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This paper discusses educational planning activities in which the Organization for Economic Co-operation and Development (OECD) has had some involvement. Only a part of these activities are dealt with--national educational planning within the context of economic and social development. An attempt is made to show how OECD's work in educational planning has led almost inevitably to the adoption of a "systems approach." Emphasis is placed on the relative merits of the "manpower" approach and the "social demand" approach to educational planning, and on how these two approaches have not been about educational planning as such, but about different criteria for establishing the objectives or goals of the educational system. An example is given of a model of the dynamic structure of the educational system in terms of student flow. (hw)

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National Educational Planning and Policy Oriented Models

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APPENDIX

Select Bibliography of OECD Publications on National Educational Planning Techniques

1. Policy Conference on Economic Growth and Investment in Education (1962)
2. The Residual Factor and Economic Growth (1964)
3. Financing of Education for Economic Growth (1966)
4. Social objectives in Educational Planning (1967)
5. Econometric Models of Education (1965)
6. Mathematical Models of Education (1967)
7. Training and Demand for High Level Scientific and Technical Personnel in Canada (1965)
8. Higher Education and the Demand for Scientific Manpower in the United States
9. The Mediterranean Regional Project: An Experiment in Planning by Six Countries.
10. M.R.P. Country Reports (separate volumes)
    - (i) Greece (1965)
    - (ii) Italy (1965)
    - (iii) Spain (1965)
    - (iv) Portugal (1965)
    - (v) Turkey (1965)
    - (vi) Yugoslavia (1965)

11. *A Technical Evaluation of the First Stage of the Mediterranean Regional Project (1966)

12. *Investment in Education in Ireland (1966)

13. *Forecasting Educational Needs for Economic and Social Development (1963)

14. *Planning Education for Economic and Social Development (1964)

15. *Lectures and Methodological Essays on Educational Planning (1966)

16. *Manpower and Education (1966)

17. Methods and Statistical Needs for Educational Planning (1967)

18. Education, Human Resources and Development in Argentina (1967)

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Towards a National Educational Planning Model

by Gareth L. Williams(1)

Introduction

1. The reflections of this paper are based upon some of the experiences of the Organisation for Economic Co-operation and Development(2) since work was started on educational planning in the late 1950's. It attempts to show how this work has led almost inevitably to the adoption of a "systems approach" to educational planning over a large part of the OECD programme. The paper is confined to educational planning activities in which the OECD has had some involvement and deals with only a part of those activities - national educational planning within the context of economic and social development.

2. In most of the European Member countries of the OECD a considerable amount of control of the provision of public educational facilities is exercised from the centre. A very imperfect indication of the extent of this central influence is given in Table I which shows the proportion of public educational expenditure coming from central government in a number of European and North American countries.

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(1) The first draft of this paper was commented upon and much improved by Louis Emmerij. Neither he, nor OECD are responsible for what remains.

(2) The OECD, successor to the OEEC has 21 Member countries Austria, Belgium, Canada, Denmark France, Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal Spain Sweden, Switzerland, Turkey, United Kingdom and United States. Yugoslavia is an associate Member and other countries participate in some activities.

Table I

PERCENTAGE OF PUBLIC EDUCATIONAL EXPENDITURE CONTRIBUTED BY CENTRAL GOVERNMENT

Austria	(1961)	65
Canada	(1960)	7
Germany	(1961)	1
Ireland	(1960)	94
Italy	(1960)	77
Netherlands	(1960)	73
Norway	(1960)	44
Portugal	(1960)	90
Spain	(1960)	67
United Kingdom	(1953)	65
United States	(1959)	7
Yugoslavia	(1952)	8

Source "Public Expenditures on Education" by Seymour Harris in Financing of Education for Economic Growth, OECD Paris 1966.

