

Tools for Manpower Planning

The World Bank Models

Volume III

User's Guide for the Regional (Expanded) Model

Ismail Serageldin

Bob Li

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When this paper was first published Ismail Serageldin was chief of the Urban Projects Division and Bob Li was senior operations officer and leader of the Organization and Management Unit, Technical Assistance and Special Studies Division, both in the Europe, Middle East, and North Africa Regional Office of the World Bank.

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Foreword

The explosion of international migration in the Middle East and North Africa Region in the 1970s was a major development on the international economic scene with profound implications for both the labor-importing and the labor-exporting countries. The World Bank undertook a research study on the subject in 1978 under the leadership of Ismail Serageldin and his group of committed colleagues in the Technical Assistance and Special Studies Division of the EMENA Projects Department. The study was completed in 1981 and the Report has been widely disseminated. It has been published in book form this year. ^{1/}

The set of simulation models developed by the Technical Assistance and Special Studies Division and elaborated during the research project has been applied to study manpower problems and planning issues in several countries and proven to be a useful tool for manpower planning. The wide availability and a full description of these models is important and to be welcomed.

Vinod Dubey

Chief Economist

Europe, Middle East and North Africa Region

May 1983

^{1/} Ismail Serageldin, James A. Socknat, Stace Birks, Bob Li, and Clive Sinclair, Manpower and International Labor Migration in the Middle East and North Africa (Oxford University Press for the World Bank, 1983).

Preface

This document, published in four volumes as part of the World Bank's staff working papers, is intended to set forth the mathematical formulation of the Bank's various Manpower Planning Models, most of which have now been used in a number of countries and studies, but whose technical documentation was not hitherto available to the public.

Applied Models are living entities, constantly changing and (we hope) improving to meet the new requirements introduced by their users. The present publication must therefore be seen as a snapshot in time, but one which presents the interested user with the opportunity of reviewing the technical documentation as well as the user's guides as they stand at the beginning of 1983. They are not likely to change significantly until a new round of intensive applications produces a new generation.

The technical presentation provides, for completeness, a detailed discussion (pp. 98-132) of a simultaneous procedure method for the migration model. This has not been implemented to date, partly because time and resources constraints prevented its complete development and elaboration, but it nevertheless sketches out the likely direction of our next round of research and development efforts, planned for 1983/84.

It is important to emphasize, however, that while we were the main protagonists in the development of these models, the work would not have been possible without the support, guidance and incisive comments of many colleagues in and outside the Bank. To all of them we owe a great debt of intellectual and moral gratitude. We emphasize, however, that any errors or shortcomings in the present manuscript are purely our own.

Among those in the Bank who provided constant support and encouragement during the six year life of these manpower planning efforts, of which this document is just a small part, we must thank in particular Mr. Vinod Dubey, Chief Economist of the EMENA region, whose constant personal and technical support from the earliest days to the present have made this task possible. The long-term study efforts have also benefitted from the strong support of Messrs. R. Chaufournier, Vice-President of EMENA; and M.P. Benjenk, currently Vice-President, External Relations and formerly Vice-President of EMENA; and Messrs. A. David Knox, currently Vice-President for West Africa (formerly Projects Director, EMENA); A. Karaosmanoglu, currently Vice-President for East Asia and Pacific (formerly Director of Programs, EMENA), and M.P. Bart, Director of Programs, EMENA; and A.S. El Darwish, Director of Projects, West Africa (formerly Assistant Director of Projects, EMENA); and especially Messrs. R. Picciotto, Director of Projects, EMENA; and J.J. Stewart, Assistant Director of Projects, EMENA. A special mention is also needed of the support given by Mr. D. Avramovic when he was Director of the Bank's Development Economics Department, and Mr. S. Acharya when he was Research Advisor.

Many colleagues from the Bank have contributed valuable comments and insights to the general studies of which these Models were the central part, among these we must name S. Birks, C. Blitzler, F. Colacó, Z. Ecevit, I. Hume, J.P. Jallade, T. King, G. Pennisi, R. Prosser, N. Sherbiny, C. Sinclair, J. Socknat, and M. Wilson. The computer related work was ably done by Peter and Tom Wolfe (Consultants). Earlier versions were programmed by A. McClinton of the Phoenix Corporation. Applications on various countries were undertaken with the support of G. Cima, B. Krishna, B. Smith, M. Pemmarazu, M. Youssef, and M. Allak.

