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MANPOWER PLANNING ANALYSIS
IN DEVELOPING COUNTRIES:
THE STATE OF THE ART

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with
Debabrata Sen

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SUMMARY

The paper is a review article covering methods that have been proposed for planning the educational system in relation to the "manpower requirements" of a developing economy. Manpower planning analysis (MPA), a technique which was transferred from developed to developing countries in the early 1960s, is the major approach examined. Although it has been subject to much academic criticism, and despite the advocacy of several alternative methodologies, it remains widely used in practice. Methods used in practical applications are reviewed, along with some developing country experiences. This review supports the opinion that MPA is a seriously flawed methodology. Yet it cannot be discarded because the questions which it addresses are important ones and alternative methodologies are no more useful in answering them. Although MPA is, in our opinion, inadequate as a single, all-purpose methodology for relating education to the economy, it does have a potential either as part of a new synthesized approach to planning or, more likely, as an information-gathering method under a decentralized approach.

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I. Introduction

We begin by defining the area of analysis with which this paper is concerned. Educational planning can be defined as the systematic consideration of alternative development paths for the educational system, leading up to the identification of that path which is deemed best according to some specified criterion. It is essentially a technical analytical process involving two interrelated but partially separable sets of considerations: the inner workings of the educational system and the ways in which that system relates to the broader society, economy and polity. Educational decision-making can be defined as the process of actually choosing an educational development path. It can be carried out in a close relationship with educational planning (i.e., in a systematic, future-oriented fashion) or it can be conducted in total disregard of educational planning. Although particular developing countries may have much or little, good or bad, educational planning, all have some kind of an educational decision-making process.

We are concerned here with the outward-looking half of educational planning, the part which tries to relate the development of the educational system to broader social outcomes. It seems safe to say that most participants in the educational decision-making process value educational development not for its own sake but for its perceived ability to promote the attainment of desired social outcomes and reduce the likelihood of

undesirable outcomes. This is surely the case with the political leader, development planning technicians and citizen/parents who may participate in the process; they all favor promotion of certain kinds of educational development, and perhaps oppose promotion of certain other kinds, because of the social, political and economic consequences which they expect to result. Only the professional educationists, perhaps, have any interest in the expansion of the system per se.

This widespread emphasis on the instrumental values of education presents the educational planner with the task of defining just what the social, political and economic results of alternative paths of educational development would be. Although this task is important, it is also difficult. Its difficulty arises from the fact that the social consequences of education are deeply embedded in a complex web of social interactions, from which it is very hard to extricate them. Because of this difficulty, the educational planner has never been able to enlighten the participants in the educational decision-making process to as great an extent as he might have hoped. He has, however, devised a number of analytical systems which attempt to cope with these difficulties.

Economic consequences of education can be defined as those which affect the production of goods and services and the distribution of the resulting income and wealth. Underlying the analysis of these consequences have been three widely (although not universally) held positions: (1) that education somehow contributes to production by enhancing the productivity of labor; (2) that at least part of this gain is realized by the individuals educated in the form of higher incomes; and, (3) that education affects the distribution of income, both through the differen-

tial application of its income benefits and through the distribution of educational costs.

The analysis of the economic consequences of education constitute an area of overlap between educational analysis and planning, on the one hand, and economic analysis and planning, on the other. Taking a cue from the prevailing fashion in development economics generally, analysis of the economic consequences of education long focused almost exclusively on education's production effects. Only within the past decade, as the general fashion has changed, have the effects of education on the distribution of income and wealth begun to receive significant amounts of attention.

Manpower planning analysis (MPA), although it can also be used as a technique of distribution-oriented planning, was developed primarily as a means of relating educational development to desired levels and patterns of economic production. We will distinguish manpower planning from other techniques for relating education to the economy by limiting our discussion to those analyses which employ the critical characteristic assumption of MPA: that for production to grow, adequate quantities of particular types of labor, which can be distinguished, at least in part, by their educational backgrounds, are required. In other words, in MPA the production value of education is assumed to derive from the unique ability of particular forms of education to prepare individuals for particular forms of work. This assumption distinguishes MPA from the rival cost-benefit analysis (CBA) or "rate of return" approach, in which the production value of education is conceptualized in the form of "human capital", which implicitly may be applied with equal effect in any of a

a variety of occupational roles. We will not review CBA here, except to the extent that some of its features have been incorporated in MPA in an attempt to remedy some of the latter's weaknesses.

Education will be defined here to include all forms of learning-- whether they take place before or after the individual's entry into economically productive life, whether they occur in an institution called a school or in an institution which bears some other name (training program, adult literary program, etc.), indeed, whether they take place in any institution at all. In practice, however, most MPA has been related to formal schooling undertaken before entering the labor force. Additionally, "needs" for output of particular specialized training programs are sometimes determined through MPA. MPA has seldom been applied to more general types of nonformal education or to on-the-job learning.

The foregoing definitions have set the stage for the discussion which follows. In the next section we will briefly review the historical development of MPA. Thereafter, we will describe the structure of the major MPA models and methods of application, examine the experiences of some developing countries which have used MPA in their planning, summarize the limitations of the technique which are revealed by those experiences and suggest means by which MPA may be improved and supplemented by other techniques so as to compensate, at least to some extent, for its inherent limitations. We conclude by summarizing the present state of the art as we see it.

II. Historical Background

We are aware of no existing history of the origins of MPA and its subsequent diffusion around the globe. It appears, however, that MPA entered third world development planning by way of experience in the more developed countries, including both those with market economies and those with central planning.

The United States became seriously interested in manpower problems during the period of massive unemployment brought in by the Depression of the 1930's (Mangum, 1969). After World War II fears of a renewal of high unemployment conditions led to passage of the Employment Act of 1946, which however failed to embody the explicit commitment to maintain full employment which had been sought by its sponsors. Later, U.S. manpower policy became more activist, largely as a result of concern for the welfare of disadvantaged and low-income groups. Manpower Development and Training Act of 1962 brought the federal government into this field on a broad and permanent basis. About the same time there was heightened interest in the question of whether the supply of scientific and technical manpower was adequate. These events led to a number of forecasts and the institution of an annual Manpower Report of the President (Gannicott and Blaug, 1973). Since the United States continued to resist the idea of national economic planning, and educational decision-making remain highly decentralized, no effort to construct a national manpower plan has yet been made in this country.

In Western Europe circumstances have been different. The task of postwar reconstruction and the years of rapid growth which followed had to be faced in conditions of tightly constrained supplies of both

labor in general and specific skills. These conditions created active concern with possibilities for increasing labor productivity, expanding the supply of unskilled and semi-skilled labor through worker migration and lessening or avoiding shortages of key skill categories through manpower forecasting and training programs. Each of the nations of Western Europe developed activist approaches to the problem of labor shortage, with the precise nature of the approach taken varying from country to country (e.g., on France see Psacharopoulos, 1973; on Norway see OECD, 1972).

Forced draft development under conditions of manpower shortage was nothing new in Eastern Europe, where Soviet planners were probably the earliest practitioners of MPA (DeWitt, 1961; ILO, 1962; Skorov, 1964). The Soviet system of central planning has allocated impressive quantities of resources to education and skill development has always ranked as a major criterion of educational planning. Efforts to integrate educational and economic planning date from 1927. Soviet planners have used a variety of techniques, especially the "density ratio" or "ratio of saturation" method, involving assumed ratios of specialized to total employment, and the "staff-normative method", based on "normal" productivity or service levels, to forecast the need for particular types of manpower, consistent with the economic plan (Skorov, 1964, pp. 135-45).

It seems likely that each of these areas of developed country experience--the United States, Western Europe and Eastern Europe--exerted a degree of influence on the development of MPA in the Third World. The basic underlying ideas about the economic significance of education and its contribution to growth were all transferred by analogy from the rich

countries to the poor. The techniques of Soviet manpower planners and American manpower forecasters were transferred through the activities of innumerable international experts and the distribution of "how-to-do-it" manuals (Bureau of Labor Statistics, 1963, 1968). In no case, however, was the transfer of the technique from the rich countries to the poor more clearcut than in the Mediterranean Regional Project (MRP) of the OECD. The MRP was an attempt by the principal regional economic body of Western Europe to contribute to manpower development in the countries of Europe's relatively poor southern fringe: Greece, Italy, Portugal, Spain, Turkey and Yugoslavia. These studies, along with the methodological manual which preceded them, written by an American academic and manpower expert (Parnes, 1962), became a model which was later copied by innumerable LDC planners, despite the telling criticisms of the techniques recorded by another American academic hired by the OECD (Hollister, 1967).

Rooted in the basic notion of stable production interrelationships which underlies input-output analysis, linear programming and other forms of economic model-building, MPA in developing countries was subject to other intellectual influences besides the MRP. The Correa-Tinbergen-Bos model (Correa and Tinbergen, 1962; Tinbergen and Bos, 1964), like the Parnes methodology, employed the distinguishing assumption that given quantities of certain types of labor (in this case, only broad higher and intermediate skill groupings, rather than detailed education (occupation groups), were needed for economic growth to proceed. Unlike Parnes, Correa-Tinbergen-Bos incorporated some of the internal features of the educational system in their model, opening the way to a series of ambitious programming models which sought to facilitate the planning of both

education and other sectors of the economy (e.g., Adelman, 1966; Bowles, 1967).

The formalization and further development by Parnes (1962) of the techniques that had long been used in developed countries, together with the suggestion that these techniques should now be applied to the developing countries, attracted a barrage of critical comment. Among the most widely read of the critics were Anderson and Bowman (1964), Hollister (1964; 1967) and Blaug (1967). The criticism centered, as had earlier critiques of manpower forecasting in the United States (Arrow and Capron, 1959), on the fact that the needs projections made in MPA were technologically based rather than labor-market based, and that no allowance had been made for the role of dynamic market adjustment in correcting for the surpluses and shortages identified.

As is so often the case in the history of ideas, however, the intellectual standing of MPA was hurt much less by the criticisms which were directed toward its structure and underlying assumptions than by the development of a competing framework which proved attractive to many. Theodore Schultz in his 1960 Presidential Address to the American Economic Association (Schultz, 1961) had sounded the call which led to the development, by Gary Becker (1964) and others, of the modern theory of investment in human capital. Most economists found this approach theoretically more acceptable than MPA, since it could claim to take some account of both demand conditions in the labor market (as reflected in earnings) and supply (cost) conditions in the educational system. Innumerable estimates were made of the rates of return to various levels and types of schooling in countries all over the world (Psacharopoulos and

Hinchliffe, 1973).

Despite its theoretical appeal and its popularity with dissertation writers and other scholars, the human capital (or rate of return, or CBA) approach was soon revealed as being of rather drastically limited use to education and manpower planners working in LDC's. Critics (e.g., Shaffer, 1961; Balogh and Streeten, 1963; Eckaus, 1964; Daniere, 1965; Merrett, 1966) showed that its underlying assumption of a perfectly functioning competitive labor market was of dubious applicability to LDC conditions, that only some of the benefits were captured at best and that policy implications, even if the entire analysis was accepted at face value, were meagre. This left well-meaning and well-read planners with a choice between two heavily criticized methodologies. There were two possible ways out: the development of new planning methodologies--perhaps improvements on either MPA or CBA, or a synthesis of them, or else something entirely different--or the pursuit by planners of an eclectic approach, in which a variety of analytical techniques is used to shed light on policy alternatives but final choice of a policy for implementation is not explicitly based on any of them.

So far no new approach has come on to the scene to sweep the MPA and CBA approaches aside. By contrast, attempts to improve these two approaches, or to effect a marriage between them, have not been lacking. The idea of introducing elasticity of supply and/or of factor substitution (either capital/labor or among different types of labor) into one or the other model has been a popular one (Dougherty, 1971; Layard, 1971; Carnoy and Thias, 1972; Freeman, 1975; Apichai, 1977).

