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ABSTRACT

Three phases of the project are identified: (1) measuring the cost, per student for each course of study; (2) calculation of the cost per student per course of study in the new institutions and analysis of the sensitivity of the cost per student to the number of students involved and the changes in the educational method; (3) measuring the return on investment in higher education, including the calculation of the internal rate of interest and the rate of return for the different courses. The conception and implementation of a management information system is described, including a definition of the administrative procedures, technical implementation, and staffing for the administrative tasks. A model is also described for forecast, simulation and resource allocation. This model, MSAR, includes a series of functional relationships connecting several submodels that make possible simulation of decision-making procedures applicable to an entirely new university. (LBH)

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PROGRAMME ON INSTITUTIONAL MANAGEMENT  
IN HIGHER EDUCATION

**COST-EFFECTIVENESS  
AND COST-BENEFIT  
TECHNIQUES  
FOR CURRICULUM  
PLANNING**

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ORGANISATION FOR ECONOMIC  
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Programme on Institutional Management  
in Higher Education

The use of cost-effectiveness  
and cost-benefit techniques in  
planning courses of study for  
new higher educational institutions

A Progress Report

9742

Second General Conference of Member Institutions (Paris 20-22  
January, 1975).

Note by the Secretariat

At any given point in time, the research groups of OECD's Programme on Institutional Management in Higher Education are in varying stages of advancement, since each has its own predetermined starting date and duration. On the occasion of the programme's Second General Conference of Member Institutions, final reports on the findings of three research groups which completed their work during 1974 are being presented. In addition, however, the Conference provides an opportunity for representatives of all the Member institutions to become acquainted with investigations in progress by other research groups participating in the programme. Thus, invitations have been extended to five on-going groups to present progress reports at the Conference. The topics included are :

- Identification of indices of performance for teaching activities;
- Identification of indices of performance for service activities;
- The use of cost-effectiveness and cost-benefit techniques in planning courses of study for new higher educational institutions;
- The costing and management of university grants and contracts; and
- Economic and pedagogical aspects for managing new communication technologies in higher education.

Of the above listed topics, the first three are the subject of full-scale investigations to be carried out over a two-year time span. By contrast, feasibility studies of a relatively limited scope have been carried out in the case of each of the last two topics and it is expected that these feasibility studies will lead to the formulation and implementation of full-scale projects in a second stage.

In co-operation with the Bureau of Research and Planning in the Portuguese Ministry of Education, Portuguese member institutions have been working on a study of the application of "cost-effectiveness" and "cost benefit" techniques in planning courses in institutions of higher education in Portugal, since the beginning of 1974. The project will be carried out in the following stages :

- (i) designing a simulation model for prediction of resource requirements (MSAR) in institutions of higher education;
- (ii) developing an information system for rationalizing management in these institutions;
- (iii) measuring the cost per student, for each course, in existing Portuguese higher educational establishments and calculating the marginal cost of developing courses in existing establishments;

- (iv) calculating the cost per student for each course, in new institutions, and analysing the sensitivity of the cost per student to variations in the number of enrolments and to modifications in teaching methods and measuring the return on investment in higher education.

The Centre for Educational Research and Innovation wishes to express its sincerest thanks to the members of the Portuguese project group for providing us with the attached report on the progress being made on this project, which is expected to be completed in about two years.

PROGRESS REPORT ON THE WORK CARRIED OUT BY THE PORTUGUESE  
GROUP IN THE FRAMEWORK OF THE IMHE/OECD PROGRAM

As explained in an article appearing in last April's "Phase 2" Bulletin, the Portuguese project submitted by the Portuguese universities deals with the subject "Cost-Effectiveness and Cost-Benefit Techniques" for the planning and performance of courses of study within the new establishments of higher education in Portugal. An active cooperation of all member institutions was foreseen, as well as the cooperation of the Research and Planning Bureau belonging to the Ministry of Education and Culture. Professor J.J. Rodiles Frausto da Silva, leader of the project, invited a technical team for the coordination and guidance of the project.

The several stages of this project should correspond to tasks well fixed in time and which would vary according to the participation of the member institutions. It was foreseen that in the first three stages the necessary statistical collection would be carried out in a decentralized way by each institution, the statistical analysis and the final report (with the conclusions) being the aim of the work of the central group in cooperation with the Research and Planning Bureau from the Ministry of Education and Culture.

The project would take two years to reach its end, and it was foreseen that until the end of 1974, the first three stages should be finished and the last one carried out in 1975, as well as the final report.

The above mentioned phases were :

- Measuring the cost, per student, for each courses of study in the establishments of higher education functioning at present;
- Calculation of the cost per student for each course of study in the new institutions and analysis of the sensitivity of the cost per student to the number of students involved and the changes on the educational method.
- Measuring of the return on investment in higher education, including the calculation of the internal rate of interest and the rate of return for the different courses.

