HIGH-LEVEL MANPOWER REQUIREMENTS FOR ECONOMIC DEVELOPMENT IN LIBYA

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CHAPTER I

INTRODUCTION

The major obstacles in the process of development in Libya are shortages of high-level manpower, which will be defined in this study as those workers with intermediate certificates and those workers with university degree. Libya, with a land area of 1,758,610 km^2 and a total population of 2,993,000, has been unable to supply the necessary high-level manpower to meet its economy's demands for this kind of labor.

The shortages of high-level manpower are large and exist in all fields of specialization in the Libyan economy. These shortages are indicated by the ratios of the foreigners to the national manpower in each field of specialization.

As Table I shows, in 1977 the total high-level manpower in Libya amounted to 55,855 workers. Of the total 32,213 held a certificate from intermediate schools and 23,642 held a university degree. Of the total high-level manpower in 1977, the foreigners represented 59.3 percent of those with a university degree and 15.5 percent of those with an intermediate certificate.

With respect to manpower with a university degree, the ratios of foreigners to Libyans differ significantly from one specialization to another. Foreigners represented 88.8 percent of those with a medical

TABLE I

TOTAL HIGH-LEVEL MANPOWER AND THE RATIO OF FOREIGNERS TO LIBYANS IN EACH EDUCATIONAL SPECIALITY

Educational Speciality	Total High-Level Manpower (1)	National Manpower (2)	Foreign Manpower (3)	Ratio of Foreign to Total (4)=(3) (1)
University Level:				
Arts	6,042	2,839	3,203	53.0
Medicine	4,257	478	3,779	88.8
Engineering	3,207	915	2,292	71.5
Economics and Commerce	2,650	1,442	1,208	45.6
Education	1,934	1,014	920	47.6
Sciences	1,902	759	1,143	60.1
Law	1,325	821	504	38.0
Agriculture	1,109	408	701	63.2
Islamic Studies	919	864	55	6.0
Veterinary Medicine	297	95	202	68.0
Total	23,642	9,635	14,007	59.3
Intermediate Level:				
Teachers Schools	26,100	23,278	2,822	10.8
Commerce and Accounting	2,810	1,934	876	31.2
Industrial Schools	1,327	843	484	36.5
Engineering Schools	992	379	613	61.8
Agricultural Schools	984	775	209	21.2
Total	32,213	27,209	5,004	15.5
Total High-Level Manpower	55,855	36,844	19,011	34.04

Sources: The Ministry of Civil Services, Local and Foreign Employment Division, The Manpower Census, Tripoli, Libya, 1971 (in Arabic); and The Ministry of Civil Services, Local and Foreign Employment Division, Report on Foreign Employment in Libya, Tripoli, Libya 1977.

degree while only 6.0 percent of those with an Islamic Studies degree. In five of the remaining eight fields, Table I, the ratio of foreign manpower in Libya ranged from 53 percent of those with a degree from College of Arts to 71.5 percent of those with an engineering degree.

The problem of dependency on foreign manpower with an intermediate level of education is less severe than is that for high-level manpower with a university degree. The highest ratio of foreigners is 61.8 percent of those workers with an intermediate engineering certificate. In the remaining intermediate fields, the ratio of the foreigners ranged from 36.5 percent of those workers with an intermediate industrial certificate to 10.8 percent of those with an intermediate teachers certificate.

The ratio of foreigners to the Libyans is very large in key industries. There is no assurance that the foreigners will stay in Libya and help with the country's development process. Most of the foreign high-level manpower comes from Egypt. Due to political differences between Libya and Egypt, which ultimately led to a military confrontation in 1977, most of the Egyptians working in Libya were called home late in 1977 and most of them obeyed. Most of the skilled Egyptian workers were teachers, engineers and doctors. The effect on the Libyan economy was substantial; activities in schools, hospitals, factories and the construction industry were severely curtailed.

For reasons of national security and national pride, as well as for economic reasons, reliance on national high-level manpower to implement its development goals is necessarily a high national priority in Libya. Since the main source of supply of national high-level manpower comes from the educational system, it then becomes necessary

to plan the educational programs in the light of economic objectives to supply the needs for high-level manpower. The aim of the study is precisely to try to relate the educational sector to the other sectors of economic activity in the light of Libya's economic development plans.

The study aims at identifying the type of educational system Libya should have in order to supply the kinds of high-level manpower that are needed by the economy. It does so through a detailed analysis of the current situation and future trends of high-level manpower and enrollments and through an attempt to quantify the link between education and the economic and social objectives of the country. The study can, therefore, be regarded as a stepping-stone to an actual educational development plan.

Generally, financial capital is a very scarce factor and a serious bottleneck in less developed countries. This factor is not scarce in Libya. The discovery of oil in 1962 and the increase in oil prices in 1973 made it possible for Libya, as an oil producing country, to overcome the financial problem limiting the development process.

The Libyan economic system is not a "free economy". It is a government dominated economy. In 1976 the country adopted a five-year economic plan. Before that Libya had three-year economic plans.[1] The government owns all the natural resources other than land. The private sector represents a low percent of the total planned investment in the current Economic Development Plan (1976-1980). Of the total planned investment, the private sector is expected to represent

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[1]The economic plans will be explained in Chapter III.

0.8 percent in the agricultural sector; 2.0 percent in oil and gas; 0.5 percent in construction; 0.1 percent in mining; 0.4 percent in manufacturing; 0.2 percent in trade; 3.6 percent in transportation; 5.5 percent in housing and 0.3 percent in other services (The Ministry of Planning, 1975, p. 48).

Because of huge investments in all sectors of the economy the demand for graduates of all fields of specialization is expected to be very large. The mix of products produced and technology used in the development process in any economy undergoes changes over time. These changes need different levels of educated manpower. To satisfy these demands and to minimize the dependency on foreign manpower, Libyanization of Libya should be given high priority in the economic and social development plans.

Education is free to all individuals in Libya. Primary education (6 years) and lower-level secondary education (3 years) are compulsory for all children (ages 6-15).

After graduation from lower-level secondary schools, the government allocates the students between high-level secondary schools and intermediate schools. The personal preference is limited only to those students with high grade point averages. The majority of the students have no choice of selecting what kind of schools they want to attend. At the university level, only those students who graduated from higher-level secondary schools with very high grades have the opportunity to select the speciality (college) in which they want to enroll. An ad hoc committee is formed each year (its members are from The Ministry of Education and the universities) to allocate the students among the university colleges. The only guideline the ad hoc

committee has used in allocating the students among different colleges is the students' grades from the higher-level secondary school. Those with the highest grades go to Colleges of Medicine, Engineering, and Sciences; and those with lower grades are distributed among the other colleges.

Graduates from the intermediate level or the university level have no choice of job. The government assigns the graduates to different jobs, each in his field of specialization.

Generally, all the graduates from the intermediate and the universities colleges are required by law to work with the government and the government is responsible for offering jobs to all the graduates from these two levels at given salaries. The salaries offered by the government are the same for all graduates from intermediate schools. The graduates from the universities colleges also receive the same salary with very small differences between technical and social sciences schools amounting to approximately $30 per month.[2]

The policy used by the Libyan government to allocate students among different fields of specialization in both the intermediate and the university level in the past lacked the economic guidelines which should be used to allocate students to different fields in order to supply the required needs of each skill. The availability of financial capital in Libya makes it possible to expand any intermediate school or university college to accommodate the required enrollment.

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[2]In 1977 the salary of graduates from the Colleges of Medicine, Engineering, Agriculture and Sciences was $350 per month and that of graduates from other colleges was $320 per month at an exchange rate of 1 LD equal to $3.20.

As Table II shows, in 1977 the enrollments in the Libyan universities amounted to 13,433 students. The past government allocation policy gave priorities to Colleges of Arts, Law and Economics and Commerce. Of the total enrollments, 18.5 percent were enrolled in Arts College, 14.0 percent in Law College and 13.7 percent in Economics and Commerce. While high priority was given to Arts, Law and Economics and Commerce, a very low priority was given to Colleges of Sciences, Medicine, Agriculture and Veterinary Medicine. As shown in Table II, the enrollments in the Colleges of Sciences, Medicine, Agriculture and Veterinary Medicine were 6.8 percent, 6.7 percent, 6.3 percent and 0.2 percent respectively.

Since one of the country's objectives is to have self-sufficiency of high-level manpower or at least to minimize dependence on foreigners in the key fields of medicine, sciences and engineering, the country should allocate larger proportions of the students to those colleges where the supply of the graduates are most needed to replace the foreigners in key fields.

The past government policy of allocating students among different colleges was not an adequate one. The inadequacy of the past allocation policy is suggested by a comparison of the enrollments and the ratios of the foreign manpower in each field of specialization. As shown in Table II, while the foreigners represented 88.8 percent of doctors and 71.5 percent of engineers, the enrollments were only 6.7 percent in Colleges of Medicine and 11.5 percent in Colleges of Engineering. The foreigners represented 53.0 percent of the workers with a degree from College of Arts and only 38.0 percent of those from College of Law. While this is the case, the enrollments in Colleges of

TABLE II

ENROLLMENTS IN UNIVERSITY COLLEGES AND INTERMEDIATE SCHOOLS BY FIELDS OF SPECIALIZATION AND RATIOS OF FOREIGNERS TO TOTAL EMPLOYMENT, 1977

Educational Speciality	Enrollments	Percent in Each Field	Ratio of Foreigners to Total Employment
University Level:			
Arts	2,485	18.5	53.0
Law	1,874	14.0	88.8
Economics and Commerce	1,846	13.7	71.5
Education	1,666	12.3	45.6
Engineering	1,548	11.5	47.6
Islamic Studies	1,338	10.0	60.1
Sciences	909	6.8	38.0
Medicine	900	6.7	63.2
Agriculture	845	6.3	6.0
Veterinary Medicine	22	0.2	68.0
Total	13,433	100.0	59.3
Intermediate Level:			
Teachers Schools	20,748	86.3	10.8
Commerce and Accounting	1,493	6.2	31.2
Agricultural Schools	654	2.7	36.5
Industrial Schools	620	2.6	61.8
Engineering Schools	518	2.2	21.2
Total	24,033	100.0	15.5

Sources: The University of Libya, Statistical Bulletin on Enrollments and Graduates, Tripoli, Libya, 1977; and The Ministry of Education, Statistical Bulletin on Enrollments and Graduates, Tripoli, Libya, 1977.

Arts and Law were the highest proportion of university enrollments: 18.5 percent in the former and 14.0 percent in the latter.

A comparison of the foreign manpower and enrollments in the intermediate level is further evidence supporting the assumption of the inadequacy of the past government allocation policy. As shown in Table II, the foreigners represented only 10.8 percent (the lowest such ratio) of those teachers with an intermediate teacher certificate and 61.8 percent (the highest) of those workers with an intermediate engineering certificate. Nevertheless, enrollments in the teachers school represented 86.3 percent of the total enrollment in the intermediate level and only 2.2 percent in the intermediate engineering schools; in other words, the lowest proportion of the students were enrolled in the intermediate engineering schools where the ratio of the foreigners was the highest and the highest percent of the students were enrolled in the teachers schools where the foreigners represented the lowest ratio.

Proper planning guidelines are needed in planning education to supply sufficient well trained manpower of various skills to meet the requirements of the future patterns of economic development and to substitute for the existing imported high-level manpower. This study will attempt to prepare an assessment of national educational needs at both intermediate and university levels of education through 1985.

Significance of the Study

The study is the first of its kind to be done in Libya. It will develop a disaggregated model which links Libya's economic development plan, high-level manpower requirements and educational system. The

significance of this study stems from the following points:

1. Libya is now in the process of rapid development. The economy is expected to experience major structural changes over the next few years as a result of huge planned investments in all sectors of the economy. As a result, the country needs high-level manpower in all fields. This study will provide estimates through 1985 of the high-level manpower required by all sectors of the economy by fields of specialization.
2. The study will attempt to develop a new simple disaggregated model to overcome the problems of the highly aggregated Correa-Tinbergen model which relates educational requirements to development rates. The emphasis of the study will be on estimating the required outputs of various components of the educational system in Libya and converting these estimates into estimates of necessary future enrollments to supply the required demands.
3. This study will recommend guidelines to the government to be followed in allocating sutdents to each field of specialization to prevent the shortages of high-level manpower in the future.
4. The study will serve as a useful guide to the economic and educational planner in Libya, and it is hoped that it will also prove useful to other countries.

Parameters of the Study

In the Economic Development Plan (1976-1980) the Ministry of

Planning has estimated the expected rate of growth of each economic sector during the period of the plan, 1976-1980. In 1978 the Ministry of Planning (1978) estimated the expected economic growth in the next Economic Development Plan (1981-1985). These estimates were based on the expected results of the Economic Development Plan (1976-1980) and the expected investment in the next Economic Development Plan (1981-1985). This study will use the rate of growth of each economic sector that has been estimated by the Ministry of Planning to estimate the change in demand for high-level manpower during the period of the study. The data about sectoral economic growth is available only up to 1985; accordingly, the period of study will be limited to eight years (1978-1985).

A related limitation of the study is that any forecasting of this kind is, of course, bound to be uncertain. Estimates of economic growth over long periods are necessarily tentative, and it is hard to judge their implications for employment. But since there is no other available alternative and the problem of coordinating education, manpower and economic sectors needs to be solved, the attempt should be made. Of course, all such estimates should be regularly revised as new evidence becomes available.

Objectives of the Study

This study is designed to estimate the required high-level manpower by fields of specialization needed by the economy during 1978-1985. The study will recommend the enrollments in the intermediate and university levels of education needed to attain the supply of skills required by the economic growth. The specific purposes of the

study are:

1. To forecast the high-level manpower requirements for each economic sector. The level of output of each economic sector will be used to derive the future requirements of each skill in the high-level manpower for the next seven years as will be explained in Chapter VI.
2. To estimate the supply of high-level manpower in the next four years. From the existing enrollments in the intermediate and university levels, the expected graduates from each field of specialization will be derived.
3. To estimate the high-level manpower needed to be imported or exported between 1978-1981. To estimate the manpower to be imported, the forecast of high-level manpower requirements (Step 1) will be compared to the expected graduates from the existing enrollments in each field (Step 2) and the shortages or surpluses will be interpreted as the need to import or export that type of manpower.
4. To estimate the enrollments in each field of study that are needed to supply the required demand of each field. To estimate the required enrollments in each field, the required demand in the next seven years will be used to derive the required enrollments as will be shown in Chapter VI.
5. To estimate (by a different technique that is more appropriate to these fields) the number of teachers and the number of doctors needed between 1978-1985. The student-teacher ratios in each level of education will be used to derive the required teachers for each level. The estimate of the required doctors

will be based on the doctor-population ratio sought by the government, that is, one doctor to every 1,000 persons.