Among the colleagues from the academic world, special thanks are due to the contributions of Professors I. Sirageldin (Johns Hopkins University), C.S. Kelly (Ohio State University), R. Davis and W. Alonso (both of Harvard University), and the late Arthur Smithies (Harvard University).

Finally, Professor John Kantner (Johns Hopkins University) and Mr. Mervin E. Muller (Senior Advisor to the Vice-President and Controller) reviewed this manuscript, and Mr. R. Wolfe (Consultant) provided editorial support. To each and everyone our thanks and appreciation.

Ismail Serageldin and Bob C. Li

The World Bank
Washington, D.C.
May 1983

Note

The purpose of this User's Guide for the Regional (Expanded) Model is to describe the input, output, use, and operation of the Regional (Expanded) Model, a manpower forecasting model, implemented for IBM 370 systems.

Staff of the Technical Assistance and Special Studies (TASS) Division of the World Bank are available, under appropriate arrangements, to discuss with potential users the collection and preparation of required input data for running the Model. In some cases, the TASS Division can also conduct short orientation and training sessions on the capabilities and operation of the Model.

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Section 1.0 Introduction

The purpose of this interim User's Guide is to provide information to users of the Regional Manpower Planning Model (The Expanded Model) on the features and design of the Expanded Model, on what reports/outputs are available and on how to prepare input data, when available, for regional manpower forecasting and analysis.

The detailed discussions of the Expanded Model are given in the Discussion Paper # 1, An Expanded Manpower Planning Model for Regional Manpower Analyses Internal Specifications, Dated January 16, 1978. In the original Compound Model, a country is treated as a single unit, in which estimated manpower stocks, requirements and supplies, though disaggregated by sector/occupation matrices and by nationality, do not have any breakdown by geographic regions. The emphasis of the original Compound Model is on stock analysis. But the Expanded Model will include both regional and national manpower analyses including but not limited to inter-regional labor force migration, and the associated movement of non-labor force due to labor force migration. The Expanded Model emphasizes both stock analyses and flow analyses at both national and subnational (regional) levels.

The reports and outputs to be produced by the Expanded Model are discussed in detail in Section 3.0 System Outputs. The users of the Expanded Model have options to select one or more or all of the reports at the selected years of projections. It is not intended to have all the available reports analyzed by one individual. On the contrary, it is recommended that a team of specialists be assembled, and each of them analyzes reports produced in their field of expertise. Through this team effort, various sensitivity analyses should then be conducted and analyzed.

Among the reports described in Section 3.0, the following reports are of particular interest for flow analyses at both the national and the subnational levels:

- (1) National Labor Force Stock by Sector and Occupation (Report ID L01), by Occupation and by Year (Report ID L02) and by Sector and by Year (Report ID L03), which give analyses, inter alia, on the leakage of nationals during a given year and labor force movements through the gain from, or the loss due to, reallocation of leaked national labor force;
- (2) Population Reports (Report ID S05 and Report ID S06), which summarize the population by locality, age group, sex, nationality as well as estimated flows on move-ins, move-outs, death and birth;
- (3) Available Manpower Pool Analyses (Report ID P08), and Regional Manpower Leakage Analyses (Report ID P09), which provide information, inter alia, on labor force waiting in transient state, the number of total leakers available for reallocation as well as the number of leakers distributed to each region in the country.
- (4) Highlight Reports including Labor Force Highlight Report (Report ID H01), Manpower Surplus/Shortage Report (Report ID H02), and Additional Achievable Outputs Due to Labor Force in Transient State (Report ID H03), which provide information on surplus/deficit manpower, and additional

achievable outputs that are obtainable if those labor force in transient state are allocated for productive uses.

Past experience in the uses of the Compound Model indicate that the initial data preparation is the most time consuming part of the exercise. This could also be true for the uses of the Expanded Model. Many different types of expertise are required to analyze what data are available, how to classify sector/occupation categories, how to construct the education training system, and how to prepare various input parameters that are required for the uses of the Compound Model or the Expanded Model. But this is not the unique problem to the Compound Model or the Expanded Model only; it is a common symptom for the uses of all models, regardless of the scale of the models. However, once the base case data are collected, and analyzed, sensitivity analysis can be easily done by changing only the data that are affected. It is through sensitivity analyses that the users of the Expanded Model should try to derive their policy recommendations and the potential consequences of the recommended policy choices.