Despite these efforts to develop a more theoretically acceptable methodological framework which is also practicable, it seems likely that

manpower planning in its original, purely technologically based form is still the methodology most commonly used by official planners for relating education to the economy in low-income countries. In some cases, we suspect, adequate care is taken--either through cautious interpretation of the results of manpower forecasts, or through the combination of MPA with other techniques--to safeguard against the limitations of the technique. In other cases, no doubt, the results of MPA are taken too literally.

We consider this state-of-the-art review to be timely because while the practice of MPA has probably continued apace, or even grown, in the past decade or so, professional discussion of it has fallen off sharply. In the mid-sixties the pages of the ILO's widely-read International Labour Review were full of articles about manpower planning. In issues published in the seventies, it is hard to find a single entry. A situation in which practice of a technique continues but discussion of underlying assumptions and alternative approaches has all but stopped (except for the attempts at synthesis cited above) is a situation which needs to be re-examined.

III. Some Manpower Models

The present section attempts to give some idea of the analytical approaches which have been developed by summarizing and briefly evaluating some of the most influential manpower planning models and other models relevant to manpower planning. The work of Correa-Tinbergen-Bos (Correa and Tinbergen, 1962; Tinbergen and Bos, 1967), Parnes (1962), Harbison-Myers (1964), Adelman (1966), Bowles (1967) and Freeman (1975), will be reviewed.

A. The Correa-Tinbergen-Bos Model

An early and relatively simple model, which is well known and has been influential is the Correa-Tinbergen-Bos (CTB) model.* The basic model consists of six linear difference equations showing the relationship among the stock of manpower with secondary and third-level education, educational outputs and the production of goods and services. Given aggregated stocks of second and third-level manpower are assumed necessary to produce particular levels of output; i.e., fixed manpower/output coefficients are assumed to hold at a highly aggregated level. Input-output relationships are embodied in the CTB model, in the sense that second-level manpower is an input into the production of third-level manpower (as students), while third-level manpower is simultaneously an input into the production of second-level manpower (as teachers). Primary education is ignored--"being assumed to be no bottle-neck for the required expansion of secondary education and for production increases" (Tinbergen and Bos, 1964, p.) and periods of six years are assumed to be required, both to create second-level manpower out of primary school leavers and to create third-level manpower out of secondary school leavers. Values for the coefficients relating the two manpower stocks to production, those expressing manpower wastage rates and those reflecting pupil-teacher ratios at the secondary and tertiary levels are set by assumption, making it possible to solve the model for the manpower stocks and educational flows "required" to attain particular levels of output at particular future dates.

* The model was presented first in Correa and Tinbergen (1962) and then refined in Tinbergen and Bos (1964), the discussion here is based on the later version.

The basic CTB model has been elaborated in a number of directions by Tinbergen and Bos (1962); by Emmerij (1965); Blum (1965) and Williams (1965), who made test applications of the model for the cases of Spain, Turkey and Greece respectively; and by the Netherlands Economic Institute (1966). Features added in these elaborations included the importation of high-level manpower as an alternative to home production, alternative manpower demand functions, sectoral disaggregation, varying treatments of school drop-outs and retirements, the introduction of more stages in the educational process and the introduction of smaller time units into the time structure.

Critiques of the CTB model have been published by Bombach (1964), Sen (1964) and Blaug (1970), while Tinbergen and Bos (1965) have offered their own appraisal. Criticism of the model has centered on the unrealism of the aggregate fixed coefficient assumption, which is belied by empirical evidence; on the failure to deal explicitly with either the principal sectors of the economy or with various streams of education; on the failure to include on-the-job learning; on the arbitrariness of the assumed fixed input-output coefficients; on the rigidity of the linear difference equation structure, which requires all variables in the model to grow at constant and equal rates; and on the model's concern with consistency rather than optimization. Blaug (1970, p. 166) comments that "in application to several Mediterranean countries, the Correa-Bos-Tinbergen model gave inconsistent results...in consequence of which interest in it seems to have dried up."

Although its direct application, and indeed its direct applicability, are thus questionable, the CTB model must be judged an ambi-

tious and influential precursor, both of manpower planning models and of efforts to model the internal dynamics of the educational system.

B. The Parnes Methodology

Parnes (1962) produced a manual for use on the Mediterranean Regional Product of the OECD, which simultaneously served to codify existing MPA practice, to extend that practice in significant ways and to provide a highly visible target for critics of MPA to shoot at. The Parnes methodology differs sharply from the CTB model, although they share the underlying assumption of fixed coefficients, in its stress on disaggregation and in its eminent applicability. The suggested approach departs from the notion of simultaneous determination of manpower and economic variables by stressing the unidirectional determination of manpower requirements through an analogy to the economic concept of derived demand (the derivation involved is technological and does not necessarily reflect effective demand).

The basic steps in the Parnes methodology have been described in the following terms (Parnes, 1962; pp. 21-22; what follows is a paraphrase):

1. Prepare an inventory of manpower stock in the base year, consisting of total employment cross-classified by industry and occupation; the occupational classification scheme should "differentiate as far as possible among occupations requiring different levels of education and, at the highest levels, between 'scientific' and 'general' education," (Parnes, 1962; p. 21).
2. Forecast the size of the labor force in the target year and for key intervening years.
3. Estimate total employment by sector in the forecast years.

4. For each sector, allocate total employment in the forecast years among occupations; sum requirements for each occupation across sectors.
5. Convert occupational requirements to requirements by educational attainment.
6. Estimate anticipated manpower supply by types of educational attainment on the basis of (a) present stocks; (b) expected outflows from the existing educational system; and, (c) losses through death, retirement and withdrawal from the labor force.
7. Compute the change in annual outflow from the educational system needed to bring anticipated requirements (no. 5) and anticipated stocks (no. 6) into balance.
8. Calculate enrollments in each level and branch of the educational system needed to achieve the required annual outflows.

This general description of the methodology leaves open the possibility of alternative ways of dealing with several of its steps (Parnes, 1962; pp. 22-62). For example, various sources of information (censuses, population surveys, establishment surveys) can be drawn on in the preparation of a current manpower inventory (step 1). Most interest, however, focuses on the means of estimating future manpower requirements (steps 3-5). Although Parnes suggests that this could be done in several different ways, the simplest of which would be straight-forward extrapolation, he is best known for a method which derives these requirements from projections of the level and structure of production through assumed sets of coefficients: those which relate total employment to value added by sector (i.e., specify the inverse of labor productivity), those which relate employment by occupation to total employment within sectors, and those which relate educational attainment to occupation.

Estimates of total manpower requirements and educational attainment requirements, as noted above, are obtained by summarizing across industries. Thus, if we let L and Y be manpower and output and use the subscripts i and j to refer to occupation and industry respectively, then total requirements for a given occupation may be expressed as:

$$L_i = \sum_j \frac{L_{ij}}{L_j} \frac{L_j}{Y_j} Y_j$$

Similarly, if the subscript k refers to education, then the total requirement for a given educational category is:

$$L_k = \sum_i \frac{L_{ik}}{L_i} L_i$$

The coefficients $\frac{L_{ik}}{L_i}$ (educational structure of an occupation) and $\frac{L_{ij}}{L_j}$ (occupational structure of an industry) are both proportions and add up to one over all educational levels and all occupations respectively.

The Parnes methodology requires only that the three sets of coefficients be specified somehow. Although applications of the methodology have often involved the assumed constancy of single historical values derived for the country in question, this is not a necessary feature of the approach. Several other possibilities exist, such as the derivation and extrapolation of historical trends for the country in question, the use of coefficients derived from other countries and the introduction of independent judgements about likely trends in labor productivity, occupational mix and educational upgrading. Some efforts to apply these methods are discussed in the following section.

Finally, although Parnes is known for his advocacy of the use of manpower criteria in educational planning, he explicitly notes in his manual that MPA at best expressed only the economic benefits of education. He therefore provides (Parnes, 1962; pp. 63-68) a brief discussion of a complementary "cultural approach" to assessing needs for education, although he has relatively little to say about how this approach might be implemented.

The Parnes methodology has come in for vigorous criticism at three levels of generality. First, as an explicit and prominent statement of the manpower planning approach, it has attracted much of the critical comment directed at MPA generally. Second, Parnes method of deriving manpower requirements from output projections can be criticized in comparison to other methods of manpower forecasting. Third, improvements can be suggested in the Parnes approach. We will deal with the first two levels of criticism below, touching only on the third at this stage.

The classic critique of the third sort is the in-house evaluation of its own work sponsored by the OECD and conducted by Hollister (1967). Hollister (1967; pp. 29-40) raised five questions about the methodology:

1. Is the quantitative impact of manpower requirements on the educational system likely to be significant?
2. To what extent do uncertainties about productivity change affect estimates of manpower requirements?
3. Are occupational input coefficients at a given point in time fixed or variable, and how much difference would it make if they were variable rather than fixed?

4. To what extent must the economic structure and labor force be disaggregated in making estimates?
5. What difference does the general ignorance of occupational-educational relationships make in the determination of the usefulness of educational requirements estimates derived from projections of manpower needed?

After some empirical investigation of these issues (Hollister, 1967; pp. 41-70), the following answers were suggested:

1. The impact of manpower requirements on education can be very significant; substantial shifts in educational patterns would be required for the LDC countries to fulfill the projected manpower requirements.
2. The problems raised by uncertainties about changes in technology and thus in labor productivity loom very large. Although the problem of estimating productivity change is shared by MPA and general economic planning, its effects on the former may be devastating, since small errors in estimates of productivity change (or of output growth) can vitiate the effectiveness of careful and accurate disaggregations of GDP by sector and of sectoral employment by occupation.
3. Occupational input coefficients are in fact variable; substitution among occupations--even with total sectoral labor productivity held constant--can substantially affect the final estimates of educational requirements. This variability can bias procedures used to estimate manpower requirements. Even more fundamentally, it undercuts the basis of MPA by indicating that a range of manpower inputs, rather than one unique set, is consistent with a given output target.
4. There is no guarantee that disaggregated estimates will be more accurate than aggregate estimates.
5. "...the lack of knowledge about the education associated with each occupation...is certainly the weakest link in the manpower requirements estimating procedure" (Hollister, 1967; p. 72). The evaluation produced no significant suggestions for dealing with this problem.

At this level of criticism, Hollister (1967; pp. 73-75) offered partial suggestions to improve the methodology, or at least make it less dangerous to use. He particularly recommended the use of sensitivity analysis (i.e., analysis of the extent to which plausible variations in key assumptions affect projected outcomes) and "analysis of courses of change" (i.e., analysis of the relative importance of different elements in the calculation--e.g., occupational shares in employment, inverse sectoral labor productivity, sectoral shares of GDP and the value of aggregate GDP itself, in the case of projected manpower requirements by occupation--in terms of effect on the projected outcome). However, he had no basic remedies for the most fundamental problems identified in the methodology--for example, the fact, frequently noted, that while the Parnes methodology assumes that the occupational and educational structures of the labor force are determined exclusively from the demand side, in fact they are clearly influenced by supply factors as well.

Despite these drawbacks, the Parnes methodology has been widely applied, as we shall see below. Its popularity derives largely, we surmise, from the apparent (but largely spurious) precision of its finely disaggregated results. The perceived value of having such results has made many planning organizations willing to pay the higher data costs which the Parnes methodology imposes, as compared to more aggregative approaches such as the CTB model or the Harbison rule of thumb (see below) or the Harbison-Myers international comparison approach. Unfortunately, many users of the methodology have collected only the minimum amount of information required for projection, and have failed to heed Hollister's injunction that users of this approach should find out as much as they

can about the nature and meaning of past trends in manpower utilization in their countries.

C. The Harbison-Myers Approach

The earliest work of Harbison and Myers (1964) is an empirical cross-country analysis of relationships between levels of economic development (usually measured by GNP per capita) and human resource development. To measure the latter, seven "human resource indicators" were considered:

1. Number of teachers at the first and second levels of education per 10,000 population.
2. Engineers and scientists per 10,000 population.
3. Physicians and dentists per 10,000 population.
4. Pupils enrolled at the first level of education as a percentage of the estimated population aged five to 14, inclusive.
5. The adjusted school enrollment ration for the first and second levels of education combined.
6. Pupils enrolled at the second level of education as a percentage of the estimated population aged 15 to 19 inclusive, adjusted for the duration of school years at the second level.
7. Enrollment in higher education as a percentage of the estimated population aged 20 to 24 inclusive.

