MODELS AND POLICY: THE DIALOGUE
BETWEEN MODEL BUILDER AND PLANNER

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1. A SUBJECTIVE INTRODUCTION

I am not a "development planner". I am commenting, more or less as an outsider, on the problems of trying to use mathematical models in the planning of developing countries.

It is true that I am only in part an outsider. For several years I participated intensively in the design and application of mathematical planning models in my country, Hungary. Hungary falls perhaps halfway between a typical developing and developed country. A significant portion of our problems are similar to those of the developing countries: Which should be the leading sectors? What new industries should be established? What should be the rate of industrialization? How can we fit into international division of labor? How should we distribute the burden of growth between present and future generations? And so on. There is also a similarity between the modelling techniques of our group in Hungary and those discussed in this volume - for example, input-output analysis and static and dynamic linear programming models.

Despite these similarities, I am still an outsider. After all, planning in Budapest is quite different from that in New Delhi or Mexico City. For one thing, the Hungarian economy is based on European economic and cultural traditions. But more importantly, Hungary is a socialist country where the bulk of production is supplied by state or cooperative enterprises, where
control of the economy is to a large degree centralized, and where there was considerable experience with nonmathematical planning and a large functioning economic organization at the time that mathematical planning began.

My opinion of mathematical planning or formal economy-wide models was shaped by personal experience in Hungary. It is true that I have participated as a consultant in several research projects which built models for developing countries. I have been present at meetings where competent development planners propounded their opinions. Before that, I tried to review the literature of the problem. Nevertheless, I derived from all this only an indirect impression, without the quality of personal experience. Now, while preparing this study, I reread some earlier material and perused some more recent work as well. I tried to choose "representative" items. I reviewed primarily the most famous, most quoted works, including the more important ones of the other contributors to this volume. The fact that I did not read these works over a long period, but almost in one sitting, one after another, probably helped sharpen my general impressions. Here, my objective is not to comment on individual works but rather to give a picture of this general impression. While my remarks do not precisely fit any one specific model, perhaps they give an accurate feeling of the image created by the "average" economy-wide planning model to an outsider.

To this, I must add a few qualifications. First, I concentrated primarily on the evaluation of the mathematical programming models. These closely resemble (from a technical point of view) the models I have worked with myself and feel most qualified to comment on. Second, my remarks are based almost exclusively on journal articles and books. It is possible that the published descriptions are not complete; perhaps much of what the authors have had to say has appeared in unpublished reports or has been said at meetings on the spot. Nevertheless, I believe that the choice the researcher makes in deciding what is most worth publishing, and what he reserves to himself or transmits only to a small circle, reflects his final priorities.
Here I emphasize the items, that I believe are missing from these studies. Yet I would like to avoid even the appearance of judging superciliously from the height of some glorious successes. Let me confess that I not only esteem but even envy the high intellectual level and the theoretical standards characterizing these works almost without exception. We Hungarian planners are all self-taught, with skills obtained through hard work, whereas many mathematical development planners have come out of the best schools with a high degree of technical knowledge. I felt, as I read all of these works, that the authors are well acquainted with all the tricks of the art, with those we in Hungary apply, and with many more. I wish that five or ten of the top workers of this group would work in our planning centers in Budapest; the professional quality of the work there would surely improve by leaps and bounds.

In addition, I envy the wonderful computing facilities at their disposal; no matter how much our facilities improve, we are always one or two steps behind in computer speed, efficiency of the algorithms, and richness of the program library.

The coin has another side: Any criticism of mine can also be seen as self-criticism. It is always easier to find distortion in the other fellow than by looking in the mirror. Much of the criticism I level at the planning models of developing countries also fits some of my own research and that of other Hungarian model builders.

There are two major topics in this chapter. In section 2, the relations between economic policy makers and model builders, and the dialogue between these two distinct groups, are discussed. Sections 3 and 4 deal with various political implications of development planning models. In other words, section 2 focuses on relations between different groups of people, while sections 3 and 4 emphasize relations between different economic and political issues. My remarks are addressed primarily, but not exclusively, to model builders from a model builder. However, much of the material, especially in section 2, is also aimed at policy makers and other participants in the planning process.
2. THE MACHINERY OF PLANNING AND MATHEMATICAL MODEL BUILDERS

The good Boy Scout performs a good deed every day. "Boy, was today's good deed difficult?" "Why, what did you do?" "I led a blind man across the road." "And why was that so difficult?" "Because he did not want to go!"

(Joke frequently told in Budapest.)

