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An Evaluation and Inventory of Educational and Manpower Planning Models : An Updated Review

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Abstract

The paper reviews the literature on economics of education, in general, and the variety of models that have enriched educational economics so far. It covers a wide area and furnishes an overview, and at times critical review of a large number of models. The models covered by the review may be broadly divided into following groups : (i) Manpower, (ii) Cost-benefit, (iii) Programming and other optimising models, (iv) Models of educational demand, and (v) Unit-cost.

The Economics of education and manpower planning is a new branch of economic theory which has developed rapidly during the post-second World War period. Education has drawn attention in the context of its widely recognised roles : (a) educational system supplies qualified manpower to meet the requirement of the economy (b) it is widely recognised that human inputs are as important in the process of production as material inputs, since education contributes significantly to the growth of an economy, (Blaug, 1968), (c) education accounts for much of the improvement in the quality of population. (Schultz, 1981) highlights the fact that investment in the quality of population and investment in education together determine the future prospects of mankind. Since education is so important for a country's economic development, educational planning must accompany economic planning. In the absence of educational planning, either the excess supply of manpower will lead to unemployment or underemployment or scarcity of high level manpower will hinder development.

This brief survey focusses on selected major issues of manpower, educational planning and policy arising from the variety of models that have been developed and used around the world, in general, but with special reference to India. Though the field is of very recent origin, yet the volume and variety of work have been growing rapidly. This article can do no more than summarise the major areas and problems which have been studied so far. The literature is now vast, and has grown rapidly. We may classify different models and approaches under following headings:

1. Models of Manpower Requirements
2. Cost-Benefit Models
3. Programming and Optimum Growth Models
4. Social Demand Models

Models of Manpower Requirements

This is the most popular approach to educational planning. It intergrates the educational planning into economic planning in general and employment planning in particular. The main purpose of this approach is to achieve an inter-sectoral balance between education and production sectors of the economy. The output of education, that is, educated and skilled manpower must be consistent with the economy's requirements of manpower. The objective of manpower requirements approach to educational planning is to determine (a) the requirements of manpower in different occupations in various sectors during the given time period, (b) translation of the manpower requirements in various occupations into different levels and types of education, (c) modification and adaptation of the educational system according to the projected requirements of educated manpower. The projection of future manpower requires a comprehensive picture of the growth of output in various economic sectors, changes in technology and the emerging demand patterns. Hence, the planning of education to meet manpower requirements implies global planning. This approach can be divided into the following steps:

Labour Use Patterns in Base Year

The distribution of labour employed by sector and skill and the pattern of distribution of output among sectors are brought together in order to derive the labour utilisation matrix in the base year. We may call it B^0. The typical element of it $b°_{(ij)}$, is derived by dividing $L_{(ij)}$, Labour of skill i employed in sector j in the base year by Y(0), output of sector j in the same period ;

$$B^0 = [\, b^0_{(ij)}] = (L^0_{(ij)}/Y_{(j)0}) \qquad \text{(i)}$$

Then, the following identity should hold :

$$L^0 = B^0\, Y^0 \qquad \text{(ii)}$$

The typical element of the vector L^0 being

$$L^0_j = \sum_i L^0_{(ij)} = \sum_i b^0_{(ij)}\, Y^0_{(j)} \qquad \text{(iii)}$$

Labour Utilisation Adjustment

The reciprocal of the labour utilisation coefficient represents the labour productivity of skill i in sector j. Since labour productivity grows over time, this would be overly simplistic to use the base year labour utilisation matrix as such for planning. It should be corrected to allow for the probable growth of labour productivity. Let us call the adjusted matrix B^.

Occupational Forecast

The ajusted labour utilisation matrix B^ is applied to the target year output vector Y^t in the order to obtain an estimate of the labour required by skill in the target year t. It can be summarized as follows :

$$L^t = \hat{B}Y^t \text{ or } L_{it} = \sum L^t_{(i)} = \hat{\sum} b_{(ij)}\, Y^t_{(j)} \qquad \text{(iv)}$$

One of the disadvantages of the ordinary version of the manpower requirements approach is that it does not take into account the indirect cross-sectoral effects on the demand for manpower. To overcome this limitation , it was found useful to integrate educational planning into economic planning in the input-output framework. Educational system is also like the economic system, that is, a system of connected processes. Students enter this system as raw materials, pass through it as fabricated work in progress, and finally go out of it as finished product.

