APPROACHES TO EDUCATIONAL PLANNING

IN

UNDERDEVELOPED COUNTRIES

by

PETER SPENCE GUDGEON

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Dr. K. Okuda
Senior Supervisor

Dr. D. Maki
Examining Committee

Dr. N. Robinson
Examining Committee

ABSTRACT

The necessity for careful planning of the educational system to meet future requirements of manpower demands in underdeveloped and developed countries is self-evident. The failure of present market forces to indicate the necessary levels of investment in education for future growth and development of an economy, arises primarily out of the large time lag between educational inputs and educational outputs. Consequently many techniques have been developed for estimating the desired structure of education at some future time and over time in an economy.

The treatment of education as a form of investment in human beings, has led to considerable research into the capital formation inherent in increasing levels of education, and the development of the human capital approach which attempts to derive an optimum level of investment in education thus to ensure a continued and sustained growth in an economy's G.N.P. per capita. Yet other techniques involve estimating the role that education plays in economic growth through increasing quality and thus the productivity of the labour force (the residual approach). The use of international and intertemporal comparisons of selected educational indices has been used to derive desired levels of education for developing countries and, represents another attempt to find objective criteria for the efficient allocation of educational investment. Manpower forecasting (the manpower approach) and the econometric approach both attempt to predict the levels of education that will be required at future dates, and are rather more objective than the essentially subjective nature of the three previous approaches mentioned. They are both primarily concerned with the internal structure of the educational system as it develops over time.

All the approaches mentioned are underlain by numerous sub-
jective value judgements as to the desired nature of an educational system.
They are for the most part narrowly economic in their conception, and view
the purpose of education as being primarily sources of manpower for the
growing demands of an economy. This does not however detract from their con-
siderable importance in helping to plan the complex educational systems of
the future in underdeveloped countries.

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INTRODUCTION

In this essay I shall mainly be concerned with the various attempts to establish economic criteria for estimating optimum levels of expenditure on education in both developed and underdeveloped countries. That the optimum level of expenditure cannot, and indeed should not, be determined solely on the basis of economic considerations alone, is intuitively obvious. However this does not, in any sense invalidate the efforts that have been made in the past to arrive at some measure or criteria based on economic analysis, since the problem involved is essentially one of resource allocation. Recognition of the growing need for some degree of planning of the future educational requirements of both developed and underdeveloped countries is based on the growing realization that the market mechanism has failed to allocate scarce resources optimally in the past and that present market forces are unable to allocate resources optimally to education facilities in the future. Much of the justification for planning of educational expenditure is based on the fact that there is a long gestation period involved in the educational process, in the sense that inputs into education now, result in outputs of graduates from higher level education at a period eighteen or more years in the future. This is based on the assumption that if there are three basic cycles in the education process, i.e. primary, secondary, and higher education, and each cycle lasts on the whole six years, then an average person will take eighteen years to complete his education. Thus it is unlikely that present market forces will reflect the requirements for certain types of educated manpower at this future date.

Naturally to justify interference with the market alloca-

tive mechanism, it must be demonstrated that educational planning, which assumes imperfect functioning of the present and future market mechanism, is more efficient or that interference can in some way improve the market mechanism. The fact that acute absolute shortages of certain types of manpower exist and persist in many underdeveloped and developed countries, may be taken as evidence that market forces are unable to eliminate such shortages. In India for example there is a high unemployment rate among certain types of Arts graduates, along with an acute shortage of high level technical manpower. For those underdeveloped countries interested in accelerating their rate of growth, the major factor preventing this is not so much a shortage of capital, but in many cases, a serious manpower "bottleneck", especially of strategic high level manpower. Consequently, if an underdeveloped country is planning to achieve a certain target income level in the future, it must also take into consideration the manpower requirements to reach this income target. Thus before any real assessment can be made of the value of educational planning to underdeveloped countries, one should analyse the contribution that education might play in determing the level of development or the rate of economic growth of these countries. Without such an analysis it would be impossible to answer such questions with any degree of precision.

The nature of the approach to educational planning will depend on the aims of planning policy and the levels of decision-making. An integrated social and economic planning policy could have the dual aims of (1) maximization of present welfare within the limits of available resources, and (2) maximization of future growth. In the sense that educa-

tion is often considered as investment, then present consumption may have to be sacrificed for future growth (investment), and the two policies may be contradictory. Yet in another sense education has been considered as consumption, and thus the dual policies are not contradictory.

Decision-making can occur at the micro or the macro level; the micro decisions being concerned with the internal structure of education, and the macro decisions concerned with the size of total spending on education in relation to aggregate national resources. All of the approaches considered in this paper combine elements of the macro and micro, but rather more of the former. Little attention is paid in this essay to such problems as the need for rolling adjustment of planning policies over time (sequential planning), or to the problems of balanced expansion versus unbalanced expansion of the educational system. Furthermore, the important question of quality versus quantity, or general versus specific education in relation to the rate of expansion of educational expenditures is not fully considered. A complete examination of all the many aspects of educational planning is impossible in a restricted essay of this nature.

Educational planning strategies in the past have been based on four major approaches attempting to establish the relationship between education, economic development, and economic growth. They are briefly: The Human Capital Approach. This is based on the simplistic assumption that educational expenditures can be treated as investment in human capital, and consequently a process of human capital formation. If this is so, then it should be possible to compare the rate of human capital formation over time with that for physical capital and the rates of return to

educational expenditures with that of other types of expenditures, and thus arrive at some "objective" criteria for overall and marginal invest-ment decisions for educational expenditures as opposed to other forms of expenditures.

The Residual Approach. Attempts to measure the contribution of capital and labor inputs to the growth of G.N.P. per capital over time, using a simple linear homogenous production function, and other restrictive assumptions, has resulted in a large "unexplained" residual factor that has also in some way contributed to the growth of output. Although much of this residual has been attributed to technical progress embodied in capital and labor (due to improved quality of the labor force as a result of better education and improved health, etc.), the exact contribution that expenditures on education has made to the overall increase is by no means clear, but it is assumed to have played a large part. If it could be ascertained then criteria could be established for the amount of expen-diture on education in the future for a certain desired growth rate.

International, Intertemporal, and Interindustry Comparisons of Certain Ed-ucational and Other Indices. The rationale behind this approach is based on historical evidence suggesting that stable relationships can be observed between educational expenditures, labor force educational levels, enroll-ment ratios, etc. to G.N.P. per capita in the now developed countries, and that underdeveloped countries should try to establish similar ratios, with implications for resource allocation.

Manpower Forecasting or the Manpower Approach. Basically this approach involves forecasting demand or requirements for various levels of manpower in relation to a given structure of industry at some future date. These

requirements are then translated into educational requirements at that
future date, and then in turn related to the present educational struc-
ture. If shortages or surpluses of certain types of manpower are predic-
ted to develop over time, then the educational system is adapted such as
to eliminate them. This may involve a large increase in educational ex-
penditures and student inflows in the immediate period to meet these
future technological requirements, and thus resource allocation problems
are bound to arise.

The Econometric Approach. The recent development of educational planning
models, mainly of the input-output and linear programming variety, are
designed to aid educational policy makers in their decision making. These
models are similar both conceptually and methodologically to the previous
approaches mentioned, and the assumptions underlying them are basically
the same. In this sense they may be regarded as an amalgam of these var-
ious approaches, and as such incorporate most of the advantages and disad-
vantages of them also. In this essay the limitations of the approach
is discussed only in relation to the Correa-Tinbergen model. For the
purposes of this essay the limitations of such optimizing models using a
linear programming approach are not discussed.