6. The study will assume that Libyanization could be accomplished by 1987 for high-level manpower with intermediate certificate and by 1992 for those with university degree. This assumption is based on the fact that the availability of students and educational facilities in Libya could be used to allocate students to different fields, based on the existing foreign labor and the expected future demands, to supply all the high-level manpower demands by the Libyan economy. The study will assume that 20 percent of the foreign manpower with intermediate certificate and 10 percent of the foreign manpower with university degree could be repatriated and replaced by Libyans starting from 1983, as will be explained in Chapter IX.

Organization of the Study

Chapter II of this study describes the Correa-Tinbergen model and discusses the disadvantages of its high degree of aggregation. Chapter III discusses the economic background of Libya and explains the economic development plans. Chapter IV explains the structure and trends in the Libyan educational system. Chapter V discusses the structure of high-level manpower in Libya and the ratios of foreigners to Libyans in each field of specialization. In Chapter VI the new disaggregated model used in this study is developed. Chapter VII presents the results of the application of the model and Chapter VIII is

devoted to the discussion of the results. Chapter IX presents the summary, conclusions and recommendations of the study.

CHAPTER II

LITERATURE REVIEW

The studies that have been done in this area are very limited. The only model that uses GDP and its rate of growth to estimate the educational requirements to supply the needs by the economy, which is the main goal of this study, is the Correa-Tinbergen model. This chapter is concerned with the explanation of the Correa-Tinbergen model and its usefulness and limitations in planning education to supply the high-level manpower needs of the economy.

The first step in planning education to meet the needs of the country is to forecast those needs. Some economists realized that target setting for GDP "eventually entailed a translation of these targets into their individual components, one of which was the manpower structure associated with different levels of output" (Tinbergen and Bos, 1965, p. 14).

Until about 1962, economists who were interested in human resources development were concerned with projections of manpower requirements geared in varying degrees to general economic planning. But there was little or no connection between the educational system in a country and the manpower requirements of the economy.

The firsts steps toward a formal integration of the educational system of the country and the manpower requirements were taken by H. Correa and J. Tinbergen. They started with a simple model for

manpower planning (Correa and Tinbergen, 1962). They divided high-level manpower into two levels: Level 2 (N^2), manpower with an intermediate education, and Level 3 (N^3), manpower with a university education and above.[1] The assumptions of the Correa-Tinbergen model are that the relationship between the growth of each level of manpower and growth of GDP is fixed and the period of study in any field in the intermediate level or university level is assumed to be six years. This assumption limits the application of the model to those countries which have a uniform period of study in both the intermediate and university levels. In Libya, the intermediate level of education lasts four years and the university level lasts four or five years. This assumption makes impossible the direct application of the model to Libya.

The Correa-Tinbergen model is an aggregative approach to ascertaining the educational expansion required by a target rate of economic growth. It is an aggregative model which does not disaggregate by different fields of specialization. It is an input-output model in which the aggregated level of output of the economy is assumed to be related to the number of intermediate and university graduates in the labor force.

The variables and coefficients of the model are:

N^2 = Manpower with secondary education;

N^3 = Manpower with university education;

n^2 = Students in secondary schools;

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[1] Level 1 of manpower consisted of those workers with an education below intermediate level and was not included in the model.

n^3 = Students in universities;

m^2 = Those who have entered the manpower N^2 within the previous six years;

m^3 = Those who have entered the manpower N^3 within the previous six years;

V = Total volume of production (GDP) of the country;

λ = A portion of the labor force that will drop out through death or retirement;

π^2 = Student-teachers ratio in secondary schools; and

π^3 = Student-teacher ratio in universities.

The relationships among the variables which are assumed to exist in the Correa-Tinbergen model are the following:

$$N_t^2 = v_t^2 V_t \qquad (1)$$

that is, the number of workers with intermediate education is assumed to be proportionate to the volume of production in the same time period, V_t. (v^2 is a technical coefficient representing the total units of labor with intermediate level of education needed to produce one unit of output.)

From equation (1), the aggregation problem is very clear in the Correa-Tinbergen model. All the high-level manpower with intermediate education are grouped into one category. A perfect substitution among all kinds of labor at this level is assumed. This assumption is not realistic. The substitution may take place only between related fields of specialization. A graduates who has trained in an intermediate School of Commerce and Accounting cannot do the job expected to be done by a graduate from an intermediate industrial school. This is one

of the major aggregation problems in the Correa-Tinbergen model.

$$N_t^2 = (1-\lambda^2)N_{t-1}^2 + m_t^2 \qquad (2)$$

Equation (2) shows that the labor force with an intermediate education (N_t^2) consists of two parts: (1) those who joined the labor force with intermediate education before six years ago (N_{t-1}^2) and (2) those who have joined it since. From those workers who joined the labor force before six years ago (N_{t-1}^2), a proportion λ^2 will have dropped out through death or retirement.

$$m_t^2 = n_{t-1}^2 - n_t^3 \qquad (3)$$

The labor force with intermediate education who joined within the last six years equals the intermediate school population six years before minus the number of students now in the university educational level.

Equation (3) shows that the model groups all the students in the intermediate level into one category. No distinction is made among the number of students in different fields. This is one of the most important limitations of the model. Unless the number of students in each field of study is known to the educational planner, the model has no useful application. In the new disaggregated model developed in this study, the number of students will be disaggregated by field of specialization. This will overcome the fundamental limitation of the Correa-Tinbergen model.

$$m_t^3 = n_{t-1}^3 \qquad (4)$$

Equation (4) shows that those workers with a university degree, who joined the labor force in the last six years, equal the number of

students in the university six years ago.

Again the aggregation problem is clear in the Correa-Tinbergen model. No distinction has been made concerning what kind of specialization each new worker has had. In planning education to meet the high-level manpower requirements, the needs of each field of specialization should be specified and the number of students in each field should be known to the planner.

$$N_t^3 = (1-\lambda^3)N_{t-1}^3 + m_t^3 \tag{5}$$

The manpower stock with a university education (N^3) consists of two parts: (1) those who joined it six or more years ago (N_{t-1}^3) and (2) those who have joined it since. Of those with a university degree in the labor force, λ^3 is the portion that will have dropped out due to death or retirement.

From equation (5) the aggregation problem of the high-level manpower with a university level of education is again very clear. All the high-level manpower with a university education is grouped into one category. A perfect substitution among all kinds of high-level manpower with a university degree is assumed; this assumption is not realistic. Substitution may take place between related fields but usually only between specific occupational groups. Graduates from the Colleges of Arts, Economics and Commerce, and other related colleges cannot do the work expected of a doctor, engineer or agricultural engineer. The disaggregation of high-level manpower to its origin of qualification is very important in planning education and manpower requirements.

$$N_t^3 = v^3 V_t + \pi^2 n^2 + \pi^3 n^3 \qquad (6)$$

Equation (6) in the Correa-Tinbergen model shows that the total labor force with a university level of education consists of: (1) those active in production, which are assumed to be proportionate to the volume of production by a coefficient, v^3, which means the number of units of high-level manpower with a university level of education needed to produce one unit of output; (2) the number of teachers needed for intermediate education is represented by ($\pi^2 n^2$), where ^{2} is the student-teacher ratio and n^2 is the number of students in the intermediate education; and (3) the number of teachers needed for university education which is represented by ($\pi^3 n^3$), where ^{3} is the student-teacher ratio in the university level and n^3 is the number of students in the university level of education.

Applications of the Correa-Tinbergen Model

The disadvantages of the highly aggregated Correa-Tinbergen model have raised many questions with respect to its application in several countries. Some improvements have been introduced to the model to make it more applicable to each country, but the major problems of aggregation have not yet been solved.

The first improvement in the model was introduced by Tinbergen and Bos (1965). The GDP was disaggregated into three sectors: agriculture, industry and services. The high-level manpower was disaggregated only into two fields: scientific and technical education and general education.

In the application of the model to Spain by L. J. Emmerij (Tinbergen and Bos, 1965), the total value of production in Spain was

broken down into three sectors: agriculture, industry and services. The type of education was broken down into two fields: scientific and technical education and general education. The end results of the application of the model to Spain were still very aggregative. It is very difficult to specify which colleges will be classified as scientific, technical or as general education. In the application of the model to Spain these distinctions have not been spelled out. The results of the model are still too aggregated to be very useful for educational planning.

In the application of the model to Turkey by J. Blum, the GDP was also disaggregated into only three sectors: agriculture, industry and services; and the educational system also was disaggregated into two fields: scientific and technical education and general education (Tinbergen and Bos, 1965). As the case in Spain, the application of the model to Turkey is still a very aggregated one. J. Blum concluded that further possible modifications to the model would be more useful. He suggested that the model could give better results if the GDP could be disaggregated by sectors and the educational system disaggregated into much more detail (Tinbergen and Bos, 1965, p. 74).

In the application of the model to Pakistan by Ryszard A. Karwanski (1970), the GDP was not disaggregated into three sectors as it was in the application of the model to Turkey and Spain. The only disaggregation of the model in its application to Pakistan was the disaggregation of intermediate high-level manpower into two fields: lower-level intermediate schools and higher-level intermediate schools; but no explanation of what fields of education each level included was made. The results of the study were very aggregated. Accordingly,

the aggregation problem of the Correa-Tinbergen model has not yet been solved.

In an expanding economy, as that in Libya, the sectors of the economy are expected to increase at different rates of growth over time. This will lead to different rates of demand for manpower by each sector. Accordingly, for the model to be useful in planning education to meet the needs of the economy for each specific field, the economy should be disaggregated into its original sectors, and the educational system should also be classified by the fields of study in each level.

In this study the researcher will introduce a new simple disaggregated model which could be used in planning education to supply the manpower needs of the country. The disaggregation of high-level manpower by fields of specialization is necessary to this kind of study. In Libya, the occupational classification of high-level manpower is very aggregated and their educational specialization is not identified, accordingly, it will not be used in this study. Instead, high-level manpower in Libya will be classified by fields of educational specialization. As explained in Chapter I of this study, the government assigns the graduates to work each in his field of specialization. This close identity of educational specialization and occupation makes the classification of high-level manpower by fields of specialization especially realistic for Libya.

The Development of the New Simple Disaggregated Model

The above mentioned disadvantages of the highly aggregated

Correa-Tinbergen model make its application to Libya useless. The levels of manpower must be disaggregated by fields of specialization to give more usable results. The students in both levels should be disaggregated into different fields of specialization.

The model used in this study will attempt to overcome the disadvantages of the Correa-Tinbergen model by disaggregation of GDP, education and manpower. The GDP will be disaggregated into the same fourteen sectors as used in the economic plans. The relevant levels of the educational system used by the model are: Level 1, the intermediate educational schools, which will be divided into five fields covering all the fields of study in the intermediate schools, and Level 2, the university level, which will be divided into ten major fields, Table VI. The new simple model which disaggregates the high-level manpower and the number of students in both levels of specialization and the GDP to its original economic sectors will overcome the aggregation problems in the Correa-Tibergen model and will be more useful in planning education to supply the high-level manpower requirements for the economy.

CHAPTER III

ECONOMIC DEVELOPMENT IN LIBYA

This chapter indicates the significant political and economic changes in Libya since 1962 and their effects on economic development. The main purpose of this chapter is to point out the great changes in the Economic Development Plans (EDP's) and the great variations in sectoral growth, past and present.

In 1958 Libya was one of the poorest countries in the world. The per capita income was estimated at about $60 (Harbison and Myers, 1964, p. 42). Before the discovery of oil in 1962, the Libyan economy depended mainly on foreign sources of finance from the United States and United Kingdom.

As a result of the discovery of oil in 1962 and the September Revolution in 1969, the country has undergone a series of momentous changes that attracted the world's attention and gave Libya a respected position in the world. The production of oil has largely solved the country's financial problems and has terminated its dependency on foreign sources to finance its economic development. The September Revolution ended the foreign influence in Libya by freeing the country from the American and British military bases that were stationed in Libya before the Revolution.

Since Libya regained control of its own destiny under the leadership of Muammar El-Qaddafi in 1969, the country's attention has been

focused on speeding the development process, diversifying the sources of income and improving the people's health, education and welfare.

Mainly as a result of the substantial increase in oil prices (1973) per capita income in Libya grew from LD 118.0 in 1962 when the oil was just discovered, to a total of LD 1,526.2 in 1976. With this high per capita income, Libya moved from the lower part of the lowest per capita income countries, when the per capita income was only $60 in 1958, to the eighteenth highest country in the world. Table III shows for 1975 the eighteen highest and eighteen lowest per capita income countries in the world.

Strategies of Economic Development in Libya

The most significant feature of the strategies for EDP in Libya is the great emphasis on the concept that development does not mean simply an increase in productive capacities but also implies the major transformation of social and economic structures. Integration of the national economy was given high priority. To reach this goal, the EDP calls for an effectively coordinated program concentrating on regional physical planning, integrated rural development, reform of local government, income policies, transportation and communication, construction and other needs.

Since the September Revolution (1969), the commitment of the leadder, Mu-Ammar El-Ghaddafi, to economic development has diversified the sources of income and changed the economic structure of the country. Before the Revolution and after the discovery of oil (1962-1969), the government spending on development was small compared to the spending after the Revolution (1970-1977). During the eight years

between the discovery of oil (1962) and the September Revolution (1969), the King's government spent only LD 562 million with an average spending of LD 70.3 million per year. Most of the spending was on public services and salaries. The source of income was mainly oil revenue which represented 63 percent of the GDP in 1970. The spending on agricultural sector was only LD 8 million and on industrial sector LD 3.5 million annually.