The first mathematical planning models appeared in Hungary in 1957-58. Economy-wide and sector planning, both for the medium and long term, had already been going on in Hungary for about a decade, but exclusively relying on traditional, non-mathematical methods. The scale of planning could be described by two values: (1) The number of people working in the machinery of planning. Hungary is a small country of ten million people. Before the appearance of mathematical planning, the central planning office had a payroll of 500 to 800. In addition, every ministry, the directorate of every industrial branch, every producing company, and every local administrative authority had a planning office. Altogether, tens of thousands of people were busy planning. (2) The number of parameters used in the documentation of the five year plan. There is no accurate count, but a crude estimate of the order of magnitude would be several million.

At the first trials of mathematical planning we had to decide what our relationship to nonmathematical planning should be.1 Confident of our technical superiority, should we try to assert our independence from the machinery of planning? Should we come forward as competitors, proposing the replacement of traditional planning by mathematical planning? Finally, the following "battle plan" emerged: The task was not the "revolutionary overthrow" of traditional planning but rather its gradual

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1. This is dealt with in detail in Kornai (1972).
transformation or "reeducation". Having the finest models was not the most important thing. It was not even so terribly important, especially at the beginning, that the numerical results of our research be accepted as the basis for the official plan. What was really important was the "infiltration" of formal or mathematical methods into the actual machinery of planning. Everything - the design of the structure of models, the choice of colleagues, the working procedures, the presentation and dressing up of results - should be subordinated to this aim. Mathematical planning should not be forced on practical economical leadership but should be built into the actual economic management and become a part of it. Progress should be achieved gradually, step-by-step, so that the planning apparatus would consider mathematical modelling as its own work. The official bureaucracy should accept the professional mathematical planner as a collaborator. Moreover, even those in the planning process who would not become modellers should at least understand the working of the models; they should help the model builders and also rely upon their help.

In Hungary, this implied that those who started their career as researchers, professors, and academic scholars, were faced with a decision. Some of them gave up their academic positions and took it upon themselves to work as mathematical planners within the planning apparatus of the economic administration. On the other hand, those who were unwilling to do this gradually handed over the day-to-day work to those permanently attached to the planning apparatus. The principal task of researchers and other academic people is the future development of improved methods, and some consulting, while the systematic application of mathematical planning is a governmental job rather than an academic one.

I do not want to idealize the Hungarian situation. We are, frequently, rightfully impatient because of the slow, uneven progress of this penetration, transformation, and reeducation. There is too much conservatism and inertia. The transformation
is slowed down by intellectual laziness and by an aversion to getting acquainted with the new methods. Nevertheless, we have made great progress.

Nowadays, there are special groups and departments in the Hungarian National Planning Office with many workers specializing exclusively in mathematical planning. The Planning Office has its own large computer center. Many models have been built — some of them of very large scale, having more than a thousand variables — with the active participation of one or another leading official of the Planning Office. The planning process has several phases which would be unimaginable now without the use of mathematical models. There is a repeated dialogue going on between the practical planner and the model builder and, with the meditation of the model builder, ultimately the model. We will return to this later.

My impression is that a very different approach has been taken by the first generation of the mathematical planners in most developing countries. Typically, the initiators of the model, the directors of research, felt that it was most important to generate a good plan, instead of improving planning per se, or if it never existed before, creating it. They considered their work as mainly economic research, starting with the design of a model and ending up with the evaluation and publication of the research result. Yet, a more important impact would have been made if organization and reeducation — in other words, the establishment of modern methods of planning the national economy — had been at the center of their work.

The following is a typical story. An outstanding Western professor, or maybe a talented graduate student, shows up in a developing country. His work is financed by some institution of his native country, a foundation or university, or perhaps by some international organization. He is filled with
desire to help and has intellectual interest in research. He completes
the work; his report is discussed on location; even a few remarks by
local economists may be muttered with proper reverence. There is no
great battle over the statements of the model. The professor or gra-
duate student leaves soon after—and life continues just as it was
before he came.

This is just like a concert given in a little hick town once
a decade by a world-famous violinist. He is listened to with proper
reverence but without a real enjoyment of the music: "Bartok, Schonberg
—this is too modern, too highbrow for us..." The effect of such an
unusual concert would be different if there were better music instruc-
tion in the local schools or if there were a town conservatory, quartet,
choir, and orchestra to make music available, even on weekdays. If all
this is missing, then when the world-famous virtuoso leaves, the little
town is left without any music at all.

Returning from music to development planning, even short re-
ferences to the following questions can hardly be found in the litera-
ture. How is the planning process working in the country under discus-
sion? What was the state of planning and its underlying quantitative
foundations before the appearance of mathematical planning, and what
became of it afterwards? To what degree were efforts to have the model
adopted by local groups successful? Was the model sound? What were
the most typical objections? A discussion of whether the plan was
accepted and "applied" is not what is missing. Everyone agrees that
the results of a mathematical model can never be accepted literally,
number by number; rather, what is missing is a discussion of how the
research, the modelling, affected "planning", i.e., the planning and
decision making process as a permanent government activity.. Did mathe-
matical planning, at least in this sense, have a lasting effect?