I. THE HUMAN CAPITAL APPROACH

In the human capital approach, expenditures on education
are considered in much the same way as investment is considered in cap-
ital models of economic growth, in that it is a process of human capital
formation. [1] Thus answers to questions involving resource allocation, so
the protagonists of this view maintain, are almost identical with and the
methods of solution similar to, those operating in the general field of
investment criteria. The search for such criteria in the sphere of edu-
cational planning has been centered around attempts to find the capital
value of the education invested in educated persons, and also to find
the private and social rates of return to various types of education. If
these figures can be established, then a measure of the overall and mar-
ginal social contribution of education to economic and social development
can be ascertained.

Before proceeding further it would be as well to ask what
are the major areas of choice with regard to educational planning. Briefly
they are: how to relate educational systems to overall development needs
(economic and social); what is the level of investment to be made in ed-
ucation; what is the optimum relation between the different levels and
sectors of the educational system (the education "mix"); how the produc-
tivity of education systems can be improved; what are the returns on in-
vestment in education; and how can education best be financed?

There are a number of ways in which expenditures on human
capital formation via education are similar to outlays on physical capital.
Firstly, it involves the use of goods and services which could be used in

other ways. Secondly, the resulting capital yields returns to the indi-
vidual in the form of income streams or non-pecuniary psychic income re-
turns over future years. As with physical capital, in which new technol-
ogy has been embodied, human capital directly affects the methods and
efficiency of production. Also, human capital, like physical capital,
can be made obsolete by changes in technology over time, hence the need
in developed countries for extensive retraining schemes. [2]

However in many respects human capital is dissimilar to
physical capital. Firstly, as Eckaus [3] has argued, the process of human
capital formation not only develops labor skills but uses them as well,
therefore it improves the quality and quantity of talent. This talent
can be used in the production of consumer goods, both physical and human
capital, but also in invention ; and innovation along scientific, technical,
or administrative lines. Furthermore, human capital is more flexible than
physical capital, and the decision as to whether it should be used rests
with the individual person, which is not the case with physical capital.
Even more significant, in terms of analytical distinctions, is the fact
that the product of educational outlays carries with it joint features of
consumption and investment. The same could be argued for physical capital
outlays, but the difference is sufficiently large in terms of relative
components to warrant, for analytical purposes, a distinction in kind.
Musgrave, [4] further differentiates the educational product into three com-
ponents, namely, consumption (i.e. enjoyment of the fuller life permitted
by education), direct investment (with the gains accruing "internally" to
the individual in the form of increased earnings), and also investment in

the functioning of the economic and social system at large. These latter gains accrue "externally", not only to those in whom the educational input is invested, but also to other members of the community. In the context of economic development efforts, these externalities, so some authors have argued, may be a very significant component. Developing the argument further, one can distinguish in the consumption component, two sub-components, namely current consumption (possibly the delights of attending school, or the pleasure derived from absorbing new ideas and associating with people of similar interests) and future consumption (the ability to appreciate life more fully later one). Since the latter element is much the larger, the consumption component is sufficiently important to consider education as a durable consumer good, "and hence investment".[5] The essential difference, so Musgrave would argue, "is not between the consumption and investment aspects of educational output, but between education investment which generates imputed income (the fuller life later on) and education investment which generates increased factor earnings to the labor supplied by the educated person."[6]

The problem arises of what weight should be given to the two components in the development context, and how is this to be reflected in the pattern of the education programme? Recent writers[7] have pointed to the extension of secondary education as being the primary goal of education policy in countries with a low level of educational capital stock, with the extension of elementary and technical training at a more advanced stage. While this priority is derived from the projected needs for various types of skill and training, it also suggests that the imputed-income

component of the educational mix tends to be of a particularly great im-
portance at the early stages of development. Thus not only must the over-
all level of educational expenditure be distinguished between its consum-
ption and investment components, but also the different levels of edu-
cation and different types of education should similarly be disaggregated
in terms of these two components. One such method is suggested by Wilk-
inson, in that:

> . . . all educational outlays on secondary schooling and beyond
> are investment and that primary schooling is consumption. [8]

However, as the author notes:

> . . . it would be incorrect to treat all those with only primary
> education as representing no investment (since) this method ig-
> nores that for a person to absorb secondary education and above,
> he must have had primary schooling.

This qualification has not been noted by some practitioners in the field
of educational planning. [9, 10]

A further distinction can be drawn between physical and
human capital formation, that, in some cases, has an important bearring
on the search for investment criteria for educational planning purposes.
This is that the "gestation period" for educational "projects", in terms
of the time between inputs into the system and resultant outputs, are
substantially longer than those for many other capital projects. Periods
of ten to twenty years or more may be involved for the formal education
process alone, and considerably more when on-the-job training is included.
This introduces a constraint in investment planning and demands a corres-

ponding longer planning horizon which in turn points to the need for

public policy guidance seen in the context of a long term development

perspective. A similar consideration relates to the relatively long use-

ful life of the education asset. Consideration of returns over, say, a

thirty year period lends great importance to the discount factor in assess-

ing the relative productivity of investment in education. Since the

useful life of competing projects tends to be shorter, except in the

case of physical social overhead capital, the relative case for invest-

ment in education is low if the appropriate rate of discount is high.

Thus the selection of the appropriate rate of discount is of paramount

importance in assessing the proper share for education in the total expen-

diture of a government. Since there is no developed capital markets in

underdeveloped countries to provide a clear indication of the appropriate

rate for educational investment, its determination becomes largely a mat-

ter of public policy. Since the time horizon of the government is trad-

itionally longer than that for private individuals they are likely to

overvalue the present value of education when compared with an individual's

assessment.

For the above and other reasons that will be developed as

the essay proceeds the various attempts to measure the capital value of

trained and educated persons can be viewed with considerable scepticism

as a basis for assessing the "optimum" investment in education both now

and for future periods, especially for underdeveloped countries. Indeed

much of the work done using this approach has been based on U.S. data, a

sufficient reason alone for doubting its relevance for developing countries.

T.W. Schultz [11] has analyzed the relationship between expenditures on ed-
ucation and physical capital formation in the U.S. for the period 1900 -
1956, measured in constant dollars. By adding together the possible
earned income foregone by those enrolled in schools, colleges, and uni-
versities (i.e. the "opportunity cost" of education) and the expenditures
for formal education of all types (with allowance for depreciation), he
calculated a figure for the total annual investment in education in the
U.S. by decades from 1900 - 1956. For high school education this "invest-
ment" in education increased 135 times from $81 million to $10,944 mil-
lion in 1956; and for college education and university education com-
bined from $90 million to $9,903 million in 1956, all expressed in 1956
figures. The total stock of "educational capital" in the labour force
of the U.S. rose from $63 billion in 1900 to $535 billion in 1957, a rise
from 22% to 42% of G.N.P. Such aggregate figures provide little basis
for estimating how much expenditure there should be on education, even
when the different types and levels of education are included in the fig-
ures. An underdeveloped country trying to decide the optimum level of ed-
ucation for a given growth rate, would presumably have to deduct the con-
sumption component of the educational capital stock to obtain a meaningful
"rule of thumb" measure of the real relationship between educational in-
vestment and economic growth.