Only Germany among the European countries cited has a highly decentralized system; though Yugoslavia, which participates in OECD educational programmes is also highly decentralized. Obviously these figures of financial sources should be treated with a certain amount of caution since provision of finance and control are not necessarily exercised by the same bodies. Indeed, one major debate in many European countries is how to establish rules of subsidising local education authorities which create efficiency incentives in the spending body. A common method is for the central government to meet a certain percentage of local authority expenditure; which clearly may distort resource allocation at the margin if the spending body has to find less than 100 per cent of the money spent. One solution adopted in the United Kingdom since 1959 is for the central government to allocate "block grants" to local authorities based upon objective criteria such as - number of persons in the 5 - 20 age group. The main problem with this is that it means the central authorities virtually abandon the use of the budget as a device for orienting expenditure in directions that may be considered nationally desirable; having the possibility only of changing the overall level of provision for all authorities and tampering somewhat with the objective allocation rules(1).

(1) The United Kingdom Department of Education and Science does have considerable reserve legal powers under the 1944 Education Acts and also considerable power through its control of authorisation for new building of publicly financed schools.

3. As a result of this strong central influence, much of the interest in educational planning in Europe, generated by the rapid educational expansion of the 1950's and the general realisation of the importance of education in economic and social development has been concerned with educational planning at the national level. One view of the difference in approach between many European countries and the United States or Canada is that in North America, federal educational administrators and planners have attempted to forecast numbers of students educational expenditures, and so on and then foresee any problems these may create, whereas in Europe the approach of planners has been to suggest how many students <u>should</u> be catered for in the different branches of education, what expenditures etc. <u>should</u> be in some future year

National Educational Planning

4. One distinction which is often not made explicit in discussion of educational planning is that between those aspects which are internal to the educational system itself and those which are in some sense external. This distinction is particularly important in the consideration of the "objectives" of education or the educational system. The nature of objectives is such that very frequently they come from outside the system - so many people with such and such qualifications, so many children desiring to enter such a branch of education and so on. If certain objectives are accepted, this has implications for the internal dynamics of the system: for example, to produce such and such a number of persons with university degrees in engineering entails such a number of persons entering university faculties X years earlier and so on. The failure to make explicit the distinction between objectives and the internal dynamics of the educational system often confuses any dialogue between model builders and educational planners generally. The importance of this distinction will recur frequently during the present paper.

5. Most of the discussion which has taken place in recent years on the relative merits of the "manpower" approach and the "social demand" approach to educational planning has been not about educational planning as such, but about different criteria for establishing the objectives or goals of the educational system. The OECD has been closely involved with the methodological development and practical application of both, but for a variety of reasons has been more closely identified with the problems of forecasting manpower requirements.

Forecasting Manpower Requirements

6. Acceptance of manpower forecasts as a basis for educational decision making depends upon a particular philosophical view of the role of formal education in modern society and on a particular set of structural arrangements for the provision of education. The philosophical view is that the labour force can be subdivided into groups of persons performing different sets of functions, that each set of functions has different skill and knowledge requirements from any other, that a large portion of this skill or knowledge is acquired through the educational system and that one of the important functions of the educational system is the provision of these skills and knowledge.

7. The view of the structural arrangements for the provision of education is that there is no mechanism analogous to the market place of perfect competition theory which ensures automatically and efficiently that the knowledge and skills provided by the educational system correspond to those demanded by the labour market. One of the main claims of manpower planners is that even if such a mechanism does exist, it operates much too slowly to ensure allocation of educational resources in accordance with national needs.

8. If this basic position or something similar to it is accepted, the problem of setting educational objectives in accordance with manpower requirements becomes the technical one of finding suitable methods of doing so. There is now a voluminous literature on the subject, and no useful purpose can be served by any summary of methodologies in the present paper. As far as the OECD is concerned, the view has always been held that forecasts of qualified manpower requirements have an important role to play in setting educational objectives but that this is by no means the only criteria to be considered. Historically, the first major operational activity undertaken by the OECD in this domain was the Mediterranean Regional Project (MRP) which was an attempt in the 6 Mediterranean Member countries of the OECD to formulate educational plans on the assumption that the most important function of the educational system is to supply qualified manpower needs. This was not an unreasonable assumption in the case of these countries which were by far the poorest in the OECD area and in which economic growth was given priority over nearly all other economic social objectives. Even in these countries, as the reports show, a substantial proportion of educational expenditure, especially at the lower levels of education. needs to be determined by criteria other than narrow manpower needs.