(Prakash, 1976). Thus, there is the use of inputs for the production of output in the educational process. Output of the educational institutions is the input in other sectors producing output of other goods/services, which in turn, may enter as inputs in production activities.

Pioneering studies of educational planning in input-output framework have been done by Tinbergen, Bos (1965) Correa (1962-63), Thonstad (1964), and Stone (1965, 1966). Input Output models of educational planning have been developed by Prakash (1971b, 1976, 1978, 1989a, 1989b). Correa (1962) developed a mathematical model of education which was modified by Tinbergen and Correa (1963). It was further extended by Tinbergen and Bos (1965). The model examines the balanced growth path of the educational system along with the rest of the econmy. The model determines equilibrium growth of manpower with different levels of education, that is primary, secondary and university education. Tinbergen and Bos revised the model by introducing the more generalised demand function for manpower of different types, explicit treatment of drop-outs of the educational system, problems of retirement, attrition and disaggregation of national economy into sectors having different fixed manpower requirements. The model has been applied to the data of several countries under an O.E.C.D. project. Sen (1968) critically evaluated the Tinbergen Bos-model and discussed several limitations like constant rate of retirement and fixed labour coefficients of the model. It has been reviewed subseqently by Sengupta and Fox (1969) and Prakash (1977). Prakash has suggested modifications of even Sen's formula for determining the attrition rates for accounting sex and age specific differentials in these rates.

Stone (1965, 1966) developed an inter-temporal and multi-sectoral input-output model of education. Educational system is defined as a chain of inter-dependent processes. This model is analogous to an open dynamic input-output model where the number of students enrolled in a given year are shown as functions of future vectors of graduate leavers. He designed an input-output accounting matrix with the number of students as inputs and graduates leaving the system as output. He makes an allowance for wastage, drop-out, and technological changes. stone's demand determined model does not discuss the cost of education or the returns on educational investment. It is, thus, assumed implicitly that private returns to education are higher than private cost (Sengputa and Fox, 1969). His model basically addressed itself to the determination of the time patterns of the production of the output of qualified graduates and its intrinsic interrelations with student's inputs as enrolments in educational system. It, thus, implicitly relates exclusively to the supply side of manpower, on the one hand, and the supply side of students as inputs into the educational production processes on the other. It, thus, takes private demand for education, more or less, as autonomously forthcoming. The model has been discussed critically by Sengupta (1969) and Prakash (1977). As against Sengupta, Prakash opines that economic inputs required for meeting specific educational output targets have been explicititly considered in the model. Sengupta may, therefore, not be correct in saying that Stone neglects educational cost.

Armitage-Smith-Alper developed a model to study the internal dynamics of the educational system. The model can easily be extended to deal with the problems of failures, passes and the graduate leavers. This model is not concerned with the determination of links between the educational system and the national economy.

An important study using manpower forecasting approach to educational planning in India is by Burgess, Layard and Pant (1968). This study formed the basis of the report of the Education Commission (1964-66). The study clearly defines the structure of employment in India by levels of education and by industry on the basis of 1961 census data. Then, they estimated the high level manpower requirements of various educational categories on the basis of several assumptions about the sectoral growth rates. The economy was divided into fifteen sectors and targets of the sectoral output were fixed for the period 1961-86. It was assumed that the number of workers with matriculation and above will grow at the same rate as the net output of each sector of the economy. It, thus, implies the fixity of labour coefficients and hence, proportional growth of employment and output. They projected the sectoral expenditure and concluded that in service sectors other than trade and transport half of the matriculates and two third of the graduates will be employed as per the fixed and given norms. Sen (1970) observed critically that the estimates by Burgess et. al. (1968) are overestimates. Similary, the sectoral growth rates are very much higher than the rates observed during 1956-61. Tilak (1975) noticed that the study ignored the issue of chronic unemployment of various kinds of skilled labour in the economy. Tilak's observations would have been relevant if the study estimated either actual supply or unemployment. It rather aimed at the estimation of likely employment.