Even after the investment component of the expenditures has
been successfully isolated, the relationship between the increase in in-
come per capita and increase in educational expenditure cannot be assumed
to have any causal significance. The calculation of Schultz of an "income

elasticity" of demand for education of 3.5 over the period, and the deduction that education considered as "investment" may be regarded as 3.5 times more attractive than investment in physical capital, with obvious implications for resource allocation, are therefore spurious.

An approach suggested by Wilkinson, whereby all educational outlays are considered as investment, in the sense that it contributes either directly or indirectly to the individual's actual or potential productivity, [12] may be more useful. This method therefore provides a maximum capital value, from which consumption items may be deducted. Even Wilkinson expresses considerable doubt however over this approach, but maintains that:

> . . . there is no reason to deprive ourselves of the usefulness
> of at least crude estimates of the value of human capital such
> as this approach provides.

Three methods have been used to measure the capital value of the education invested in individuals. The first and simplest of these is to calculate the years of schooling represented by the populace, and is only a very crude aggregate measure, and thus of little use for educational planning purposes. The second involves computing the production of replacement costs of educated persons. The major problem presented by such calculations is the amount of the costs to be represented by opportunity costs of education (i.e. income foregone), and other costs. It is not proposed to deal at length with the many suggestions put forward by various authors on the problem of costs. However it is as well to note that what costs are included in the calculations will affect the ratio of

benefits to costs tremendously in underdeveloped countries. [13] Recent discussions of the economics of education emphasize, that this cost not only includes teacher's salaries, buildings and other equipment, but also the opportunity cost of lost income on the part of the student. Depending on the structure of the developing country, this latter component may be of varying significance. Where there is a general labour surplus, or very high open or disguised unemployment, the opportunity cost in terms of income foregone may be very low, and in some cases almost zero.. On the other hand other components of education cost (teacher's salaries in particular) may be relatively high in underdeveloped countries, due to the acute shortage of domestic teachers or to a policy, especially in many African countries of importing European teachers at high salaries. The problem thus arises whether the possibly artifically high salaries of school teachers in underdeveloped countries are to be included in a guide for future investment decisions on the basis of present cost-benefit ratios, when the danger exists that the elements of present costs are at only a transitory level.

The third method of calculating the capital value of human beings involves estimating the discounted values of peoples' future earnings, to derive present value estimates of educational expenditures. The work of Weisbrod, Renshaw, and Becker, can be consulted for the ramifications of this approach. [14]

The estimation of private rates of return, and present value of education, based on future expected income streams, suffers from a number of methodological limitations. Among the most serious limita-

tions is the assumption of perfect competition in the labor market, which

may hold for the United States labor markets for certain types of·skills,

but is highly doubtful for most skills. The existence of monopoly elem-

·ents, such as restrictive entry, may distort the pattern of income

streams to such an extent that the marginal productivity theory of wages

is seriously questioned. To deduce investment criteria for the promotion

of economic growth on the basis of an assumed causal relationship between

incomes and productivity, may consequently be very misleading. Some

economists have argued that by comparing the net returns on different

occupations we should be able to determine how efficiently resources are

being allocated among such occupations. The basis for this argument is

that:

> . . . if rates of return to educational investment and to. teacher
> .investment fall below alternative rates of return, then from an
> economic point of view clearly economic resoures are being misal-
> ocated. [15]

The normal calculation of private rates of return also neglects the pos-

sible private non-pecuniary costs of or returns to education. Possible re-

turns may include the option of obtaining additional education which

should be included along with the advantages of a wider choice of jobs

and the related patterns of income, living, leisure, and security.

The application of·internal rates of return for sub-

optimizing problems in educational planning may however be more useful,

in that it may be possible to evaluate the payoff on investments in two

or more different kinds of educational programmes. It may be possible to

construct present value comparisons of two educational processes in terms of net earning streams, as an aid to general cost-benefit analysis. Becker,[16] for example, uses internal rates of return comparisons of on-the-job versus formal education. The application of this approach for planning purposes may be of value in that a government might try to choose that policy regarding education which maximizes the rate of return or present value. Assuming away for the moment the choice of the appropriate discount rate, one could try to compare various strategies for terminal levels of education in terms of present value, where buget constraints are important. [17] For a more reliable basis for educational planning the use of private rates of return and present value is dubious, since they do not reflect the social rates of return. It is generally agreed that for planning education, private rates of return are less accurate than social rates of return, as used in a general cost-benefit approach.

Although there is considerable disagreement as to what should be included in the social costs and social returns to education, it has still not prevented its use in educational planning and cost-benefit analysis. Some economists argue that the external social returns to education are very small indeed, or so inaccessible to quantification as to be almost useless for educational planning. Among these sceptics is Wilkinson, who writes:

> Using any of these techniques, increasing intensity of education for the populace could be justified up to almost any amount of education. The difficulty is that such techniques are not useful in any rigorous fashion. There is no satisfactory way of assigning monetary values to items which are largely subjective

by nature. Nor is there any way of determining what portion of
educational spending is investment . . . . Educational expendi-
tures are increasing in most countries; the popular demand is
for more education for everyone. Consequently there is undoubt-
edly a desire when calculating (social) rates of return on ed-
ucation to obtain rates which indicate these expenditures are
justified. Where the rate so obtained are lower than required to
support these outlays on purely pecuniary grounds, and economic
grounds, there is a temptation to fall back on the non-pecuniary
and cultural benefits—in order to tip the scales in the other
direction . . . . In short we can use social rates of return an-
alysis to prove anything we want to . . . . Any technique of an-
alysis which can be twisted . . . to justify whatever action one
wishes to take should be suspect. In general then, we must con-
clude that further research along the lines of social rates of
return as a method of efficiently allocating resources appears un-
warrented. [18]

The calculation of external returns to education in un-

derdeveloped countries has been justified by many authors on the grounds

that the external returns constitute a substantial part of the total gain,

and thus should not be neglected for educational planning purposes.

Perhaps the most important aspect of the external benefits of education

lies in the change in the social and cultural climate, incident to the

change in the development horizon. As has been pointed out many times,

such a change may be an essential condition for economic growth in under-

developed countries. At the same time, this benefit result is not an

automatic consequence of education at large, but only of the proper type,

quality and quantity of education. Supply of educated persons who can-

not be absorbed into appropriate positions may readily become an external

diseconomy and source of instability in underdeveloped countries. The

rising unemployment levels of relatively highly educated arts graduates

in India, is witness to this fact; but whether growing frustration of

the educated populace is conducive to or a hinderance to economic growth

in the long run is a matter of opinion.

For more general criticisms and the limitations of the use of private and social rates of return in obtaining useful investment criteria for educational planning, and general discussion of the use of cost-benefit analysis in education, the reader should turn to other sources. [19, 20, 21] An interesting example of the use of rates of return comparisons between human and physical capital is the work of A.C. Harberger in India. He found that despite a "conscious" biasing upward of the measures of the rates of return to education, the "best" estimates resulting from the computations suggest that the economic rate of return to investment in physical capital is higher (and may be substantially higher) than the economic rate of return to investment in secondary and higher education. It is noteworthy that Harberger's estimates excluded social external returns to education.

