
Tools for Manpower Planning

The World Bank Models

Volume IV

User's Guide for the Migration 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 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

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Note

The purpose of this User's Guide for the Migration Model is to describe the input, output, use, and operation of the Migration 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.

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. Colaco, 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.

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Section 1.0 Introduction

The purpose of this User's Guide is to provide information to users of the International Migration Model on the features and design of the Model, on what reports/outputs are available and on how to prepare input data. An overview of the system is given in Section 2. The reports and outputs to be produced by the Model are discussed in detail in Section 3.0. System inputs are discussed in Section 4 and the Appendices.

Section 2.0 Overview

The International Migration Model simulates the manpower supplies and demands in a number of separate localities. These will usually be individual countries but may be portions of countries or even groups of countries. The combined localities simulated are referred to as the global region. Laborers not originating in one of the localities of the region are referred to as rest of world expatriates and may be subdivided into nationality categories. From time to time this document will refer to nationality. This refers to the source locality of an individual or to a rest of world expatriate nationality. Although two localities may actually be parts of the same country, they are identified as separate nationalities (perhaps more accurately "locationalities") for purposes of analysis. Since each such "nationality" is identified by its corresponding locality ID, there is little danger of confusion in data preparation or output interpretation.

The system is divided into four modules as shown in Figure 2.1. The first module is the edit module which checks all of the input data cards for errors and generates input data diagnostics and a listing of the input deck. The input cards are described in general in Section 4.0 and in detail in Appendix A. Diagnostic outputs produced by the edit module are listed in Appendix B.

The edit module saves the edited input data in a specially formatted file, the edited input file. The second module, the data listing module, can optionally be used to obtain a formatted listing of the edited input data from this file. The formatted listing highlights data changes between simulation years and is useful in ensuring that the input data are correctly specified. It also serves as an easy-to-read record of simulation inputs.

The third module is the simulation module where the input data is actually used to calculate manpower and migration projections. The module

contains several models. These models are:

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

The Labor Force Model maintains the national and expatriate labor force for each locality on an annual basis. Each year the model accounts for attrition, leakage, move-ins, move-outs and new supplies of laborers.

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 stock. There is a capability to directly input manpower requirements for sectors which have readily available data.

The Education/Training Simulation Model (ESM) is based upon a simplified version of a model developed by UNESCO. It simulates an educational system made up of a user-specified course structure. User-supplied input controls the course entrance levels and repetition, dropout, and promotion rates. The user can enter course-specific skill levels of school leavers permitting their allocation into the labor force. Teacher requirements are also computed.

The Manpower Policy Model (MPM) compares the net manpower requirements with local manpower supplies, and attempts to allocate local laborers in accordance with a priority matrix, in which the priority and proportion