The main reason for choosing these seven indicators seems to have been that data on them were available for 75 countries. Two "indicators of orientation of higher education," for which fewer data were found, were:

1. Students enrolled in scientific and technical faculties as a percentage of total third-level enrollment.
2. Students enrolled in faculties of humanities, fine arts and law as a percentage of total third-

level enrollment.

Eventually, a simple "composite index of human resource development" was compiled. Since correlations among the seven indicator series were high, it was deemed reasonable to base the index on just two series: secondary and tertiary enrollment ratios (numbers 6 and 7 in the list above). Noting merely that "in our judgment, higher education should be weighted more heavily than second-level" (Harbison and Myers, 1964; p.), Harbison and Myers decided to attach a weight of five to the second component in the index, the third-level enrollment ratio.* The 75 countries studied were grouped into four levels of human resource development according to the composite index: underdeveloped (17 countries), partially developed (21), semi-advanced (21) and advanced (16).

Recognizing that "quantitative relationships . . . do not establish causal relationships" (Harbison and Myers, 1964; p.), the authors go on in the remainder of their book to discussions of policy for further human resource development at these four levels of achievement. In general, the role of higher education in making it possible to replace foreigners and in breaking manpower bottlenecks is stressed. The low correlation which Harbison and Myers found between primary school enrollment and GNP per capita tells very little about the importance of primary education in developing human resources, particularly in the poorest countries. The Harbison-Myers approach might therefore be accused of introducing an elitist bias into manpower and educational plan-

*Sundrum (1964) examined the effects of alternative weighting schemes on the degree of correlation between the composite index and GNP per head. He found that it varied considerably with the weights chosen; a weight of 5-9 maximized the correlation. The arbitrary choice of weights which achieve a high correlation stands out as a major weakness of the Harbison-Myers analysis.

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The potential use of the Harbison-Myers study, and of international comparative studies of occupational structure such as those conducted by Layard and Saigal (1966) and by Horowitz, Zymelman and Hernstadt (1966), is that they furnish information about patterns in "more advanced" countries which might be used in setting manpower targets in particular settings. The underlying assumption of this approach is of course that all countries in the long run follow a single reasonably well defined development path. More developed countries can therefore be looked to for indications of what developing countries should try to achieve. Despite the disclaimers of Harbison-Myers and other comparative analysts, this use of their work does rest on a causal interpretation--that developing the human resource stock typical of a richer country will help a particular country become richer. Hollister (1964) has shown how rigorous and unlikely to be achieved in practice are the ancillary assumptions necessary for the single development path assumption, much less the causal interpretation of it, to be valid.

We thus conclude that the appeal of the international comparisons approach to MPA, which has been inspired by the work of Harbison-Myers and others, is based largely on highly dubious assumptions. Although the international comparison studies do provide data which can be used in place of missing or uncertain national data, their contribution to MPA is likely to be limited to providing a very general long-run perspective at best.

D. Linear Programming Models

Linear programming models, exemplified by the work of Adelman (1966) and Bowles (1967), are worth at least a brief mention, although their relationship to MPA is only tangential. These models attempt to characterize some of the principal relationships involved in educational resource allocation in such a way as to permit an optimal allocation to be defined, either dependent on economic needs or through simultaneous determination of optimal activity levels in both the educational and the economic sectors. The characterization of needs may rest on either an MPA or a CBA rationale.

Bowles developed a framework which used data from Northern Nigeria and addressed four major questions (Bowles, 1967; p. 189):

1. What amount of society's resources should be devoted to education?
2. How should the total resource use be distributed among various types of education?
3. What education technologies should be chosen?
4. What is the optimal level and composition of the importation of labor for use within the educational system?

The objective function of the model was defined as the net benefits of education, measured in terms of the discounted present value of the net earnings gain (net both of the direct costs of education and of income foregone) associated with a particular level of education. (The entire associated income differential was assumed to be caused by education.) This measure of net benefits, summed across types of education, was maximized in the model, subject to various specified constraints.

A weakness of the Bowles model is that it assumes the demand for educated manpower to be infinitely elastic at prevailing earnings levels. It thus joins CBA in taking a diametrically opposite position from that of MPA, in which labor demand is assumed to be totally price inelastic.

The Adelman (1966) version of the linear programming approach attempts to optimize resource allocation simultaneously in the education and economic sectors. This approach, according to Adelman, was necessitated by the fact that in the Argentine economy, for which the model was designed, attempts which were being made to expand heavy industry appeared to be facing a high-level manpower supply constraint; neither education nor the economy could thus be projected independent of the other. The model assumes fixed labor-output coefficients for six educational classes, while at the same time treating income as a function of education. This represents a sort of marriage of the MPA and CBA approaches. The significant departure of the model is in determining rates of return to education from the production profiles and educational patterns implied by solutions to the model, rather than from the kind of historical data used by Bowles and most CBA analysts.

The Adelman model was run using three alternative objective functions: (a) maximizing the discounted present value of future GNP; (b) maximizing the change in GNP over the plan period; and, (c) minimizing the discounted sum of net foreign capital inflows. The model embodies constraints in both the education and the production systems. Educational system constraints involve initial conditions relating to supplies of students, teachers and buildings, plus a production function for the edu-

cational system. Production system constraints are presented in an input-output framework and consist of the technological conditions of production, plus investment, labor skills, sectoral capacity, foreign exchange and savings specifications.

Solution of the model results in identification of the optimum levels at which various processes should be operated in each period of the program. A linear programming model generates "efficiency prices" for each resource, corresponding to the use of levels of each in the optimal program. In the Adelman model, shadow prices were used to determine the optimum levels for graduates and drop-outs of the various schools, and the marginal social costs and benefits of education. The link between the educational and production sectors is achieved by means of "labor force change" equations. The demand for labor is translated into demand for education via productivity differences through different levels of schooling for a particular skill. Adelman assumes that labor within each skill class is highly substitutable, but between skill classes no substitution is possible.

Some aspects of the model require critical comment (see also Bowles, 1966). First, Adelman's assumption relating to the productivity coefficients and substitutability of skills can be criticized. While it may be true that skills within a given occupational category are substitutable, it is less likely that the level of productivity would remain constant. Secondly, the linearity assumptions of all these models introduce some unreality, although they do not invalidate their insights. Finally, the model, when used, was found to be insensitive to the changes in industrial structure and to the planners goal of reducing high-level

manpower needs in Argentina. This may be attributed to the estimation of labor-efficiency units in the model, based on the observed productivity (i.e., earnings) of the various categories of laborers. The productivity of professionals and technicians is assumed to be three and a half times greater than that of secondary school graduates. This assumption, apparently arbitrary, reduces the empirical acceptability of the model. In fact, as Bowles has pointed out (Bowles, 1966; p. 415), this assumption, plus the fact that the estimated social cost of higher education is less than three and a half times that of secondary education, yields a unique identification in the model between higher education and professional and managerial manpower which does not correspond to reality. This specification in the model may thus be responsible for exaggerating, if not actually creating, the "high-level manpower constraint."

The major contribution of the Adelman model lies in showing how simultaneous optimizing solutions to the resource allocation problem in the economy generally and the education system in particular can be modeled. From the viewpoint of MPA, it shows how manpower requirements specifications can be included within such a model. At the same time, it appears a fair judgement that the linear programming approach to educational planning has not proven equal to its ambitious self-assigned task. Cases of its actual application in national manpower planning appear to be rare, although they do exist.

E. The Manpower Adjustment Model

The "manpower adjustment model" (MAM) recently developed by Freeman (1975) may be taken as an example of the efforts made by several analysts in recent years to improve on MPA by incorporating wage and

labor market adjustment considerations. This class of models thus represents a kind of synthesis of the MPA and CBA approaches.

Freeman begins with critiques both of the manpower requirements approach, which he characterizes as dealing solely with quantities and ignoring prices, and rate of return analysis, which assumes wages to be fixed and thus ignores quantities. The MAM tries to incorporate price and quantity variables, and thus provide a model which will be more realistic and usable, either for planning or for projection in an unplanned economy. The MAM can be expressed terms of labor demand and supply functions, as follows:

$$\dot{N} = \alpha \dot{W} + \dot{D} + \dot{X}$$

$$\dot{N} = a \dot{W} + \dot{S}$$

- where
- \dot{N} = % change in employment in a given occupation
 - \dot{W} = % change in wages paid
 - \dot{D} = manpower requirements due to % shift in product demand
 - \dot{X} = manpower requirements due to other forces
 - \dot{S} = % shift in supply
 - α = long-run price elasticity of demand
 - a = long-run elasticity of supply

In applying the model, Freeman attempts to go beyond the mechanical calculation of demand and supply, seeking extensive information on prices and quantities from surveys, interviews and related statistical sources for estimating the parameters and checking the output of his model. He also models the stock adjustment process through

equations which express the demand for and supply of new labor market entrants from the school system. The policy variables upon which the analysis focuses are sectoral development emphases, salary policies and other relevant policies such as taxes on the demand side, and enrollment and scholarship policies on the supply side, of the skilled labor market.

As Freeman himself notes, the value of his approach depends on the validity of the hypotheses which underlie it. Freeman lists these explicitly (1975, pp. 33-34) as:

1. "Students and other suppliers of high-level skills are reasonably responsive to market incentives, increasing their supply when salaries and related variables increase.
2. Shifts in demand for labor in particular specialties can be measured and predicted, to a tolerable level of error, from knowledge of the changing industrial structure of the economy. More formally, manpower requirements calculations should yield unbiased predictions and a 'reasonably' high correlation with actual changes.
3. Other factors that shift demand for labor, with wages fixed, such as changes in skill coefficients due to technological changes associated with economic development or the life-cycle of industries, or specified spending programs, can be specified and their effect on the level of demand estimated.
4. Enterprises react in an economically rational way to changes in relative wages, altering demands in the direction of workers whose relative cost is falling.
5. The structure of incentives, as reflected in relative salaries, job opportunities, and similar factors, adjusts to supply/demand imbalances in the market, so that such imbalances 'signal' employers and individuals to alter their decisions."

The model was empirically tested in Venezuela. Five categories of data were used: (1) cross-sectional employment and income data in

"some occupations" were used for estimating the demand and supply elasticities; (2) time series data were gathered for a limited number of occupations to estimate the "critical behavioral adjustment parameters"--- the parameters linking the economy with school enrollments; (3) data on the demand for high-level manpower were collected from "particular companies" to improve the estimates of demand for specific skills; in addition, the elasticity of substitution was estimated from the production functions of individual companies; (4) a survey of students and recent graduates was undertaken to find out their career plans and labor market experiences; (5) finally, the results of the model were checked through interviews with relevant employers.

By way of evaluating Freeman's approach, it should be evident from the above description that it has two major advantages over previous MPA methodologies. One advantage is that it is based on an underlying theoretical model which embodies much more of the real-world complexity of a market economy. The strength of this advantage is of course proportional to the strength of "rational" market forces in the actual case being dealt with. Unlike the CBA approach, the MAM does not depend for its validity on the assumption of a perfectly competitive economy, only on a "reasonable" degree of play of market forces. The other great advantage of Freeman's approach is the fact that it gets away from reliance on self-contained sets of mechanical calculations and uses information of various types from several different sources, checking them against each other. This requires considerably more effort than, say, running through the calculation in the Parnes MRP methodology, but we would expect the effort to be repaid in terms of better understanding of the forces influ-

encing the demand for, and supply of, manpower.