II.   THE RESIDUAL APPROACH

One of the major discoveries of recent years has been the large part of national income growth in the industrialized countries that cannot be explained by increases in quantity or labor and physical capital inputs. Attempts by various authors to measure the contribution of capital and labor inputs to the overall increase in G.N.P. per capita using the Cobb-Douglas production function, has resulted in the creation of a large "residual" element in calculations. The "residual" of unexplained growth has been given many labels, the most accurate of which is undoubtedly the "measure of our ignorance". [22] To attribute all of this to education is entirely unjustified. However the magnitude of the residual has stimulated efforts to examine some of its components, and notably among them schooling, or education.

The pioneering modern aggregate production function study was Jan Tinbergen's essay entitled "Theory and Measurement of Factors in Economic Growth" written in 1942. [23] Tinbergen concluded that an unspecified trend variable or "efficiency increase" accounted for 19% of the 75% growth in national income in England from 1870 to 1914, and for 27% of the 56% growth in the United States, 44% of the 44% in Germany, and 58% of the 16% growth in France for the same period. [24]

Aukrust, writing in 1959, [25] tried to show that "the human factor " (organization, professional skills, and technological progress) was at least as important to the rate of economic growth as the volume of physical capital. He found that the "organization factor" accounted for 1.81% per annum of a total growth rate of 3.39% per annum

in Norway from 1948 to 1955. Among the policy conclusions of his study
was that instead of trying to increase the rate of progress by keeping
the level of investment high:

> . . . we ought to reconsider our plans and policies, and look
> into the possibilities of achieving greater gains by increas-
> ing our efforts in the fields of research and education. [26]

Kendrick, [27] attempted to disaggregate the various com-
ponents of the residual or "other forces" contributing to the growth of
the U.S. economy for the period 1899 - 1953, (such as technological
change, economies of scale, better management, health improvements, ed-
ucation, and etc.) and concluded that from 1899 - 1953 they accounted
for more than half of the rate of growth of National Product. Other
authors have ascribed, using similar methods to those of Kendrick, an
even larger share of the increase in G.N.P. to the residual. [28]

Denison, [29] tried to isolate the specific contribution
that education has made to increased factor productivity over time, and
the effect of improved quality of labour in the U.S. from 1909 - 1957.
He estimates that over the period 1909 - 1929, 12% of the growth rate in
the U.S. could be ascribed to education, and 23% for the period 1929 -
1956, in terms of growth in Total Real National Income. The figures for
growth of Real National Income per person employed are higher, respectively
29% and 42% for the two periods ascribed to the education input.

Denison indicates a number of ways in which additional
education contributes to productivity through raising the quality of the
labour force.

(a) Additional education makes individuals more receptive to new ideas and more aware of better ways of doing things.

(b) Within a given occupation, a better educated person is likely, with many exceptions but on the average, to do a job better than a less educated one. Not only does he do the same things better, faster, or with less supervision, but he does more things——tasks that will otherwise be done at a higher occupation level.

(c) Additional education widens the range of choice open to individuals in the choice of occupation and their appreciation of alternatives, enabling them to grasp chances for economic advancement in positions where their marginal productivity is larger and to find different employment when the demand for a specialized skill achieved through experience or narrow vocational training disappears. It is usually the least educated who fare worst in the process of economic change.

(d) The availability of better educated labour has led to changes in the whole organization of production as among occupational groups in order to take advantage of labour supply of higher quality. Without an upgrading of labour and the shift of patterns of demand towards occupations requiring more education, (i.e. towards education-intensive technological progress) these advances could not have been adopted.

When these effects are all considered, it is surely reasonable to suppose that the real National Income in 1960 would have been a great deal smaller than it was if the 1930 educational distribution had remained. [30]

Galenson and Pyatt, [31] have conducted a study of the effects of labour quality on economic growth in underdeveloped countries using the aggregate production function. Among the important determinants of labour quality are education levels, health, housing, and social security. Denison's study which attributed almost one quarter of U.S. growth from 1929 - 1957 to education, aroused much interest in less developed countries since it is usually assumed that the marginal returns to ed-

ucation are higher in less developed countries. Galenson and Pyatt es-

timated that a 1% increase in labour quality in 52 countries was accom-

panied by a 2.27% increase in calories per head, 0.13% increase in invest-

ment in dwellings, 0.11% increase in higher education, 0.04% increase in

social security benefits. Galenson and Pyatt admit however that there

are many conceptual difficulties in the way of measuring effective

educational inputs, and the growth producing effect of the different

levels and types of education is not at all uniform. In addition there

is the problem of time lags between educational input and output. An

increased expenditure on primary education at year t will not become an

economic asset until year t + n, the n varying with the year of school-

ing. The lag will be smaller for other forms of education, particularly

short term vocational training, but it exists. Another problem is that

of the intrinsic value of a particular type of education as a development

stimulus. The case for vocational training is clear. Students in voca-

tional schools are being prepared directly for working life, and such

training can be looked upon as an immediate input into a nation's pro-

ductive fund. Adult education, on the other hand, varies greatly in its

purpose. Much of it, particularly in underdeveloped countries, is quite

utilitarian in purpose, including literary courses and evening technical

training. Galenson and Pyatt decided that:

> Since so little is known about the composition of adult edu-
> cation, it was felt that this category had better be ommitted.
> Of conventional primary, secondary, and higher education,
> there can be little doubt in terms of ultimate contribution
> to economic efficiency, though immediate payoffs may vary with
> the specific type.

The primary conclusion of the study was:

> The increase in higher educational enrollment showed some prom-
> ise as an explanatory variable, particularly among the low in-
> come countries. This suggested that particular attention might
> be paid to the role of this factor in these countries. However,
> the relationship was not sufficiently strong to warrent the
> flat assertion that an expansion of higher education is essen-
> tial to growth.[32]

Apart from criticisms of the statistical limitations
of the studies mentioned, the planning of educational expenditure based
on these studies has somewhat dubious relevence for both developed and
underdeveloped countries. Firstly, and possibly most damning, is the
reliance of such studies on the marginal productivity theory of factor
incomes. Secondly it does not provide a basis for showing how much ad-
ditional investment there should be in education, or marginal invest-
ment decisions. There is also no distinction between consumption and
investment aspects of education. Fourthly, no valuable indication is
forthcoming of the sort of education that should be encouraged in un-
derdeveloped countries in the future. Fifthly, since there is a high
degree of complementarity between education, health, research, and devel-
opment and capital and labour inputs, the marginal returns to investment
in education could be brought to zero quickly enough if the other "sources"
of growth are not present as well.