The connections between policymakers and "domestic" model buil-
ders are probably closer than the ties with "imported", short-term visi-
tors. Moreover, even in the case of foreign consultants, the real-world
experience is somewhat better than one would conclude from publication,
or more precisely, from the lack of pertinent published information. In
any case, the literature reflects the subjective priorities of the re-
searchers and other model builders; they are not writing about these problems, or hardly at all. Neither positive nor negative feedback is mentioned. How, then, should a model building project be organized in order to make an effective contribution to "planning"? I offer the following set of recommendations based on my own experience, both its successes and setbacks. We emphasize requirements for projects led by academics in countries where there has been little experience with model building. Most of the lessons also hold in more "sophisticated" settings.

(i) The entire task, each individual phase of it - from data compilation, to design of the model, to appraisal of results - should be performed as a team project. There should be local people, who are present or future planners, as members of the team. In their selection, their immediate contributions to the current project should not be the only considerations. An equally important or even more important consideration should be: Will they be able and willing to take over the relay stick from us some day, to continue the construction and computation of models similar to those we worked on together? This is typically an area where real pedagogical results can be obtained only by the principle of "learning-by-doing." My impression is that in the few countries where such teams were developed, e.g., in South Korea and perhaps in India, an enduring effect can indeed be found.

(ii) Occasional discussions between the model builders and the local practical economic leaders, economic politicians, and official planners are not enough; rather, a constant, lively, working relationship is needed. Here I am thinking of the people who are not participating directly in the team but who have actual planning and economic leadership responsibility. It is no less important to establish lively contacts with local academic economists, who may exert strong influence on public opinion, and who perhaps act as advisers to the local government or planning agencies. If these people observe the activities of the modellers with suspicion or, even worse, with envy and adversion, there can be little hope for acceptance; they will be permanent opponents and critics. The friendlier the contacts with local academic circles, the smoother will be the progress of new methods.
(iii) The structure of the model should be simple, especially in the initial phases of introducing mathematical methods and formal models. The degree of complexity should not be set to satisfy the high standards of the university colleagues or the professor in charge of the project; rather it should be adjusted to the intellectual "absorptive capacity" of the local practical planners. The primary consideration should be that the local planners understand and accept the simpler model, consider it their own, and begin to apply it independently. If this "revolutionary" change take place in the planning process, all the rest can be left to gradual development; in this case, the local planners will be able, by themselves, to change over from simpler to more complex models.

This is a difficult requirement and requires selflessness. It may not add to the academic reputation of the professor directing the research. Sometimes there may be a legitimate need for compromise between these two research objectives. In any case, this criterion is a most important gauge of the real goal of the researcher, the improvement of planning in the country involved, or his own scientific achievement.

(iv) Local decision makers and planners face numerous economic policy problems. A model, or rather the series of computations performed with a model, should be designed to be able to furnish valuable information about the real-world problems of the planners and practical decision makers. I used the broad wording, "to furnish information," intentionally. We cannot expect our model to give final, decisive answers; it can be considered an accomplishment if it only inspires interesting thoughts, if it furnishes additional points of view for a decision. Neither will I take a stand about the mathematical form that the information should take. Suppose that the problem under consideration is the balance of payments. The balance of payments may be an endogenous variable of the model; it may be a maximand or objective function; or it may be an exogenous constraint subject to parametric variation. In each of the three forms, we may gather information about the mutual relationship between the balance of payments on the one hand and about other economic events and activities on the other.
We also have to take into account an internal dilemma for the researcher, similar to the one already mentioned in connection with the simplicity of the model. Every researcher has one or more pet themes. One is interested in import substitution, another in increasing returns to scale, a third in the length of the time horizon, a forth in the stability of shadow prices. It is quite understandable, and scientifically very useful, if the researcher views his work in a developing country as an opportunity to experiment with the real numbers of a real economy in connection with investigating his pet interests. It can only be to the advantage of his own research if he discusses such questions with the local practical planners. But he should be aware of the real weight and importance of his pet theme in the totality of all of the problems and development dilemmas of the country in question. His problem may be only one of methodology; even if the issue concerns economic policy directly, it is only one of many such problems. The impossible, to completely ignore one's personal scientific interests, should not be asked. But self-discipline and sober compromise are possible and needed in deciding the weight to give to the problems of economic policy as they are perceived by local policy makers as opposed to those of the research scholar.

(v) With these points in mind, it is highly desirable that both the structure of the model and the series of computations to be performed with it are fully designed at an early stage. But even the best thought-through design cannot substitute for an active dialogue between the model builder and the decision makers who will be asked to use it. It is important to emphasize this recommendation, for it is a most important element of the general requirement for a lively working relationship.