TABLE III

PER CAPITA INCOME IN SOME COUNTRIES,
HIGHEST AND LOWEST, IN 1975
(in American dollars)

Highest Per Capita	1975	Lowest Per Capita	1975
Qatar	12,300	Vietnam	52
United Arab Emirates	11,500	Cambodia	67
Kuwait	10,000	Laos	71
Switzerland	7,020	Rawanda	77
Sweden	6,870	Upper-Volta	83
U.S.A.	6,490	Burundi	86
Canada	6,310	Mali	89
Iceland	6,270	Ethopia	89
Germany, F. R.	5,990	Chad	91
Norway	5,910	Somalia	92
Denmark	5,900	Bangladesh	100
Luxembourg	5,480	Nepal	102
Belguim	5,420	Yemen	104
Australia	5,290	Niger	112
Netherlands	5,040	Benin	115
France	4,910	Burma	116
Finland	4,650	Pakistan	131
Libya	4,353	Haiti	140

Source: United Nations, World Military Expenditures, 1966-1975, 1976.

After the September Revolution, the development of the country was given first priority. Between 1970-1977, the total spending of EDP's reached a total of LD 5,417 million which is 9.64 times what was spent in the same period before the Revolution. The average annual spending was increased from LD 70 million before the Revolution to a total of LD 677 million which was 9.7 times what was spent before the Revolution.

To accomplish the EDP's goals, which are diversification of the sources of income and integration of the economy, the agricultural and industrial sectors have been given the highest priority. Between 1970-1977 the total actual spending on the agricultural sector was LD 1,260 million, an average annual spending of LD 157.5 million. The spending on the industrial sector, during the period 1970-1977 amounted to LD 1,027 million, an annual average spending of LD 128.4 million.

The huge investment in agriculture, industry and other sectors increased the GDP and decreased the dependency on oil as the major source of finance. The proportion of the oil revenue to the GDP decreased from 63 percent in 1970 to only 51 percent in 1975. As a result of the large investment, the non-oil sectors reached an annual compound rate of growth of 15.5 percent between 1970-1977 (The Ministry of Planning, 1978).

The Economic Development Plans (EDP's) in Libya (1970-1980)

The initial three-year EDP's (1970-1972) and (1973-1975) aimed at the realization of several objectives: to have self-sufficient

agricultural production, to decrease the dependency on oil as the major source of income and to increase income distribution. Diversification of the sources of income has been given first priority in the economic development plans since 1970. Investments have been concentrated on agricultural and industrial sectors, particularly in relation to the establishment of new agricultural projects and new factories capable of increasing production. The development of infrastructure such as education, health, and electricity was given high priority.

The investment allocation among economic sectors was significantly different from one EDP to another. As Table IV shows, the agricultural sector was given first priority in the EDP (1970-1972). The agricultural sector was allocated a total of LD 153.4 million (17.69 percent). Housing, communication and mining and industrial sectors were given the next highest priorities in EDP (1970-1972).

As Table IV shows, the total volume of expenditure allocation to fixed capital formation over the Three-Year EDP (1973-1975) amounted to LD 2,115 million which was 2.4 times the 1970-1972 figure. To accomplish the objectives of the plan, LD 441.285 million was spent on agriculture, amounting to 20.85 percent of the total investment. The housing sector was given second priority (LD 294.991 million). The mining and industrial sector was allocated the third largest share (LD 261.845 million).

The investment in most sectors of the economy was increased between the two economic plans. The differential spending is expected to lead to differential growth rates among sectors. As Table IV shows, the expenditure on agricultural development was increased from LD 153.4

TABLE IV

ALLOCATION OF THE INVESTMENT AMONG THE SECTORS OF THE ECONOMY DURING THE ECONOMIC DEVELOPMENT PLANS FOR 1970-1972 and 1973-1975

Economic Sector	EDP (1970-1972) Million Dinars	Percent	EDP (1973-1975) Million Dinars	Percent	Rate of Change During the Two Plans
Agriculture	153.400	17.69	441.285	20.85	187.67%
Housing	124.553	14.37	294.991	13.90	136.84%
Communication	113.944	13.14	199.003	9.41	76.45%
Mining and Industry	100.628	11.61	261.845	12.34	160.21%
Local Administration	88.293	10.18	141.068	6.67	58.77%
Education	78.757	9.08	185.919	8.75	136.07%
Electricity and Water	71.910	8.29	220.000	10.40	205.94%
Petroleum	53.258	6.14	189.039	8.94	254.95%
Health Services	36.734	4.24	69.793	3.26	90.00%
Labor and Social Affairs	14.705	1.70	22.439	1.04	52.59%
Information and Culture	11.017	1.27	31.978	1.47	190.26%
Economic and Tourism	10.504	1.21	9.630	0.43	- 8.32%
Projects Reserve	4.803	0.55	23.000	1.09	378.87%
Planning	4.57	0.51	5.000	0.24	12.18%
Youth and Social Affairs*	0	0	17.000	0.80	---
Administrative Development*	0	0	2.515	0.12	---
Total	866.963	99.98	2,115.000	99.71	

* new sectors created in 1973.

Sources: Central Bank of Libya, Sixteenth Annual Report of the Board of Directors, Tripoli, Libya, 1972, p. 112; and Central Bank of Libya, Eighteenth Annual Report of the Board of Directors, Tripoli, Libya, 1974, p. 115.

million in the EDP (1970-1972) to a total of LD 441.285 million in the EDP (1973-1975), an increase of 187.67 percent. The spending in the other economic sectors was increased between the two economic plans, in petroleum by 254.95 percent; in electricity and water, 205.94 percent; in information and culture, 190.26 percent in mining and industry, 160.21 percent and the other sectors as shown in Table IV. The only decrease in the investment spending was in the economic and tourism sectors. This is because after the September (1969) Revolution, alcohol and night clubs were prohibited by law.

The EDP (1976-1980) was approved in 1975. As Table V shows, a total investment allocation of LD 7,869 million is specified in the EDP (1976-1980). The manufacturing sector has been given the first priority. A total of LD 1,506.7 million is allocated to the manufacturing sector, that is, 19.15 percent of the total investment.

Due to the huge land area of the country, the distances between cities are very large which creates problems of transportation and communication. Accordingly, the government has given the second highest priority to this sector, with a planned investment of LD 1,477.8 million, that is, 18.77 percent of total investment. In the EDP (1976-1980) the "ownership of dwellings" (housing) sector has been given third priority and the agricultural sector, fourth priority.

The expenditure on education has been increased from LD 78.757 million in EDP (1970-1972) to LD 185.919 million in EDP (1973-1975) to reach a total of LD 462.5 million in EDP (1976-1980). The percent of each EDP that has been allocated to education decreased from 9.08 percent in EDP (1970-1972) to 8.75 percent in EDP (1973-1975) and reached a low of 5.87 percent in EDP (1976-1980). The decrease in

percent spending on education was due to the fact that the establishment of the primary, lower-level and intermediate levels of education was accomplished in the early EDP's. In spite of this drop in the percent allocation, the absolute amount that has been allocated to the educational sector was increased.

TABLE V

ALLOCATION OF THE INVESTMENT AMONG THE SECTORS OF THE ECONOMY DURING THE FIVE-YEAR PLAN (1976-1980)

Economic Sectors	Million Dinars	% to the Total
Manufacturing	1,506.70	19.15
Transportation and Communication	1,477.80	18.77
Ownership of Dwellings	1,194.30	15.17
Agriculture	939.10	11.93
Public Service	759.10	9.65
Electricity and Water	706.70	8.97
Educational Services	462.50	5.87
Projects Reserve	335.30	4.26
Oil and Gas	195.00	2.48
Health Services	148.60	1.88
Construction	72.00	0.91
Wholesale and Trade	47.90	0.60
Mining	19.00	0.24
Finance and Insurance	5.00	0.06
Total	7,869.00	99.94

Source: The Ministry of Planning, The Economic Development Plan (1976-1980), Tripoli, Libya, 1975.

This huge sum of money should be allocated efficiently among the different levels of education. As has been explained in Chapter I of this study, there exists an inappropriate mix among the different fields within both the university level and the intermediate level. The educational system should be designed to meet the requirements of the country for high-level manpower (graduates from university and intermediate schools), or at least to minimize the existing imbalances.

Since the agricultural sector was given first priority in both EDP's (1970-1972) and (1973-1975) and manufacturing sector was given first priority in EDP (1976-1980), the development in these sectors will be explained next.

Development in the Agricultural Sector

One of the most important sectors in the Libyan economy is the agricultural sector. It is a vital sector in economic development and employs a large percentage of the population. Of the total labor force in 1975, 19.6 percent was engaged in agriculture. The agricultural labor force decreased to 18.7 percent of the total labor force by 1977 (The Ministry of Planning, 1975, p. 150).

Agricultural development was given high priority in the development plans for the following reasons: to increase the level of income of the agricultural labor force, which amounted to 146,200 in 1977 (see Chapter V of this study); to introduce technology and increase the productivity of labor so that labor could be drawn from agriculture to industry and other sectors without reducing agricultural output; and to fulfill the objective of the plans for self-sufficiency in food products.

Development in the Manufacturing Sector

Industrial development in Libya has been given highest priority in the EDP (1976-1980). As Table V shows, a total of LD 1,506.7 million, 19.15 percent of the total planned investment has been allocated to the manufacturing sector.

This huge investment needs considerable high-level manpower to implement the process of industrialization. However, already there are great shortages of Libyan engineers and technicians. As Table I shows, 71.5 percent of the total engineers working in Libya in 1977 were foreigners. In the fields of intermediate engineers (intermediate industrial and general engineers) 47.3 percent were foreigners in 1977.

Major Constraints on Manufacturing Developments

The development of the manufacturing sector in Libya has been constrained by a limited domestic market, shortages of high-level manpower (especially experienced industrial personnel) and a lack of raw materials. The industrial sector in Libya still represents a foreign enclave in the national economy. Although efforts have been made by the Libyan state to overcome the above mentioned constraints, the industrialization goals set out in previous national development plans have not yet been achieved.

To sum up, most of the economic sectors require specific kinds of high-level manpower; for example, the agricultural sector needs agricultural engineers; the education sector needs graduates from education colleges and teachers schools; the health sector requires graduates

from medical colleges; and manufacturing sector requires engineers, etc. These different requirements for specific high-level manpower by each economic sector point up the need for a disaggregated model to estimate the high-level manpower requirements by the economy.

As shown in this chapter, the actual spending on each economic sector was different from one plan to another. Between 1962-1969, the actual annual spending on economic development amounted to LD 70 million. The annual spending changed drastically during the period 1970-1977 and reached an annual spending of LD 677 million. The huge spending not only changed from year to year and between plans, but also there was a very significant change in spending among economic sectors. The large differential spending among sectors is expected to result in differential growth rates. The differential growth rates of economic sectors are a very determinant and significant factor in this kind of study. The variation in sectorial growth should be taken into account in estimating the high-level manpower requirements of the economy. This is one of the major criticisms in the application of the Correa-Tinbergen model, which did not disaggregate by sector and used only an overall economic growth rate. This study will develop a model which is disaggregated by sectors and will overcome the Correa-Tinbergen aggregation problem.

CHAPTER IV

EDUCATIONAL STRUCTURE IN LIBYA

The aim of this chapter is to explain the structure of the educational system in Libya. The trend of enrollments in each field will be explained and compared with those of the other fields in the Libyan educational system.

The educational system in Libya is divided into five levels as shown in Table VI. The primary education (6 years) and the lower-level secondary education (3 years) are complusory in Libya for all children (ages 6-15). The third level of education is the higher-secondary education which lasts three years. Only the graduates from the higher-level secondary education are eligible to enter into the university level. The fourth level of education is the intermediate educational level; only the graduates from the lower-level secondary schools are eligible to enter into the intermediate level. This level lasts for four years and is divided into five fields: intermediate industrial, intermediate engineering, intermediate agricultural engineering, intermediate commerce and accounting and intermediate teachers schools. The graduates from the intermediate educational level are the main source of the high-level manpower with intermediate level of education. The government is responsible to offer jobs to all graduates and by law all graduates should work with the government.

Level five is the university level. The University of Libya was

TABLE VI

EDUCATIONAL SYSTEM AND ITS LEVELS IN LIBYA

Level of Education	Classification	Period of Study
1	Primary Schools	6 years
2	Lower-Level Secondary Schools	3 years
3	Higher-Level Secondary Schools	3 years
4	Intermediate Education:	
	1. Intermediate Industrial	4 years
	2. Intermediate Engineering	4 years
	3. Intermediate Agricultural Engineering	4 years
	4. Intermediate Commerce and Accounting	4 years
	5. Intermediate Teachers Schools	4 years
5	University Education:	
	1. College of Sciences	4 years
	2. College of Engineering	5 years
	3. College of Agriculture	4 years
	4. College of Education	4 years
	5. College of Arts	4 years
	6. College of Economics and Commerce	4 years
	7. College of Law	4 years
	8. College of Islamic Studies	4 years
	9. College of Medical	5 years
	10. College of Veterinary Medicine*	5 years
	11. College of Petroleum Engineering*	5 years

* Colleges of Veterinary Medicine and Petroleum Engineering will not be included in this study because they were recently added to the universities and no students have graduated.

founded in 1977 consisting of one College, the College of Arts, located in Benghazi. By 1974 the total number of colleges had reached nine. Colleges of Sciences, Engineering, Agricultural Engineering, Education and Medicine were located in Tripoli and Colleges of Arts, Law, Islamic Studies and Economics and Commerce were located in Benghazi. In 1975 the University of Libya was divided into two separate universities: University of El-Fatah in Tripoli and University of Ghar-Unis in Benghazi. New Colleges of Medicine, Engineering and Sciences have been added to the University of Benghazi and new Colleges of Veterinary Medicine and Petroleum Engineering were added to the University of El-Fatah.