9. One of the basic problems is to interpret the meaning of requirements. In the simplest sense manpower requirements are a function of the level of output. This means that there are fixed relationships between various types of manpower inputs and economic output. Carrying it a stage further this means that there is a somewhat rigid complementarity between physical capital inputs and qualified manpower inputs, and also between the inputs of different kinds of qualified manpower. Clearly this is open to criticism. In the first place, many types of qualified manpower are only remotely connected with physical outputs. It would be difficult in most countries, for example, to show how G.N.P. would be affected by a thousand more or fewer lawyers. Secondly, even in production sectors, substitution between different qualifications is clearly

possible*. This may mean that with a given state of technology, a particular function can equally well be performed by persons with various different qualifications or that different functions can themselves be combined in different ways to give the same output. Most of the available evidence on this subject is obtained from cross sectional analysis, either of different enterprises within the same country or international comparisons between countries. It is, therefore, subject to all the difficulties of using the results of cross sectional analysis for projections through time. Unfortunately very few time series exist in individual countries which are long enough to yield useful results. The empirical evidence available from OECD cross sectional studies suggests that there are some general relationships between output and productivity levels and employment of some types of skilled manpower, but that the range of possible substitution is considerable*.

10. Another difficulty in forecasting manpower requirements, particularly in the advanced countries is to predict the effects of technological progress. Although some progress is being made**, it remains extremely difficult to foresee the effects of such developments on manpower needs a decade hence. In many cases the new technology creates new occupations. It is safe to say that no manpower forecasts that might have been made in the early 1950's in Europe or North America would be likely to have gauged at all accurately the phenomenal demand a decade later, for a whole range of skills associated with computer technology. This problem is somewhat easier in Europe than the United States since there is in many fields a technological lag of several years between the United States best practice and general practice in Europe.

11. Another rather serious technical problem in the manpower approach is that persons do not stay in the same occupations all their working lives; a closely related problem is that of obsolescence of skills, such as the oft asserted fact that engineering skills are superseded every decade. Clearly occupational mobility and job retraining have enormous implications on the extent to which manpower forecasts can provide a basis for planning the education of juveniles.

12. Many of these problems are by nature insoluble if they are regarded as problems of foretelling the future, and the essence of most of the technical objections to manpower forecasting has been that it is impossible to foresee the future development of the economy sufficiently far ahead and in sufficient detail to be useful for educational planning purposes. This basic problem is merely aggravated by the fact that at present, data do not exist which permit reliable

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* See for example "Technical Evaluation of the Mediterranean Regional Project" by Robinson Hollister. OECD 1965.

** See for example, "Technological Forecasting in Perspective" by Eric Jantsch, OECD Paris 1967.

testing of different hypotheses about degrees of substitutability or complementarity between qualified manpower and other production factors and between different types of qualified manpower. A study currently being undertaken in OECD to test various hypotheses is using cross sectional data from 53 countries. The basic statistics collected for this study will be published early in 1968 and the OECD Secretariat analysis before the end of 1968.

13. For these reasons there has been a fairly severe reaction against some aspects of the manpower requirements approach to setting educational objectives . However, there are many signs of a revival of interest. Among the reasons are:

(i) All other approaches to educational planning, including the apparently more down to earth "social demand" approach have been found upon rigorous examination to be subject to equally serious methodological difficulties. This is considered in the next section.

(ii) Rising educational expenditures everywhere continue to high-light questions of the pay-off to the expenditure and the contribution of the educational system to increased production; even where manpower requirements are rejected as a criterion for determining overall resource allocation to education they are being used to indicate priorities within the total.

(iii) The explicit linking of matrices of qualified manpower requirements to economic input-output matrices of the Leontief type reveals that the assumptions made by manpower planners are no stronger than those normally used in input/output analysis of growth: and that techniques developed in this field to deal with such problems as changes in technological coefficients can have equal applicability for estimating future manpower needs. The paper by Mr. LeVasseur describes preliminary OECD exercise in this direction.

(iv) The use of computerised models permits the testing of a large number of different configurations of the economic and manpower system. These models cannot say what will happen any more than traditional statistical analysis, but by showing policy makers which configurations are feasible, they encourage rational choice between alternatives and can further indicate the paths by which the desired configuration can be achieved. The OECD is currently beginning work on a model of this type.