Three other limitations of the MAM may be noted in conclusion. It is not an optimizing model. Unlike some of the models discussed earlier, it ignores the internal workings of the education system in concentrating on the twin problems of filling the demand for trained labor and finding employment for new entrants bearing particular qualifications. Second, the model, despite its greater flexibility, is subject to some of the same objections to assumed fixity of coefficients as other forms of MPA. Finally, there is a problem which arises if the model is applied across the whole economy rather than just in a specific industry. "By summing shifts in demand across industries into a single shift variable D and then taking account of demand elasticity, we are assuming that aggregation does not affect the elasticity of demand" (Freeman, 1975; p. 29); about the only way this assumption could be valid would be if demand elasticities were equal in all industries, a condition which is unlikely to hold. On the other hand, if demand for particular categories of manpower were concentrated in just a few industries, which might be assumed to have similar demand elasticities, then the severity of the problem would be much reduced.

F. Conclusion on MPA Models

This section has consisted of a summary, high-points tour of the development of MPA methodologies. All the models discussed have featured the definitive assumption that manpower requirements are related to production through a set of coefficients which may be assumed to be fixed. They have differed with respect to several characteristics:

1. The degree to which manpower requirements are treated as derivative from production targets or projections, as opposed to simultaneously determined with them.
2. The way in which coefficients are selected for use in the analysis.
3. The degree to which the internal workings of the educational system are modeled.
4. The extent to which the models are self-contained analytical systems, which may be interpreted as discouraging the investigation through research on variables which may be important for policy but which do not feature prominently in the model.

The models reviewed in this section give a fair idea of the range of analytical approaches from which the practical manpower planner can draw. In the following section we will review some real world manpower planning efforts to see what approaches they have in fact taken, and what the results of their activity have been.

IV. Lessons from Manpower Planning Experience

A. Introduction

In this section, then, we review manpower planning experience in the developing countries. We have tried to select the cases to be discussed and shape the nature of the discussion so as to facilitate judgements about the validity and limitations, both of MPA as a whole and of alternative approaches to it. There are however a great many countries practicing MPA,* so our review is necessarily selective. We have selected for review some of the countries which have had the longest experiences with MPA, and some which illustrate differing approaches. We have been limited in our range of choice, however, to those experiences which are either known to us personally or which have been written up by others and become available to us in that way.

*Blaug (1970, p. 137) quotes a UNESCO survey conducted in the late sixties as showing that out of 91 countries (presumably developed as well as developing), for which data are available, 69 have economic plans, 73 have educational plans, and 64 of these have educational plans which are specifically tied to development planning. Of the 73 educational plans, 60 are based on projections of future manpower requirements. (For details, see UNESCO, 1968, p. 46.)

B. Alternative Approaches to MPA

Manpower forecasting is the troubled heart of MPA, but it is not the whole analysis by any means. As Parnes (1962) brings out very clearly in his methodology discussion, we are dealing with the transition from an existing manpower stock to a "required" future stock which is larger and of higher quality than the present one. Educational outputs are a major contributor to this growth process, but there is no one-to-one relationship between educational output and labor force change. The stock of employee manpower with particular educational qualifications can in fact be increased by the following five means:

1. Employment of new labor force entrants from the school system (although not all school system leavers join the labor force).
2. Upgrading, through continuing education, of persons previously working at a lower skill level.
3. Reentry or delayed entry into the labor force of previously inactive persons.
4. Employment of previously unemployed persons.
5. Employment of immigrants.

Methods 2 through 5 supplement the contribution of the school system, reducing the gap to be filled by that means if the total requirement is given. On the other hand, as noted under number 1 above, not all educational outputs may become available for work (this may become especially pertinent if educational opportunities for women exceed their employment opportunities and/or desire to work, resulting in nonparticipation in the labor force, unemployment or employment in occupations not regarded as requiring the educational attainments which the women possess). Moreover, the deficit to be filled by the educational system consists not

just of the net additional "requirements" created by economic growth but also replacements for people who leave the active labor force for any of the following four reasons:

1. Death.
2. Retirement.
3. Temporary departures for child-rearing and other reasons.
4. Emigration.

There has been surprisingly little discussion in the literature on MPA of either those factors which bolster school system outputs as a means of supplying manpower needs or those factors which increase the size of the deficit to be filled. In some cases this may be justified by the relative smallness and/or predictability of the flows involved. However, the situations which make these flows quantitatively significant--widespread education of women who will subsequently not join the labor force; extensive movement in and out of the labor force, especially by women, existing unemployment of the educated, significant importation and/or exportation of educated manpower--are sufficiently common to make us believe that the neglect is unwarranted. Be that as it may, the literature, even when it mentions the existence of these factors and the need to take them into account, has very little to say about how their likely magnitudes might best be estimated.

A related point is that little attention seems to have been devoted to the relationship between future manpower needs and the utilization of existing manpower stocks. The possibility that future requirements can be satisfied, at least in part, through better use of educated people who are currently economically inactive, unemployed, working

abroad or underemployed domestically in terms of prevailing education-occupation norms seems to receive scant consideration. The implicit assumption is often that existing manpower stocks are employed not only fully but optimally.

What the literature does discuss, as criteria for distinguishing different approaches to MPA, are the alternative methods which may be used to project manpower requirements. Mehmet (1965, p. 1) and Blaug (1970, p. 146) both give lists of the major alternatives, but neither list seems to us to capture the critical differences in approach among the real-world MPA exercises with which we are familiar. We therefore offer our own list of possibilities, as follows:

1. Direct projections of manpower needs
 - a. Using Harbison's "rule of thumb."
 - b. Using employer surveys.
 - c. Using the density ratios method.
2. Manpower needs projections derived from output projections (with varying degrees of disaggregation).
 - a. Assuming constancy of some historical set of coefficients.
 - b. Based on extrapolation of historical trends.
 - c. Borrowing coefficients from "more advanced" countries.
 - d. Other assumed variations.
3. Manpower needs determined simultaneously with education and/or economic system models.

We shall now review a few examples of MPA which used some of these projection techniques.

1. Harbison's "Rule of Thumb"

On the basis of his international comparative studies, Harbison (in the Ashby Report, 1960) proposed the "rule of thumb" that total employment should increase at one-half the rate of GNP growth, that the stock of high-level manpower should increase at twice the growth rate of GNP and that middle-level manpower should grow at three times that rate. These ratios were widely applied in early examples of MPA in developing countries. In addition to their initial appearance in the Ashby Report, which served as the basis for educational expansion in Nigeria in its early post-independence years, they were used by Hunter to forecast manpower requirements, first in three East African countries (1963; 1965) and later in seven Southeast Asian countries (1967). They also appeared in development plans published by the governments of Kenya, Uganda, Malaysia and no doubt other countries.

The conceptual basis for Harbison's "rule of thumb" is precarious in the extreme. Rado and Jolly (1965, p.) comment that "to the best of our knowledge, the empirical evidence (if any) on which this formulation is based has never been published." In reality, ratios among university graduates, secondary school leavers and GDP vary widely among countries, and not in any consistent relationship to GDP per head (Rado and Jolly, 1965; p.). Blaug's (1970, p. 150) characterization of the Harbison "rule of thumb" as "thoroughly discredited" is probably fair, if a bit harsh. It is probably no longer used anywhere. In retrospect, it can be seen to have been a simple, comprehensive methodology which could be used in conditions of extreme data scarcity and justified merely by reference to authority.

2. Employer surveys

Employer surveys, including both descriptions of the existing employment structure and projections of future manpower needs, have long been a feature of MPA in developed countries (Blaug, 1970, pp. 146-47; Mehmet, 1965; pp. 31-33). They are generally deemed to be more appropriate for short-run projections (i.e., periods of five years or less) than for longer-run projections and better for specific projections for limited industrial or occupational groups than for the entire national manpower stock. A possible rationale for this approach is to diffuse the responsibility for guessing about the future; perhaps the sum of employer responses is less likely to be far off the mark than the single-valued projection of the manpower analyst. The problem, however, is that the universe of respondents may not be the right one (some employers will go out of business during the projection period, while some new ones will set up) and that their responses may not be consistent (i.e., they may be assuming different things about output levels, prices, wages, etc.). At best, the technique can only forecast the need for employees; it leaves the self-employed entirely out of the picture.

The extent of use of the employer survey method in developing countries is not known by us. Perhaps, however, the experience of Malaysia with this technique is fairly typical of those countries which have employed it. The Malaysian Departments of Labor and Statistics collaborated on a national manpower survey in 1965, which asked employers in key sectors (including the public sector) what manpower they currently employed and what needs they foresaw five years hence and ten years hence. The results were used by the Higher Education Planning Committee

to draw up recommendations for educational development at the third level. However, the projections yielded by the manpower survey were generally regarded as too incomplete and too arbitrary to give more than a general view of how manpower needs were likely to develop in the future. By contrast, the information on current manpower use patterns was regarded as a useful supplement to existing information on the subject.

3. The density ratios methods

This approach to MPA, which involves assumed ratios of specialized manpower to total employment, has been discussed above as a feature of Soviet-type planning. It is doubtful that it has been widely applied in the developing countries. However, it and its close relative, the "staff-normative method" (see p. 5, above), do find limited use in public sector manpower planning. For example, curative health services are often planned on the basis of one clinic per X thousand people, one small hospital per Y clinics, one large hospital per Z small hospitals, and so on. Staffing patterns (so many doctors, nurses, orderlies, etc.) are set for each type of unit, so the needs for each type of manpower can easily be determined once the size of the population and the normal level of service are defined. This is an example of a set of arbitrarily fixed coefficients which works fine, within its own set of limitations, because the demand structure itself is defined arbitrarily. The limitations of the process relate the arbitrariness of the defined service standard from which everything else flows and of the assumed staffing ratios. The methodology does nothing to assist--indeed, it tends to hinder--analysis of the costs and benefits of alternative service norms

and staffing patterns.

4. Derived manpower projections

All the forecasting methodologies discussed so far are widely regarded as discredited or of very limited use. The dominant method in current use is to derive projected manpower needs from projected output using an assumed set of coefficients. There are several variants on this methodology, involving different levels of aggregation and coefficients taken from different sources.

A simple version based on the international comparison rationale is to use the Tinbergen equations (see Netherlands Economic Institute, 1966) relating total stocks of second- and third-level manpower to GNP and GNP per capita, as follows:

$$G = 5.2(YX 10^{-6})^{1.202} \frac{Y}{P}^{-0.164}$$

$$S = 163.7(YX 10^{-6})^{1.314} \frac{Y}{P}^{-0.655}$$

where G = manpower stock with higher education

S = manpower stock with secondary education

Y = GNP in 1957 U.S. dollars

P = population

Rado and Jolly (1965) used these equations in projecting manpower needs in Uganda. They justified their choice of this technique by arguing that market forces create a strong tendency for actual manpower stocks in a country to be the "right" ones, i.e., those which equate supply and demand. In general, therefore, they argued that the equation could be used to determine whether existing manpower stocks in a country

were appropriate. They also contended that the Tinbergen equations could be differentiated to obtain appropriate rates of growth for the two classes of manpower (although they recognized that technological change could throw the calculation off). These defences of the approach seem rather optimistic in view of Hollister's (1964) demonstration of the improbability of the proposition that all countries follow essentially similar manpower development paths.

The results of the Rado-Jolly projections are interesting and instructive. They suggested that the total number of graduates would have to increase 5 1/2 times between 1962 and 1981; allowing for full Ugandanization by the terminal year, the number of local graduates would have to increase over twenty times in the period. These projections necessitated an enormous expansion of the single local university. The reasons for these massive needs projections appear to have been two in number: (1) Uganda had less than the "appropriate" stock of graduates in total terms and especially in terms of Ugandan citizens at the start of the projection period and therefore had to "catch up;" (2) the GDP growth rate assumed--8.5 percent--had been set by the Planning Commission at level much higher than anything actually achieved, before or since.

More disaggregated projections can also be carried out using coefficients borrowed from other countries or idealized country-types which are thought to be roughly representative of the probable or desired economic and educational structure of the projection country in the terminal year of the projection period. Thus, a forecast made for Puerto Rico in 1957, covering the period up to 1975, used United States data for 1950 and a guide to probable productivity levels and occupational

and educational structures (Puerto Rico, 1959; Knowles, 1965). Similarly, a recent study of human resource needs in the Dominican Republic (Zymelman 1974) borrowed coefficients from various developed countries to project needs for several categories of manpower up to 1985. The latter study took an eclectic approach, since it also used a regression technique to estimate expected changes in labor productivity, as well as carrying out surveys of employers and employees in an effort to achieve better understanding of the determinants of the demand for and supply of workers in different categories.