Due to several factors, some parts of the above outlined programme were changed, not only with respect to the stages already mentioned but also in regard to new areas of interest which materialized. We intend in this report to give a brief account of the stages which have already been carried out and of new areas which seem of current interest to us and should therefore continue to be pursued and integrated in the framework of the initial project.

The main considerations which brought about changes in the project were :

- (a) The difficulty in cooperating with the institutions of higher education which, overloaded with work due to the high number of students and to the problems arising from the present political situation, have considerable difficulties to start detailed analysis of the unit costs which will require detailed and careful gathering of many elements for which they have not available staff.
- (b) The appointment of the leader of the project - Professor Fraústo da Silva, for the post of Rector of the New University of Lisbon who called the team already working in the above-mentioned project to cooperate in the establishment and development of this new institution. The need for rational planning and management in this new University requires, on the one hand, more directed efforts towards this purpose and, on the other hand, creates new tasks more closely related with the organizational and managerial system which concerns higher education institutions. This situation of a University which can develop itself according to a rational plan and management structure and not, as usually, within an already established and working framework, is an original one and offers considerable interest.

The factors already mentioned have limited the performance of the first project presented, of which we will make a brief description, and they have brought about the initiation of other complementary studies which we shall outline. The difficulties mentioned in (a) above caused the team to keep on working on the calculation of the direct average costs for which the team had the statistical elements and afterwards began the calculation of returns to higher education. Those aspects which depended more closely on the statistical cooperation of the other institutions were therefore discontinued. Thus, the progress of the initial project can be described as follows.

#### Calculation of the average costs per student in the universities

A document was elaborated in which direct costs per student for the four universities and for the different courses of study which they offer are compared. The differences in the costs among the same courses provided in different universities, namely the teacher-student ratio by ranks of teachers, the charges with technical and assistant staff, the expenses in material and other general expenses, etc, were found neither to be proportional to the number of students nor to vary regularly in time according to the growth of institutions or even in the different universities. These results were analysed in regards to dynamics of growth of the student numbers and corresponding growth of the factors necessary to provide education in the University. The change between some ranks of teachers was detected as a reason for the decrease of unit costs at constant prices, as well as the decrease of the teacher/student ratios.



The inavailability of data hampered the calculation of indirect costs, such as allocation of the central expenses for each course, depreciation of the buildings and their maintenance, repair and replacement of materials, etc. The detection of differences between subjects which constitute the different courses was not elaborated upon.

The results obtained were compared with some average data concerning the European universities and made it possible to evaluate the additional investment needed in those institutions in order to reach European standards.

#### Calculation of the Returns to Higher Education

Having data on direct costs, general indirect costs were estimated for the higher educational system. The elements for analysis of the incomes of holders of a degree in higher education were collected in the statistics available from tax records as well as in the annual statistics printed by public departments connected with the Ministry of Labour. The major difficulty consisted in distinguishing incomes by ages. Calculations were performed under two assumptions. The first consisted of not taking these distinctions into account and the second of adapting for Portugal the profiles of ages and of income/education available for several European and American countries.

This stage, which is not yet finished, also studies the effects or the connections existing between the internal productivity of the system as measured by rates of success, repeaters and drop-outs and the return to public investment in higher education as opposed to other kinds of investment. Thus, it is hoped that conclusions can be reached as to whether or not the return on investment in higher education depends only on the work market and on the wages paid by the economy to the holders of academic degrees, or also on the functioning of the system which retains the students more time than it should, delaying their graduation without neither a counterpart nor an increase of wages when they leave the system before finishing the degree, etc. Thus, at this level, we are working with estimates of incomes and costs not only from a private viewpoint from which one can reach conclusions about the behaviour of the student in the selection of his course of study in higher education, but also from a public viewpoint, where the rationality of the Government while investing in the several branches of education is studied.

The analysis of the possibility of substituting different courses of study giving access to one type of profession only has also been started, as well as the analysis of the effects produced in the level of wages by an increase in the supply of graduates that is not proportional to the requirements of the work market.

Concerning the implementation of a new University, the items emerging as new tasks for the team are as follows :

- Need to implement a rational system for forecasting the growth of the University in terms of student admissions, teaching staff, buildings, support centres, infrastructures, creation of departments and courses, etc, to accommodate about 8,000 students by 1985.



- Study of an organizational process more suitable for a new University that must be constantly in the process of change and growth.
- Creation of a management information system, closely related with a planning process which can be used to control the functioning of a University.
- Conception and establishment of a data base which can be used for university management and planning as well as for day-to-day administration.
- Training of teams which can ensure the functioning of the planning and management systems in order to fulfil the needs of both centralized and decentralized services at all levels.

From this list of concerns related to the creation of the new University of Lisbon, two plans arise whose implementation is just being carried out now.

- I. Conception and Implementation of a Management Information System.
- II. Conception and Implementation of a short and a long-term forecasting model in order to plan the implementation of the University.

Although closely related, these two projects will be separately outlined because, at present, they correspond to distinct working groups.