III. INTERNATIONAL AND INTERTEMPORAL, COMPARISONS OF SELECTED EDUCATIONAL

INDICES

The use of "norms", or international, intertemporal, and inter-

industry comparisons of such figures as educational expenditures, enrollement

ratios, and labour force educational levels to relation to G.N.P. per capita,

is illustrated par excellence by the work of Harbison and Myers. [33] To ob-

tain a rough idea of the nature of this approach, it would be as well to

quote from one of these two authors, in this case F. Harbison.   There are

two principal objectives of this approach:

> The first is to rank a large number of countries on the basis of
> one or more quantitative indicators of human resource development
> and to group them into levels of human resource development.   The
> second is to determine whether the are significant statistical
> relationships among various human resource indicators and measures
> of economic development.   If we can establish some quantitative
> benchmarks, these will be useful for a more detailed qualitative
> analysis of levels of human resource development. [34]

Benjamin Higgins, comments rather scornfully on this approach

as a basis for educational planning and decision making on resource allo-

cation. To quote:

> From a logical point of view the use of "norms" to determine
> the appropriate size and pattern of the educational budget, is
> a primitive form of "econometric approach".   That is it involves
> looking at advanced countries in the past and saying "high in-
> come countries seem to spend about 5% of their G.N.P. or 25% of
> their aggregate governmental budgets, or X percent of total pub-
> lic investment, on education." [35]

Therefore if developing countries want to have high incomes too, they must

do the same—i.e. implying that there are causal relationships between

these various indices and economic growth; and yet many educational plans

of underdeveloped countries attempt to achieve the various ratios of developed countries, without acknowledging that comparisons of developed countries in the process of development with present day underdeveloped countries can lead to very misleading conclusions. The use of cross section studies of developed countries to project and plan the future growth patterns of present day developing countries suffers from a large number of statistical problems, that are also inherent in the approach being considered.

Harbison and Myers, in their study, employed fourteen different types of indicators of human resource development in their classification of 75 countries into four major catagories. Among these was a composite index consisting of the:

> . . . arithmetic total of (1) enrollment at second level of education as a percentage of age group 15-19, adjusted for length of schooling, and (2) enrollment at the third level of education as a percentage of the age group, multiplied by a weight of 5. [36]

The reason for the weights selected was that in their judgement:

> . . . higher education should be weighted more heavily than second level in such an index. [37]

Using this index the 75 countries in their sample were classified into four catagories:

Level I.   Underdeveloped countries (17).
Level II. Partially developed countries (21).
Level III. Semi-advanced countries (21).
Level IV. Advanced countries (16).

A high positive correlation was found between the composite index and G.N.P. per capital (expressed in U.S. dollars), while a high negative correlation

was observed between this index and the percentage of the labour force enga-
ged in agriculture. The deviation of individual countries for this trend
line are explained variously in terms of physical natural resource availa-
bility, over or under investment in education relative to their financial
capacity as indicated by G.N.P. per capita, prior investment in human re-
sources which has provided a base for later, more rapid economic growth, etc.
Although Harbison and Myers emphasize that there is no suggestion of causal
relationships in high or low correlations between their indices, they do
tend to assert that their method provides answers to the critical areas of
choice which confront all nations, irrespective of their level of develop-
ment. These critical questions are:

(1) The relative emphasis on quality versus quantity in all lev-
els of formal education.

(2) The stressing of science and technology versus law, arts, and
humanities in secondary and higher education.

(3) The reliance on pre-employment formal education versus in-
service training in skill development.

(4) The conscious manipulation of wage and salary structure ver-
sus dependence on market forces, building incentives.

(5) Consideration of the needs and desires of the individual
versus the needs and desires of the state in the general ra-
tionale of human resource development.

The authors' answers to the above questions are presented in
their section on "Choices of Strategy of Human Resource Development". These
choices are related to the imperatives and pressures that are present at
each level of development. In the underdeveloped countries (Level I) the
increase in production of primary industries is a prime necessity for econ-

omic development, and the expansion of primary education is a major social

objective. Furthermore a "crash" programme must be undertaken of secondary

education, along with "major reliance" on institutions for skill develop-

ment. At a higher level, university graduates are also needed, and:

> . . . they must be sent abroad until local instutions for higher
> learning are developed. [38]

> In the partially developed countries (Level II):

> . . . the economic imperative is to build the base for industri-
> alization while expanding agricultural development. [39]

Thus there is an acute shortage of all catagories of technical and prof-

essional personnel, requiring the importation of such skills from abroad.

"University education is an attainable and mandatory goal." The top pri-

ority must be given to reform and expansion of secondary education, with

special emphasis on mathematics and science, and also the education of sub-

professional personnel and technicians.

In the semi-advanced countries (Level III), the emphasis again

is on technical and scientific training at all levels of education, along

with expansion at all levels.

In the advanced countries (Level IV), there is universal secondary

education, and higher education is "within the reach of all that are quali-

fied for it." [40]

The obvious naivete of many of the suggestions by Harbison and

Myers tends to detract from the possible importance of their approach as a

general indication to underdeveloped countries on a strategy of human re-

source development. They have assumed implicitly that the developing coun-

tries will follow a certain path, and that this growth path will be similar

to that which the presently developed countries took in the past. Further-

more they neglect the essentially heterogeneous nature of underdeveloped

countries in such an aggregate approach. Many of their suggestions are

given without consideration of cost constraints, and underlying the whole

analysis is the implication of causality. In parts of the book the impli-

cation becames a mere statement of fact. For example, in the case of

Japan:

> . . . the fact that its current rate of growth is the highest
> of any industrial nation suggests a causal connection between
> an educated labour force and subsequent economic growth. [41]

Despite the obvious limited applicability of the Harbison and

Myers or the "norms" approach as a guide to efficient resource allocation,

it has still been used in underdeveloped countries for educational planning.

> In the course of the series of UNESCO conferences,a figure of
> 4-5% of GNP has come to be accepted as an appropriate figure
> for expenditure on education, for no other reasons except that
> a number of advanced countries spend about this amount. [42]

Furthermore, concentration on these norms means that a country is ignoring

the flexibility which exists with regard to education policy because of the

elasticity of substitution between different educational levels, and between

other factors of production for education. India, for example, appears to

have a very "education intensive" programme system in comparison to coun-

tries at the same level of development. The possibilities of factor substi-

tution and education level substitution, is not countenanced in the approach

being considered, whereas such substituion is a very real possibility in the

future, given the rate of technical progress. This approach seems to imply a certain inflexibility over time of the education system, whereas flexibility within education for rapid economic growth is probably a more desirable goal for the educational planners.

IV. MANPOWER FORECASTING OR "THE MANPOWER APPROACH"

Rather than attempting to estimate the precise contribution that education makes to economic growth, manpower forecasting or the manpower approach proceeds on the assumption that economic growth cannot take place without a certain stock of skilled and trained manpower. As the title suggests, the method involves forecasting the future demand or requirements for different levels of manpower at some predetermined date in the future, on the basis of technological rather than economic (i.e. market) requirements.   Through this method, so its protagonists proclaim, shortages or surpluses can readily be identified, and thus the educational system can be corrected to meet these technological discrepancies as closely as possible.   Apart from the statistical problems that arise through the use of this approach, a number of preliminary questions come to mind. First and foremost, is this approach a method of planning of education or more fundamentally a forecasting technique, that allows little range of choice for the decision makers? How and in what ways does shortage and surplus differ from the economic concepts of excess demand and excess supply? It would be opportune at this juncture to examine the reasons why market forces have been in the main rejected as a means of equilibrating future supply and demand for manpower in both developed and underdeveloped countries, and more reliance placed on the use of projection techniques for estimating future surpluses and shortages of skilled manpower.

It is common for many underdeveloped countries to have surpluses along with shortages of certain skills. In order to understand why this situation should arise, one needs to examine the factors that determine the

supply and demand for various types of skills, and to consider the way the
market functions with respect to such skills. A fuller treatment than I
propose to give, would consider not only the determinants of the distribu-
tion of skills in an economy, but also the social, cultural, and economic
determinants of the supply and demand for such skills in the market. In
this brief outline the major question asked is why the market for skills
may not be cleared, especially in underdeveloped countries.