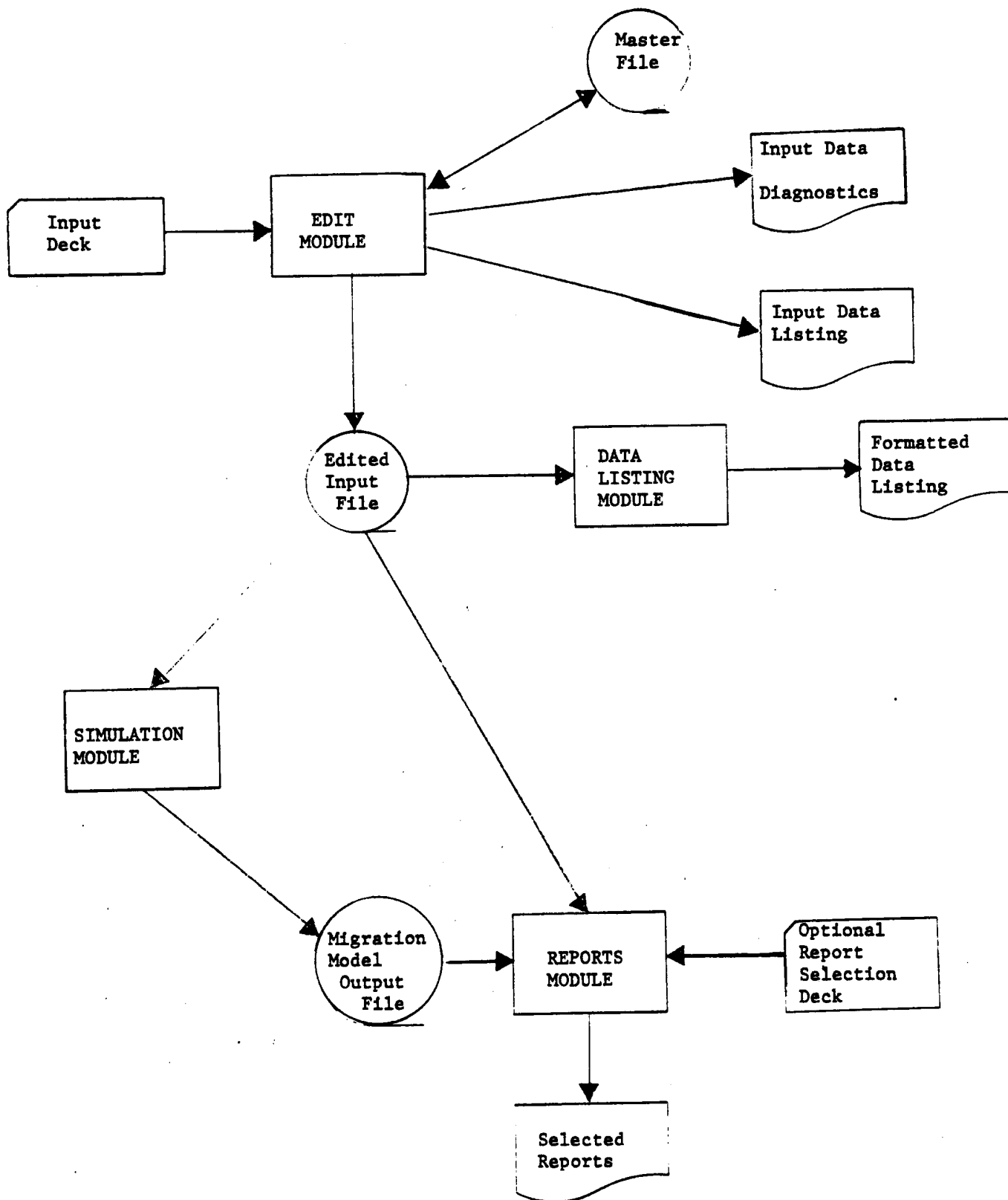


Figure 2.1: International Migration Model Overview

of nationalization in each sector/occupation are specified by policy makers. In addition, MPM also estimates global achievable output, net requirements for expatriates and surplus/deficient national manpower in each locality.

The Migration Model computes the pattern of labor flows among the localities based on user-supplied input which specifies regional patterns of worker importation. It interacts with the Labor Force Model to simulate the movement of laborers according to these flows.

The final module is the reports module. It takes the outputs of the various models of the simulation module and generates the reports described in Section 3.0, including consolidation reports for the region as a whole.

Together, the five models of the simulation module:

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. Perform user-specified labor migration among localities.
7. Estimate non-labor force movements due to labor force movements.
8. Calculate local net manpower requirements.
9. Calculate local achievable outputs.
10. Calculate regional net manpower requirements;
11. Calculate regional achievable outputs; and
12. Estimate net importation/exportation of "rest of world" expatriates at both the local and the regional levels.

Section 3.0 System Outputs

The International Migration Model will generate both printed reports and diagnostic outputs. The contents of reports generated by the Model are described in the remainder of this section. The diagnostic outputs which describe errors committed in input preparations are in Appendix B.

The reports are labeled with a 3-letter code (e.g., M01, M02, etc.) beginning with a letter which identifies the type of report. The years to be included in the reports as well as the report ID's can be separately selected for each locality and for the global output. The reports are selected using the G05 card, with the years being specified on the C03 card. Alternatively, specific reports can be selected using special control cards for the report module.

The reports can be divided into five major categories:

- (i) Labor Force Status Reports;
- (ii) Manpower Requirements Reports;
- (iii) Education/Training and Manpower Supply Reports;
- (iv) Manpower Policy Implications Reports; and
- (v) Highlights Reports.

Labor Force Status Reports include:

(L01) Local Labor Force Stock by Sector and by Occupation
(Report ID L01)

For each selected year, this report gives an overall view of the local labor force stock by sector and by occupation.

It contains the following items:

- A. The existing local labor force at the beginning of a year;
- B. The attrition during the year;
- C. The available labor force after attrition;
- D. Current year allocation of school leavers;
- E. Labor lost or gained from migration; and
- F. Total labor available at the end of the year.

(L02) Local Labor Force Stock by Occupation and by Year
(Report ID L02)

This report gives the same information as Report L01 except that the information is summed across sectors. All selected report years are combined into a single table.

(L03) Local Labor Force Stock by Sector and by Year
(Report ID L03)

This report gives the same information as Report L01 except that the information is summed across occupations. All selected report years are combined into a single table.

(N01) Expatriate Labor Force Analyses by Nationality, by Sector, by Occupation (Report ID N01)

For each selected year this report gives expatriate labor force stock by sector and by occupation, for each expatriate nationality. It has the following contents:

- A. The existing expatriates at the beginning of a year;
- B. The attrition during the year;
- C. The number available after attrition;
- D. The inward migration of laborers from other localities of the region.
- E. The expatriate labor force required to fill the manpower shortage (these data are obtained from the solution in the Manpower Policy Submodel); and
- F. The net importation/exportation of "rest of world" expatriates.

(N02) Expatriate Labor Force Analyses by Sector and by Occupation
(Report ID N02)

This report gives the same information as Report N01 except that the information is summed across nationalities.

(N03) Expatriate Labor Force Analyses by Occupation and by Year
(Report ID N03)

This report gives the same information as Report N01 except that the information is summed across nationalities and sectors. All selected report years are combined into a single table.

(N04) Expatriate Labor Force Analyses by Sector and by Year
(Report ID N04)

This report gives the same information as Report N01 except that the information is summed across nationalities and occupations. All selected report years are combined into a single table.