The Trend of Enrollments

In 1977, 723,815 students were attending schools in Libya, that is, 24.2 percent of the Libyan population were attending schools, distributed as follows:

Primary Level	546,757
Lower-Level Secondary Level	121,763
Higher-Level Secondary Level	17,829
Intermediate Level	24,033
University Level	13,433

Source: The Ministry of Education, Department of Educational Planning, Statistical Bulletin, 1977.

The educational authority in Libya is the Ministry of Education. There is no private education in Libya. All students attend government supported public schools at all levels.

Primary Education

The primary education lasts six years. The enrollment in this

level has increased significantly from year to year. Between 1953 and 1963 the enrollment in primary schools increased by 246.5 percent. The discovery of oil in 1962 improved the economic condition of the country and the government established many new schools all over the country. As a result, the number of students increased from 145,925 in 1963 to a total of 451,928 students in 1973, an increase of 209.7 percent. The enrollment ratio in the primary schools was 98 percent in 1975 and the government plans to have a 100.0 percent enrollment ratio in primary schools during EDP (1976-1980) (The Ministry of Planning, 1975, p. 304).

Lower-Level Secondary Education

Between 1955 and 1965, the number of students in the lower-level secondary schools rose from 2,585 students to a total of 18,720 students, an increase of 624.2 percent. The enrollment ratio in the lower-level secondary schools was not as high as the government planned it to be. Since the lower-level secondary education is compulsory for all children, the enrollment ratio should be very high. The enrollment ratio was only 62.1 percent in 1977 (The Ministry of Planning, 1975, p. 304). This level of education in the Libyan educational system is very important. Graduation from this level is the requirement for all students to enroll in either higher-level secondary schools or the intermediate schools. Between 1966 and 1976 the enrollment in the lower-level secondary schools increased from 18,720 to a total of 121,763 students, an increase of 550.4 percent (The Ministry of Education, 1977). This level of education is expected to be no bottleneck for the required enrollments in the other levels.

Higher-Level Secondary Education

The certificate from the higher-level secondary education is a prerequisite for entrance into Libyan universities. All the students compete in a general comprehensive examination in the third year of higher-level secondary schools, and only those who pass the examination can enter into the universities. Those who fail have to repeat the third year of schooling in the level and retake the examination the next year.

The enrollment in the higher-level secondary schools increased by 302.8 percent between 1963 and 1973. The total number of students rose from 10,908 in 1973 to 17,829 in 1977, and increase of 63.5 percent (The Ministry of Education, 1977).

The Intermediate Level of Education

The total enrollment in the intermediate level of education amounted to 24,033 students in 1977. Of the total enrollment, 86.3 percent were enrolled in teachers schools, 6.2 percent in commerce and accounting, 2.7 percent in agriculture, 2.6 percent in industrial and 2.2 percent in intermediate engineering. Each will be discussed in turn.

Intermediate Teachers Schools. The intermediate teachers schools have been given first priority in the intermediate level of education. Of the total enrollment in the intermediate level 20,748 students were enrolled in intermediate teachers school in 1977.

As Table VII shows, between 1963 and 1973, the number of students enrolled in teachers schools increased from 2,295 students to a total

TABLE VII

ENROLLMENTS AND PERCENT INCREASE
IN TEACHERS SCHOOLS FOR
SELECTED YEARS

Year	Total Enrollments			Percent Increase		
	Male	Female	Total	Male	Female	Total
1963	1,752	543	2,295			
1973	6,903	4,087	10,990	294.0%	652.7%	378.9%
1977	8,490	12,258	20,748	23.0%	199.9%	88.8%

Sources: The Ministry of Education, Department of Educational Planning, Statistical Bulletins, Tripoli, Libya, 1964, 1974, and 1978.

of 10,990 students, an increase of 378.9 percent. Between 1973 and 1977, the total enrollment in teachers schools increased from 10,990 students in 1973 to reach a total of 20,748 in 1977, with an increase of 88.8 percent. The high rate of enrollment in teachers schools is expected to lead to a self-sufficiency of domestic teachers in both primary and lower-level secondary education.

The Intermediate, Commerce and Accounting, Industrial, Engineering and Agricultural Schools. The total enrollments in these four fields are very low compared to that of teachers schools. This level of education in Libya is the only source of supply of high-level manpower with an intermediate level of education. The demand for this kind of labor differs significantly from one field to another. While the total demand for graduates from commerce and accounting schools reached a total of 2,810 in 1977, the demand for industrial, engineering and agriculture graduates was 1,327, 992 and 984 respectively. Foreigners represent very high ratios of the intermediate level of manpower. In 1977, the foreigners represented 61.8 percent of workers with a certificate from intermediate engineering schools, 36.5 percent from industrial schools, 31.2 percent from commerce and accounting and 21.2 percent from agricultural schools (Table I).

The University Level of Education

As Table VIII shows, between 1961 and 1971 the number of students in the Libyan universities rose from 546 to 3,663 students. Between 1971 and 1977, enrollments increased to a total of 13,433 students an increase for this last period of 266.7 percent.

TABLE VIII

ENROLLMENTS AND PERCENT INCREASE
IN THE LIBYAN UNIVERSITIES FOR
SELECTED YEARS

Year	Total Enrollments			Percent Increase		
	Male	Female	Total	Male	Female	Total
1961	526	20	546			
1971	3,253	410	3,663	518.4%	1,950.0%	570.9%
1977	11,167	2,373	13,433	243.3%	479.0%	266.7%

Sources: The Ministry of Education, Department of Educational Planning, Statistical Bulletins, Tripoli, Libya, 1964, 1974 and 1978.

The female enrollment in the Libyan universities is still very low. The female enrollment increase from 410 in 1971 to 2,373 in 1977, an increase of 479.0 percent The proportion of the females to the total enrollments increased from 3.7 percent in 1961 to 11.2 percent in 1971 and reached 17.7 percent in 1977. In a society with 45 percent of the population female, the 17.7 percent enrollment in the universities is considered to be very low. The government should encourage female enrollment in the universities colleges.

Enrollments by Colleges. As explained in Chapter I of this study, the choice of the student in which college he wants to enroll is very limited and is determined primarily by the government. As Table II shows, enrollments in the various colleges differ significantly. In 1977 the largest proportion of the students was allocated to College of Arts. Of the total enrollments, 2,485 (18.5 percent) were enrolled in Arts College. The enrollment in College of Law was 1,874 (14.0 percent); Economics and Commerce, 1,846 (13.7 percent); Education, 1,666 (12.3 percent); Engineering, 1,548 (11.5 percent); Islamic Studies, 1,338 (10.0 percent); Sciences, 909 (6.8 percent); Medical Colleges, 900 (6.7 percent); Agriculture, 845 (6.3 percent); and Veterinary College, 22 (0.2 percent).

Cost and Financing of Education

Education is free to the individual in Libya at all stages. Over the years the government has given high priority to education. The expenditure on education increased from LD 3.9 million (21.6 percent) of the total budget in 1962, to reach a total of LD 41.3 million (24.3

percent) of the total budget in 1969 (The Ministry of Education, 1974, p. 63).

After the September Revolution (1969), special consideration has been given to the educational sector. As shown in Tables IV and V (see Chapter III), the government allocated LD 78.8 million, that is, 9.1 percent of the total EDP (1970-1972) and LD 185.9 million in EDP (1973-1975) with a rate of change during the two plans amounting to 136.1 percent. In the EDP (1976-1980) the government has allocated a total of LD 462.5 million to be spent on education. The annual expenditure increased from LD 62.0 million in EDP (1973-1975) to LD 92.5 million in EDP (1976-1980).

In summary, the enrollments in both the primary and lower-level secondary schools are expected to grow and are assumed to be no bottleneck for the enrollments in the other levels. In 1977 the female enrollment represented only 17.7 percent of the total university enrollment which is a very low proportion. To secure the number of students needed to be allocated among different fields, the government should encourage female enrollment in the intermediate and the university levels. The government should use economic and social guidelines in allocating students among different fields in each educational level. This study will provide a policy guideline for the government to follow in allocating students among different fields to meet the needs of the country of high-level manpower.

CHAPTER V

HIGH-LEVEL MANPOWER IN LIBYA

This chapter is concerned with the high-level manpower in Libya. The demand and supply during 1971-1977 are explained and the ratio of the foreigners to the total high-level manpower is shown.

Manpower and Education Levels in Libya

Manpower is a nation's most precious and critical resource. Libya's manpower problems have grown out of the country's economic, social and institutional structure. For many years vigorous full employment policies have been maintained. The economy can be characterized as one of manpower shortages in the context of growing demands on its limited high-level manpower supply.

As Table IX shows, the total labor force amounted to 781,042 workers in 1977. Of the total 75.9 percent had little or no education; 11.6 percent had a primary school certificate; 5.3 percent had a lower-level secondary school certificate; 0.1 percent had a higher-level secondary school certificate; 4.1 percent had an intermediate school certificate and 3.0 percent had a university degree and above.

The proportion of labor force with a university degree and above, which amounted to 3.0 percent, seems to be high compared to the ratio in other countries. For example, this ratio was 1.2 percent in Portugal, 1.6 percent in Argentina and 2.7 percent in France in 1963

(Organization for Economic Co-operation and Development (OECD), 1965, p. 360).

TABLE IX

EDUCATIONAL LEVELS OF THE TOTAL LABOR FORCE IN 1977

Educational Levels	Number of Workers	Rate to the Total Labor Force
Below primary and illiterate	593,083	75.9
Primary schools certificate	90,240	11.6
Lower-level secondary school	41,196	5.3
Higher-level secondary school	650	0.1
Teacher's Certificate	26,100	3.3
Commerce and Accounting Certificate	2,810	0.4
Intermediate Industrial Certificate	1,327	0.2
Agricultural Engineering Certificate	984	0.1
Intermediate Engineering Certificate	992	0.1
University level and above	23,642	3.0
Total	781,042	100.0

Sources: The Ministry of Civil Services, Manpower Survey Report, Tripoli, Libya, 1977; and The Ministry of Labor, Manpower Survey, Tripoli, Libya, 1977.

High-Level Manpower in Libya

As a result of huge investments in all sectors of the economy and the limited supply of national high-level manpower, the demand for high-level manpower since 1971 increased more rapidly than the

supply. While the demand for high-level manpower increased from 18,885 workers in 1971 to a total of 55,855 workers in 1977, the supply of national high-level manpower increased from 10,664 workers in 1971 to 36,844 workers in 1977.

As shown in Table X, the discrepancy between supply and demand for high-level manpower in Libya created shortage problems. These shortages can be seen by the ratio of the foreigners to the Libyans. The imported high-level manpower increased from 8,221 workers (43.5 percent) in 1971 to a total of 20,341 workers (38.5 percent) in 1976. This increase in the number of foreigners in the Libyan labor force is a national crisis. There is no assurance that the foreigners will stay in Libya. As a result of the political differences between Libya and Egypt in 1977, as explained in Chapter I, most of the Egyptians, which represents the majority of the foreign manpower in Libya, were called home and most of them obeyed.

For economic reasons as well as for national security and national pride, reliance on national high-level manpower in Libya is necessarily a high national priority.

Educational Structure of the High-Level Manpower in Libya, 1977

As shown in Table I, the total high-level manpower in Libya amounted to 55,855 in 1977. Of the total, 23,642 held a university degree and 32,213 held a certificate from an intermediate level of education. Of the total high-level manpower, the foreigners amounted to 19,011, that is, 34.0 percent of the high-level manpower in Libya was imported in 1977.

TABLE X

TOTAL HIGH-LEVEL MANPOWER, THE RATE OF INCREASE AND THE RATIO OF FOREIGNERS TO LIBYANS DURING 1971-1977

Year	National High-Level Manpower	Foreign High-Level Manpower	Total High-Level Manpower	Rate of Increase (Increase)	Ratio of Foreign to Total
1971	10,664	8,221	18,885	----	43.5
1972	14,308	7,739	22,047	10.9	35.1
1973	18,990	9,483	28,474	29.2	33.3
1974	23,410	12,278	35,688	25.3	34.4
1975	28,523	20,167	48,690	36.4	41.4
1976	32,524	20,341	52,865	8.6	38.5
1977	36,844	19,011	55,855	5.7	34.0

Sources: The Ministry of Civil Services, The Foreign Manpower Department and the Local Manpower Department, 1977; The Ministry of Education, Statistical Bulletin on Students and Graduates, 1977; and The Ministry of Civil Services, The Manpower Census, Tripoli, Libya, 1971.

High-Level Manpower with University Degree

As shown in Table I, the total high-level manpower with a university degree amounted to 23,642 workers in 1977. Of the total, 14,007 workers were foreigners, that is, 59.3 percent of high-level manpower with a university degree was imported. As shown in Table I, the majority of high-level manpower with a university degree came from Colleges of Arts, Medicine, Engineering and Economics and Commerce. The foreign manpower was dominant in most of the fields. Of the total high-level manpower with university degree, 6,042 workers came from College of Arts with 53.0 percent foreigners; 4,257, Medical Colleges with

88.8 percent foreigners; 3,207, College of Engineering with 71.5 percent foreigners; and 2,650 came from College of Economics and Commerce with 45.6 percent foreigners. Graduates from Islamic Studies and Veterinary Medicine amounted to 919 workers and 297 workers respectively. The remaining high-level manpower came from Colleges of Sciences, Education and Law with a high foreign ratio in most of the fields.

High-Level Manpower with Intermediate Certificate

As shown in Table I, the total high-level manpower with intermediate certificate amounted to 32,213 workers in 1977. Of the total, 5,004 were foreigners, that is, the foreigners represented only 15.5 percent. The majority of high-level manpower with intermediate certificate came from teachers school. Of the total, 26,100 workers had a certificate from teachers school, that is, 81.0 percent of the intermediate high-level manpower came from teachers school. This ratio was very high compared to the other intermediate fields where the ratios were: 8.7 percent from commerce and accounting school; 4.1 percent from intermediate industrial schools; 3.1 percent from intermediate engineering schools and 3.1 percent from intermediate agriculture schools.

Distribution of High-Level Manpower Among Economic Sectors

As Table XI shows, the distribution of high-level manpower among the economic sectors is significantly different. Because different activities require specific skills and special training, it is

expected that different economic sectors require different skills. The number of workers required by each sector is different in quantity and types of school training.