Harvey Leibenstein [43] distinguishes three ways in which the
terms shortage and surplus can be used. Firstly, in the sense it is used
in market theory, implying failure to clear the market; secondly, shortage
or surplus of a certain skill may be said to exist when there is too little
or too much of it to achieve a certain end; thirdly, shortage may refer
to factor bottlenecks in what would appear to be otherwise a feasible sit-
uation. Under the conventional (marginal productivity) economic theory,
the price system will operate in such a way as to eliminate surpluses and
shortages, but in reality it does not for a number of reasons. One possible
reason is that there exists fixed factor proportions with regard to certain
skills, such that the elasticity of substitution between skills is almost
zero, under certain technical or institutional conditions. Although substi-
tution elasticities of zero are very unlikely in reality, for certain types
of occupations they may be very low, and thus impose an intolerable burden
on the price mechanisms. Institutional arrangements may also prevent the
proper working of the price mechanism to reflect the demand and supply sit-
uation; such arrangements will then give rise to shortages and surpluses.
A lack of perfect information on job opportunities in the market, may lead

to a desire to stay in a particular market rather than risk the changes involved in entering a wider market. Furthermore firms in underdeveloped countries may not know all the possible techniques of production and the possible output outcomes associated with each different production technique, and thus overestimate the degree of factor rigidity among different types of labour. This may also result in the deliberate over-exaggeration of skill requirements for certain jobs. These distortions in the labour market may be even more acute when the long gestation lag between education inputs and outputs on the market is brought into the picture, and the additional fact that the market adjustment process via the price mechanism is subject to supply and demand type lags. It is for the above reasons, (and no doubt other more subtle reasons) that the manpower approach tends to reject the functioning of the market via the price mechanism to eliminate shortages and surpluses in the future, and rely more on the estimation of certain technological requirements for skilled manpower.

A further question that arises is whether the manpower approach is a planning approach or merely an example of the use of projection techniques and nothing more. If this is so, in what way does planning, as it is usually defined, differ from forecasting? Planning, which could generally be defined as aiming at the fulfillment of certain objectives, is somewhat different from forecasting, which could be defined as aiming at predicting future developments. The difference between the two, if often defined by the way in which autonomous variables are defined. In forecasting, autonomous parameters are determined on the basis of expected behaviour by public or private institutions (i.e. individuals). In the planning case, the value

of one or more parameters are regarded as targets, either in terms of def-
inite values to be assigned to certain parameters, or variables to be max-
imized. A priori, it does not make any difference to the forecaster/planner
from an analytical point of view. Thus as long as the values of the para-
meters are "given", it does not matter whether these values are regarded
as targets or not. The essential difference between the forecaster and
planner, is rather to be found in the choice of dependent variables. Plan-
ning. assumes or rather implies the possibility that policy makers (those
who make the targets) can influence certain parameters in the model, where-
as the forecaster cannot, and must rely on constant or fixed parameters and
coefficients. The forecaster will tend to use the parameter to which target
conditions have been assigned as his variable, and the instrument variable
in the planner's model being regarded as autonomous by the forecaster. This
difference in assumptions and conditions is essential to the understanding
of the theoretical impact of planning.   While the forecaster is not con-
cerned, as such, with the degree of optimality in his system, this is the
planner's raison d'etre. Empirically this means that the planner will have
to focus on the degree of optimality of different factor combinations and
distributions. A detailed knowledge of the actual technical relationships
reflected in his model is essential. In the sense that the manpower approach
is not concerned with optimality, but rather with the prediction of manpower
requirements in the future on the basis of a projected pattern of final de-
mand, industrial and occupational structure, it would be difficult to con-
sider it anything more than a tool of educational planning, as indeed are
the previously mentioned approachs. The contention that the manpower ap-
proach is basically nothing more than a forecasting approach, is borne out

when the approach is examined.

One can conceptualize the manpower approach on two levels: at either the production requirements level, or at the consumption demand for education services level. The first method involves forecasting the production requirements for different levels of manpower, whereas the second method involves estimating the overall social and economic demand for education on the basis of income elasticities of demand for education. In reality the manpower approach as used, has concentrated on estimating future labour requirements along similar lines to those sometimes used in projecting the demand for the factors. In the manpower approach the price aspect is ignored or considered unimportant for projection purposes, and there are fixed or determinable labour-output coefficients for the various types of labour. The end goals of a manpower forecast are estimates of the numbers of people required at the forecast date in each economic activity and occupation and estimates of the numbers of people who must be trained to meet these requirements.

The starting point is an analysis of the current structure of employment by economic activity (sectors and industries), and occupational groups, further subdivided by educational and training attainments, age, and sex. Then the civilian labour force must be estimated for the forecast year, and perhaps for one or two intermediate years, depending on the length of the forecast period. Labour force requirements of individual sectors must then be projected, and then summed to find the total anticipated labour force. Forecast employment in each sector must then be allocated to occupational categories, and thus the estimated demand for various types of manpower at

the target year is arrived at. The problem now occurs of translating these occupational requirements into educational requirements of both a general and specific nature. From the estimates of educational requirements, the required inflow to the labour force of trained personnel can be derived. This involves subtracting from these figures, for planning purposes, the anticipated retirements, deaths, withdrawals, and emigrants, during the forecast period from the current stock of workers. A comparison of the expected needs and the expected remaining stock of workers indicates the inflow of workers of each type that will be needed over the planning period. The resulting figures can then be matched with the anticipated supply of people in each occupation who will be entering the labour force over the time horizon of the plan. Thus proper manpower planning involves both forecasts of production needs and projections of the number of students entering the educational system. The comparisons of production requirements with the anticipated supplies of labour force entrants will indicate whether existing educational facilities are adequate and of the right type to provide the training required by the labour force of the future, or whether, if current enrollment trends continue, surpluses or shortages of skilled people may arise. Appropriate policy decisions might then be taken to ensure the desired occupational mix. [44, 45, 46]

Criticisms of the manpower approach as presented here can be on the basis of ideological or ethical considerations or merely on the basis of mere practicability. Those who would argue against the approach on ideological or philosophical grounds, generally base their criticisms on the con-

tention that the "true" purpose of education is to contribute to an individ-
ual's personal development, and thus an approach to educational planning that
is essentially economic in its orientation and which seems to use society's
needs for a "human capital" as a basic criterion, is immoral or unethical,
to say the least. This criticism however could be flung at all the approaches
described in the essay. On the other hand, there are those who profess no
philosophical objections to the manpower approach, but who feel that the im-
possibility of making valid long term forecasts of manpower needs makes
this approach dangerous, the more so because individual careers can be
wrecked if people pay too much attention to faulty official forecasts.
This point of view holds little water when one compares the possible payoff
between the prospects of a long period of unemployment due to not listening
to correct official forecasts, rather than heeding a possible guideline to
future employment possibilities. In this sense the value of the approach
in suggesting possible strategic bottlenecks or possible chronic surpluses
in the process of development in underdeveloped countries is self-evident.