As an alternative to selecting a particular country as a model, an idealized country-type can be selected from international comparative data sets such as those compiled by Layard and Saigal (1966) and Horowitz, Zymelman and Herrstadt (1966). In evaluating the "borrowed coefficients" approach, we hark back to our earlier point that the underlying theoretical rationale for expecting countries to follow a common growth path is exceedingly weak. Any validity possessed by the technique would have to rest on the forecaster's ability (by what means we cannot say) to choose a model which is actually a good representation of the future structure of the country for which he is projecting.

Probably more manpower projections use domestic coefficients than use borrowed coefficients. As we have noted above, these can be (1) assumed constant at some single observed value, (2) extrapolated according to some observed trend or (3) otherwise varied in line with the judgement of the forecaster. The first of these methods is clearly downward-biased, in that it takes no account of either productivity increase or educational upgrading--the widely-observed tendency for given types of

work to be done by increasingly well educated people as the stock of educated manpower grows. The second method, extrapolation, is an improvement on the first, since it at least takes some account of these types of change. Its principal difficulty is the unreliability of past trends as a guide to future changes, particularly in labor productivity. To the extent that the forecaster can foresee such discontinuities as a result of his familiarity with economic and educational trends (and such familiarity is a tremendous asset in manpower forecasting work), the forecasts can be improved by systematic or ad hoc variation of coefficients to represent expected discontinuous changes.

The Parnes-MRP approach provides a general framework in which any of these approaches to the choice of coefficients for use in projections can be employed. Besides the six studies carried out for Southern European countries, the OECD also applied the methodology to studies of Peru and Argentina (OECD, 1967). Many others have used the Parnes approach. For example, McGinn and Davis (1969) estimated minimum demands for educated manpower in the new city of Ciudad Guayana, in Venezuela, generally following the Parnes-MRP methodology. They found that requirements could be identified fairly precisely for a few major industries which were planned for development in Ciudad Guayana, while much rougher estimates had to be used for secondary industries and the service sector. They also employed demographic analytical techniques to estimate the growth of population in the region, labor force participation rates and probable rates of unemployment.

Although Hollister (1967) and others have provided a priori critiques of the Parnes-MRP methodology, there has been little ex post

evaluation of the results of projections which have been made using this approach. (This is becoming possible now, as the periods covered by the original OECD projections are now coming to an end). No doubt such evaluative studies, if they were undertaken, would show large deviations between projected and actual outcomes. The large number of assumptions which must be made in the course of a Parnes-type projection is so large, and the basis for many of them so shaky, that it would be amazing if many of the estimated did not turn out to be far wide of the mark. Indeed, the only hope for accuracy in these projections lies in the possibility that the errors will be offsetting.

5. Use of MPA in complex models

The incorporation of MPA in models of greater complexity, either on the side of the education system or on the side of the economy, seems to have been limited primarily to academic research and studies sponsored by international aid agencies so far. The World Bank is collecting models which may be useful for educational planning and has sponsored the publication of a survey volume which includes a chapter on the use of complex models in human resource planning (Blitzer in Blitzer, Clark and Taylor, 1975; pp. 177-96). However, we know of no examples in which such models, incorporating MPA, have actually been used in developing planning for a low-income country. This paucity of applications has something to do with lack of competence in the construction and manipulation of complex models among developing country nationals, but it is also largely attributable, in our opinion, to the failure of these models, so far, to be developed to a state in which they can contribute significantly to planning. In the present state of model development, there is a very

real question of whether the utility of these models is adequate to justify their very considerable cost (Taylor in Blitzer, Clark and Taylor, 1975; pp. 103-104).

C. Some Country Experiences

The preceding review of field experience with MPA focused on questions of the efficacy of various manpower projection techniques. A different and broader question relates to the validity of MPA in general, as a method of relating educational development to the economy. To shed some light on this issue, we briefly evaluate several country experiences with MPA--those of Nigeria, other African countries, India, Thailand and Malaysia.

There have been two excellent and important evaluations of MPA published in the past. One of these is the evaluation of African manpower plans by Jolly and Colclough (1972). The other is the review of manpower forecasts by Ahamad and Blaug (1973). The former study covers all aspects of MPA, while the latter focuses on forecasting aspect, including examples from developed countries as well as developing countries and from occupationally specific as well as general manpower forecasting exercises. The interested reader is referred to both these works for much more comprehensive evaluation of MPA in practice than is possible within the confines of this paper.

1. Nigeria*

Nigeria is an important case to study because, as Hinchliffe (1973, pp. 135-136) has said, "the idea of manpower forecast-

*This section is based mainly on the excellent review of manpower planning in Nigeria by Hinchliffe (1973).

ing as a tool for educational planning may be said to have been born in Nigeria in 1960 with the publication of the Ashby Report." The Ashby Commission was charged, at time of Nigerian independence, with assessing needs for post-secondary and higher education in the coming 20 years. The Commission suggested targets for 1970, based on needs estimates made by Harbison. These implied very rapid enrollment expansion, which, the Commission noted, was likely to create financial problems. The commission explicitly rejected the notion of a more cautious expansion program, implying that the need for more high-level manpower was so critical that the educational expansion program would have to be carried out at virtually any cost.

The Ashby Report was prepared in a state of extreme data scarcity. It was noted that "no attempt has been made to predict what the number of persons in the HLMP (high level manpower) category is likely to be in the next decade. Nor is this a manpower survey, because as yet the statistical information is lacking for such a survey. The report merely suggests minimum HLMP targets for the period 1960-70" (Ashby Report, 1960; pp. 52-53). Without explaining its basis for doing so, the report asserted that if GNP was to grow at its target rate of four percent, then senior manpower (those with university degrees) should grow at eight percent and intermediate manpower (those with two or three years of post-secondary education) should grow at 13 percent. (This was, as noted earlier, the first use of Harbison's "rule of thumb.") On the basis of this report educational targets were drawn up for each year through 1970 and the program, after some modification by the Federal Government, was implemented.

The Ashby Report provided an important rationale for rapid expansion of higher education--first in Nigeria and later, by example, in other African countries. Its proposals--as refined into year-by-year enrollment projections in the Archer Report (1961)--were not, however, followed in detail. A comparison by Hinchliffe (1973, p. 137) shows that through 1965 primary enrollment lagged 20 percent behind the proposed level while university degree courses were actually enrolling 15 percent more than proposed, even in the Report's ambitious projections.

One benefit of the Ashby Report was that it led to the establishment of systematic manpower planning and analysis in Nigeria. A National Manpower Board (NMB) was founded in 1962. It produced a comprehensive report called Nigeria's High Level Manpower 1963-70. This report projected manpower requirements in firms and agencies employing ten or more persons for 1968 and 1970, using a mix of methodologies which included (1) an employer survey, (2) an assumed full employment economic structure and 1963 skill mixes, "adjusted where suitable" and (3) recommendations from an International Manpower Seminar. This report, too, proved in time to have yielded inaccurate estimates, in part because of the paucity of data available. Beginning in 1964, Hinchliffe (1973; pp. 144-) reports the emphasis of the NMB began to shift away from macroeconomic projections to more limited sectoral surveys and studies of the existing manpower situation. In the Second National Development Plan 1970-74, the Harbison rule-of-thumb and employer survey approaches were finally abandoned in favor of a modified version of the Parnes-MRP methodology. Subsequently, of course, implementation of this plan was disrupted by the civil war.

The most obvious critical comment about MPA in Nigeria, to which Harbison (1970) subscribes upon reflection, is that it was pre-occupied with a tiny and perhaps, after all, not so very important segment, of the total manpower stock and economy. Most of Nigeria's manpower studies ignored the low-productivity, unorganized rural and urban sectors which employed 85 percent or more of the labor force to concentrate their attention on the comparatively modern sector. Even for that sector, data were inadequate for accurate analyses to be carried out. Looking back from a 1970 vantage point, Harbison had a completely different prescription for Nigerian human resource development, emphasizing rural economic development, manpower training institutes and school reform.

2. Other African countries

Jolly and Colclough (1972) surveyed 33 manpower studies prepared for 20 African countries between 1959 and 1970. They also examined nine rate of return analyses. The main objective of their survey was to evaluate the adequacy of the studies as a planning tool. Although they had hoped to compare projected figures with actual outcomes, there was only one case (Tanzania) in which this proved possible.

The large number of manpower studies undertaken in Africa can be attributed to the low levels of school achievement prevailing in most countries, relative even to the standards of Asia and Latin America, and to the presence of numerous expatriates. The studies sought primarily to identify current shortages (not deal with possible surpluses) and to forecast the demand for skilled and educated manpower (Jolly and Colclough, 1972; p. 212). Other objectives, in some cases, "included the provisions

of guidelines for education expansion; the examination of priorities and prospects for localizing skilled jobs, particularly in the civil service; formulation of recruitment and immigration policy in respect of skilled expatriate manpower; and the establishment of priorities for training schemes of various sorts" (Ibid.). Common weaknesses of the studies were their limitation to skilled wage-earning employment, their failure to take into account wage movements and incomes policy and their weakness with respect to the allocation of the labor force among sectors, occupations and geographical regions.

"Many of the weaknesses of African manpower planning in the 1960's are those of economic planning in Africa in general" (Jolly and Colclough, 1972; p. 253). Planning offices were weak relative to treasuries and economic planning exercises were seldom effectively linked to implementation. "Given this general situation, it is not surprising that the manpower plans themselves were primarily documents to influence the climate of opinion rather than clear guidelines for action" (Ibid.) As long as they were projecting large deficits of high-level manpower and consequent needs for rapid educational expansion, their popularity among the African elites was assured.

The Jolly-Colclough survey includes a careful analysis of some of the technical problems encountered in African manpower analyses. (1) The treatment of existing vacancies in estimating future demand is a problem; inclusion of the vacancies in the projection may lead to over-estimation of demand, while exclusion of them may result in under-estimation of demand. (2) Aggregative projection techniques of the types discussed earlier (Harbison rule-of-thumb, Harbison-Myers idealized skill

levels, Tinbergen equations, although often forced upon the forecasts by the lack of detailed detail, are of very limited validity and use. (3) None of the studies surveyed, as we noted above, took any account of the effects of wage changes on the future demand for educated manpower, although this is technically feasible. (4) No study considered training or nonformal education as a possible means of developing manpower resources. (5) Insufficient attention was paid to international migration, wastage and changes in labor force participation rates as influences on the supply of manpower. (6) No account was taken of the effect of changed working hours on supply. (7) In general, the surveys either neglected, or did a patch-up job of, bringing about an equilibrium of projected supply and demand in the target year. (8) No sensitivity analysis was done.

Finally, Jolly and Calclough (1972, p. 256) note that most African manpower plans overestimated the growth of manpower needs, resulting in an imbalance between supply and demand. "In most countries, furthermore, the expansion of secondary and higher education has proceeded more rapidly than was estimated to be necessary by manpower plans. For these reasons, the typical situation in the coming decade, at least in the countries studied, seems likely to be one in which shortages of skilled and educated manpower are first eased and then give way to surpluses at a more rapid rate than was originally envisaged" (Ibid.) In this respect, Africa seems to be imitating the experience of a number of Asian countries.

3. India

India is one of the Asian countries which preceded Africa into a state of oversupply of educated manpower. India has also had one

of the longest and broadest experiences with manpower planning of any low income country. We will not be able to provide a comprehensive review of that experience here,* but we did not feel that India's MPA activities should go unmentioned in this review of country experiences.