Two alternative input-output models for educational planning in India have been developed by Shri Prakash (1971b, 1976, 1978). The models deal with the methodologies of estimating the manpower requirements on the basis of a given rate and pattern of future economic growth and the techinques of determining the supply of personnel with different types of educational qualifications. Thus, the models deal both with the demand and supply sides of the equation. Initially, he has analysed data with the assumption of constancy of various coefficients like labour coefficients. Subsequently, he relaxed the constancy assumption. The models deal with the flow of inputs and output of the educational system. The model can be expressed in matrix form. If matrix A has the ordered coefficients of repetition and transition, B matrix has the ordered elements of drop-outs and coefficients of leavers, G, H, C are diagonal matrices, then

$$A.n(T-1) = n(T)$$

$$B.n(T) = S(T)$$

$$C.An(T-1) = S(T)$$

$$l(sT) = g(s)$$

$$n(T) = A^{-1} n(T-1)$$

Graduate leavers of the system are expressed in terms of enrolments by the inverse of B. Graduate leavers may be related to the enrolments of preceding year through inverses of A and B matrices :

$$n(T) = B^{-1} S(T)$$

A^{-1}, B^{-1} describe the available educational technology and facilitate the computation of both direct and indirect requirements of students' inputs per unit of final delivery of qualified manpower of each type. It may be noted that the elements of A and B are arranged in a highly specialised manner to furnish the simultaneous solution of several variables. Leading diagonal of A has the coefficients of repetition and the sub-diagonal elements just below the leading diagonal are the transition coefficients. Matrix B has coefficients of leavers in the main diagonal and coefficients of drop-outs in the sub- diagonal just above the main diagonal. This model has been empirically tested with Indian data. It is found that the difference between the actual and estimated parameters at every stage is very well within the limits of tolerance. The models have also been estimated by dropping the assumption of constancy. This model deals with only the supply side of manpower requirements without considering the demand side. The general criticism against the assumption of fixed input-output coefficients does not apply to this model as the assumption has been dropped in empirical exercises. In a theoretical model in input-output frame work for educational planning, Sen (1969) analysed the inherent interdependency of the educational system. The students are current inputs, teachers are capital inputs and the 'educated' students are the output. Thus, the output of education activity i is represented by :

$$X_i = \sum_{j=1}^{n} X_{(ij)} T_{(ij)} + N_i + W_i + U_i$$

where

X_i = Output of students of i-th education activity

T_i = Teachers' input into i-th education activity

N_i = Supply to labour market or employed manpower

W_i = Involuntarily unemployed

U_i = Voloontarily unemployed

X_{ij} = Supply of students' inputs from i to j-th education activity

Further, the model assumes that the demand for educated labour is given independently and the degree of unemployment is exogenously determined. After making adjustment of drop-out rate in student enrolments, retirement of teachers, the flow patterns of enrolments, students at various levels of education can be marked out from the equation :

$$X_i = \sum_{j=1}^{n} a_{ij}K_jX_j + \sum_{j=1}^{n} n_{ij}K_jX_j + Q_{in_{ij}}k_jX_j + N_i + W_i + U_i \qquad i=1,2.....n$$

where $a_{ij} = X_{ij}/Y_j$

$Y_i = K_iX_iY$ is the current enrolment produced or required students' output,

$K_i = [1/X_i]\,[1/(1-d_i)T_i]$, d_i is the uniform rate of drop out

every year, and t_i is the period of the course

$T_{ij} = [n_{ij}\Delta Y_j + O\, n_{ij}\, Y_j]$

n_{ij} = The student teacher ratio

O = The rate of depreciation of the stock of teachers.

This model, like Shri Prakash's model referred above, provides the theoretical underpinning of an equilibrium system. But Sen's model needs empirical verification.

