students and university officials and with members of the governing bodies. No subjects of interest to the university are barred from discussion and, although the Committee usually leaves it to the group concerned to make the running, the Committee finds it most helpful to concentrate on such matters as plans for academic development, the balance between teaching and research, teaching-methods, library services, inter-faculty and inter-departmental co-operation, channels of communication (e.g. between junior and senior staff and between staff and students), staff/student relations and student welfare. The Committee is sometimes asked, on visits, to help secure more money for one particular purpose or another or to endorse some proposal in which one of the groups is particularly interested. It is unwilling to intervene in this way in matters which are for decision by the university itself, though the Committee may, in appropriate cases, draw them to the attention of the governing body.

The visits are not operational - no decisions are taken - nor are they in any sense "inspections". They provide an opportunity for the Committee to acquaint itself, collectively and at first hand, with individual universities' policies and problems, as seen on the ground by the various groups, and to exchange views in a fairly informal atmosphere. The general impression which is obtained of the state of affairs in each university is of real value to the UGC in getting the feel of the university scene throughout the country.

Visits and conferences are also arranged from time to time by the UGC's advisory sub-committees in order to inform themselves of developments in their particular field and thus to fortify the advice they give to the UGC.

INDEX

(This index is not meant to be comprehensive, but, rather, indicative of the major subjects covered and of the most relevant pages on which they are found.)

OECD SALES AGENTS
DÉPOSITAIRES DES PUBLICATIONS DE L'OCDE

ARGENTINE
Libreria de la Nacion
Alsina 500, BUENOS AIRES

AUSTRALIA – AUSTRALIE
B.C.N. Agencies Pty. Ltd.,
178 Collins Street, MELBOURNE 3000.

AUSTRIA – AUTRICHE
Gerold and Co., Graben 31, WIEN I
Sub-Agent : GRAZ : Buchhandlung Jos. A. Kienreich, Sackstrasse 6

BELGIUM – BELGIQUE
Librairie des Sciences
Coudenberg 76-78, et rue des Eperonniers 56,
B 1000 BRUXELLES 1.

BRAZIL – BRESIL
Mestre Jou S.A., Rua Guaipá 518,
Caixa Postal 24090, 05000 SAO PAULO 10
Rua Senador Dantas 19 s/205-6, RIO DE JANEIRO GB.

CANADA
Information Canada
OTTAWA.

DENMARK – DANEMARK
Munksgaard International Booksellers
Norregade 6, DK-1165 COPENHAGEN K.

FINLAND – FINLANDE
Akateeminen Kirjakauppa, Keskuskatu 2,
HELSINKI.

FORMOSA – FORMOSE
Books and Scientific Supplies Services, Ltd.
P.O.B. 83, TAIPEI,
TAIWAN.

FRANCE
Bureau des Publications de l'OCDE
2 rue André-Pascal, 75775 PARIS CEDEX 16
Principaux sous dépositaires :
PARIS : Presses Universitaires de France,
49 bd Saint-Michel, 75005 Paris.
Sciences Politiques (Lib.)
30 rue Saint-Guillaume, 75007 Paris.
13100 AIX-EN-PROVENCE : Librairie de l'Université.
38000 GRENOBLE : Arthaud.
67000 STRASBOURG : Berger-Levrault
31000 TOULOUSE : Privat.

GERMANY – ALLEMAGNE
Deutscher Bundes-Verlag G.m.b.H.
Postfach 9380, 53 BONN.
Sub-Agents : BERLIN 62 : Elwert & Meurer.
HAMBURG : Reuter-Klöckner ; und in den massgebenden Buchhandlungen Deutschlands.

GREECE – GRECE
Librairie Kauffmann, 28 rue du Stade,
ATHENES 132
Librairie Internationale Jean Mihalopoulos et Fils
75 rue Hermou, B.P. 73, THESSALONIKI.

ICELAND – ISLANDE
Snaebjorn Jonsson and Co., h.f., Hafnarstræti 9,
P.O.B. 1131, REYKJAVIK.

INDIA – INDE
Oxford Book and Stationery Co. :
NEW DELHI, Scindia House.
CALCUTTA, 17 Park Street.