The planner and the model builder should try to delineate together the issues to be analysed. In any intellectual problem-solving activity, developing a clear formulation of the problem is often more difficult than finding the actual solution. The dialogue between planners and model builders should usually start with the planner thinking aloud about the range of problems which concern him, and the modeller explaining what his tools can accomplish in analyzing them. Ideally,
the model builder would later take the results of his computations to a responsible economic politician, to a planner in a high position, and evaluate the results jointly. The economic politician then may ask, "And what would be the result is we did this instead of that?" The mathematical planner then returns to the computer, translates the question into the language of the model, runs one or more new computations, and returns to the planner with the result. Of course the questioning can take the opposite direction as well. The model builder may ask, on the basis of the lessons learned from computed results, whether this or that assumption of the policy maker is realistic.

If I had to judge on the basis of a single phenomenon whether the work of mathematical planners has "matured", in a given country, I would try to observe whether such a question-and-answer process had been developed or not.

(vi) The estimates, forecasts, and plans of the nonmathematical planners should be utilized to a considerable degree. We should not strive to generate all of our computations exclusively by a "parthenogenesis," drawing directly from objective statistical sources. This is only one way to approach problems. At least some experiments should be constructed on the basis of numbers obtained from practical, nonmathematical planners. For example, with programming models we frequently use the procedure of describing as constraints certain aggregate targets, which are forecast by nonmathematical methods, leaving the model free in the choice of details. In other words, the model tests whether the aggregate forecast of the planners could be accomplished more efficiently. The interest of the nonmathematical planners is usually increased if they see "familiar" numbers, if they can relate the results obtained by modelling to something they know. The following approach creates confidence: "We are not aiming at something completely different from your ideas. At least as an approximation, we want to investigate how your plans can be realized, only a little bit more efficiently."

I am not proposing that, in the computation phase, we should not deviate courageously from the original ideas of the planners. But gradual change of thought can be assured by calculating variants close to the original ideas as well.
This is complemented by another related proposal: The calculations obtained with the model should be compared carefully with independent nonmathematical plans. One also has to take into account the sensitivity, and possibly even the resistance, of those who developed the original plans; these people would not like their ideas to be shown as stupid by the mathematical planners. I am not proposing a lack of principle but rather special attention to fitting together different arguments and approaches. The superiority of a plan computed using a model should be demonstrated convincingly. No one is convinced by the mere fact that the plan projections were computed by a mathematical model using an electronic computer, not even if we call them "better" or even "optimal", according to an indicator (objective function) designed arbitrarily by us.

The mathematical planner must not believe that, when he debates with practical planners, he is always right, and that the only problem is to convince the other side about his truth. We should be very modest and quite critical of our own work. In many cases the practical planner, relying on long experience, will be right. His naive and subjective estimates will sometimes be more reliable than ours, generated by mathematical models, which are also based on very strong simplifying assumptions. The modeller should approach the men of practice with the double aim of teaching and learning.

(vii) The model's results should be summarized in a report clearly understandable to practical people. This task closely resembles that of a translator. The mathematical planners have developed a peculiar slang, full of such terrifying expressions as "complementary slackness," "two-gap model," "gradualist path," and "turnpike." We have to acknowledge that even academic economists, working in other specialties, do not necessarily understand this slang, to say nothing of the economic politicians. It is sometimes a real headache to determine how to present the end results of computations, involving several hundred thousand numbers and obtained from a large system of equations, in only a few words, tables, and simple diagrams, so that they are really understandable, yet without unnecessary oversimplification.
(viii) Another necessary (but not sufficient) condition for successful completion of the project is that the practical planners and economic leaders should consider the results meaningful and interpretable. Unconditional acceptance of our recommendations cannot be expected, and there is nothing wrong with objections voiced to the results obtained by a formal model. But as a minimum requirement, the results should not be considered absurd or naive. In my view it is very important that the computations should not be smiled at behind the back of the model builder. We should not begrudge some expenditure of energy in finding out how the people who are responsible for economic decisions in the country really feel about the results. We should try to provoke a frank discussion and should not relax until we are convinced that the computations are taken seriously.

(ix) Finally, work is not finished with the preparation of a particular set of computations for a given plan. The proponents of mathematical planning should try to instill a familiarity with their methods and assure their inclusion into the systematic institutional planning framework. If the work was led by a foreign consultant, it should not be irrelevant to him what happens after he leaves, who is going to continue his work, and under what conditions. Future systematic improvement of the statistical data base (along the lines advocated in Chapter IV), further development of the computational basis of mathematical planning, and training of mathematical planners should be advocated. In the foundation of enduring results, the researcher should be not only a scientist and adviser, but also an organizer and "agitator," a popularizer of modern planning methods.