TABLE XI

DISTRIBUTION OF HIGH-LEVEL MANPOWER WITH A UNIVERSITY DEGREE AND INTERMEDIATE CERTIFICATE AMONG THE SECTORS OF THE ECONOMY (1977)

Economic Sector	Manpower with University Degree	Percent	Manpower with Intermediate Certificate	Percent
Public Services	6,832	28.9	3,040	9.4
Health Services	4,743	20.1	183	0.6
Educational Services	3,405	14.4	22,420	69.6
Agriculture	2,086	8.8	1,197	3.4
Oil and Gas	1,366	5.8	668	2.1
Manufacturing	1,310	5.5	988	3.1
Construction	803	3.4	904	2.8
Mining	640	2.7	404	1.3
Other Services	591	2.5	1,427	4.4
Trade and Commerce	474	2.0	445	1.4
Trans. and Comm.*	473	2.0	315	1.0
Electricity and Water	399	1.7	170	0.5
Ownership of Dwellings	265	1.1	97	0.3
Finance and Business	255	1.1	64	0.2
Total	23,642	100.0	32,213	100.0

*Transportation and Communication

Sources: The Ministry of Civil Services, Local and Foreign Affairs Department, The Allocation of Graduates Among Economic Sectors, Tripoli, Libya, 1977; and The Ministry of Labor, Manpower Survey, Tripoli, Libya, 1977.

The majority of high-level manpower with university degree was engaged in public services in 1977. Of the total, 6,832 workers (28.9 percent) were engaged in public sectors; 4,743 (20.1 percent) in health services; and 3,405 (14.4 percent) in educational services. The high-level manpower engaged in agricultural sector, oil and gas and manufacturing sectors were 2,086, 1,366 and 1,310 respectively.

Of the total high-level manpower with intermediate certificate, 22,420 (69.6 percent) were engaged in educational services; 3,040 (9.4 percent) in public services and the rest distributed among the remaining sectors with ratios ranging from 3.4 percent in agriculture to 0.2 percent in finance and business sector.

To sum up, the demand for high-level manpower increased faster than the supply of the national high-level manpower. This problem led the government to import 59.3 percent of the high-level manpower with a university degree and 15.5 percent of that with intermediate certificate. Because of the huge investment in all economic sectors, which is expected to exist in the next years, the demand for high-level manpower is expected to increase even faster than before. The large expected increase in demand for high-level manpower in Libya makes it urgent for the country to plan to supply the needs of the economy for this kind of labor. For national pride and national security, as well as for economic reasons, the government should plan to depend on the national high-level manpower or at least to minimize the dependency on foreign manpower in key occupations such as engineers, doctors, agricultural engineers and other technical and qualified personnel.

Since the source of supply of national high-level manpower comes from the educational system, the country should plan the educational

system to supply the needs of its economy for different skills. Where a general economic development plan exists, it is clear the educational planning must be related to the overall production targets for each sector established by the economic plan. This study will develop a model to relate the educational requirements to the country's EDP's to supply the high-level manpower needs.

CHAPTER VI

THE SIMPLE DISAGGREGATED MODEL

In this chapter, a simple disaggregated model will be introduced and compared with the very aggregated Correa-Tinbergen model, which was described in Chapter II of this study. Using the new simple disaggregated model, the study will attempt to derive from Libya's economic objectives its high-level manpower requirements. Accordingly, the EDP (1976-1980) will be taken as the point of departure. This document is an expression of Libyan aspirations as well as statements of targets and programs. The study, using the new simple model, represents a useful initial planning effort, and its translation of planning goals into human resource terms will suggest the key manpower issues that confront Libya. The study develops a basis for gearing Libya's manpower program to the future rather than to the past.

The Method of Analysis

The future demand for high-level manpower in Libya will be considered in terms of two major components: growth and replacement. The growth factor is importantly effected not only by the absolute economic growth (as the Correa-Tinbergen model assumed), but also by changes in the composition of the economy, the expansion of present government services (especially education, agricultural programs, etc.), and also the assumption of new government responsibilities in

establishing new health services, a postal system, etc. All these important elements in determining the future needs of high-level manpower have been spelled out in the EDP (1976-1980) and its target of growth will be used to estimate the required high-level manpower for each economic sector by field of specialization.

The replacement component for high-level manpower in this study will be considered as the sum of wastage, losses by death, illness or dropping out of workers. In calculating the attrition rate of high-level manpower in Libya the retirement rate will be assumed to be equal to zero. This assumption is valid in the case of Libya. Most of the Libyan technical and intermediate institutions were established in 1950 and the first college in the Libyan universities was founded in 1955. This means that the first students were graduates from the intermediate level of education were in 1954 and from the Libyan universities in 1959. These graduates will not reach the age of retirement (65) during the period of this study. Accordingly, the retirement coefficient will not be used and will be expected to have no effect on the results of the study.

The annual attrition rate, other than retirement, was estimated by the Ministry of Planning, Manpower Division, in 1975, to be equal to 0.008; that is, eight persons per one thousand workers from high-level manpower will die or drop out of work annually. This ratio will be used in this study to estimate the attrition.

Steps of the Analysis

The analysis in this study to estimate the demand and supply of high-level manpower will be as follows:

1. The number of high-level manpower required by the economy by educational level and by each economic sector will be calculated first by fields of specialization for the next seven years, 1978-1985.
2. The supply of high-level manpower from the existing (1977) enrollments in the intermediate and university levels will be calculated by fields of specialization.
3. Since nothing can be done to change the expected supply in the next four years, 1978-1981, the period of study, 1978-1985, will be divided into two periods: period one, 1978-1981, and period two, 1982-1985. The expected graduates from each field of specialization during the first period, 1978-1981, will be compared to the required high-level manpower, which has been estimated in Step 1 for the period 1978-1981, and the difference will be interpreted as a surplus or shortage in each field of specialization.
4. The calculated required graduates from each field of specialization that are needed during period two, 1982-1985 (estimated in Step 1), will be used to estimate the required enrollment in each field of specialization in each corresponding college and intermediate school to secure the required supply from each field to meet the estimated required future demand.
5. The required teachers will be estimated on the basis of student-teacher ratios which were planned by the Ministry of Education in the EDP (1976-1980) and (1981-1985).
6. The estimate of the required doctors will be based on the

planned population-doctor ratio that has been established by the government in order to have high-standard health services.

The Assumptions of the Model

1. The high-level manpower will be divided into two levels: Level 1, the intermediate level, and Level 2, the university level. Then Level 1 will be divided into five fields of specialization, including teachers, and Level 2 will be divided into nine fields of specialization.
2. The current (1977) distribution of high-level manpower by fields of specialization among the economic sectors will be used to estimate the technical coefficient for each field in each sector. This means that this study will assume that each skill will have a fixed relationship to real GDP.

   In developed countries this assumption may not be realistic. Learning by experience, together with advanced technology used in the production process, leads to an increase in the productivity of labor; and this will decrease the labor-output ratios in the long-run. But this simplifying assumption may not be unrealistic for Libya. Limited use of technology in Libya and the dominance of foreign labor in most sectors of the economy, together with the medium term of projection that is anticipated by this study, may justify the assumption of constant productivity of labor, and the related assumption of fixed linear relationships between high-level manpower and GDP. There is evidence from comparisons of countries at different levels of economic development

that the number of "highly qualified" people in the labor force tends to vary proportionately with output (Layard and Saigal, 1966).

An empirical analysis of the growth of GDP and the high-level manpower in Libya between 1971-1977 supports the validity of the assumption. As Table XII shows, the only drop in the technical coefficients occurred in 1974 and was not significant. This was, in fact, due to the unexpected increase in the oil price in 1973 which led to a high rate of growth in GDP. Between 1973 and 1974, the GDP increased from LD 2,182.3 million to LD 3,908.3 million, an increase of 79.1 percent. It is difficult to find data to measure the productivity of labor. Some planners, in order to forecast productivity, prefer to use comparisons with more advanced countries. This is not very applicable to Libya because of the differences in type of economy, technology, etc. Professor Harbison's (1964) forecasts for manpower in Nigeria assume that employment will rise in proportion to output.

Michel Deveauvais (1964) explains that productivity of labor may have no effect on the forecast of required manpower in a newly independent country where the majority of the high-level manpower is foreigners, because the foreigners are expected to leave and new national graduates will substitute for them. These explanations, together with the empirical results in Table XII, support the assumption that the effect of change in the productivity on the demand for labor in Libya may be negligible for the period with which this study deals.

TABLE XII

GDP, HIGH-LEVEL MANPOWER AND THE TECHNICAL COEFFICIENTS (1971-1977)

Year	GDP in LD (Million) (1)	High-Level Manpower (2)	Technical Coefficient (2÷1)	Rate of Increase In the Demand for High-Level Manpower (Percent)
1971	1,468.6	18,885	12.5	----
1972	1,982.2	22,047	11.1	10.9
1973	2,182.3	28,474	13.1	29.2
1974	3,908.3	35,688	9.1	25.3
1975	4,024.0	48,690	12.1	36.4
1976	4,440.5	52,865	11.9	8.6
1977	4,907.7	55,865	11.4	5.9

Sources: The Ministry of Planning, Economic Development Plan (1976-1980), Tripoli, Libya, 1975.

3. All graduates from intermediate schools and university colleges are expected to join the labor force immediately after graduation. This assumption is reasonable for Libya. For all such graduates the government is the main source of employment. By law, all graduates must take assigned jobs, each in his major field of study in one of the economic sectors.
4. The total number of students below intermediate level of education was 668,520 in 1977, which represented 22.3 percent of the total population. The enrollments in these levels are expected to grow and the flow of students from Levels 1,

2, and 3 of education to the intermediate schools and the universities colleges need not be considered a bottleneck.

The New Simple Model

The Demand for High-Level Manpower

The number of high-level manpower workers required by each sector of the economy by educational qualification will be calculated by the following equation:

$$d_t^i = \sum_J viJ \, \Delta V_t^J \qquad (1)$$

where:

d_t^i = change in sectoral demand of high-level manpower with field i of specialization in year t.

viJ = technical coefficient which measures the number of units of labor force with field i of specialization required to produce one unit of output in sector J.

V_t = the GDP of Libya in year t.

and

i = 1, 2, . . . 5 in case of high-level manpower below university level and 1, 2, . . . 9 in case of the university level, as shown in Table VI.

J = 1, 2, . . . 14 economic sectors.

After calculating the required manpower by field of specialization for each economic sector, the total high-level manpower with field i of specialization for the economy will be calculated by the following equation:

$$D_t^i = \sum_i d_t^i + wL_{t-1}^i \quad (2)$$

where:

D_t^i = total change in the demand for high-level manpower required by the economy with field i of specialization in year t.

d_t^i = increment in demand for high-level manpower required by economic sectors with field i of specialization in year t.

L_{t-1}^i = total high-level manpower with a field i of specialization in the economy in year t-1.

w = the attrition rate of high-level manpower due to death or drop-out of labor force, which has been estimated to be equal to 0.008 annually.

The Supply of High-Level Manpower

The following equations will be used to estimate the required enrollments in each field of study:

$$D_t^i = \alpha_4 X_{t-1}^4 \quad (3)$$

$$X_{t-1}^4 = \alpha_3 X_{t-2}^3 + \beta_4 X_{t-1}^4 - \lambda_4 X_{t-1}^4 \quad (4)$$

$$X_{t-2}^3 = \alpha_2 X_{t-3}^2 + \beta_3 X_{t-2}^3 - \lambda_3 X_{t-2}^3 \quad (5)$$

$$X_{t-3}^2 = \alpha_1 X_{t-4}^1 + \beta_2 X_{t-3}^2 - \lambda_2 X_{t-3}^2 \quad (6)$$

where:

D_t^i = total number of graduates required by the economy with field i of specialization.

X^4_{t-1} = required enrollment in graduating (fourth) year (t-1).

X^3_{t-2} = required enrollment in third year (t-2).

X^2_{t-3} = required enrollmend in second year (t-3).

X^1_{t-4} = required enrollment in first year (t-4).

and α_4, α_3, α_2 and α_1 are percent of students passing from year 4, 3, 2 and 1 respectively. β_4, β_3. β_2 and β_1 are percent of students repeating from year 4, 3, 2 and 1; and λ_4, λ_3, λ_2 and λ_1 are percent of students dropping from year 4, 3, 2 and 1.

The average values of α's, β's and λ's, by fields of specialization are calculated and presented in the Appendix, Table XXX.

Using the demand for high-level manpower estimated by equation (2) and the level of α's, β's and λ's, Table XXX, the required enrollments in each field of specialization for 1978-1982 are estimated and presented in the Appendix, Tables XXXI and XLIV.

This analysis will be applied to all fields of specialization to estimate the required enrollments in each class and in each field of study. After estimating the required enrollments in each class and field of study, the total required enrollments, year by year (1978-1981) in the universities and intermediate schools, will be calculated by the following equations:

University Level

$$E^{Ci}_t = \sum X^T_i \qquad (7)$$

where:

E_t^{Ci} = total number of students in College Ci required to produce the required high-level manpower with field Ci of education.

X_i^T = the number of students in class T in college i.

Ci = college i where i = 1, 2, . . . 9 (as identified in Table VI).

the total required enrollments in the Libyan universities to secure the supply of the total high-level manpower with university degree are:

$$E_t^u = \sum E_t^{Ci} \tag{8}$$

where:

E_t^u = the total number of students required to be enrolled in the Libyan universities (1978-1981) to supply the required labor with university levels (1982-1985).

Intermediate Level

Equations (7) and (8) will be modified to calculate the required enrollments in intermediate level of education as follows:

$$E_t^{Ii} = \sum X_t^T \tag{7.1}$$

where:

E_t^{Ii} = the total number of students in intermediate level field i required to produce the required intermediate high-level manpower with field Ii of education.

X_i^I = the number of students in class T in intermediate level i.

Ii = intermediate field of study i where i = 1, 2, 3 and 4 (teachers estimated separately).