#### Conception and Implementation of a Management Information System

The aim of this work is to create a data base which will meet the needs of university management. The planning, programming and control of activities, as well as university administration, should have available a large set of elements concerning basic information, classified and aggregated at various levels. This set of interrelated information will constitute the data base of the University. From such a data base the general manager can obtain information about students, members of his staff, existing equipment, facilities, etc. The same applies to the intermediate administrators (about the costs directly involved in the various programmes, about financial affairs, etc.) and the planners (about the choice of courses of studies, the student/professor ratio and the material charges "per capita"...., for instance, at the department, university or major level).

The aim in creating a data base in the new University of Lisbon is closely related to the establishment of a rational automated management system, as well as with the implementation of a resource allocation model. Nowadays we cannot accept the creation of university institutions (taking into account the large human and financial resources involved and the large masses of students which come to the universities) without a forecasting mechanism with a reasonable degree of accuracy.

In order to perform this work the following phases have been established, which are the result of a global project started under the technical assistance of Professor K. M. Hussain, from the New Mexico State University.

1. Definition of the administrative procedures

- a) General Administration;
- b) Student Administration;
- c) Pedagogical Administration;
- d) Staff Administration;
- e) Economic and Financial Administration;
- f) Space and Equipment Administration;
- g) Activities Programming and Control;
- h) Planning.

Every item above is studied by a working group which seeks to define rationalised and mechanised procedures and prepares a report on it. Each report includes, among other documents, the outputs of the process. The "outputs" from the various procedures will be analysed in order to build up an input-output matrix, to define the simple elements which will be the basis of the matrix. Such a matrix will permit the definition of the elements which should constitute the data base, as well as its organization. Every element should be exactly defined in order to permit the elaboration of a Data Element Dictionary.

The limitations upon this work caused by legal requirements concerning university management create some difficulties, but it is hoped that the alterations proposed (e.g. programme budgeting instead of classical budgeting) will meet with official approval.

2. Technical Implementation of the Administrative Procedures

This phase, which is being carried out by a team of programmers and analysts responsible for the performance of the technical part of the project, is structured as follows :

- a) Analysis of the results of the foregoing phase and definition of the processes to be automated and of the calendar for doing this;
- b) Definition of the files which should constitute the data base and its internal organization;
- c) Analysis, programming and testing;
- d) System implementation.

3. Choice and training of the staff suitable for the administrative tasks

A rationalized system calls for suitable human support. For a good performance of the project it will be necessary to choose and to train suitable staff in order to provide an adequate functioning of the University. In order to meet such needs, the following steps were outlined:

- a) Definition of the work posts in regards to profile and number, according to the administrative process defined by the respective working teams and the amount of work foreseen.
- b) Pre-selection of the candidates through suitable tests;
- c) Intensive training of the same pre-selected staff during a pre-contractual period;
- d) Final selection and appointment of the candidates.

The work group which has been defined in 1. and 2. above should elaborate the necessary training material in order to perform c).

Model for Forecast, Simulation and Resource Allocation (MSAR)

The model (M.S.A.R.) is divided into two parts. The first part which is very disaggregated, encompasses the intended structure for the university and aims to provide simulated forecasts of the financial, human and physical resources necessary for the global structure as well as its component parts. It is based upon the definition and programme of the University and its Management Information System. It will simulate different hypotheses for the growth of the various sectors, according to the hypotheses raised by the rector and the persons in charge of different services.

Because the New University of Lisbon is an emerging institution, the simulation of resources can be useful in the decision-making process. Analytical processes appropriate for dealing with multi-objective decision-making methods will be used, and, at the same time, the restrictions concerning financial means, teaching and availability of space for the various activities which constitute the whole of the University will be simulated. The utilization of subjective prices for each activity will make it possible to rank activities and to design alternative hypotheses of development. The two parts of the model will be divided into submodels.

The first submodel, concerned with the flow of students entering the system, is very detailed and goes down to the level of the course and type of instruction but can also give more aggregated results at the departmental and university levels. In this submodel, the factors related to the efficiency of selectivity of the system are implicitly considered. The second submodel relates to staff and is closely dependent upon staff policies followed by the University, but it may contribute, through simulation, to the decision-making process. The third submodel, for which a special methodology was defined, is related to the administration of the "space-types" which can be used as a calculation and forecasting unit. The fourth submodel concerns expenses. The fifth submodel concerns equipment, which can be dealt with, to a limited extent by using the method developed for "space-types".

The first version of the complete model includes a series of functional relationships connecting the several submodels which make it possible to simulate, as a whole, the consequences of a certain decision related to the implementation of the expansion of the various activities. This model will also have built in control variables which make it possible to evaluate, through cost simulation, the results of various decisions.

From what we have just related, it appears to us that the modifications introduced in the initial project give it a renewed interest, since they apply now to an entirely new University. The study of the process of setting up a new institution using rational management may be very useful to other institutions facing the same situation.