(x) Summary. If the time spent by the leaders of a research project on the construction of a model, securing that data, carrying out the computations, and evaluating and publishing results is considered as taking up 100 percent of their time (that is, if they are unconcerned about whether the methodology itself is being adapted and whether the model's results will have any practical effect in the distant future) then, according to my experience, this "basic working time" may be doubled if the nine above recommendations are carried out. The education and convincing, in words and writing, of both the research team and other practical planners are extremely time consuming.
I have not read anywhere an account of how the working time of the development planning model builder has been divided. But I am probably correct in believing that it is closer to the above-described "research" 100 percent than to the "organizing-educating" 200 percent. But as long as this is the case, real penetration of mathematical methods into the planning processes of the developing countries is going to remain very, very slow.

I believe my proposals have much general validity; however, their practical implementation depends on the degree of maturity of non-mathematical planning. It is only clear what aims are worth striving for if there is already organized, institutional, nonmathematical planning. The development of the "battle plan" is more problematic if, at the first appearance of the mathematical planners, there is no or hardly any other kind of planning available. Should we then start exclusively with modeling? Not in my opinion. No matter how much I believe in these methods, I feel that they cannot really stand alone. Life is much more complicated than our greatly simplified and condensed models. We need double-checking tools, including the estimates and "naive" calculations of the practical planners and high-level economic administrators, at least as a complementary control. In a single model, only a few hundred relationships and constraints can be considered. But people working in the central planning agencies and lower-level institutions and enterprises "sense" hundreds of thousands of further constraints and relations, and they can give expression to these in their own estimates. Mathematical planning will develop successfully only when it develops as one element of well-prepared and well-oriented institutional planning, connected by many threads with real economic life in developing countries.

3. THE SCARCITY OF THE PROBLEMS EXAMINED WITH MODELS

In the previous section there was a detailed discussion of how to establish a closer relationship between model builders, on the one hand, and official government planners and high-level economic administrators, on the other. While agreeing with these proposals, I wish to call additional attention to one particular danger: It is not at all certain that the official planning bureaucracy senses correctly the
actual development problems of the country or, more precisely, the relative weight of different problems. Planners can be inhibited by many different factors, ranging from erroneous theoretical economic views to social and political bias. It would be a serious mistake for the model builder to exclude from his investigation those burning questions which the politicians in power would like to forget.

I do not wish to discuss here what kind of recommendations the mathematical planner should propose but rather what alternatives he should examine. In my view, the models, and the experiments performed with them, should be constructed in such a way that it would be possible to analyze the conditions and consequences of various social-political trends and various development strategies. For example, in a country in which there is argument about whether there should be agrarian reform, and whether the reform should be moderate or radical, the long-term, economy-wide planning model should be capable of testing the implications of at least a few policy variants.

Of course, in this regard the model builders should not restrict their intellectual contacts exclusively to the circle of government planners. They should also pay attention to what other groups and movements have to say or what they write.

Let us take a look, more concretely, at the key questions of economic policy that have been usefully studied using economy-wide planning models:

(i) The growth patterns between various sectors;
(ii) The structure of foreign trade, import substitution, the trade balance, and the balance of payments;
(iii) Foreign credit and aid;
(iv) Technical development, especially in the allocation of capital and labor;
(v) The scale and proportion of saving and investment. Along with this the time paths of accumulation and consumption, and, ultimately, the division of the benefit and cost between present and future generations.
This list is, of course, not complete. Several other problems, discussed in one study or another, may be added. But I feel that it contains the intersection of the principal problem sets studied in practically every significant research project described in the development planning literature.

The listed problems are extremely important. The criticisms below are not aimed at diminishing their significance. The themes I will emphasize next are not meant to take their place but to stand next to them at the center of attention. They are important issues which have been largely ignored in previous research in developing countries.

3.1 Targets versus Instruments

Economy-wide planning models concentrate their attention primarily on "real" flows such as physical inputs and outputs of the economy, the structure of production, foreign trade, and consumption. The objective of the analysis is to determine numerical, quantitative development targets in these areas. At the same time, these models rarely specify how these goals and targets are to be realized. The models are not particularly instrumental in character. This is one of the most important criticism made by potential users who feel there is nothing they can do with the results of planning models.

In my view, economy-wide modellers who leave careful analysis of instruments to other models (such as short-run econometric models) or to the practical planner working independently are mistaken. One of the most important elements for further research in methodology is how to build instrumental variables and relations into development planning models. Admittedly, this is a difficult task, requiring careful analysis and raising a number of perplexing problems.

One major problem is disaggregation. A model becomes, at least in part, "instrumental" as soon as individual investment projects are included in addition to several rather aggregate sectors. Indeed, the model itself could then decide about whether or not the projects should be accepted. There are several techniques for attempting this.
For example, one method is to treat several especially important projects as indivisible integer variables and then link them with the rest of the economy. Another way is to "blow up" one or two key sectors for detailed examination. Finally, there exists a still more comprehensive technique: The development of a multilevel planning system such that aggregate sectors are placed in the higher levels, while in the lower levels disaggregated individual projects are included.