A worth mentioning attempt using I-0 techniques is by Ramanujam (1973) which is based on the labour output relation in the year 1964-65. Ramanujam estimated the requirements of manpower with different educational levels for the period 1975-76 and 1980-81 at the annual compound rate of growth of eight per cent. He made two sets of projections, one on the basis of the Manne-Rudra table and another on the basis of 77 sectors table. Ramanujam followed the method used by Rabindra Nath (1967) by and large, which, of course, is the standard input-output procedure. The major limitation of the model is that this covers wage employment only and ignores self-employment and wage employment paid in kind. As a result, his projections are underestimates. Reference may also be made to the study by Veena (1974) for the State of Gujarat in India. Dalvi also developed an I-O model for manpower supply and for manpower demand with the data for Newfoundland. Significant contribution has also been made, among others, by Parnes (1962a, 1962b). Mehta (1981), Sinha (1967) and Pandit (1969).

Shri Prakash (1971a) projected occupational-educational structure of manpower for two public sector industries. His paper is mainly methodological where he has tested the sensitivity of the results to the relaxation of the core assumptions of the input output model with the data of two industries. He concludes that the labour coefficient approach is approporiate from the point of view of educational planning. In another case-study of Hindustan Steel Limited, Shri Prakash (1973) tested the stability of labour coefficients at different aggregated and disaggregated levels with the change in output and product mix. In this study, he disaggregated labour force into various occupational levels. It is found that the labour coefficients at aggregate level are relatively more stable than at disaggregated level. Hence, he justifies the stablitity of labour coefficients at industry level in short-run, if technology remains the same. Nath's (1967) study deals with the estimation of personnel input coefficients for 57 occupations and 17 industrial sectors using ASI data and I-0 tables of 1959. Bhardwaj and Bhagwati (1971) estimated human capital requirements of Indian foreign trade. They estimated sector-wise percentage of skilled and non-skilled workers to total employment on the basis of wage differentials, using Harberger's estimates (Harberger, 1965) of rates of return investment in education in India to compute the estimates of human capital directly and indirectly employed in 36 sectors of the Indian economy. Thus, this study extends the horizons of manpower planning by bringing foreign trade within its fold.

Cost-Benefied Models

Cost-benefit analysis is also known as "rate of return" analysis and is similar in principle to the procedure followed in general investment/project evaluation. The fundamental ingredients of the cost-benefit analysis in education are age-earnings profiles by educational levels. In some cases, like Gould (1972), Psacharapoulos (1975), only average (overall ages) wages by school leavers have been used. Under these circumstances a rate of return could still be computed through the following formula :

$$r_h = [\bar{W}_h - \bar{W}_{h-i}]/s[\bar{C}_h+\bar{W}_{h-i})]$$

where C_h is direct annual cost of schooling, W_h is the average (not age-specific) wage rate and s is the length of the school cycle in years. The human capital earnings (y) are regressed on years of schooling and years of labour market experience (Ex) in a semi-logarithmic form :

$$\ln Y = a + bs + cEx = dEx^2$$

so that the rate of return is $b = \delta \ln Y/\delta s$

which may be put in discrete form for expository purposes :

$$b = (\ln Y_s - \ln Y_0)/\Delta s$$
$$= [(1-Y_s/Y_0)]/\Delta s$$

where Y_s and Y_0 refer to the earnings of those with s and 0 years of schooling respectively. In a non-competitive labour market, where the existence of monopolistic and institutional elements create distortions, the observed earnings cannot reflect the social marginal product of labour. Hence, it cannot be used to estimate the social rate of return to investment in education. In such cases, the need for shadow pricing arises. The fômal way of finding the intrinsic or shadow price (MPi) of labour with educational level i is to first specify and fit a production function of the general type :

$X = f[K, L_1, L_2, L_3]$, where X is output, K is capital and L_1, L_2, L_3 are the amounts of labour with, for example, primary, secondary and tertiary education used in production.