The total required enrollments in the intermediate level of education to secure the supply of the total high-level manpower with intermediate certificate are:

$$E_t^I = \sum E_t^{Ii} \tag{8.1}$$

where:

E_t^I = the total number of students required to be enrolled in the intermediate level of education (1978-1981) to supply the required labor with intermediate certificate in year t (1982-1985).

Estimate of the Graduates That Will be Available from the Existing Enrollment

To estimate the expected graduates from the existing system of education based on current (1977) enrollments, the following equations will be used:

$$G_t = \alpha_4 X_t^4 \tag{9}$$

$$G_{t+1} = \alpha_4 X_{t+1}^4 \tag{10}$$

$$G_{t+2} = \alpha_4 X_{t+2}^4 \tag{11}$$

$$G_{t+3} = \alpha_4 X_{t+3}^4 \tag{12}$$

where:

G_t = expected graduates in year t.

X_t^4 = number of students in fourth year of school.

and

$$X_{t+1}^4 = \alpha_4 \left[\alpha_3 X_t^3 + \beta_4 X_t^4 \right] \tag{13}$$

$$X_{t+2}^4 = \alpha_4 \left[\alpha_3 (\alpha_2 X_t^2 + \beta_3 X_t^3) + \beta_4 X_{t+1}^4 \right] \tag{14}$$

$$X_{t+3}^4 = \alpha_4 \left[\alpha_3 \left[\alpha_2 (\alpha_1 X_t^1 + \beta_2 X_t^2) + \beta_3 X_t^3 \right] + \beta_4 X_{t+2}^4 \right] \tag{15}$$

t = year 1978.

This method will be applied to each field of specialization in Levels 1 and 2. The results of this analysis will be compared to the manpower required by different sectors of the economy which will be estimated in Chapter VIII of this study. The difference between the two will be interpreted as shortage or surplus of that kind of labor.

This analysis will tell us how much "foreign aid" in the form of skilled labor will be needed to be imported or repatriated in each year and by field of specialization.

Comparison Between the Correa-Tinbergen Model and the Simple Disaggregated Model

The disadvantages of the aggregated Correa-Tinbergen model have drawn the attention of economists who are interested in manpower planning. Professor J. C. Shearer was one of the first economists who strongly criticized the application of the model to manpower planning

as it was presented first by H. Correa.[1] The projection of high-level manpower requirements without disaggregation into specific fields of specialization has little usefulness for planning. The major advantages of the new simple disaggregated model over the Correa-Tinbergen model are the following:

1. In the Correa-Tinbergen model, the high-level manpower was assumed homogeneous, that is, the high-level manpower was assumed to be a capital good and had a fixed capital-output ratio. In this study, the high-level manpower is disaggregated into 14 different fields of specialization and the technical coefficient for each field of specialization in each of the 14 economic sectors will be calculated separately; and hence, the Correa-Tinbergen assumption of free substitutability among high-level manpower is replaced by the more reasonable assumption of zero substitutability.
2. The Correa-Tinbergen model estimated the total number of students to be enrolled in intermediate level of education to supply the required high-level manpower with intermediate education as one homogeneous group and that the number of the university students required to be enrolled in the university also as a homogeneous one. They did not differentiate among the required students in each field of specialization which is necessary for manpower planning.

The new simple disaggregated model estimates the required

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[1]Professors Correa and Shearer were colleagues in The Latin American Institute of Economic and Social Planning (UN, Economic Commission for Latin America), Santiago, Chile, 1962-63.

enrollment in each field of specialization separately and overcomes these disadvantages in the Correa-Tinbergen model.

3. The estimate of high-level manpower in the Correa-Tinbergen model was divided into only two levels: Level 2, intermediate level and Level 3, university level. In educational and manpower planning, it is necessary to know what kinds of skills are needed for each sector of the economy and what qualifications are required for each skill. This is the only way by which education can be planned to supply the skills required by the economy. In this study, using the new simple disaggregated model, the enrollments in each field of study and within each class in all fields are estimated separately.

4. The economy was not disaggregated into its original sectors in the Correa-Tinbergen model. The economy was assumed to have one sector and an absolute rate of growth for the whole economy was assumed. But each sector of the economy has a different rate of growth over the years and requires different kinds of skills. The simple disaggregated model overcomes this problem in the Correa-Tinbergen model. The economy is disaggregated into 14 sectors and the growth rate of each sector is used to estimate the expected change in the contribution of that sector to GDP. The change in level of output in each sector is used to estimate the required skills in that sector.

To sum up, it is hoped that this disaggregation will overcome the aggregation problems of the Correa-Tinbergen model and will prove

useful in estimating the required high-level manpower by each economic sector and in deriving the required enrollments in each field of specialization within each level of education.

CHAPTER VII

THE APPLICATION OF THE MODEL

This chapter is concerned with the application of the new disaggregated model. The sources of the data used in this study will be explained. The calculation of the technical coefficients will be presented and the expected change in the level of output in each economic sector will be shown and used to estimate the incremental in the demand for each field of specialization. Then, the trend and structure of the high-level manpower up to 1985 will be explained.

Data Sources

The steps taken and the types of data collected follow:

1. The manpower survey by the Ministry of Civil Services in 1971 was the basic source for the high-level manpower data in 1971. The survey includes detailed information about the total manpower in Libya by sectors of the economy, tabulated by level of education and field of specialization.
2. For the period between 1972 and 1977, the distribution of imported manpower and the graduates from the University of Libya and the intermediate schools were calculated from the original files of the Ministry of Civil Services.
3. The graduates from the Libyan university have been tabulated by colleges since the foundation of the university in 1959 to

1977. The statistical bulletins from the universities of Libya and the Ministry of Education were used in this study.

4. The data about the level of output from each economic sector were tabulated by the Ministry of Planning in the EDP (1976-1980). This plan contains reliable information about the level of education of the high-level manpower and its distribution among the economic sectors, the growth of each economic sector and the planned investment allocation to the economic sectors during EDP (1976-1980).

All the data were collected from original sources in Libya between September, 1977, and February, 1978.

The data are tabulated by ten fields of specialization (colleges) within the university level and five fields (schools) of specialization within the intermediate level, Tables XIII and XIV. To simplify the analysis, Table XV presents the expected level of output of the various economic sectors during the EDP (1976-1980). The government has estimated the expected change in the level of output by each economic sector during the next five year EDP (1981-1985), and these levels of output are presented in Table XVI from the Ministry of Planning's Economic Development Plan (1976-1980). The expected changes in the level of output of various economic sectors, which are used with the technical coefficient in each sector to estimate the incremental demands of high-level manpower, are calculated and presented in Table XVII. The calculation of the rate of growth in each economic sector was based on the planned rate of growth as projected by the

TABLE XIII

TOTAL LABOR FORCE WITH UNIVERSITY EDUCATION BY FIELD OF STUDY IN EACH ECONOMIC SECTOR IN 1977

Economic Sector	Sciences	Engi-neering	Agricul-tural Engi-neering	Educa-tion	Arts	Economics & Commerce	Law	Islamic Studies	Medi-cine	Total
Agriculture	170	164	1,003	23	254	164	3	0	8	1,789
Oil and Gas	59	972	0	23	121	180	11	0	0	1,366
Mining	202	256	0	39	60	80	1	0	2	640
Manufacturing	578	337	22	15	139	212	3	0	4	1,310
Electricity and Water	78	128	0	0	30	159	0	0	4	399
Construction	120	661	0	0	0	11	3	0	8	803
Trade and Commerce	61	0	11	6	121	270	5	0	0	474
Trans. and Comm.*	15	398	0	0	0	56	4	0	0	473
Finance and Business	10	0	0	21	54	167	3	0	0	255
Ownership of Dwellings	40	32	0	12	66	111	4	0	0	265
Education	156	35	45	1,644	1,136	74	18	280	17	3,405
Health	224	16	0	0	133	164	7	0	4,199	4,743
Public Services	189	208	28	93	3,626	784	1,250	639	15	6,832
Other Services	0	0	0	58	302	218	13	0	0	591
Total	1,902	3,207	1,109	1,934	6,042	2,650	1,325	919	4,257	23,345

*Transportation and Communication

Sources: The Ministry of Civil Services, Local and Foreign Employment Division, Report on Foreign Employment in Libya, Tripoli, Libya, 1977; and The Ministry of Civil Services, Local and Foreign Employment Division, The Manpower Census, Tripoli, Libya, 1971.

TABLE XIV

TOTAL LABOR FORCE WITH INTERMEDIATE EDUCATION
BY FIELD OF STUDY IN EACH ECONOMIC SECTOR
IN 1977

Economic Sector	Diploma in Industrial	Diploma in Agricultural Engineering	Diploma in Intermediate Engineering	Diploma in Commerce & Accounting	Diploma in Teaching	Total
Agriculture	40	866	32	146	13	1,097
Oil and Gas	122	0	13	528	5	668
Mining	190	0	33	180	0	403
Manufacturing	598	24	28	338	0	988
Electricity and Water	31	0	21	118	0	170
Construction	107	0	498	281	16	902
Trade and Commerce	27	21	79	292	26	445
Trans. and Comm.*	80	0	206	28	0	314
Business and Finance	0	0	0	56	8	64
Ownership of Dwellings	0	0	57	28	10	95
Education	42	44	16	133	22,185	22,420
Health Sercives	13	0	0	64	104	181
Public Services	77	29	9	314	2,610	3,039
Other Services	0	0	0	304	1,123	1,427
Total	1,327	984	992	2,810	26,100	32,213

*Transportation and Communication

Source: The Ministry of Civil Services, Local and Foreign Employment Division, The Manpower Census, Tripoli, Libya, 1971: and The Ministry of Civil Services, Local and Foreign Employment Division, Report on Foreign Employment in Libya, Tripoli, Libya, 1977.

TABLE XV

THE EXPECTED LEVEL OF OUTPUT OF EACH ECONOMIC SECTOR 1976-1980
(LD Million)

Economic Sector	Output 1975	Output 1976	Output 1977	Output 1978	Output 1979	Output 1980	Compound Rate of Growth
Agriculture	83.80	97.04	112.37	130.13	150.69	174.50	15.8
Oil and Gas	2,276.60	2,454.17	2,645.60	2,851.96	3,074.41	3,314.21	7.8
Mining	19.00	20.96	23.12	25.50	28.12	31.02	10.3
Manufacturing	84.70	110.70	144.69	189.11	247.16	323.04	30.7
Electricity and Water	14.60	17.96	22.09	27.17	33.42	41.10	23.0
Construction	434.50	488.81	549.91	618.65	695.98	782.98	12.5
Trade and Commerce	204.40	226.88	251.84	279.54	310.29	344.43	11.0
Trans. and Comm.*	231.30	274.55	325.89	386.84	459.18	545.04	18.7
Finance and Business	91.00	103.74	118.26	134.82	153.69	175.21	14.0
Ownership of Dwellings	126.20	139.96	155.21	172.13	190.89	211.70	10.9
Educational Services	284.70	309.75	337.01	366.67	398.94	434.04	8.8
Health Services	111.50	127.11	144.91	165.19	188.32	214.68	14.0
Public Services	47.90	53.65	60.09	67.30	75.37	84.42	12.0
Other Services	13.80	15.18	16.70	18.37	20.20	22.23	10.0
Total	4,024.00	4,440.46	4,907.69	5,433.38	6,026.66	6,690.00	10.7

*Transportation and Communication

Source: The Ministry of Planning, The Economic Development Plan (1976-1980), Tripoli, Libya, 1975.

TABLE XVI

THE EXPECTED LEVEL OF OUTPUT OF EACH ECONOMIC SECTOR DURING 1981-1985
(LD Million)

Economic Sector	Output 1981	Output 1982	Output 1983	Output 1984	Output 1985	Expected Compound Rates of Growth
Agriculture	212.02	257.60	313.0	380.28	462.04	21.5
Oil and Gas	3,499.81	3,695.79	3,902.76	4,121.31	4,352.11	5.6
Mining	35.67	41.02	47.18	54.25	62.40	15.0
Manufacturing	438.69	595.74	809.01	1,098.64	1,491.95	35.8
Electricity and Water	51.38	64.22	80.27	100.34	125.43	25.0
Construction	867.54	961.24	1,065.05	1,180.08	1,307.52	10.8
Trade and Commerce	382.32	424.37	471.05	522.87	580.39	11.0
Trans. and Comm.*	654.05	784.86	941.83	1,130.2	1,356.23	20.0
Finance and Business	202.54	234.14	270.67	312.89	361.70	15.6
Ownership of Dwellings	234.78	260.37	288.75	320.22	355.12	10.9
Educational Services	477.44	525.19	577.71	635.48	699.03	10.0
Health Services	248.60	287.88	333.36	386.03	447.03	15.8
Public Services	97.08	111.65	128.39	147.65	169.80	15.0
Other Services	25.25	28.69	32.59	37.02	42.06	13.6
Total	7,427.05	8,272.76	9,261.62	10,427.26	11,812.81	12.00

*Transportation and Communication

Source: The Ministry of Planning, The Economic Development Plan (1976-1980), Tripoli, Libya, 1975.

TABLE XVII

EXPECTED CHANGE IN OUTPUT OF SECTORS DURING 1978-1985
(LD Million)

Economic Sector	in Output 1978	in Output 1979	in Output 1980	in Output 1981	in Output 1982	in Output 1983	in Output 1984	in Output 1985
Agriculture 180.13 / 12.37	17.76	20.56	23.81	37.52	45.58	55.4	67.28	81.76
Oil and Gas	206.09	222.72	239.71	185.6	195.98	207.0	218.55	230.8
Mining	2.38	2.62	2.9	4.65	5.39	6.16	7.07	8.15
Manufacturing	44.42	58.05	75.88	115.65	157.07	213.27	289.63	393.91
Electricity and Water	5.09	6.25	7.68	10.28	12.84	16.05	20.07	25.09
Construction	69.14	77.33	87.0	84.56	93.7	103.81	115.03	127.44
Trade and Commerce	27.70	30.75	34.14	37.89	42.05	46.68	51.82	57.52
Transportation and Communication	60.95	72.34	85.86	109.01	130.81	156.97	188.37	226.03
Business and Finance	16.56	18.87	21.52	27.33	31.6	36.53	42.22	48.81
Ownership of Dwelling	16.92	18.76	20.81	23.08	25.59	28.38	31.47	34.90
Education Services	29.66	32.27	35.10	43.4	47.75	52.52	57.77	63.55
Health Services	20.28	23.13	26.36	33.92	39.28	45.48	52.67	61.0
Public Services	7.21	8.07	9.05	12.66	14.56	16.74	19.26	22.15
Other Services	1.67	1.83	2.03	3.01	3.44	3.90	4.43	5.04

Sources: Tables XV and XVI.