Another important issue is the building of financial variables and relations into the model. While literally all economy-wide models deal with the international balance of payments, there are other financial considerations of equal importance:

(i) The national budget and system of taxation. If there are significant regional problems in the country, then the regional budgets are also important;

(ii) The financial requirements and sources of financing investment which usually must be specified in a disaggregated form according to different forms of ownership (for example, state, private, capitalistic, small farmer); and possibly according to different sectors;

(iii) Economy-wide balance of private purchasing power and the supply of consumer goods and services, which is very significant from the point of view of possible inflationary tendencies; and

(iv) Credit balances.

Some mathematical programmers object to including financial considerations because a whole series of new constraints would show up in the model, making more difficult any conceptual interpretation of the system of underlying shadow prices. I feel that this objection is irre-

2. For an example of this approach for Korea, see Westphal (1969).
4. This has been attempted for Mexico and reported in Gareux and Manne (1973).
5. The large-scale linear programming model of the Hungarian five year plan for 1971-75 contains a large set of fiscal and financial variables and equations. See Morva and Bager (1972).
levant. It is not necessary and, indeed, is probably impossible for the shadow price system of a long-run, economy-wide programming model for a developing country to have a strong resemblance to a real market price system. I am not going to expound the arguments and counterarguments which are well discussed in Chapters III, V, VII, and especially in VIII.

I should remark here that, in principle, the shadow price system itself is instrumental in nature, usable in the cost-benefit analysis of investment projects; however, use can be made only with great circumspection, care, and much reservation. In cost-benefit analysis and project evaluation, several other sources of information also have to be taken into account. As a result, I cannot agree with the quite widespread point of view that the shadow price system should be main or even the only instrumental result of such models. Much more important and effective would be the inclusion of the instruments mentioned above; however, their introduction would require some restructuring and reformulating of existing modelling techniques.

3.2 "Physical" versus "Human" Aspects

Two adjectives originating with Hegel and Marx, "Versachlichung" and "alienation", apply very well to most planning models for developing countries. Although these models describe the flow of objects, things, physical inputs and outputs (and perhaps of money), somehow, living people are missing from them. Let us use an example: The model states that as a result of industrialization, certain changes will occur in the technological structure of production, the capital-output ratio, the balance of payments, and so on. Yet at the same time a deep-seated social change is taking place as a consequence of industrialization. Millions of people become factory workers, giving up their traditional rural living patterns. As cities swell, masses of people stream to the slums. Urbanization, together with the both beneficial and malevolent effects of overturning the whole fabric of society, is an important a consequence of economic development as the deficit in the balance of payments. Despite the fact that this is well known to every economist and model builder who deals with the developing countries, somehow the convention that it does not belong in the model has become established,
I will try to summarize, at least in key words, which social processes, in my opinion, should be included: 6

(i) The transformation of the occupational structure;
(ii) The transformation of the structure of learning, training and culture;
(iii) The transformation of the residential structure (the proportions living in hamlets, towns, cities, and giant metropolises);
(iv) The transformation of property and class relations (small farmer, plantation owner, domestic servant, factory worker, small businessman, big businessman, and so on).

These processes are not simply to be reclassified into sociology, “urban economies”, or some other related sciences; they belong most intimately in the process of economic development; they are accompanying phenomena, causes and effects, goals and methods, all at the same time. Neither should we argue that they cannot be “mathematized,” as they are all observable, measurable, and quantitatively describable phenomena.

3.3 Allocation versus Distribution - Employment

Although very closely connected with the previous point, distribution questions are so important that they deserve special consideration. Most planning exercises are models of rational allocation of resources. The distribution of the social product among various individuals, groups, and classes is, for the most part, ignored.

The truth is that, in the majority of developing countries, the most acute economic and political problems are mass poverty, unemployment, and underemployment. These are extremely painful problems which, considering the entire Third World, affect hundreds of millions of people. There is no need for lengthy statistical arguments, as the phenomenon is well known and described in hundreds of different documents, official data, statements of politicians, studies of economists, and newspaper reports.

6. Some of these processes are reflected in the Ivory Coast model of Goreux (1973) and Condos and Davis (1973a).
The entire economic profession is more or less in agreement that an enduring solution can be effected only by economic growth over a very long time period. Nevertheless, a pertinent question is: What about until then? Should we wait until the economic development of 10, 20, or 50 years somehow overtakes the period of mass misery? And, although with an aching heart, should we leave hundreds of millions of people in destitution until then? Or should something be done urgently? How much of a compensation is a better life in the twenty-first century to people hungering today?  