Shadow rates of return can be used in an ex-post sense to determine existing misallocation of educational investment (Harberger, 1971), or they can be used in an ex-ante sense for simulating the allocative effects of projected manpower requirements in the synthetic method of educational planning (Psacharapoloulos, 1979).

It may, however, be noted that the conventional method of estimating economic value of education from the age-education- earning profiles or average earnings furnish understimates of the true value of education as inter-sectoral linkage effects are neglected. It has been recently highlighted by Prakash et. al. (1989) that indirect contribution of education to income may be important conceptually and substantial empirically. They have developed a comprehensive input-output model having education as one of the endogenous sectors of the economy for estimating both direct and indirect contribution of education to income. Their calculations for the Indian economy (1959-60, I-0 table) have highlighted (i) relative dimensions of the two magnitudes, (ii) data requirements, and (iii) estimation method.

Programming and Optimum Growth Models

Linear programming is a technique for the mathematical solution of a constrained optimization problem. As such, it has been used in educational planning by formulating an objective function to be maximized or minimized subject to a set of resource constraints. The Bowles' model has been designed to answer the most pressing question facing the educational planner, namely how to allocate resources within the educational sector. The model assumes that the level of admission(s) by school type(s) is the main variable to be optimized (Bowles, 1967). The following set of equations presents the basic structure of this model developed for a period of one year.

Objective function

Max. $Z = U_1 S_1 + U_2 S_2 + \ldots\ldots\ldots$

Subject to $c_{11} s_1 + c_{12} s_2 + \ldots\ldots\ldots\ldots \leq G_1$

input constraints $c_{21} s_1 + c_{22} s_2 + \ldots\ldots\ldots\ldots \leq G_2$

activity bounds $s_1 \leq s_1 \leq s_1$

$s_2 \leq s_2 \leq s_2$

with non negative constraints $s_1 \leq 0$ and $s_2 \leq 0$ .....

Gs are the availability of school inputs.

The model developed by Adelman (1966) is a linear programming dynamic model of the entire economy which aims to lead to the optimum resource allocation between different levels of education and between the educational sector and other sectors of the economy. The Bowles' model could be considered as being a special case of the general Adelman's model. The production level of the various economic sectors compete for the use of resources along with the educational sector. On the technology side, the coefficients of an input-output table are used along with those representing educational technology.

The model relationships could be divided into two parts : those referring to the educational sector and those referring to the rest of the economy :

Max $z = u_1 s_1 + u_2 s_2 + \ldots\ldots\ldots + f_1 + f_2 \ldots\ldots$

subject to

$[I-a_{11}]x_1 - a_{12}x_2 - .... - f_1 \geq 0$

$- a_{21} x_1 + [I-a_{22}]x_2 - .... - f_2 \geq 0$

$e_{11}s_1 + e_{12}s_2 + ... G_1$

$e_{21}s_1 + e_{12}s_2 + ... G_2$

$-w_{11}s_1 - w_{12}s_2 + ... + b_{11}X_1 + b_{12}X_2 + ... \leq L_1$

$-w_{21}s_1 - w_{22}s_2 + ... + b_{21}X_1 + b_{22}X_2 + ... \leq L_2$

In matrix form, model appears as follows :

$\text{Max } Z = VS + iF$

subject to $(I-A) X-J \geq 0$

$ES \leq G$

$-WS + BX \leq L$

In this model, education contributes to the creation of occupational skills through labour coefficients(w). The last constraint links the educational sector to the economy as a whole. Educated persons contribute directly to GNP (via their future discounted earnings) and at the same time they provide the necessary skills to produce the output of the other sectors. Synthetic educational planning models offer a compromise between the polarised assumptions of the manpower requirements approach and the cost-benefit model (Psacharopoulos, 1979). A synthetic model takes substitution into account by utilising a value other than zero or infinity, and by considering the cost and benefits of satisfying alternative manpower development strategies. This is gengerally performed in a two-step process. First, an estimate of the likely shifts of demand for different types of labour into the target year is arrived at by means of the manpower requirements approach. Second, the economics of proposed labour skill structure is examined by shadow pricing the different kinds of labour and arriving at the marginal products. If on cost benefit grounds the target year skill structure is not profitable, an alternative structure is proposed within a feasible substitution range. This is also known as iterative planning.