Ministry of Planning in the EDP (1976-1980).

The first step in the application of the model is the calculation of the technical coefficients as follows:

The Technical Coefficients

The technical coefficients for each field of specialization in each economic sector are calculated by using equation (16):

$$viJ = \frac{L^{i}_{J,\ 1977}}{V_{J,1977}} \qquad (16)$$

where:

viJ = the technical coefficient of high-level manpower with i field of specialization in economic sector J.

L^{i}_{J} = total high-level manpower with i field of specialization working in economic sector J in year 1977.

V_{J} = the level of output of sector J, in million of Libyan Dinars, 1977.

i = 1, 2, 3, . . . 9 in case of university fields (College of Veterinary Medicine and Petroleum Engineering not included) and 1, 2, . . .5 in case of intermediate fields.

and

J = 1, 2, 3, . . . 14 (the Libyan economy in the EDP (1976-1980) was divided into 14 sectors).

The technical coefficients of high-level manpower in 1977 are presented in Table XVIII for the university level and in Table XIX for the intermediate level. These technical coefficients will be used to estimate the required high-level manpower needed by each economic

TABLE XVIII

THE TECHNICAL COEFFICIENTS OF MANPOWER
WITH UNIVERSITY EDUCATION
IN 1977

Economic Sector \ College	Sciences	Engineering	Agricultural Engineering	Education	Arts	Economics & Commerce	Law	Islamic Studies	Medicine
Agriculture = 170/112.37	1.51	1.46	8.93	0.2	2.26	1.46	0.03	0	0.07
Oil and Gas	0.02	0.37	0	0.01	0.05	0.07	0	0	0
Mining	8.7	11.0	0	1.69	2.60	3.46	.04	0	0.09
Manufacturing	4.0	2.33	0.5	0.10	0.96	1.47	.02	0	0.03
Electricity and Water	3.5	5.8	0	0	1.36	7.20	0	0	0.18
Construction	0.22	1.2	0	0	0	0.02	.01	0	0.02
Trade and Commerce	0.24	0	0.04	0.02	0.21	1.07	0.02	0	0
Trans. and Comm.*	0.05	1.22	0	0	0	0.17	.01	0	0
Finance and Business	0.08	0	0	0.18	0.20	1.41	.03	0	0
Ownership of Dwellings	0.25	0.21	0	0.08	0.43	0.72	.78	0	0
Education Services	0.46	0.10	0.13	4.88	3.37	0.22	0.05	0.83	0.05
Health Services	1.55	.11	0	0	0	1.13	0.05	0	29.0
Public Services	3.15	3.46	0.47	1.55	1.55	13.05	20.80	10.63	0.23
Other Services	0	0	0	3.47	3.47	13.05	0.78	0	0

*Transportation and Communication

TABLE XIX

THE TECHNICAL COEFFICIENTS OF MANPOWER
WITH INTERMEDIATE EDUCATION IN 1977

Economic Sector	Diploma of Industrial	Diploma of Agricultural Engineering	Diploma of Intermediate Engineering	Diploma of Commerce & Accounting	Diploma of Teaching
Agriculture	0.36	7.71	0.2	1.3	0.12
Oil and Gas	0.05	0	.01	0.2	0
Mining	8.22	0	1.47	7.8	0
Manufacturing	4.13	0.17	0.19	2.34	0
Electricity and Water	1.4	0	0.95	5.34	0
Construction	0.2	0	0.91	0.51	0.03
Trade and Commerce	0.11	0.08	0.31	1.16	0.1
Trans. and Comm.*	0.25	0	0.64	0.09	0
Business and Finance	0	0	0	0.46	0.07
Ownership of Dwellings	0	0	0.38	0.24	0.06
Education Services	0.13	0.13	0.05	0.40	65.83
Health Services	0.09	0	0	0.44	0.72
Public Services	1.28	0.48	0.17	5.23	43.4
Other Services	0	0	0	18.2	67.24

*Transportation and Communication

sector in the next seven years.

The Required High-Level Manpower

The projection of high-level manpower requirements is based on the 1977 distribution of the high-level manpower among the economic sectors and the expected rate of growth of these sectors in the next seven years. This calculation is based on the assumption that there was no unsatisfied demand in 1977. Libya has an open market economy for labor. People can come to work in Libya from different countries. Because of the high salaries offered, vacancies are expected to be very few in number.

Equation (1) is used to forecast the required demand for all the skills by each economic sector and the results are presented in Tables XX and XXI. The total demand is composed of two parts: the annual increment in demand as a result of a change in GDP and the demand due to attition. Attrition by field of specialization is calculated and presented in Table XXII.

The Structure of the Demand

In 1977, distribution of high-level manpower in the Libyan economy is expected to change in the next seven years as a function of the growth and output of each of the sectors of the economy. The investment allocation to different sectors of the economy is expected to lead to a different demand for skills by each sector.

The targets for economic growth in each sector are those proposed by the Ministry of Planning as shown in Tables XV and XVI. The EDP (1976-1980) proposed a compound rate of growth of 10.7 percent

TABLE XX

ESTIMATED ANNUAL INCREASES IN DEMAND FOR HIGH-LEVEL MANPOWER WITH A UNIVERSITY DEGREE 1978-1985

Year	Sciences	Engi-neering	Agricul-tural Engi-neering	Educa-tion	Arts	Economics & Commerce	Law	Islamic Studies	Medi-cine	Total
1978	360	479	198	461	286	401	184	109	130	2,608
1979	442	560	238	334	325	458	205	121	135	2,818
1980	542	662	274	492	369	538	229	134	139	3,379
1981	782	827	417	571	479	722	308	180	144	4,430
1982	1,001	1,014	515	1,107	568	873	341	204	149	5,772
1983	1,295	1,251	636	1,180	679	1,064	402	232	154	6,893
1984	1,673	1,556	788	1,305	816	1,303	459	265	159	8,324
1985	2,181	1,950	976	1,373	998	1,612	525	303	165	10,083
Total	8,276	8,299	4,042	6,823	4,520	6,971	2,653	1,548	1,175	44,307

TABLE XXI

ESTIMATED ANNUAL INCREASES IN DEMAND FOR HIGH-LEVEL MANPOWER WITH AN INTERMEDIATE CERTIFICATE 1978-1985

Years	Certificate in Industrial	Certificate in Agricultural Engineering	Certificate in Intermediate Engineering	Certificate in Commerce & Accounting	Certificate in Teaching	Total
1978	276	158	109	403	1,876	2,822
1979	349	185	126	472	1,997	3,129
1980	435	214	146	556	2,120	3,471
1981	635	334	165	741	1,252	3,127
1982	832	406	195	913	1,289	3,635
1983	1,096	497	229	1,129	1,329	4,280
1984	1,449	609	269	1,409	1,370	5,106
1985	1,923	744	316	1,770	1,413	6,166
Total	6,995	3,147	1,555	7,393	12,646	31,736

TABLE XXII

THE ESTIMATED ATTRITION IN THE HIGH-LEVEL MANPOWER WITH INTERMEDIATE AND UNIVERSITY LEVELS OF EDUCATION, 1978-1985

Field of Specialization	1978	1979	1980	1981	1982	1983	1984	1985
1. University Level:								
Arts	48	50	52	54	57	61	66	72
Medical	33	34	34	35	36	36	37	38
Engineering	25	29	33	38	44	52	62	74
Economics and Commerce	21	24	27	31	37	44	52	62
Education	15	18	21	24	29	37	46	55
Sciences	15	18	22	26	32	40	50	63
Law	10	12	13	15	17	20	23	26
Agriculture	8	10	12	14	17	21	26	32
Islamic Studies	7	8	9	10	11	12	14	16
Total	182	203	223	247	280	323	376	438
2. Intermediate Level:								
Teachers	208	222	236	251	259	267	276	284
Commerce and Accounting	22	25	29	33	38	45	54	65
Industrial School	10	11	13	14	17	20	24	29
Engineering School	7	9	10	12	14	17	21	26
Agriculture School	7	8	10	12	13	15	16	18
Total	254	275	298	322	341	364	391	422
Total Attrition	436	478	521	569	621	687	767	860

and the next EDP (1981-1985) expects a rate of growth of 12.0 percent. Within these overall targets, sectoral growth rates vary from highs of 30.7 percent a year in manufacturing industry between 1975 and 1980 and 35.8 percent between 1981 and 1985, to lows of 7.8 and 5.6 percent in oil and gas industry for the same period.

How many jobs for skilled workers will be created during the next seven years? What kind of skills will be required most by the economy and what should the government do about it? The answers to these questions are main objectives of the study and will be addressed next.

Future High-Level Manpower Needs 1978-1985

The demand for high-level manpower in this study is assumed to be a function of the rates of growth of the economic sectors. Using the 1977 distribution of high-level manpower (Tables XIII and XIV), with the output of economic sectors in 1977 (Table XV) the technical coefficients have been estimated and are presented in Tables XVIII and XIX. Using the estimated technical coefficients together with the expected change in the level of output in each economic sector (Table XVII), the total annual increases in demand by each economic sector and by field of specialization are estimated in this study and presented in Tables XX and XXI. The estimated increase in demand for high-level manpower between 1978 and 1985 is expected to reach a total of 76,043 workers. Of the total estimated, 31,736 workers will need certificates from intermediate education and 44,307 will need university degrees.

The Estimated Change in Demand for High-Level Manpower with University Degree

The estimated incremental in demand for high-level manpower with university degree is expected to reach a total of 44,307 workers from the nine major fields under this study. The expected change in demand for the component fields of specialization is explained next.

The Estimated Change in Demand for Graduates from College of Engineering

The new job opportunities in the Libyan economy between 1978 and 1985 are estimated to be the highest in engineering fields. A total of 8,299 new engineers are estimated to be needed between 1978 and 1985. The incremental demand for engineers is expected to increase from 479 in 1978 to a total of 1,950 new engineers in 1985.

Libya is now in the process of industrialization. The investment in industry, construction and manufacturing has been given high priority in EDP (1976-1980). This high priority is also expected in the next EDP (1981-1985) (The Ministry of Planning, 1975).

New factories, roads, housing and other establishments are planned for the future and more and more engineers are expected to be needed. All these important elements in the Libyan economy need well qualified engineers from different fields of specialization.

The Estimated Change in Demand for Graduates from College of Sciences

Libya, as a developing country, needs well qualified personnel

in all fields of science. The country needs large numbers of graduates in all fields of mathematics, physics, chemistry, geology, botany, etc. The majority of these technical and important jobs are now held by foreigners. The ratio of the imported high-level manpower with a degree from College of Sciences was 60.1 percent in 1977, as explained in Chapter I. The industrialization process needs many specialists in different fields of science; and the College of Sciences in Libya is the only major source of domestic supply of these skills. Shortages of the graduates from science fields will handicap the whole economy.

As Table XIII shows, the graduates from the science college are distributed among all the economic sectors. Of the total graduates from the College of Sciences, 8.2 percent was engaged in the educational sector, 8.9 percent in agriculture, 10.0 percent in public services, 10.6 percent in mining, 30.4 percent in manufacturing and the rest in other sectors of the economy.

As a result of this overall distribution of science graduates among all economic sectors, this study estimates that a total of 8,276 graduates will be needed to join the labor force from the College of Sciences. This study projects increments in demand for graduates from sciences college will increase from 360 in 1978 to a total of 2,181 graduates by 1985.

The Estimated Change in Demand for Graduates from College of Economics and Commerce

The third largest area for expected new job opportunities is for graduates from the College of Economics and Commerce. The estimated

increment in demand for graduates from this college is expected to increase from 401 graduates in 1978 to 1,612 graduates by 1985. The estimated number of graduates from College of Economics and Commerce is expected to reach a total of 6,971 between 1978 and 1985. This large demand is due to the fact that most managers, accountants and administrators are graduates from the College of Economics and Commerce.

The Estimated Change in Demand for Graduates from Agriculture College

The agricultural sector is a vital sector in the Libyan economy. The agricultural sector has been given high priority in the economic development plan. During the Three-Year Plan (1973-1975), 441.285 million Libyan Dinars were spent on the agricultural sector, that is, 20.0 percent of the total economic development expenditure. In the EDP (1976-1980) 939.1 million Libyan Dinars were allocated to agricultural development, 11.9 percent of the economic development plan.

As a result of the large investment in this sector, the high-level employment is expected to increase, especially for the agricultural engineers. By 1977, 90.4 percent of the total high-level manpower with a degree from the agriculture college was engaged in agriculture. Of the total agricultural engineers, 2.0 percent were engaged in manufacturing, 1.0 percent in trade and commerce, 4.1 percent in education and 2.5 percent engaged in public services.

The total number of agricultural engineers working in the Libyan economy amounted to 1,109 in 1977; the increment in demand is expected

to increase from 198 in 1978, to 976 in 1985. The study estimated that the increment in demand for agricultural engineers between 1978 and 1985 will amount to 4,042.

The Estimated Changes in Demand for Graduates from Colleges of Arts, Law and Islamic Studies

Estimates of the increment in demand for graduates from Colleges of Arts, Law and Islamic Studies vary significantly by field. The lowest expected increment in demand estimated in this study is for graduates from the College of Islamic Studies. The annual increment in demand is expected to increase from 109 in 1978 to reach 303 graduates in 1985; that is, the estimated demand for graduates from Islamic Studies is 1,548 new graduates between 1978 and 1985. This low estimate, in comparison to other fields, is because the job opportunities for the graduates from the Islamic Studies are limited. The distribution of graduates from Islamic Studies in 1977 was only between two sectors. Out of the total of 919 graduates with a degree from Islamic Studies that were working in Libya in 1977, 280 graduates were working in educational services and 639 graduates in public sector. Foreigners represented only 6 percent in this skill in 1977; that is, there were only 55 foreigners with an Islamic Studies degree working Libya.