On more practical grounds, the approach suffers from a large num-
ber of empirical difficulties. It virtually ignores the consumption aspects
of education, and the probably very high income elasticity of demand for
education in developing countries due to this consumption component. The
approach may succeed at its very best in estimating the private production
minimum requirements for educational facilities, but not minimum social re-
quirements. This social element in education will vary greatly with the ob-
jectives of the various countries, and will thus also vary greatly in size.
The possible fluctuations in business activity over time will affect the demand
for various types of skills; and unless these fluctuations can be accurately

predicted, shortages and surpluses are bound to arise. Factor prices may also change over time, especially with regard to different types of skilled labour, that may have a disincentive effect in terms of market response to undertaking a certain type of education in the short run. Also as prices of different types of labour change, so also will the labour output co-efficients and thus the quantities of each type of labour in the production process, that is the price elasticities of demand for factors may not be zero or near zero, as the manpower approach assumes. This is an argument for more flexibility in the education system, rather than strict vocational training programmes, in the form of a more general education. This view is enforced by the impossibility of predicting the progress and pattern of technological change over time. A further difficulty is that preparation for various jobs can be obtained by a number of different routes, viz. apprenticeships, on-the-job training, and formal education. A whole range of difficulties arises regarding the type of facilities that should be provided, which is the most efficient approach, and what quality of worker is required. The difficulty of interpreting occupational requirements in terms of educational requirements is not overcome in this approach. Associated problems include what pupil-teacher ratios should be assumed, and what type and length of training the teachers themselves should have.

It is difficult to arrive at any fundamental conclusions with regard to the manpower approach, other than to note that it suffers, as do the previous approaches from a certain degree of imperfection in its imple-mentation. The fact that it is used as a basis for educational planning in many, if not most underdeveloped countries, is possibly a tribute to its being slightly less inaccurate than the other approaches and also to its

being possibly easier to compute.

Manpower forecasting, although far from an ideal approach to rational development of educational resources, does at least provide a framework for analysis and a guide to the collection of additional required data, in a way that no other method possibly does. To close on a note of qualified optimism, I would like to quote from Wilkinson, who notes that although:

> . . . manpower planning is not an exact science . . . (in fact)
> at best it is an art, still in its infancy . . . . (to delay plan-
> ning until) our data were complete and a fool proof methodology
> were developed . . . (would mean that) no forecasts of educa-
> tional needs would ever be made . . . . (Furthermore,) the enor-
> mous outlays on education today and in the future demand that we
> at least make a determined effort to determine how we can best
> allocate these expenditures to meet our needs efficiently. [47]

V. THE ECONOMETRIC APPROACH

The use of econometric models for assisting educational planning is a comparatively recent development in the field, and they fall into two major categories; those based on input-output approach, and those relying mainly on linear programming techniques. For the most part they have sprung out of the previous manpower approach to educational planning, in the sense that they are conceptually and methodologically very similar. The two different types of model arose out of a need for a more rigorous statement (i.e. in mathematical terminology) of the problems facing the manpower approach, namely those of intertemporal consistency and balance in the growth of the educational system, and those associated with optimizing problems both between the educational expenditures and other expenditures, and between the different types of education (sub-optimizing problems).

In this section I propose to examine only one model, that of the input-output type, and to leave the linear programming models to a later paper. [48] This model is the simple input-output model as first developed by H. Correa in his book, [49] and presented in a more simple fashion in a joint article with J. Tinbergen in _Kyklos_, 1962. [50]

The original simple model consisted of six linear difference equations, designed to take into account the following characteristics of the relationship between economic development. Firstly that economic life needs a stock of qualified manpower, and the flows of graduates from secondary and higher education represents at any one time "a very small portion of this stock." [51] Secondly, education often consists of a series of successive stages, each depending on the former level for its supply of new re-

cruits. Thirdly, that part of the stock of qualified manpower must be used

in the education process itself, in the form of a "feed-back" into the edu-

cation system in the form of teachers. Fourthly, qualified manpower may be

imported, to meet initial shortages that may develope especially in the in-

itial stages of economic growth. Thus the simplicity of the model is jus-

tified by the authors on the grounds that on the basis of clarification,

" . . . it brings out some of the basic properties of the mechanisms." [52]

Furthermore the model does not aim at a complete description of the educa-

tional system under the forces of supply and demand, but rather it aims to

describe the demand flows of various types of qualified manpower to be ex-

pected from the organizers of production and education. Thus:

> The purpose of their model is to aid in the process of planning
> for education and for labour market policies, tacitly assuming
> that ways and means can be found to induce the population to
> seek the desired education. [53]

The complete model, as first presented, is designed to bring out

the relationships outline above, and the importance of stocks and flows in

the education system. It consists, as previously mentioned, of six linear

difference equations.

The following symbols are used, leaving out the time index t:

V : total volume of production (income) of the country.
N^2 : the labour force with a secondary education.
N^3 : the labour force with a third level education.
m^2 : those who have entered the labour force N^2 within the previous 6 years.
m^3 : those who have entered the labour force N^3 within the previous 6 years.
n^2 : the number of students in secondary education.
n^3 : the number of students in third level education.

(1) $\quad N_t^2 = a^2 V_t \quad$ where $a^2 = $ a technical coefficient $= .2$ (U.S. data).
Thus the number of people with secondary education in the labour

force, is directly proportional to the volume of production,
thus if a^2 is constant, then this relationship will hold over
time.

(2) $N^2_t = (1-\lambda^2)N^2_{t-1} + m^2_t$ where λ^2 = a "disappearance" or dropout ratio per
unit of time from the secondary level educated lab-
or force.
$$= .01.$$
Thus the number of people with secondary level education in the
labour force, is also related to the previous period labour
force with secondary education, plus the additional entrants
within the previous six years.

(3) $m^2_t = n^2_{t-1} - n^3_t$
Thus the number of newcomers to the labour force with secon-
dary education is equal to the number of students one time
earlier minus the number of students now in a third level ed-
ucation.

(4) $N^3_t = (1-\lambda^3)N^3_{t-1} + m^3_t$ where λ^3 = a "disappearance ratio" = .01.
and λ^2 = .01.
Thus the number in the work force with third level or higher ed-
ucation equals the number in the work force with third level or
higher education in period t-1 reduced by a proportion (λ^3 = .01)
who die or retire plus the entrants into the work force of stu-
dents in one year t with third level education.

(5) $m^3_t = n^3_{t-1}$
Thus the number of newcomers into the labour force with third
level or higher education, equals the number of students in the
third level of higher education in the period t-1.

(6) $N^3_t = a^3 V_t + \pi n^2_t + \pi n^3_t$ where a^3 = a "technical coefficient" = .02.
π^2 = the teacher/student ratio for those with
higher education who are teaching at sec-
ondary level = .04.
π^3 = the teacher/student ratio for those with
higher education who are teaching at third
level or higher education = .08.
Thus π^2 implies a student/teacher ratio = 25:1.
and π^3 implies a student/teacher ratio = 12.5:1.

The authors stress the need for educational planning and exten-
sion of the educational system over time. They mention the long lags between
inputs into the educational system, and the final output, in the form of
qualified graduates. In fact if every process of education takes six years

to complete (which they assume), then the three processes of primary, secondary, and higher education, require an educational cycle of eighteen years. However, in their model only the two latter processes are considered, since the primary level of education is not recognized as a bottleneck to the expansion of the secondary and higher processes. This assumption is a very extreme one to take especially with regard to underdeveloped countries, where the expansion of secondary and higher education, due to the very nature of the successive nature of the system, is conditional upon the expansion of primary education.