Woodhall (1972, p. 157) summarizes India's long-standing interest in the following terms:

"For over 20 years the Indian government has been producing periodic forecasts of the economy's future requirements for skilled manpower. Even before the preparation of the First Five Year Plan it was recognized the 'the education and the training of the manpower required should the sheet-anchor for every plan of national development... Since the setting up of the Planning Commission in 1950, there have been a number of working groups on manpower, technical education and general education, and in 1956 a special Manpower Division was set up in the Planning Commission, which was later merged with the Perspective Planning Division. On the basis of their recommendations, the Five Year Plans established enrollment targets for each level of education and, in particular, the expansion of technical education was planned in accordance with forecasts of requirements for scientists and engineers. Similarly, the Education Commission, which reported in 1966, based its recommendations for expansion of enrollments in secondary and higher education upon specially prepared forecasts of demand for matriculates and graduates in 1976 and 1986 in the expressed belief that estimates of future manpower needs from a useful basis for regulating enrollment patterns above the primary level..."

"The Third Five Year Plan announced the setting up of an Institute of Applied Manpower Research, which has existed since 1962, and has undertaken research on supply and demand for different categories of manpower, including a calculation of the

*For more on Indian manpower planning, see Datar (1958); Naik (1965); Burgess, Layard and Part (1968); Laska (1968); Tobias and Queener (1968); Woodhall (1973); and Mathew (1973).

stock of engineering manpower estimates of the demand for engineers, doctors, nurses and certain other occupations, and studies of costs and wastage in technical education."

It seems unlikely that any other developing country has devoted so much effort to manpower planning. Ironically, of course, India is notorious for being the home of educated unemployment on a massive scale (Blaug, Layard and Woodhall, 1969). The question of whether there is any connection between these two facts is all but unavoidable. Woodhall (1972, p. 158) addresses the question in the context of her study of engineering manpower:

"All the main problems of manpower forecasting in India can be illustrated from the experience of forecasting demand for engineers and this experience is particularly interesting because of the marked changes that have taken place in the labor market for engineers in the past 20 years. All the early forecasts, from 1949 onwards, were dominated by the problem of overcoming shortages of engineers. But the focus of manpower forecasting has gradually shifted and recent forecasts have emphasized the need to cure the problem of unemployment of engineers...How is it that, having geared the development of engineering education over 20 years to forecasts of the requirements for engineers, India should find itself in 1969 with almost one in five of its engineers unemployed?"

The tendency for manpower planning to the extent that it actually influenced educational policy (and this extent is not easily judged, as is discussed below), to yield surpluses of educated manpower is probably not attributable to specific forecasting methodologies which were or were not applied in India. A wide variety of methodologies were in fact used, for example relating the demand for high level manpower to sectoral

output, investment, or total employment. One well-known study, undertaken after educated unemployment became a prominent feature of the economy (Burgess, Layard and Pant; 1968), distinguished between "sectors" and "services." Services included public administration and defense, education, health and miscellaneous services; remaining economic activities were included under sectors (agriculture, industry, mining etc.). Different methods were used to forecast demand in the various "services" and "sectors," but in general the approach used was similar to the Parnes-MRP methodology.

Several methodological questions have been raised about Indian MPA. Woodhall (1972, pp. 193-200) notes that forecasts have often been single-valued, based on highly optimistic economic growth targets, dependent on untested fixed-coefficient assumptions and little informed by data on existing manpower utilization patterns, which in later years included substantial substitution vis-a-vis prevailing education-occupation norms. By far the most important failing of manpower forecasting in India, however, is its frequent reliance on output growth targets which are unreasonable, in the sense that they represent sharp and unexplained upward deviations from past trends. For example, the forecasts for 1961-1986 made by Burgess, Layard and Pant (1968, p. 50) assumed GNP growth at 6.5 percent per annum up to 1976 and 7 percent a year thereafter. In sober reality the growth of the Indian economy has been averaging between 3 and 4 percent for many years now. When manpower requirements estimates are derived from an output projection which is double what is actually likely to be achieved, it does not greatly matter by what method the

derivation has been made. The forecast will be greatly overstated in any case.

It is, however, impossible to determine what impact such manpower projections actually had on educational policy. The social and political pressures working for the expansion of secondary and higher education in India have been strong and varied. There can be no doubt that manpower forecasts calling for rapid growth of the stock of educated people were often cited, and sometimes even commissioned, by those who already favored enrollment expansion and were merely looking for additional arguments to buttress their position. As Blaug, Layard and Woodhall (1969) have shown, private economic incentives for those whose children can obtain entrance to secondary and tertiary educational institutions have provided a strong motivation for such arguments, even in the era in which burgeoning educated unemployment has strongly suggested that further rapid expansion is probably not socially desirable.

4. Thailand

Interest in MPA in Thailand dates from the early 1960's when publication of the 1960 Population Census results and the Second Economic and Social Development Plan (1962-66) gave it its first impetus. Five major manpower forecasting exercises were conducted between 1963 and 1967, covering periods reaching only to 1966 or 1970 in some cases and as far as 1986 in others. These have been reviewed by Blaug (1971; 1973).

Thailand's first MPA effort was that of the Joint Thai-U.S. Task Force, which took place in 1963. The Task Force made no fewer than ten long-term projections (based on different assumptions) up to

1980, of which three also included short-term projections up to 1966. Although the authors of the Task Force report placed more reliance on some of their projections than on others, they were modest about the accuracy of their calculations and took comfort in the view that the economy would compensate somewhat for inadequate educational attainment of its manpower by such means as superior on-the-job training, borrowing techniques and know-how from abroad, reducing underemployment, and improvement in physical capital" (quoted in Blaug, 1973; p. 113). Precise means for promoting these kinds of compensation were not spelled out, however.

In general, the Task Force projections overestimated the future manpower deficit, both because it exaggerated the growth of demand (the demand for secondary school graduates was projected to grow at the unlikely rate of around 25 per cent, annually) and because it underestimated supply by understating the supply of primary school leavers in the short run and assuming a one-third decline in the birth rate in the longer run (although the latter may now be on the way to being achieved).

The second MPA exercise was the Secondary Education Programs study of 1964. It further examined the secondary school leaver deficit predicted by the Joint Task Force. Using international comparisons data and some highly arbitrary translations of occupational structure into educational needs (see Blaug, 1973; p. 118), this study projected an enormous, unbridgeable deficit of middle-level manpower. Since the planning implications of an unbridgeable deficit are difficult to fathom, this study could not have had much impact on educational planning

except to support further efforts to accelerate the pace of enrollment growth.

The third study was conducted by the National Economic Development Board by V.R.K. Tilak of the ILO and H.F. McCusker of the Stanford Research Institute. They used the Parnes-MRP methodology to forecast manpower requirements up to 1971. The work was hampered by the inadequacy of data needed to estimate the various coefficients employed in the methodology. The study projected substantial deficits of specified types of high-and middle-level manpower. To a considerable extent, these "deficits" were the results of high and arbitrary assumptions about "standards of service" in health, education and other fields (see Blaug, 1973, p. 122).

The fourth and fifth studies reviewed by Blaug are those conducted by Hunter for UNESCO and the International Association of Universities and by an ILO team. As mentioned earlier, Hunter used the Harbison rule-of-thumb to project "needs" in Thailand and other Southeast Asian countries. The ILO study made extensive use of the international comparative work of Horowitz, Zymelman and Hernnstadt (1966) and Layard and Saigal (1966). Neither study appears to have had much impact on Thai planning and policy.

A sixth study, not reviewed by Blaug, is that of Mabey (1973; also see Mabey and Tanomjit, 1972). Mabey combined a flow model of the educational system with a modified MRP methodology for demand projection to predict the supply of and demand for skilled manpower in 1976 and 1981. In contrast to all previous projections for Thailand,

Mabey projected surpluses for most categories of post-primary educated manpower, despite the assumption of 7.9 percent annual growth rate of GNP. This forecast seems to accord better with the observed reality of growing unemployment of educated people than do the earlier projections.

There is little in Thai experience to inspire confidence in MPA. Blaug (1973; pp. 129-130) comments:

"The record of the 3-4 year medium-term manpower forecast in Thailand can only be described as poor to dismal. We can imagine what we will say about the 20 year long-term forecasts when the time comes to assess these retrospectively. No doubt, there is considerable scope for improving the technical quality of medium-term manpower forecasting, but at best, the method itself seems so unreliable that it ought never to be given more than a subsidiary role in educational planning."

5. Malaysia

The final national experience with MPA which we examine has not been systematically evaluated as those discussed earlier have been. It has features, however, which deserve at least a brief mention.

MPA in Malaysia had its origins in the activities of the Higher Education Planning Committee (HEPC), which was constituted in 1963 and finally issued its report in 1967. The problems which led to the creation of the HEPC were similar to those faced by many African countries at that time and up to the present: a low level of indigenous educational skill development; widespread employment of expatriates; high projected rates of growth of output, and therefore of manpower needs.

Under the aegis of the HEPC an employer manpower survey was conducted, as was noted earlier. In its report (Malaysia, 1967; pp. 40-56), the Committee used the survey, international comparisons based on the Harbison-Myers (1964) study and the "Asian Model" of educational expansion which was recommended at a Conference of Asian Ministers of Education held in Bangkok in November, 1965 as alternative means of target setting. The Committee also considered the "social demand" approach adopted by the Robbins Report (1963) in the U.K., but rejected it as financially impracticable. Ultimately, as a broad guideline, the HEPC adopted a ration of 1:4:20, which it claimed to have derived from international comparative data, as a guideline to be followed in the expansion of university-level, college or sub-professional level and secondary school-level manpower, respectively.

The HEPC report obviously rests on a shaky intellectual foundation, and it has come in for its share of criticism (see Lee, 1972). In fact, its influence on decision-making was probably quite limited, compared with the interplay between strong social demand, which surged upward from the primary school level through the lower and upper secondary school levels during the 1960's, and the rearguard efforts of a fiscally conservative treasury. The latter were undermined by the growing prosperity of the country, and by the end of the 1960's enrollments and school outputs had increased so much that educated unemployment (at the secondary level; not, as yet, at the post-secondary level) made its appearance in Malaysia, as it had in so many other countries. The surge of secondary school leavers boosted demand for university places,

and the number of universities in the country went from one to five in a short period in the early 1970's.

All this is familiar from the experience of other countries, but Malaysia does have as a distinguishing characteristic its sharp ethnic division into an economically and educationally underprivileged Malay majority (50-55 percent of the population) and relatively better-off ethnic Chinese and Indian minorities. Ethnic riots in 1969 were followed by heightened government efforts to speed the entry of Malays into the higher levels of the school system and the more modern sectors and higher occupational levels of the economy. It is interesting to note that this intense interest in the distribution of employment, especially at middle and high levels, led to renewed interest in MPA. Although the 1965 manpower survey had not been regarded as very successful and subsequent MRP-type projections by the Economic Planning Unit were treated as only rough indications of future trends, political pressures for another detailed employer survey grew, leading to the actual undertaking of such a survey in 1973. The presumed purpose of this survey, which has not yet been made public, is to specify manpower needs with sufficient accuracy, at a sufficient level of disaggregation and sufficiently far in advance to make it possible to plan education and training programs and enroll enough Malays to assure attainment of the target ethnic employment shares which the government has set. Based on the past history of MPA, this goal seems unlikely to be achieved, but the incident does point up the relevance of MPA to distributional goals as well as output growth goals.

V. Overall Evaluation of MPA

Based on all that has gone before, we shall now give our overall assessment of the value and limitations of MPA in the present state of the art. We will not reiterate most of the specific comments and criticisms which have been made in preceding sections, but instead will concentrate on a few points which we regard as truly fundamental.