Social Demand

14. The social demand approach to planning educational needs has a number of variants, but all start from the basic assumption that plans should be made in such a way that educational facilities are provided for all who wish and are able to benefit from them. The philosophical approach and the techniques associated with it can also be used to formulate a more positive social policy in education. For example, it may be felt that policies should be designed in such a way as to increase the participation of those social and cultural groups that are not at present making full use of the facilities available.

15. Philosophically, the approach commends itself to those who consider education too important to be subjected to the scrutiny of an economic calculus and who view it as a consumption benefit rather than an investment. The approach is also natural if it is considered that there are mechanisms which ensure that student demand for places is sensitive to the labour market demand for qualified manpower.

16. Social demand is certainly the basis on which educational decisions are most frequently made, and even educational plans that purport to be based on other methods often base a large part of their estimates on what students and their families are thought to be desiring. Once again the principal problem of the approach is not so much the philosophy, but the technical one of converting vaguely defined individual and social preferences into a concrete basis for operational action.

17. The problem was largely concealed so long as educational plans were made on a piecemeal basis: For example, the Robbins Committee in the United Kingdom* took as a starting point for its deliberations that "Courses of higher education should be available for all those who are qualified by ability and attainment to pursue them and who wish to do so". The Committee interpreted this as meaning that places should be provided to all persons achieving a certain standard of secondary education and who intimated that they wished to enter an institution of higher education. Essentially, therefore, the Committee estimated the size of the age group who would be of an age to complete secondary education, the proportion of the age group likely to complete secondary education successfully, and the

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* See "Higher Education - Report of the Committee appointed by the Prime Minister under the Chairmanship of Lord Robbins 1961 - 1963" H.M.S.O. London, Cmnd 2154, 1963.

proportion of the successful completers who would apply for university entry. Such a methodology, which was applied with considerable sophistication by the Committee can give fairly reliable figures provided it is no part of the Committee's terms of reference to plan also the number of persons who will be proceeding through secondary education. Recent work in Europe has concentrated on developing models which show the interrelationships between the various branches of the educational system and thus forecast developments on all the branches simultaneously.

18. Such models, whose basic methodology is becoming well known - one such is described in the paper by Dr. Freytag - have brought into clear relief the contradictions involved in treating such models simply as forecasting tools. The values of many of the important coefficients of the model are themselves the result of, or at least have been strongly influenced by, previous policy decisions. The planner who relies on forecasts based on past trends finds himself in the position of using past policy decisions as a basis for giving advice on what policy ought to be. In this, educational model builders are in rather a different position from economic model builders in most OECD countries. It is legitimate to treat a large part of the economic system as out of direct public control and thus susceptible to trend analysis etc.; the educational system is usually very much in the public domain and hardly any part of it can be considered autonomous or uninfluenced by policy decisions.

19. This becomes particularly clear in what is coming to be called 'the bottleneck problem'. A 'bottleneck' occurs when there are insufficient places in any branch of education for all the students who would like to enter that branch if capacity was unlimited. The number of students who entered that branch in any past year was determined, therefore not by student demands but by previous decisions about available capacity. Even if the models avoid the pitfalls of assuming that the numbers who entered this branch in the past in fact represented students' wishes, it is extremely difficult to define what is meant by student demand in such cases. Is it the number who apply for places? In this case what about the students who apply for places in more than one institution as usually happens when capacity is restricted? Furthermore, behaviouristically, supply and demand are not independent. It is probable that whether or not a student applies for entry to a particular institution is heavily influenced by his own estimate of his chances of getting in. For example, it is almost certain that in the United Kingdom many pupils from State secondary schools do not apply for entry to Oxford or

Cambridge because they believe their chances of success are low. The problem is further complicated by the extremely complex interrelationships between the different branches of education both sequentially and simultaneously. For example, the effective decision about whether to apply for a university place in mathematics may be taken half way through secondary school when a student decides which courses to follow; and his choice will probably be determined by the available specialist teachers in his secondary school, whose presence or absence is itself strongly influenced by previous policy decisions. Again, observed entry into some faculties or some institutions may be much higher than it would otherwise be because entry into other faculties or institutions is restricted.