Correa and Tinbergen were interested in the quantitative changes in the structure over time as it adapts and responds to the requirements of the educational planners (or goal setters). These quantitative changes they were interested in took the form of asking three main questions.

(1) What structure of the educational system is required to let the economy grow at a given rate, and how does the educational system change with that growth rate?

(2) What foreign assistance (in the form of imported teachers or manpower) is needed if the growth of the economy is to be accelerated without changing the technical coefficients of either the economy or the educational system?

(3) What adaptations are needed if the same acceleration is to be obtained if there is no foreign assistance?

The answers to these questions are uninteresting in the light of the extreme simplicity of the original model, and will consequently not be examined. Balogh's criticism of the "Cavalier approach" taken by the two authors, [54] is somewhat unjustified in view of the explicit statement by them, that the model was not intended to be more than an introduction to the problem of a mathematical approach to planning. One can however, criticise the basic structure of the model. [55, 56]

The assumption that a given output requires a fixed volume of manpower with fixed amounts of education and training, is a very extreme limitation on the flexibility of the model, and deprives the educational planner of one of the most valuable methods of varying the manpower requirements with variations in labour intensity in industry. The same is true of the relatively inflexible nature of the other parameters, especially the teacher/student ratios. This ratio is one of the most important strategic policy variables in the hands of educational planners, who by varying the ratio can greatly affect the production rate of the educational system, and also minimize the teacher supply bottleneck in underdeveloped countries. The fact is that considerable latitude exists for substitution of labour for capital and vice versa, and for substituting additonal manpower education for manhours, i.e. via automation, it may be possible to produce the same output with a smaller number of well trained workers. In short, the choice of technology and its implications for education, is a major aspect of development planning, as is the choice between more education and training and less employment, or less education and training and more employment in each sector. Owing to the fact that the model is at such a high level of aggregation, it has the disadvantage when applied to underdeveloped countries of failing to anticipate certain strategic bottlenecks, that may hold up economic growth.

The model suffers, as do the other approaches outlined, from too much emphasis on the investment aspects rather than the consumption aspects of educational expenditures. To plan the requirements for education on the basis of fixed production coefficients will seriously underestimate the over-

all social requirements. As Wilkinson has remarked:

> The basic weakness of the model stems from its being nothing more
> than an adaptation of the popular two sector physical capital
> models involving a fixed capital-output ratio, (cf. q^2 and q^3), al-
> lowance for depreciation, (λ^2 and λ^3), and real capital from one
> sector being used to produce the output in the second sector. [57, 58]

Due to the model's similarity to the capital models, there are
more of the problems in the capital models incorporated in its structure.
The assumption that only higher level educated manpower teachers in the
secondary level of education, is but one example of the attempt to approx-
imate a physical capital model, along with the limitation to only two
"sectors", the secondary and higher education levels. In addition the
model works on the implicit assumption that there is some sort of existing
optimum educational structure in the initial planning period, such that no
shortages in that period need to be eliminated. Many more criticisms of
the original model and the subsequently developed models could be presented.

From this brief exploration of one model used in the so-called
"econometric approach" it is evident that as a basis for decision making and
educational planning it leaves much to be desired. In common with the pre-
vious approaches, it suffers from a large number of statistical, methodol-
ogical, and practical difficulties and limitations, but this should not be
allowed to detract from its usefulness in helping the educational planner to
conceptualize the problems he faces. The only really meaningful conclusion
one can arrive at from the examination of the approach, is that the planning
of education in developed and especially underdeveloped countries, is still
very much an art, with a heavy reliance on informed judgements or "guess-
timates", even in the "econometric approach".

CONCLUSION

The various approaches to educational planning, examined in this essay have all shown, in different ways, the major problems facing planners desiring to obtain objective criteria for the allocation of resources to education, even in developed countries.

The human capital approach, in which education is considered in terms of investment in human capital, suffers from a large number of statistical problems, such as the measurement of the returns to education in the form of income streams. Problems also arise over the choice of the appropriate rate of discount to use in deriving present values for educational investment. To what extent are the returns to private education only private returns, and how large are the external social costs and benefits of education? Furthermore, how can one successfully distinguish between the consumption and investment components of different types and levels of education? It appears that no definite criteria can be obtained for planning and appropriate "mix" of education for developing countries using the human capital approach. If educational investment is to be maximized for growth purposes, it could be argued that vocational rather than formal education of a specific type should be emphasized, but even this may lead to a rather narrowly based technical type of education, that introduces rigidities into the educational system and prevents a flexible adaptation to rapid economic growth.

The residual approach also remains unsatisfactory for planning education in underdeveloped countries. Little work has been done on the size of the residual and the importance of improvements in labour quality towards increasing factor productivity and growth. The existing literature suggests that the residual is a "catchall" variable, including such diverse

components as education, health, housing, social security, economics of scale, etc., and consequently presents almost insuperable problems in "disentangling". The work of Denison has gone a long way toward isolating the contribution of education to growth of national income per capita, but not far enough to state with any certainty that a given amount of investment should be allocated to various types of education. The assumptions underlying the use of Cobb-Douglas type production functions also increases the scepticism over the interpretation of the size of the residual. Solow's "Vintage" model, for example, successfully incorporates most of the residual back into the labour and physical capital variables in the form of "capital embodied" and "labour embodied" technical progress. [59] As with the human capital approach, few clues are forthcoming for criteria to select the optimum level of investment in education in underdeveloped countries. The highly aggregative nature of the analysis does not permit this.

The use of educational indices (such as teacher/student ratios, educational expenditures and enrollment ratios in relation to G.N.P.) has certain planning advantages in terms of simplicity. But comparisons between countries and over time of such indices, do not necessarily imply that desirable levels of educational expenditures can be derived. Educational planning theorists who argue that every country should have an educational system geared specifically to that country's needs, would also look upon such an approach with considerable doubt. Since it is almost impossible to predict an individual country's time path of development with any degree of accuracy, it would also be precipitous to base future educational expansion and the desired eduational structure on indices obtained from the history of economic development of other countries.

The manpower planning approach, suffers from similar methodological, conceptual, and statistical problems to the educational indices approach, in that it is impossible to accurately predict future manpower requirements in relation to future economic growth. It is also impossible to accurately assess future supply and demand conditions for different levels of skilled manpower in the labour market in rapidly developing countries.

The highly mathematically sophisticated econometric approach, relies on a large number of value judgements as to the "desired" nature of education. The attempts by Tinbergen, Bos, and Correa to develop an internally consistent econometric planning model for education can only be considered rudimentary to say the least. However it is a start to perhaps more sophisticated educational planning models that may provide important indicators of the structure and development of education for developing countries.

Ideally educational planning policy makers in underdeveloped countries should not, and indeed generally do not, concentrate on any one of the approaches mentioned, but should judiciously integrate them——if for no other reason than to minimize the possibility of committing a major planning blunder. Although each approach has its major shortcomings, collectively they may provide very useful tools for planning education in developing countries.

No one would advocate that educational planning can be reduced to a completely quantitative dimension, indeed this would be tragic, in the sense that many unquantifiable qualitative phenomena (cultural, social, political, and economic) may be the most important ingredients of an educational plan for underdeveloped countries. The possibility and dangers of neglecting the "human" element and concentration on the "human capital" elements of education are very real in a narrow economic approach.

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do manual work requiring little knowledge and skill, a capacity with
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