And misery is only one side of the picture. Most economists agree that the typically observed process of development actually increases the income inequality in most poor countries (at least in the short run). Should we acquiesce to this as an unavoidable fact of life, or is it possible to do something about it? I really do not have the answer; I only raise questions. But, do not forget that these questions are raised daily in developing countries, not only by the opposition to the establishment, not only by revolutionaries. They are also posed by important supporters of governments, and even by those in power, because an explosion of mass dissatisfaction might threaten their power and position.

Quite intentionally, I do not want to go too far along these lines; I do not wish to discuss changes that are accompanied by a radical transformation of the existing power structure, either political or economic. Instead, as an illustrative example, consider the eventual application of those Keynesian prescriptions that are now adopted without hesitation even by many conservative politicians in developed, capitalist countries. Mass misery in many underdeveloped countries would be quickly reduced if the unemployed were given work opportunities through public works such as building roads, canals, public buildings, schools, and hospitals. This would have little direct foreign exchange cost and

7. Many of the issues raised here are summarized and discussed in Chenery and associates (1974).
would require very few skilled workers. Yet, such projects could absorb a considerable portion of the unemployed and the underemployed. In addition, well-planned public works would be a productive use of labor, for they would enrich the national wealth by creating useful social facilities.

This is an important measure, suggested and urged by the Committee for Development Planning of the United Nations. No one thinks that such a policy, by itself, is sufficient to solve the problem; however, it seems clear that implications of these kinds of policies can and should be tested using economy-wide models. Variables could be introduced into the model to represent the labor-absorbing public works projects, together with equations which assure the consistency of these activities with the rest of the economy.

I have not seen any economy-wide model which deals seriously either with the idea of urgent labor-absorbing public works or with any other economic policy directly aimed at attacking mass poverty and unemployment. Seeing this deficiency, I regard as sterile and grotesque the endless discussions about appropriate time horizons in "welfare maximizing" models. It is a bit ridiculous to debate whether welfare should be maximized over twenty years, thirty years, or over an infinite horizon, when millions of people who are hungry and unemployed right now are demanding immediate help. The well-known Keynesian saying: "In the long run, we are all dead..." is true here in the medium run, too; many may starve if economic policy does not provide help soon. I am not against long-run planning; I do not want to push one-sided, short-run considerations. But we must study very carefully the interactions between urgent short-run measures focused against mass poverty and unemployment, and the long-run growth of the economy.

The main reason for this neglect is almost certainly the political circumstances in the developing countries. If the local policy makers were really concerned with the organization of public works, they would force the planners to insert such activities into their models.

Nevertheless, model builders need not wait for the initiatives of the politicians; they have their own responsibility. Therefore, as an additional explanation, we must look also at the theoretical background of the model builders. I think that, at least in the case of economy-wide models, mathematical planners are strongly influenced by the neoclassical tradition. The typical mode of thought, with perhaps slight exaggeration, is described below.

The country modelled has surplus unskilled labor or open unemployment. **Ergo, we do not need to regard labor allocation as a constraint for the model. In other words, the purpose of the plan is to solve the conventional neoclassical problem of resources to be allocated. It does not matter whether this is done in the framework of a firm, or a competitive market economy, or a developing country. All cases are alike since the crucial problem is always the same: The efficient allocation of scarce resources.**

I, for one, think that the scope of economics, and within economics the scope of scientific planning, is much wider. Resource allocation is only a narrow subset in the larger set of economic problems. You do not need to be a Marxist, or a Keynesian, or an adherent to the new Cambridge school, but only to be a sound pragmatic economic policy maker to admit that the serious exploration of employment problems simply cannot be left out of any development planning model. The importance of employment is greater, the farther we are from achieving it. It is a somersault in logic to say that since there is surplus labor, we may disregard labor in the model.

**Why do the designers of planning models usually think in terms of scarcities, and consider only upper bounds on scarce resources? Why not apply lower bounds on the minimum level of employment, at least for some experiments?**

Let me add some qualifications to these critical remarks. What I am criticizing is not planning as such, but formal, mathematical planning. There are countries where some nonformalized planning exercises.

try to deal with the questions mentioned above. My comments are mainly concerned with improving the medium- and long-run economy-wide studies which are discussed in this volume. We can notice signs of improvement. Some of the practical models discussed in Chapters V and VII try to focus on income distribution and employment. It would be very helpful to give wide publicity to these experiments, and to develop further the methodology of formal planning of income distribution and employment.

### 5.4 Disharmonic versus Harmonic Growth

It is easy to understand why developing countries wish to grow as rapidly as possible. Unfortunately, this rush may lead to one-side, distorted growth and to disharmonies of the following kinds:

1. Usually physical capital growth is given prominence, and human capital development lags behind;

2. Usually the quantitative expansion of output is emphasized, with improvements in the quality of goods and services lagging behind;

3. Usually the construction of new housing, schools, hospitals, and roads comes into prominence, and careful and continuous maintenance of old buildings lags behind;

4. Usually increases of reproducible national income and wealth are emphasized, and the conservation of the nonreproducible environment lags behind.