20. In concluding this section it may be repeated that the debates of recent years about the relative merits of the "manpower approach" and the "social demand approach" have in one sense not been about educational planning at all. They have been about different methods of establishing overal educational objectives and the only conclusion that can be reached in the debate, which will undoubtedly continue, is that in principle both are valid bases for establishing objectives and that circumstances in a particular country will determine the extent of the emphasis a policy maker needs to put on each. When the OECD started the M.R.P. it was quite clear that a country such as Turkey with very low income levels, enormous shortages of many types of qualified manpower, and few resources available for education, needed to put considerable emphasis on providing qualified manpower. The same might be true of a country whose educational system has got out of step with its economic development so that there are evident shortages of some types of qualified manpower (engineers in the United States?) or evident surpluses (first degree social scientists in India?). In other circumstances (e.g. when the existing educational system is oriented in favour of certain social groups) more emphasis might be given to social objectives.

Descriptive Models

21. One of the unfortunate results of the emphasis on objectives in recent years is that it has tended to divert attention from the educational system itself. The rapid expansion of almost all aspects of education - enrolments, teachers, expenditures - which has come about partly as a result of the acceptance of ambitious social and economic objectives for education, has caught planners almost unawares. With the rapidly increasing proportion of national resources being devoted to education, more and more attention is being devoted to questions related to the internal dynamics of the

of the system so that questions may be answered about how it can function more efficiently, whatever its ultimate objectives.

22. Much of the methodological work within the OECD is now being directed toward the construction of accurate descriptive or structural models of educational systems which show how the systems work and how they relate to other parts of the economic and social systems. One such model for example studies the dynamic structure of the educational system in student flow terms. It can be established on the following lines. A child of five may be :

(i) in grade 1 of primary school, or
(ii) not in school

He may also be male, from the Eastern region of the country and an orphan. One year later, he will still be male, his home may have changed his parental background is unlikely to have changed radically. Educationally he may be :

(i) still in grade 1 after having been there the previous year
(ii) in grade 1, having been out of school the previous year
(iii) in grade 2
(iv) not in school

23. A picture of the internal dynamics of the whole educational system may be built up in this way, defined in the first instance simply in terms of what is structurally possible and what is structurally impossible. It is structurally impossible for example for a pupil to move from primary school to university.

24. It is readily seen that such a structural description of an educational system can soon become excessively complex and much of the art of educational model building, as of all model building consists of choosing those simplifications which leave the important structural aspects unimpaired. Fortunately, a considerable amount of research work has been done which can be of immense value in determining which simplifications are valid. One task in constructing an educational model is to ensure that the results of such research are systematically fed into the model building exercise.

25. Having defined the structure of the system - and few models so far have done this in any but the most general terms, the problem becomes one of measuring the values or possible range of values of the parameters. Some of these can be determined a priori. That a boy aged five this year has a very

high probability of being a boy aged six next year does not require lengthy surveys. Similarly many values can be deduced from fairly simple reasoning. All persons in the system in one period must be accounted for in the next. Thus if there are no possibilities of dropping out of the lower grades of primary education all pupils either proceed to the next grade or stay in the same one.

26. Similarly, the model can be constructed in such a way that it shows what happens to people with different qualifications when they leave school: Once again it can initially be constructed on the basis of what is possible and what is not possible - for example no one without a degree in medicine can become a doctor.

27. When the structure of the model has been adequately specified and trial runs with dummy values of the variables have shown that it performs similarly to the real system it describes; it is necessary to fix realistic values of the parameters for whatever planning purposes the model is required. One way of doing this is to estimate statistically the values of the parameters in some past period and to make assumptions about the relationship of past and future values of the coefficients. It is at this stage that the distinction between objectives and the internal dynamics of the system becomes important. For certain of the variables which may be considered autonomous statistical estimation may be the only method open. For example, the number of persons who will be of an age to start school for the first time is independent of interventions of the authorities. On the other hand, some factors for example number of places available in teacher training institutions are often under the direct control of the authorities. Most of the variables in educational planning models fall somewhere between those which are completely autonomous and those over which the policy making authority has one hundred per cent control.