Our most basic conclusion is that MPA is a seriously flawed methodology for planning education in relation to the economy. Its most obvious limitations may be the following:

1. MPA may be manageable on the supply side but on the demand side it is much more difficult. Predicting the future--in any context--is an exceedingly difficult task. The models used in MPA are all too simple, even the most complex of them. They leave too many potentially important factors out of their specifications and they deal crudely with the factors which they include, particularly on the demand side.
2. A particular weakness of MPA is the widespread use of coefficients which are assumed (sometimes arbitrarily, sometimes on the basis of at least some evidence) to be fixed for technological reasons. Conventional MPA approaches completely ignore the price adjustments and incentives which, there is good reason to believe, play an important role in any system featuring decentralized decision-making by individuals, schools and employers.
3. When manpower "requirements" specified in terms of schooling attainments are justified, as they usually are, as necessary for economic growth, a theory about the economic function of schooling--that it leads directly to increased worker productivity; indeed, in the most literal applications of MPA, that a particular level of schooling is necessary to get any level of worker productivity at all in a given kind of job--is implicitly being endorsed. Yet this theory is under hot attack today by those who argue that schooling is primarily a grading and a socializing mechanism, which

sorts people out into socio-economic categories but does much less to raise their productivity than has been believed. If this alternative theory of the economic function of schooling were accepted, then MPA would retain some significance on distributive grounds but its fundamental justification in terms of economic growth would disappear.

4. MPA is woefully incomplete as an educational planning tool because it concentrates on the numbers of people receiving various (arbitrarily defined) quantities of education and ignores both the quality dimension (i.e., different types of education as alternative means of supplying manpower "needs") and the cost of education. It therefore introduces a bias in favor of schooling over other forms of education broadly defined (now usually characterized as nonformal and informal education) and a presumption that manpower "needs" must be supplied, regardless of cost.
5. In sociopolitical terms, MPA could be said either to introduce or to reflect an elitist bias. By concentrating on the higher levels of schooling, which are most accessible to the elites of society, and totally ignoring primary schooling (except as a prerequisite to higher levels of schooling), the analysis focuses on problems and opportunities which intensely concern the elites and have much less relevance for the masses. It is noteworthy that in many countries MPA has flourished during periods in which there is a strong case to be made for expanding secondary and higher education (to replace expatriates and bring the indigenous manpower stock up to comparable international standards). Later on, when educated unemployment and other signs of overexpansion of schooling at the middle and higher levels begin to appear, fewer manpower planning exercises seem to be done.

This may appear to be an overwhelmingly damning bill of particulars, leading irresistably to the conclusion that MPA is not worth the effort and should be scrapped. Although some commentators have indeed come to this conclusion (e.g., Blaug, 1973, p. 130, and elsewhere), we

believe that it would be premature to do so before two other questions have been faced. (1) Are there better methodologies for answering the questions which MPA tries to answer? (2) Or can these questions somehow be finessed and replaced with different questions, which may prove more tractable? These are the issues which we consider in the next section of this paper.

VI. Ways of Coping with the Limitations of MPA

There appear to be four possible ways in which manpower planners could attempt to deal with the limitations of MPA. These are: (1) trying to improve the MPA methodology, perhaps by synthesizing it with CBA; (2) substituting some other methodology, such as CBA; (3) abandoning centralized manpower planning as too difficult and/or undesirable, allowing decisions to be made on a decentralized basis in response to market signals; and (4) continued use of MPA, despite its many flaws, as part of an eclectic manpower assessment approach combining MPA and other types of analysis. These four possibilities will now be discussed in turn.

A. Alternative Methodologies

It is a textbook cliché that MPA and CBA are the major contending alternative methodologies for relating education to the economy. Of the two, CBA has firmer roots in economic theory and was once strongly preferred by leading academic authorities (Blaug, 1967). Although a strong "human capital" school of thought has persisted to the present day, continuing experience with CBA has created major doubts, about its adequacy as a planning tool (Blaug, 1976)--or at least about

its appropriations as a sole, or principal, planning tool. We cannot, in the confines of this paper review all the arguments for and against the use of CBA in the educational field, or compare CBA and MPA explicitly in an effort to determine which is the more acceptable. For present purposes it is sufficient to note that there are substantial difficulties with CBA, as there are with MPA, and that manpower planners therefore cannot entertain the possibility of simply substituting the one for the other.

The "social demand approach" is sometimes listed as third possible planning methodology. Since this approach makes no effort to trace a relationship between education and the economy, we regard it as an abrogation of the planning function, and deal with it in Section C, below.

B. Improving MPA Methodology

Many attempts have been made to improve MPA methodology so as to overcome some of the limitations enumerated in preceding sections of this paper. Some of these efforts have been discussed in Section III, above. Much of the recent attention has been directed toward methodologies which relax the standard fixed-coefficient assumption, allowing for substitution responses to relative price changes. The work of Freeman (1975) was cited as an example of this type of analysis. Another example is the recently published model of Apichai (1977). Many writers have seen their task as synthesizing the MPA and CBA approaches. Some (e.g., Freeman and Apichai) have approached such a synthesis from the side of MPA, while others (e.g., Thias and Carnoy, 1972) have approached it from the CBA side, using manpower projections as a basis

for projecting changes in the relative earnings of workers with different amounts of education and thus getting away from the standard CBA assumption of fixed relative earnings.

We would not wish either to impugn the interesting work of these and other synthesizers or to write off the possibility of substantially improving MPA methodology. At the same time, we cannot foresee that such improvements will ever succeed in overcoming all the limitations of MPA which have been cited. There is no easy way to determine exactly what kind of substitution assumptions should be adopted in place of the usual fixed coefficient assumptions, so the new models often end up merely testing plausible alternatives, in the manner of sensitivity analysis. Perhaps more fundamentally, these new approaches do not deal with other basic limitations of MPA, such as the basic uncertainty of the future and the ambiguity of education's economic role. We see no easy way around these problems, and for that reason do not foresee the development of a perfect MPA methodology, although we do not expect further improvements to be made.

Perhaps a fresh start could be made, beginning from MPA's basic premise that something provided through education is required to perform particular types of work. Very possibly the "something," if it can be defined, is better measured in some units other than years of schooling. Past efforts to proceed along these lines have not been very successful, however.

C. Abandonment of Centralized Planning

A strong case can be made that MPA is so subject to errors of significant magnitude that it is best abandoned. Blaug, (1970, 1973)

takes this view. If the argument is accepted, and the CBA approach is also regarded as seriously flawed, and there is no third methodology readily available, then one reaches the position that centralized educational and manpower planning as a whole should be given up. This position has been forcefully argued recently by Windham (1975). The alternative, of course, is the "social demand approach," or simply the decision to leave education and occupational choices to decentralized decision-making by the individuals involved. The claimed virtues of this approach are that it respects consumer sovereignty and avoids the possibility of massive errors brought about by the miscalculations of central planners.

Our evaluation of this appeal for decentralization and use of the market in place of centralized planning is that, while it has substantial virtue as a palliative to the view that manpower planning should be carried out at the center using implicit planners assumptions and mechanistic models, it is itself seriously flawed and, at a minimum, in need of modification. Like all proposals to use the market it is based on the premise that the market works. But labor markets are widely recognized as highly imperfect, so the question arises as to whether there are ways that the scheme could be modified so as to simulate more nearly the workings of a perfect market.

The major difficulties with the proposal to rely on the market appear to be that participants in the market have highly imperfect information; that many other market imperfections, particularly unequal access for various socio-economic groups, are present; and that a systematic bias is introduced by the underpricing (subsidization) of education.

1. If it is possible to carry out manpower forecasts that convey more information than misinformation (a premise which, as we have seen, not everyone accepts), then manpower planning deserves to survive as an information service to the decentralized decision makers. Individuals, schools and employers will all make better decisions if they have access to the best information available about future manpower supply and demand.
2. Unequal access to education and jobs, if it is regarded as a social policy problem, requires special programs to assist the affected groups to obtain improved access. Such programs require planning.
3. A fundamental objection to the proposal is that the markets involved are fraught with price distortions. These work in various directions and are partially offsetting. One major distortion is introduced by the fact that schooling is usually financed largely through the public budget, so that the individual doing a calculation of whether a particular bloc of schooling is "worth it" is using a price in the calculation which is substantially below the cost of that schooling to society (some of the social benefits are also omitted from the individual's calculation, but the offset is probably only partial). This can lead to a systematic over-provision of schooling in social terms, such as Blang, Layard and Woodhall (1969) have argued exists with respect to higher education in India.

These points have all been discussed much more in connection with education and manpower policy issues in the United States and other developed countries than in relation to the developing countries. They deserve more discussion in the latter context, since faults in the techniques used in central planning inevitably strengthen the case for decentralized decision making. However, we do not believe, for the rea-

sons just enumerated, that the total abolition of planning in favor of the market is the preferred solution to the problem of how to link educational planning to the economy in the developing countries.

D. Ecclectic Manpower Assessment

If manpower planning is to continue in the developing countries, it seems obvious to us that the rational approach to its methodological difficulties is to make use of various methodologies and avoid total reliance on any single approach. This is in fact what good manpower planners are doing the world over. An eclectic approach uses both manpower forecasts and cost/benefit studies. It puts much less stress on combining all relevant factors into a single unified model, and focuses much more on particular forms of education and particular occupational or industrial employment categories. It heavily emphasizes improved understanding of past trends and present patterns as a prerequisite for being able to say anything intelligent about what may happen in the future. Besides the methodologies discussed in this paper, it would also make extensive use of present-oriented techniques such as earnings surveys, current labor market assessments and tracer studies of graduates of particular types of schools. This kind of manpower planning, in short, tries to gain a general idea of the long-term prospect while simultaneously keeping a close watch on what is actually happening in the school system and in the labor market. It will undoubtedly be clear to the reader that it is our preferred alternative.

For further discussion of the approach to manpower planning advocated here, see McMeekin's (1975) discussion based on his experience

in Malaysia.

VII. Conclusion: The State of the Art

Virtually all that we have to say has been said already. We will conclude by summarizing concisely what we consider the present state of the art of manpower planning to be.

Manpower planning took a lot of academic criticism and lost most of its intellectual following to the cost/benefit approach in the late 1960's. Yet it has continued to be practiced because some planners find it useful and many politicians find its simple logical basis comprehensible and appealing. Perhaps its inherent elitist bias has gained it further support, although the transition in many countries from perceived manpower shortages to perceived surpluses has probably reduced its frequency of use.

Like the CBA approach, and despite the efforts of methodological innovators to render it more acceptable, MPA is, in our opinion, inadequate as a single, all-purpose framework for relating education to the economy. Its true potential appears to us to be more limited: conceivably as part of a new synthesized approach, more likely as an information-gathering device under a decentralized system or as part of an eclectic manpower assessment methodology under a more planned approach. Selective application is a further possibility. The technique would appear to be more applicable to structured employers who define desired employee attributes mainly in terms of educational attainments. Governments and, to a lesser extent, corporations meet this criterion better than small firms or, obviously, self-employment. MPA may therefore be

more appropriate in sectors, or in development strategies, in which these types of employers predominate. Even here, however, the match is partly a matter of corresponding rigidities between education and employment, rather than true manpower requirements.

BIBLIOGRAPHY

- Adelman (1966). Irma Adelman, "A Linear Programming Model of Educational Planning: A Case Study of Argentina," in Irma Adelman and Erik Thorbecke (eds.), The Theory and Design of Economic Development, (Baltimore: Johns Hopkins University Press): 385-412.
- Ahamad and Blaug (1973). Bashis Ahamad and Mark Blaug (eds.), The Practice of Manpower Planning, (San Francisco and Washington: Jossey-Bass).
- Anderson and Bowman (1964). C. Arnold Anderson and Mary Jean Bowman, "Theoretical Considerations in Educational Planning," in Donald Adams (ed) Educational Planning, (Syracuse, New York: Syracuse University Press).
- Apichai (1977). Apichai Puntasen, "Manpower and Educational Planning for Higher Education in Thailand," Economic Development and Cultural Change, 25, no. 2 (January): 279-292.
- Archer Report (1961). Educational Development in Nigeria, 1961-1970. A Report on the Phasing and Cost of Educational Development on the Basis of the Ashby Commission Report on Post-School Certificate and Higher Education in Nigeria, (Lagos: Federal Government Printer).
- Arrow and Capron (1959), Kenneth J. Arrow and William M. Capron, "Dynamic Shortages and Price Rises: The Engineer-Scientist Case," Quarterly Journal of Economics (May).
- Ashby Report (1960). Investment in Education. The Report of the Commission on Post School Certificate and Higher Education in Nigeria (Lagos: Federal Ministry of Education).
- Balogh and Streeten (1963). T. Balogh and P.P. Streeten, "The Coefficient of Ignorance," Bulletin of the Oxford Institute of Statistics 25, No. 2: 97-107.
- Becker (1964). Gary S. Becker, Human Capital (New York: Columbia University Press for the National Bureau of Economic Research).
- Blaug (1967). M. Blaug, "Approaches to Educational Planning," Economic Journal 77, No. 306: 262-88.
- _____ (1970). An Introduction to the Economics of Education, (London: Allen Lane The Penguin Press).
- _____ (1971), "A Post-Mortem of Manpower Forecasts in Thailand," Journal of Development Studies 8, No. 1 (October): 59-78.
- _____ (1973). "Thailand," in Ahamad and Blaug: 106-30.
- _____ (1976). Human Capital Theory: A Slightly Jaundiced Survey, "Journal of Economic Literature 14, No. 3, (September): 827-55.
- _____, Layard and Woodhall (1969). M. Blaug, R. Layard and M. Woodhall, The Causes of Graduate Unemployment in India (London: Allen Lane The Penguin Press).