The first half of each phenomenon listed above refers to processes which are well defined in conventional statistical accounting, particularly in aggregate indicators of production, physical capital,

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11. For further elaboration of these ideas see the author's book, Rush Versus Harmonic Growth (1972).
and consumption. Accordingly, they are easy to include in economy-wide planning models. At the same time, statistical accounting is very deficient regarding the processes in the second half of each of the phenomena. These processes are usually barely treated or completely ignored in compiling national income accounts. Accordingly, they are also neglected in planning models. In economies we have many respectful names: "externalities," "imponderabilia," "public good." The tradition of our profession is to mention them occasionally to demonstrate that we are aware of their importance and then continue the discussion of any problem as if they did not exist. Small wonder that development planning models continue the tradition!

The set of problems just described partly overlaps another set, often called "quality of life." Our policy recommendations for a developing country are based partly on our judgments about the factors influencing the quality of life. I shall discuss only one example, that of consumption.

Almost without exception all models use either demand functions or fixed consumption patterns. The Engel curves which are often used are usually based on the assumption that the consumption pattern of a developing country will simply follow that of the developed countries. Is this really necessarily so? Consider the case of transportation. Leaving aside cost levels, is it beneficial to permit the widespread use of personal passenger cars, which leads sooner or later to pollution noise, fatal traffic accidents, and complete financial failures of public transport systems? Perhaps it is already too late to reconsider the question in the United States or Western Europe. The automobile is there, and life would stop without cars. But it is not too late to think about this, and about similar aspects of the quality of life, in Nigeria or Burma. Nevertheless, economy-wide planning models, and even sectoral models, rarely treat such problems; in most cases they regard the composition of future consumption as already decided through known demand functions. They tacitly assume that if we raise the illusion of consumer sovereignty, the problem is already settled. Unfortunately, that is not

12. For a discussion of the use of Engel curves in planning models, see Chapter III.
the case. The decision on consumption patterns is extremely complex and full of dynamic externalities. To continue the previous illustrative example: The automobile customer of today decides on his own expenditures of transportation. Buying a car in a developing country, he will enjoy the fact that there are only a few cars on the road. But, in making this decision, together with many other consumers, he does not take into account the future externalities of preferring individual transportation to public transport. All the harmful consequences will fall on future generations, including future car owners and commuters using public transport facilities. Of course, this is only an illustration, showing that the design of future consumption patterns should not be left exclusively in the hands of isolated individuals. The decisions must be supplemented, and if necessary corrected, by planning and active governmental intervention.

4. TWO POSSIBLE COUNTERARGUMENTS

I just described what I see as the missing factors in most development planning models. There are two usual counterarguments brought up in debates. One argument refers to technical difficulties. It states that until now, planning models have been designed mainly for modelling the real sphere, i.e., production, trade, investment, and similar physical activities. I do not find the argument convincing. There are no technical obstacles to adding variables and equations which describe income determination, employment, education, urbanization, and various social characteristics. Mathematical programming is a very flexible device and can be expanded to include a very large set of problems; even when optimizing techniques are not feasible, simulation models can be utilized to investigate many important questions.

The other counterargument refers to the academic freedom of the research scholar. All criticism is answered by saying that there is no book or article that could not be attacked for leaving this or that problem out of the discussion. I think those using this reasoning are confusing two very different matters: The role of the academic scholar versus that of the responsible planner. I agree with the principle of freedom and sovereignty in the choice of subject matter for
academic research, perhaps because I, too, am an academic. The probability of success is, of course, higher when the scholar is researching topics in which his interest is strong.

The situation for the development planner is quite different. He must deal with all socially important questions. The choice of problems cannot depend completely on his personal taste and intellectual interest. He simply does not have the right to neglect any important question, because to do so may harm the country. Perhaps he will not be able to handle all important problems, because of lack of skill or experience, or because of theoretical or technical difficulties, or limited information. These are acceptable excuses. But the intentional exclusion of some problems simply because as an economist he does not find them interesting is never justified.

The dilemma stems from the fact that most designers and builders of planning models are both scholars and planners at the same time. I think they should apply a double moral criterion. When writing a book or an article, or when lecturing at the university, they could follow the principles of academic freedom. But, when developing a model for serious discussion by responsible decision makers, they should adopt the moral criteria of a planner. In that case, they must try to consider all the important questions when building their models. And, furthermore, they must weigh the relative importance of various policy issues on the scales of their social importance rather than their academic challenge.

From these ideas we can draw a general conclusion. We must step out from the narrow circle in which we are moving. The model builder does not make a final political decision; usually, he only explores problems; however, the exploration should be much broader than in the past. We cannot be satisfied with bureaucratic or technocratic "allocation" exercises. A development planning model should demonstrate the consequences of different alternative economic policies on the whole life of the society in question.