Benard (1967) maximises welfare function subject to constraints of human resources, educational facilities, etc.. Biswas et al (1975) applied linear programming techniques to Indian education system. Enrolments at various levels of education are maximised for the year 1963-64 subject to natural constraints, budget constraints, teacher-student constraints, etc.. The last one is a constraint on the quantity of education, while other constraints are qualitative in nature. This study reveals that actual enrolment level in 1963-64 is below (estimated) optimum if all stages of education are taken together. In professional education, it appears that the actual levels are more than optimum, which implies that there is over-investment in professional education. The programming models are useful in the decision making process in educational planning for the given objectives. But assumption of a welfare function is arbitrary; and lots of contradictory inferences may be drawn from assuming different and equally justifiable welfare functions.

Gautam Mathur (1964) developed a model of activity analysis and demonstrated that there is a close link between education and economy. He proposes the strategy of according higher priority to basic goods and education sectors to obtain the steady state growth of the economy.

However, he has used hypothetical rather than actual data. Recently Prakash (1989) using P.N. Mathur's solution of a dynamic input-output model translated Gautam Mathur's model into an input output model of maximal growth. The model has been empirically estimated for 1960. Illustrative calculations show that the feasible maximal growth of the economy is about 27 per cent when current consumption vector is endogenised and the economy, including education, is allowed to grow in a balanced manner. Ramanujam (1967) has also developed a programming model for educational planning with different objectives. In the first model, the objective is to minimise the net contribution to the present value of the future national income of an educational policy subject to budgetary constraints. The second model maximises the stock of human capital at different periods, subject to budgetary and other constraints. This model gives an economic view of educational planning. In the third model, the objective is to minimize the total cost of education subject to manpower supply and other constraints. However, all the three models need empirical testing. A programming model developed by Panchamukhi (1969) minimizes the cost of supply of education subject to the constraints that the increasing trend in the level of education, expansion of educational facilitity, and teacher-student ratio are raised and a balance between general and professional education is obtained. The multi-variate statistical technique of factor analysis has been used by Panchamukhi (1965) to develop an index of educational level for the country.

Social Demand Model

Social demand refers to the demand for education emerging from the needs and aspirations of individual persons. Concept of social demand refers to demand at collective level where the decisions of individual persons are aggregated. Social demand is an important variable in educational planning at the stages where alternative path-ways through the educational system are provided. Social demand indicators are included in mathematical models for educational planning.

The Organisation for Economic Cooperation and Development (OECD) played an important role in sponsoring studies of social demand and its implications for educational planning. A historical overview of this work is found in OECD (1980).

The central philosophy of the social demand approach is to predict the number of school places likely to be demanded in future by individuals and the society as a whole and to provide these places so that social demand is satisfied (Robbins, 1963). The starting point of the social demand approach is the construction of a model describing the educational system. Let us distinguish h activities corresponding to the various educational levels. Let St be the vector of stock of students in each activity in year t, with elements S_{ht} such that :

$S_t = (S_{ht}) = [S_{1t}]$

$[S_{2t}]$

let M_{ht} and G_{ht} be inflow and outflow of students

$S_{ht} = S_{h-1\,,\,t-1} + M_{ht} - G_{ht}$

Let us also define transition proportion

$p_t = F_t\, S_{t-1}$

F_t, vector of students net of those who disappeared from the system between year t-1 and year t.

In matrix notation :

$S_t = P_t S_{t-1} + M_t$

Therefore, by using the recurrent formula above, one can obtain conditional forecasts of the future state of the system, given values of P and M.