This interim User's Guide is prepared primarily for the users of the Expanded Model to start collecting data and when available, put in key punch forms as described in Appendix A Card Formats. A finalized version of User's Guide is being prepared to replace this interim User's Guide. Any question regarding data preparation for the Expanded Model should be addressed to:

Technical Assistance and Special Studies Division
The World Bank
1818 H Street N.W.
Washington D.C. 20433, U.S.A.

Section 2.0 Overview

2.1 General Description of the Model Designs

The system is divided into 3 modules, according to their function, as shown in Figure 2.1. The first module is the edit module which checks all of the data for errors and generates an optional listing for the user of the input deck. The input cards are described in general in Section 4.0 and in detail in Appendix A.

The second module is the simulation module where the input data is actually used to calculate manpower projections. The model contains several submodels. These submodels are:

- (i) Labor Force Model;
- (ii) Manpower Requirement Model;
- (iii) Educational Simulation Model (ESM); and
- (iv) Manpower Policy Model.

The Labor Force Model maintains the national and expatriate labor force for each locality on an annual basis. Starting from base year information, the model applies an annual attrition rate to expatriates and attrition as well as leakage rates to nationals. The leaked national labor force is then re-allocated among localities within the country. The Labor Force Model also accounts for the move-ins, move-outs and supplies from available labor force.

The Manpower Requirements Model calculates the total manpower requirements by sector/occupational categories to achieve the desired target outputs. It also calculates the net manpower requirements by sector/occupational categories after comparing the total manpower and the available.