28. The next problem is to decide the degree of influence of each policy making node on each of the coefficients of the model. In an initial approach the variables of the model can be divided into policy variables, i.e. those which the policy maker wants to influence e.g. enrolment rates of 17 year old girls, instrument variables - those over which the policy maker has control, e.g. number of places in teacher training institutions, and autonomous variables over which the policy maker has no control. These autonomous variables may be further subdivided into exogenous variables (e.g. demographic trends) and variables which are endogenous to the model but autonomous from the point of view of not being able to be directly influenced by policy decisions (e.g. number of universit

trained engineers who become managers). In a real situation many variables are likely to be part decision, part instrument, part autonomous; in particular variables that are autonomous for one decision making point are instruments or objectives at another. The interactions become extremely complex and it may indeed prove impossible to model many of them in an explicit manner.

29. It is often claimed, indeed with a certain amount of truth, that one of the advantages of simulation models of the type mentioned above is that they permit the technician to present the policy maker with a number of alternative viable solutions and thus put the problem of choice where it belongs - in the laps of the policy makers and not disguised as technical coefficients in so-called forecasting models. In the view of the present author, however, it is not valid to take the view that the technician or model builder has no interest in policy.

(i) In even quite a simple model with perhaps two alternatives for growth of final demand, distribution of final demand by economic branch, implications of final demand for gross output per sector, manpower requirements per unit of gross output, qualification structure of occupations, education needed to obtain given qualifications, population growth rate, the number of alternatives to be considered can be very large and selection between them is itself a complex technical problem.

(ii) Apart from general policy objectives, e.g. highest possible rate of growth of G.N.P.; democratisation of secondary and higher education etc. policy makers require assistance from technical experts to specify objectives in concrete operational terms.

(iii) The model can suggest that some objectives are bad because they entail undesirable consequences, or their achievement would require actions by policy makers which are themselves undesirable; it can show that some objectives conflict with other objectives.

(iv) The discipline of building and solving a model can help to define objectives in operational terms.

30. The model builder can no more abdicate responsibility for assisting in the specification of objectives than his predecessors who were interested in the "manpower" or "social demand" approaches could ultimately fail to become interested in the dynamics of the educational system itself. The model builder who pleads that he is a mere technician expecting concrete objectives to be provided from elsewhere, must not complain if he is treated as such and if all the interesting planning work is carried on elsewhere. What is worse is that if model builders adopt this attitude a potentially powerful decision making tool will be wasted as a mere academic plaything.

31. The role of the national educational planning model and the technicians building such a model is the following:

(i) Within broad policy objectives specify precise mutually consistent objectives in concrete operational terms.

(ii) Identify and measure or estimate autonomous variables.

(iii) Identify the variables over which the policy maker has some control.

(iv) Estimate the effects of changes in the control variables.

The construction of such a model must be a rather large scale interdisciplinary exercise comprising at a minimum the work of administrators, educationists, economists, sociologists statisticians and mathematicians. The work ranges from detailed preparation of statistics for data processing to sophisticated mathematical theory.

31. The OECD model building project which is currently being initiated will be attempting to carry out the principles enunciated in the preceding paragraphs. Initially the model will be constructed for a very small number of Member countries. It will be a macro-planning model concerned only with the major strategic decisions involved in educational policy. It will start with the definition of an accounting system which describes the major dynamic relationships of the educational systems of the countries participating in the project and the relationships of the educational systems to the general economic and social systems. It is hoped even at an early stage to include teachers and resource inputs measured in monetary terms as well as student flows. As well as being interesting in their own right these are important instrument variables for many education authorities.

32. The next stage in the model building exercise will be to identify the major decision making points in the system, the instrument variables open to each of them, the degree of control they have over the instrument variables and the extent of influence of these instrument variables over the other parameters of the system.

33. Finally, the attempt will be made to estimate the values of the most important parameters of the system in the participating countries. A very preliminary version of the type of model OECD will be developing is given in Mr. LeVasseur's paper.

34. The purpose of the OECD model will be to evaluate educational policies in Member countries in accordance with the OECD country review procedure. It is anticipated that the first evaluations could take place about two years after the project commences early in 1968.