The demand side of education is complementary to supply side. Demand for education is also a function of its price just like any other commodity. The various factors of the price of education are fees, expenditure incurred on books, papers etc. and the earnings foregone. The proportion of income spent on education by the individual is a fairly good measure of one of the components of the price of education. In a case study, Shri Prakash and Radhakrishnan (1973) tried to estimate the private demand for education as a function of a number of socio-economic, cultural, demographic and educational factors. Briefly, their main findings are : (i) the higher the level and type of education, the greater is the influence of parental income and occupation, (ii) professional and technical education as compared to education in arts and humanities appears to be influenced to a greater degree by the level of income and occupation of the parents and students' own ability. Mathur (1969, 1971) studied the various aspects of the demand and supply of the professionals and the employment outlook of the technicians in India.

In an aggregative study of the Indian education as a whole, Prakash and Chaudhary (1990) have formulated simultaneous equation on models of educational demand and supply where demand is measured stockastically. A sophisticated logit model of demand has been empirically estimated after having sorted out the problem of identifiability. Income has emerged as the significant determinant of demand for places. It may pave way for extensive empirical analysis of educational demand which has been so far rather a weak read.

The studies using manpower projection approach reveal the features of the future prospects of education in India. In a study, Shri Prakash (1978) projected the demand for education in India. In his view, in an economy like the Indian one, where there is observed educated unemployment, persons with higher educational qualifications (higher than required for the job in which they are employed) become the part of the input-output coefficients and such data base might mislead the forecasts.

Cost effectiveness analysis is a technique for measuring the relationship between the total inputs or costs of a project or activitity and its output or objectives. Cost effectivencess analysis can take two different forms. In the first case, a comparison is made between alternative ways of achieving the same objective. The other method of using cost-effectiveness analysis is to compare two or more educational institutions with similar levels of cost in order to discover which one achieves the highest level of output or results (Fielden and Pearson, 1978).

Cost of education plays an important role in planning of education. There are three important aspects of the cost of education; (a) the institutional cost, (b) the private cost, and (c) social cost. Pandit (1969) discussed the various aspects of the cost of education. The institutional cost of education is incurred by an institution for the production of education, whereas alternative social cost consists of institutional cost as well as the earnings foregone by the students while at school and college. This opportunity cost constitutes an important part of the real cost of education. Attempts at measurement of unit cost of education at various stages have been made by Shah (1968, 1969). Interestingly enough, he pointed out that the higher stages of education are far more expensive when considered as multiple of the expendidutre per pupil at primary stage as compared to the situtation obtaining in the USA. Kamat (1967) has also estimated the unit institutional cost of education. He has estimated unit cost of education of the colleges of

Poona University. Subsequently he estimated the cost of school education in Maharastra. Shri Prakash (1975) estimated the relationship between productivity and unit cost of Indian educational system. A mention should be made of a case study by Shri Prakash and Bansal (1985) which measures the unit cost of collegiate education in Punjab and examines its variations among colleges of different types and sizes. They suggest that for purposes of financial planning for educational development, optimum size and its corresponding minimum cost should be estimated for each type of institution separately since the optimum size and minimum cost vary sharply between colleges of different types. They also find the quality of service to be an important determinant of institutional cost.

Closing Remarks

This article could do no more than summarize the main areas and topics which have been studied in this field of economics of education in recent years. The literature is now vast and has been growing rapidly in India and abroad. Even from the limited sample of material covered, we may conclude that the model building activities and related techniques have very clear relevance to educational and manpower planning. The data availability and other problems associated with the model building have been challenging enough to attract the research workers. There is a need for optimum educational system which satisfies the requirements of changing socio-economic, and demographic situation in India. Despite enormous literature having already been generated, some important gaps remain. To mention a few of these, accelerated research is needed in the field of educational demand, since, as Prakash highlights, Say's law of markets has failed to operate in educational field. Consistently rising supplies have eliminated shortages but the deficiency of demand has prevented the realisation of the objective of universalisation of elementary education. Similarly, spatial locations of educational activities remain to be explored. Then, chagning nature of employment-education linkages continue to be the bug-bear of manpower requirements approach to educational planning. Pioneering study of Lawma (1990) may inspire others to take up this rather difficult area of research. He has attempted to measure empirically the divergence between the educational qualifications possessed by those appointed and the qualifications demanded.

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