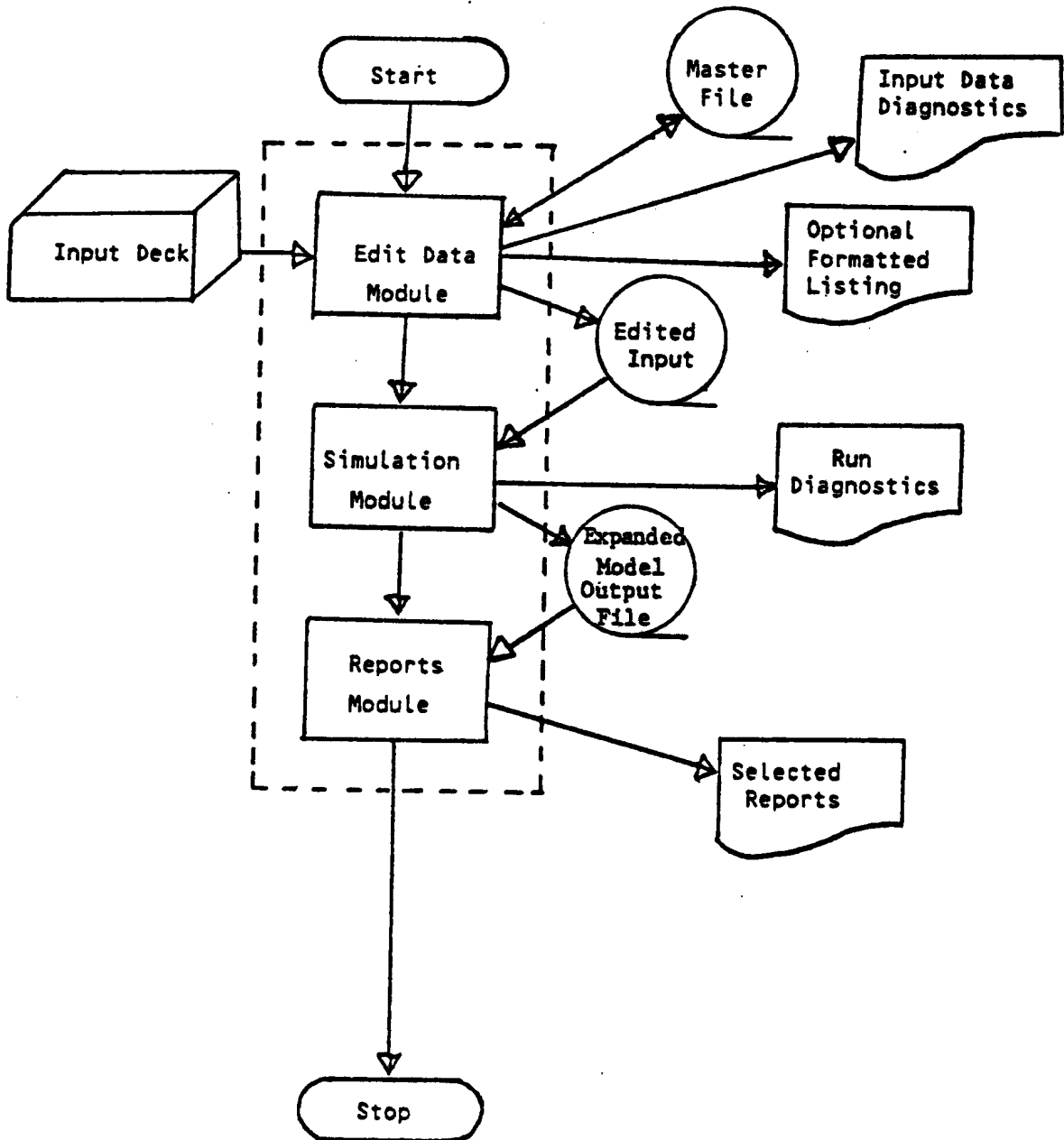


Figure 2.1 Expanded Model Overview

manpower stock. There is a capability to directly input manpower requirements for sectors which have readily available data. Also, teacher requirements may be summed directly from the Educational Simulation Model (ESM).

The Education/Training Simulation Model (ESM) is based upon a simplified version of a model developed by UNESCO. It has specific new capabilities to meet the need of the Expanded Model's objectives, including the abilities to:

- (i) Forecast school leavers by age and by educational level;
- (ii) Forecast number of school leavers who will participate in the labor force; and
- (iii) Maintain pools of those who are below the legal minimum age to participate in the labor force.

The Manpower Policy Model (MPM) compares the net manpower requirements against manpower supplies from the educational systems, and attempts to allocate them in accordance with a priority matrix, in which the priority and proportion of nationalization in each sector/occupation are specified by policy makers. In addition, MPM also estimates global achievable output, labor force in transient state, net requirements for expatriates and surplus/deficient national manpower in each locality.

The final module is the reports module. It takes the outputs of the various submodels of the simulation module and generates the reports described in Section 3.0. Consolidation reports for the country as a whole are also generated by the report module.

Together, these four submodels perform simulation runs for the following functions:

1. Estimate labor force inventories and leakages;
2. Estimate labor force requirements;
3. Estimate manpower supplies from education/training systems;
4. Perform labor force supply poolings;
5. Perform manpower allocation of current year school leavers according to poolings;
6. Re-allocate labor force leakages to localities with time lags taken into account;
7. Estimate non-labor force movements due to labor force movements with time lags taken into account;
8. Calculate local net manpower requirements;
9. Calculate local achievable outputs;
10. Calculate national net manpower requirements;
11. Calculate national achievable outputs;
12. Estimate net importation/exportation of expatriates at both the local and the national levels.

2.2 Input Capability Improvements over the Original Compound Model

In addition to the major capabilities of the Expanded Model for stock and flow analyses on labor force and non-labor force movements as described above, there are several improvements in input capabilities relative to those of the original Compound Model. These improvements are described in the remainder of this section:

- (1) In the original Education/Training Submodel a limitation of not more than 12 follow-on courses was imposed. This limitation has now been removed. In the Expanded Model, there is no limitations on the number of follow-on courses.
- (2) The D cards have been substantially revised. The streaming cards can now be used jointly to specify interpolation points and a number of interpolation intervals rather than a single one (i.e. only the first year and the last year of simulation run). In addition, growth rates can also be applied after the interpolation intervals rather than for the entire range of years. Thus, a combination of direct entry, interpolation, and growth rates can be used for a single sector.
- (3) New options have been made available on E06 Card (PRDD and Repetition/Dropout Data Card). These options are:
 - (i) If 0 or blank, then both Repetition/Dropout rates and PRDD's are present;
 - (ii) If 1, then only the Repetition/Dropout rates are present;
 - (iii) If 2, then only PRDD's are present; and
 - (iv) If 3, then the Repetition/Dropout and PRDD values are to be added to last year's values to obtain new Repetition/Dropout rates and PRDD's.
- (4) Labor pools are now identified by a 3-character alpha-numeric code rather than a number. This provides greater flexibility and allows the use of the "ALL" option on some cards to specify all labor pools.