- Blitzer (1975). Charles R. Blitzer, "Employment and Human Capital Formation," in Charles R. Blitzer, Peter B. Clark and Lance Taylor (eds), Economy Wide Models and Development Planning (London: Oxford University Press): 177-96.
- Blum (1965). J. Blum, "Planning Models for the Calculation of Educational Requirements for Economic Development in Turkey," in OECD, Econometric Models of Education (Paris): 55-76.
- Bombach (1964). G. Bombach, "Comment" (on Tinbergen Model) in OECD, The Residual Factor in Economic Growth (Paris): 188-98.
- Bowles (1966). Samuel Bowles, "Comment" (on Adelman Model), in Irma Adelman and Erik Thorbecke (eds.), The Theory and Design of Economic Development (Baltimore: Johns Hopkins University Press): 412-17.
- ____ (1967). "The Efficient Allocation of Resources in Education," Quarterly Journal of Economics 81, No. 3: 189-219.
- Bureau of Labor Statistics (1963). Bureau of Labor Statistics, U.S. Department of Labor, The Forecasting of Manpower Requirements, Report No. 248 (Washington).
- ____ (1968). How to Make an Inventory of High-Level and Skilled Manpower in Developing Countries, Report No. 331. (Washington).
- Burgess, Layard and Pant (1968), T. Burgess, P.R., G. Layard and P. Pant, Manpower and Educational Development in India 1961-1986 (London: Oliver and Boyd).
- Carnoy and Thias (1972), Martin Carnoy and Hans Thias, "Educational Planning with Flexible Wages: A Kenyan Example," Economic Development and Cultural Change 20, No. 3 (April): 4, 38-73.
- Correa and Tinbergen (1972). H. Correa and J. Tinbergen, "Quantitative Adaptation of Education to Accelerated Growth," Kyklos 15: 776-
- Daniere (1965). Andre Daniere, "Planning Education for Economic Productivity," in Seymour E. Harris (ed.), Challenge and Change in American Education (Berkeley, Calif.: McCutchan Publishing Corp.).
- Datar (1958). B. N. Datar, "Manpower Planning in India," International Labour Review (July).
- DeWitt(1961). Nicholas DeWitt, Education and Professional Employment in the U.S.S.R. (Washington: Government Printing Office).
- Dougherty (1971). C.R.S. Dougherty, "Optimal Allocation of Investment in Education," in Hollis Chenery (ed). Studies in Development Planning (Cambridge, Mass: Harvard University Press): 270-92.
- Eckaus (1964). Richard S. Eckaus, "Economic Criteria for Education and Training," Review of Economics and Statistics 46, No. 2. (May).

- Emmerij (1965). L. J. Emmerij, "Planning Models for the Calculation of Educational Requirements for Economic Development, Spain," in OECD, Econometric Models of Education (Paris): 33-53.
- Freeman (1975). Richard B. Freeman, "Manpower Analysis for Economic Development: The Manpower Adjustment Approach," Methodological Document No. 1, Center for Policy Alternatives, M.I.T., mimeo (May).
- Gannicott and Blaug (1973). Kenneth Gannicott and Mark Blaug, "The United States," in Ahmad and Blaug: 48-76.
- Harbison (1970), Frederick H. Harbison, "From Ashby to Reconstruction: Manpower and Education in Nigeria," in Carl Eicher and Carl Liedholm (eds.), Growth and Development in the Nigerian Economy (East Lansing, Michigan: Michigan State University Press).
- _____ and Myers (1964). Frederick H. Harbison and Charles A. Myers, Education, Manpower and Economic Growth (New York: McGraw Hill).
- Hinchliffe (1973). Keith Hinchliffe, "Nigeria," in Ahmad and Blaug: 131-56.
- Hollister (1964). R. G. Hollister, "The Economics of Manpower Forecasting," International Labor Review 89, No. 4, (April): 371-97.
- _____ (1967). A Technical Evaluation of the First Stage of the Mediterranean Regional Project (Paris: OECD).
- Horowitz, Zymelman and Herrnstadt (1966). M.A. Horowitz, M. Zymelman and J.L. Herrnstadt, Manpower Requirements for Planning: An International Comparison Approach (Boston: Department of Economics, Northeastern University).
- Hunter (1963). Guy Hunter, Education for A Developing Region. A Study in East Africa (London: Allen and Unwin).
- _____ (1965). "Issues in Manpower Policy: Some Contrasts from East Africa and Southeast Asia," in Frederick H. Harbison and Charles A. Myers (eds) Manpower and Education, (New York: McGraw-Hill).
- _____ (1967). Higher Education and Development in South-East Asia. Vol III, Part I. High-Level Manpower (Paris: UNESCO - International Association of Universities).
- ILO (1962). International Labour Office, "Manpower Planning in Eastern Europe," International Labour Review (August): 3-35.
- Jolly and Colclough (1972). Richard Jolly and Christopher Colclough, "African Manpower Plans: An Evaluation," International Labour Review 106, Nos. 2-3 (August-September): 207-64.
- Knowles (1965). William H. Knowles, "Manpower and Education in Puerto Rico," in Frederick H. Harbison and Charles A. Myers (eds.), Manpower and Development (New York: McGraw-Hill): 108-39.

- Laska (1968). J.A. Laska, Planning and Educational Development in India (New York: Teachers College Press).
- Layard (1971). P.R.G. Layard, "Economic Theories of Educational Planning," in M.H. Peston and B.A. Corry (eds.), Essays in Honour of Lionel Robbins (London: Weidenfeld and Nicholson).
- _____ and Saigal (1960). P.R.G. Layard and J.C. Saigal, "Educational and Occupational Characteristics of Manpower: An International Comparison," British Journal of Industrial Relations (July).
- Lee (1972). Eddy Lee, Educational Planning in West Malaysia (Singapore: Oxford University Press).
- McGinn and Davis (1969). Noel F. McGinn and Russell G. Davis, Build a Mill, Build a City, Build a School: Industrialization, Urbanization and Education in Ciudad Guayana (Cambridge, Mass.: MIT Press).
- McMeekin (1975), Robert W. McMeekin, Educational Planning and Expenditure Decisions in Developing Countries with a Malaysian Case Study (New York: Praeger).
- Mabey (1973). Bevars D. Mabey, Economics of Manpower and the Labor Market (New York: Intext Educational Publishers).
- _____ and Tanomjit (1972). Bevars D. Mabey and Tanomjit P. Kompar, "Manpower Imbalances in Thailand," Western Economic Journal 10, No. 4, (December): 428-48.
- Malaysia (1967), Malaysia, Report of the Higher Education Planning Committee (Kuala Lumpur).
- Mangum (1969), Garth L. Mangum, The Emergence of Manpower Policy (New York: Holt, Rinehart and Winston).
- Mathew (1973). N.T. Mathew, "Manpower Planning in India," Demography India 2, No. 2. (December): 305-13.
- Mehmet (1965). Ozay Mehmet, Methods of Forecasting Manpower Requirements, (Toronto: Department of Labour and Center for Industrial Relations, University of Toronto).
- Merrett (1966). A. Merrett, "The Rate of Return to Education: A Critique," Oxford Economic Papers (November).
- Naik (1965). J.P. Naik, Educational Planning in India (Bombay: Allied Publishers).
- Netherlands Economic Institute (1966). Netherlands Economic Institute, Financial Aspects of Educational Expansion in Developing Regions, in OECD, Financing of Education for Economic Growth (Paris).

- OECD (1967). OECD, Problems of Human Resource Planning in Latin America and in the Mediterranean Regional Project Countries (Paris).
- _____ (1972). Manpower Policy in Norway (Paris).
- Parnes (1962). Herbert S. Parnes, Forecasting Educational Needs for Economic and Social Development (Paris: OECD).
- Psacharopoulos (1973). G. Psacharopoulos, "France," in Ahamad and Blaug. _____ and Hinchliffe (1973). G. Psacharopoulos and Keith Hinchliffe, Returns to Education: An International Comparison (Amsterdam: Elsevier Scientific: San Francisco: Jossey-Bass).
- Puerto Rico (1959). Puerto Rico, Committee on Human Resources, Puerto Rico's Manpower Needs and Supply (San Juan).
- Rado and Jolly (1965). E.R. Rado and A.R. Jolly, "The Demand for Manpower: An East African Case Study," Journal of Development Studies 1, No. 3. (April): 226-43.
- Robbins Report (1963). Higher Education Report of the Committee under the Chairmanship of Lord Robbins, Cmd. 2154 (London: HMSO).
- Schultz (1961). Theodore W. Schultz, "Investment in Human Capital," American Economic Review 51, No.1. (January): 1-17).
- Sen (1964). A.K. Sen, "Comments on the Paper by Messrs. Tinbergen and Bos," in OECD, The Residual Factor and Economic Growth (Paris).
- Shaffer (1961). H.G. Shaffer, "Investment in Human Capital: Comment," American Economic Review 52, No. 4 (December): 1026-35.
- Skorov, (1964). G. Skorov, "Manpower Approach to Educational Planning: Methods used in Centrally Planned Economies," in UNESCO, Economic and Social Aspects of Educational Planning (Paris).
- Sundrum (1964). R.M. Sundrum, "Notes on Harbison and Myers' Index of Human Development, Mimeo (Bangkok: Asian Institute of Economic Development and Planning).
- Taylor (1975). Lance Taylor, "Theoretical Foundations and Technical Implications," in Charles R. Blitzer, Peter B. Clark and Lance Taylor (eds), Economy-Wide Models and Development Planning (London: Oxford University Press): 33-104.
- Thias and Carnoy (1972). Hans Heinrich Thias and Martin Carnoy, Cost-Benefit Analysis in Education. A Case Study of Kenya, World Bank Staff Occasional Papers No. 14 (Baltimore: Johns Hopkins University Press).

- Tinbergen and Bos (1964). J. Tinbergen and H.C. Bos, "A Planning Model for the Educational Requirements of Economic Development," in OECD, The Residual Factor and Economic Growth (Paris): 147-69.
- ____ (1965). "Appraisal of the Model and Results of its Application," in OECD, Econometric Models of Education (Paris): 95-99.
- Tobias and Queener (1968). G. Tobias and R.A. Queener, India's Manpower Strategy Revisited, 1947-67 (Bombay: N.M. Tripalti Pvt. Ltd.).
- UNESCO (1968). UNESCO, Educational Planning. A Survey of Problems and Prospects (Paris).
- Williams (1965). Gareth Williams, "Planning Models for the Calculation of Educational Requirements for Economic Development. Greece," in OECD Econometric Models of Education (Paris): 77-93.
- Windham (197). Douglas Windham,
- Woodhall (1973). Maureen Woodhall, "Engineers in India," in Ahmad and Blaug: 157-200.
- Zymelman (1974). Manuel Zymelman, "Projeccion de la Demanda de Recursos Humanos para la Republica Dominicana," in Educational Development Center, Los Recursos Humanos y El Empleo en La Republica Dominicana, Vol. 2. (Cambridge, Mass.): 143-211.