IRELAND – IRLANDE
Fason and Son, 40 Lower O'Connell Street,
P.O.B. 42, DUBLIN 1.

ISRAEL
Emanuel Brown :
9, Shlomzion Hamalka Street, JERUSALEM.
35 Allenby Road, and 48 Nahlath Benjamin St.,
TEL-AVIV

ITALY – ITALIE
Libreria Commissionaria Sansoni :
Via Lamarmora 45, 50121 FIRENZE
Via Bartolini 29, 20155 MILANO.
sous-dépositaires :
Editrice e Libreria Herder,
Piazza Montecitorio 120, 00186 ROMA.
Libreria Hoepli, Via Hoepli 5, 20121 MILANO.
Libreria Lattes, Via Garibaldi 3, 10122 TORINO.
La diffusione delle edizioni OCDE è inoltre assicurata dalle migliori librerie nelle città più importanti.

JAPAN – JAPON
Maruzen Company Ltd.,
6 Tori-Nichome Nihonbashi, TOKYO 103,
P.O.B. 5050, Tokyo International 100-31.

LEBANON – LIBAN
Redico
Immeuble Edison, Rue Bliss, B.P. 5641
BEYROUTH.

THE NETHERLANDS – PAYS-BAS
W.P. Van Stockum
Buitenhof 36, DEN HAAG.

NEW ZEALAND – NOUVELLE-ZELANDE
Government Printing Office,
Mulgrave Street, (Private Bag), WELLINGTON
and Government Bookshops at
AUCKLAND (P.O.B. 5344)
CHRISTCHURCH (P.O.B. 1721)
HAMILTON (P.O.B. 857)
DUNEDIN (P.O.B. 1104).

NORWAY – NORVEGE
Johan Grundt Tanums Bokhandel,
Karl Johansgate 41/43, OSLO 1.

PAKISTAN
Mirza Book Agency, 65 Shahrah Quaid-E-Azam,
LAHORE 3

PORTUGAL
Livraria Portugal, Rua do Carmo 70, LISBOA.

SPAIN – ESPAGNE
Mundi Prensa, Castelló 37, MADRID 1.
Libreria Bastinos de José Bosch, Pelayo 52,
BARCELONA 1.

SWEDEN – SUEDE
Fritzes, Kungl. Hovbokhandel,
Fredsgatan 2, 11152 STOCKHOLM 16.

SWITZERLAND – SUISSE
Librairie Payot, 6 rue Grenus, 1211 GENEVE 11
et à LAUSANNE, NEUCHATEL, VEVEY,
MONTREUX, BERNE, BALE, ZURICH

TURKEY – TURQUIE
Librairie Hachette, 469 Istiklal Caddesi, Beyoglu,
ISTANBUL et 12 Ziya Gökalp Caddesi, ANKARA.

UNITED KINGDOM – ROYAUME-UNI
H.M. Stationery Office, P.O.B. 569, LONDON
SE1 9NH
or
49 High Holborn
LONDON WC1V 6HB (personal callers)
Branches at : EDINBURGH, BIRMINGHAM,
BOL, MANCHESTER, CARDIFF,
BAST.

UNITED STATES OF AMERICA
OECD Publications Center, Suite 1207,
750 Pennsylvania Ave., N.W.
WASHINGTON, D.C. 20006. Tel. : (202)298-8755.

VENEZUELA
Libreria del Este, Avda. F. Miranda 52,
Edificio Galipan, CARACAS.

YUGOSLAVIA – YOUGOSLAVIE
Jugoslovenska Knjiga, Terazije 27, P.O.B. 36,
BEOGRAD.

Les commandes provenant de pays où l'OCDE n'a pas encore désigné de dépositaire peuvent être adressées à :
OCDE, Bureau des Publications, 2 rue André-Pascal, 75775 Paris CEDEX 16
Orders and inquiries from countries where sales agents have not yet been appointed may be sent to :
OECD, Publications Office, 2 rue André-Pascal, 75775 Paris CEDEX 16

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 Paris Cedex 16 - No. 29.891-1972
PRINTED IN FRANCE