The low foreign ratio in Islamic Studies, together with the high number of students enrolled in this field, which was 1,338 students in 1977 representing 10.0 percent of the total enrollments in the Libyan universities, suggests that a surplus of 496 graduates will be created between 1978 and 1981 as will be shown in Chapter VIII.

The increment in demand for graduates from College of Law

amounted to 2,653 graduates, that is, only 6.0 percent from the total estimated increments in demand between 1978 and 1985. Although demand is expected to be relatively low, in 1977 the College of Law had the second highest enrollment of university speciality, that is, 14.0 percent of the total university enrollments.

The fifth largest increment in demand is estimated to be for graduates from the College of Arts. Between 1978 and 1985, the study estimates that a total of 4,520 new graduates will be needed for the labor force. Although the increment in demand is expected to be relatively low, in 1977 the College of Arts had the highest enrollment of any university speciality: 2,485 students, 18.5 percent of the total students in the universities of Libya.

The Estimated Change in Demand for Graduates from Medical Colleges

The health services in Libya have been given high priority in the economic development plans. Between 1972 and 1975, the number of beds increased from 8,830 in 1972 to reach a total of 12,241 in 1975. It is planned to increase to a total of 21,024 beds by the end of the EDP (1976-1980) (The Ministry of Planning, 1975, p. 350). The number of centralized hospitals and health centers increased from 65 in 1972 to a total of 116 in 1975, and the number of public hospitals increased from 439 in 1972 to 576 in 1975. The number of doctors increased from one doctor per 1,400 persons for 1972 to one doctor per 1,124 persons in 1975 (The Ministry of Planning, 1975, p. 351).

In the EDP (1976-1980), the government intends to have one

doctor for each 1,000 persons in the country. Because this goal offers a better basis for estimating the number of doctors required than the method used in determining the estimated demand for other occupations, it is used in this study, together with the estimated population growth, to estimate the required number of doctors up to 1985 (The Ministry of Planning, 1976, p. 354). As Table XXIII shows, the total population is expected increase from 2,500,000 in 1977 to a total of 3,395,192 in 1985 with a compound rate of growth of 3.9 percent. The increase in demand for doctors between 1978 and 1985 is thereby estimated to be equal to 1,175 doctors.

TABLE XXIII

THE POPULATION GROWTH AND THE DOCTORS DEMAND
1978-1985

Years	Total Population	Change in Total Population	Compound Rate of Growth	Required Doctors
1977	2,500,000			
1978	2,597,500	97,500	3.9	97
1979	2,698,802	101,302	3.9	101
1980	2,804,055	105,253	3.9	105
1981	2,913,413	109,358	3.9	109
1982	3,027,037	113,624	3.9	113
1983	3,145,091	118,054	3.9	118
1984	3,267,750	122,659	3.9	122
1985	3,395,192	127,442	3.9	127

Source: The Ministry of Planning, Department of Manpower, Population Planning, Tripoli, Libya, 1976 (in Arabic).

The Estimated Change in Demand for Graduates from College of Education

The graduates from the College of Education are required by law to teach in the intermediate and higher-level secondary schools of education. Nevertheless, this study finds that only 85.0 percent of the total teachers with a university degree are involved in teaching. The remaining 15 percent of teachers are engaged in other economic sectors. A total of 7.8 percent of the teachers are working in public sector, 1.2 percent in agriculture, 2.0 percent in mining and 1.2 percent in oil and gas industry and 2.8 percent in other sectors.

In the EDP (1976-1980), the government intends to improve the quality of education by having one teacher for every 10.6 students in both the higher-level secondary schools and the intermediate level. Because this offers a better basis for estimating the number of teachers required than does the method used in determining the estimated demand for other occupations, it is used in this study together with the estimated change in the enrollments in the intermediate and higher-level secondary schools to estimate the number of such teachers needed between 1978 and 1985. However, since some teachers may be needed to work in sectors other than education, the estimate of the total number of required graduates from College of Education will be based on two estimates: First, the student-teacher ratio (10.6), together with the change in enrollment, is used to estimate the change in demand for teachers. Second, the estimated change in demand for teachers that are expected to work in other sectors other than teaching, is estimated by using the new model as that in other professions.

As shown in Table XXIV, the study estimates that a total of 6,819 new teachers with a university degree will be needed between 1978 and 1985.

TABLE XXIV

REQUIRED DEMAND FOR TEACHERS WITH A UNIVERSITY DEGREE 1978-1985

Years	Required Teachers as a Result of Changes in Enrollment	Demand by the Sectors	Demand Due to Attrition	Total Demand
1978	265	181	15	461
1979	119	197	18	334
1980	253	218	21	492
1981	275	272	24	571
1982	769	308	30	1,107
1983	796	347	37	1,180
1984	869	390	46	1,305
1985	879	439	55	1,373
Total	4,224	2,350	245	6,819

The Estimated Change in Demand for High-Level Manpower with Intermediate Education

The high-level manpower with intermediate education plays a vital role in the total manpower in a growing economy. As Table XXI shows, this study estimates that in the next seven years, a total of 31,736 new job opportunities will be created in the Libyan economy. It is

estimated in this study that the total high-level manpower with intermediate level of education will increase from 32,213 in 1977 to a total of 63,949 in 1985, an increase of 98.5 percent. The structure of the change in demand for the intermediate level of manpower in each field of specialization is explained next.

The Increase in Demand for Graduates from Teachers Schools

The Ministry of Education plans to increase the quality of education by increasing the number of teachers in the primary and lower-level secondary schools. In the EDP (1976-1980) it has been planned to have one teacher for every 23 students in primary schools and one teacher for every 15.7 students in the lower-level secondary schools. (The Ministry of Planning, 1975, p. 335). The change in the enrollments in both primary and lower-level secondary schools has been estimated by the Ministry of Planning and is presented in Table XXV.

These plans and projections provide a better basis than does the model for estimating the required teachers. In this study the planned student-teacher ratio, together with the expected change in the enrollment, is used to estimate the increase in demand for teachers required to meet the change in the enrollment. As Table XXV shows, the new demand for teachers will decrease from 1,668 teachers in 1978 to 1,129 teachers in 1985. The total number of teachers that will be needed to meet the increase in the enrollments in primary and lower-level secondary schools are estimated to be equal to 10,643 between 1978 and 1985. Comparing the demand and supply of teachers, the study estimates that a large surplus of teachers will

exist as will be explained in Chapter VIII.

TABLE XXV

CHANGE IN THE ENROLLMENTS IN PRIMARY AND LOWER-LEVEL HIGH SCHOOL AND THE REQUIRED TEACHERS 1978-1985

Years	Primary Schools	Lower-Secondary Schools	Required Teachers for Primary Schools	Required Teachers for Lower-Secondary Schools	Total Required Teachers
1978	19,200	13,100	834	834	1,668
1979	19,900	14,300	865	910	1,775
1980	20,500	15,600	891	993	1,884
1981	11,900	7,600	517	484	1,001
1982	12,000	8,000	521	509	1,030
1983	12,300	8,300	534	528	1,062
1984	12,600	8,600	547	574	1,094
1985	12,800	9,000	556	573	1,129
Total	121,000	84,500	5,265	5,378	10,643

Source: The Ministry of Planning, Economic Development Plan (1976-1980), Tripoli, Libya, 1975. Student-teacher ratios which were used to calculate the required teachers are 15.7 for lower-level secondary schools and 23 for primary schools as established by the Ministry of Education.

The Estimated Change in Demand for Graduates from Intermediate Industrial, Commerce and Accounting, Agriculture and Engineering Schools

The study estimates that the increments in demand for graduates

from intermediate schools (teachers not included) amounted to 19,090 graduates. Of the total, 7,393 will come from intermediate commerce and accounting schools; 6,995, industrial schools; 3,147, agriculture; and 1,555, engineering schools.

The increments in demand for graduates from intermediate level of education are estimated to be 31,736 graduates. Of the total 39.9 percent will come from teachers schools; 23.3 percent from commerce and accounting schools; 22.0 percent from industrial schools; 9.9 percent from agriculture schools and 4.9 percent from engineering schools. Although the increments in demand for teachers represents only 39.9 percent from the total intermediate graduates, in 1977 the enrollment in teachers schools represented 86.3 percent of the total intermediate enrollment. While the increments in demand for graduates from commerce and accounting and industrial schools represent 23.3 percent and 22.0 percent, the enrollment in 1977 was only 6.2 percent in commerce and accounting and 2.6 percent in industrial schools. This inadequate allocation policy will create a surplus in one field, teachers, and shortages in many other fields as will be explained in Chapter VIII next.

CHAPTER VIII

THE RESULTS OF THE STUDY

The previous chapters of the study have analyzed the past and looked at the expected future structural changes in high-level manpower in Libya. In Chapter VII the study projected the total increase in demand for high-level manpower by fields of specialization that are expected to be needed by the economy during the period of study (1978-1985). In this chapter, the expected supply of graduates from the intermediate and university levels of education by fields of specialization is estimated. The estimated supply and demand are analyzed and the differences will be interpreted as shortages and surpluses. The foreign manpower needed to be imported between 1978 and 1981 by field of specialization will be presented.

The first step in the analysis is to estimate the expected supply of graduates from the existing 1977 enrollments by field of specialization from the university and intermediate levels. Supply is then compared to the movement in demand for the same period, as explained next.

The Expected Demand and the Expected Graduates from the Universities and Intermediate Schools Between 1978-1981

In Table XXVI the expected graduates from the university and

intermediate levels by fields of specialization are presented and compared to the estimated demand for each field between 1978-1981.

As shown in Table XXVI, the expected graduates from the Libyan universities are estimated to be 9,213. The graduates from the College of Arts are estimated to be the most numerous. A total of 2,143 graduates are expected to join the high-level manpower from the College of Arts. Graduates from the College of Education are estimated to number 1,500; Law, 1,081; Economics and Commerce, 1,054; and Islamic Studies, 1,040. A total of 6,818 graduates from the Colleges of Arts, Education, Economics and Commerce, and Islamic Studies are expected to be available between 1978-1981. That is, 74 percent of the total graduates between 1978-1981 will come from these colleges.

The total number of graduates from sciences, engineering, agriculture and medicine are estimated to be 2,395 (26 percent) of the total graduates. Similar numbers of graduates are expected from Colleges of Sciences (682), Agriculture (632) and Engineering (618). The number of graduates from the College of Medicine is the lowest of all; it is estimated that only 463 doctors will be available between 1978-1981.

On the demand side, the study estimates that a total of 13,235 graduates with a university degree from the nine major fields of specialization will be needed by the economy between 1978-1981. This demand varies significantly from one field to another and from one year to another. The increment in demand for graduates from the College of Engineering is the highest; out of the total increment

TABLE XXVI

THE EXPECTED GRADUATES, THE EXPECTED DEMAND AND THE RESULTING DIFFERENCES BY FIELDS OF SPECIALIZATION 1978-1981

Given in Table XX page 79

Field of Specialization	Expected Graduates (Supply) 1978	1979	1980	1981	Total	Expected Demand 1978	1979	1980	1981	Total	Differences Between Supply and Demand 1978	1979	1980	1981	Total
I. University Level:															
Arts	656	388	385	714	2,143	286	325	369	479	1,459	370	63	16	325	684
Education	304	349	394	453	1,500	461	334	492	571	1,858	(157)	15	(98)	(118)	(358)
Law	182	230	266	403	1,081	184	205	229	308	926	(2)	25	37	95	155
Economics and Commerce	210	218	247	379	1,054	401	458	538	722	2,119	(191)	(240)	(291)	(343)	(1,065)
Islamic Studies	155	206	216	463	1,040	109	121	134	180	544	46	85	82	283	496
Sciences	148	157	137	240	682	360	442	542	782	2,126	(212)	(285)	(405)	(542)	(1,444)
Agriculture	104	141	153	234	632	198	238	274	417	1,127	(94)	(97)	(121)	(183)	(495)
Engineering	62	149	164	243	618	479	560	662	827	2,528	(417)	(411)	(498)	(584)	(1,910)
Medicine	38	103	181	141	463	130	135	139	144	548	(92)	(32)	42	(3)	(85)
Total	1,859	1,941	2,143	3,270	9,213	2,608	2,818	3,379	4,430	13,235	(749)	(877)	(1,236)	(1,160)	(4,022)
2. Intermediate Level:															
Teachers School	3,583	4,423	3,538	4,929	16,473	1,876	1,997	2,120	1,252	7,245	1,707	2,426	1,418	3,677	9,228
Commerce and Accounting	232	242	484	504	1,462	403	472	556	741	2,172	(171)	(230)	(72)	(237)	(710)
Industrial School	29	61	224	243	557	276	349	435	635	1,695	(247)	(288)	(211)	(392)	(1,138)
Agriculture School	127	93	152	238	610	158	185	214	334	891	(31)	(92)	(62)	(96)	(281)
Engineering School	176	43	99	135	453	109	126	146	165	546	67	(83)	(47)	(30)	(93)
Total	4,147	4,862	4,497	6,049	19,555	2,822	3,129	3,471	3,127	12,549	1,325	1,733	1,026	2,922	7,006

() indicate manpower needed to be imported.

in demand between 1978-1981, 2,528 will be for engineers; 2,119 from the College of Economics and Commerce; 2,126, Sciences; 1,858, Education; 1,459, Arts; 1,127, Agriculture; and 2,018 from Colleges of Law, Islamic Studies and Medicine.

The inappropriateness of governmental enrollment policy in the past is becoming clear at this stage of the analysis. To show that the allocation policy for enrollment in the past has not been in correspondence with the needs of the economy, the increment in demand and the supply between 1978-1981 will be compared.

As shown in Table XXVI, while a surplus is expected of graduates from Colleges of Arts, Islamic Studies and Law, a shortage is estimated to be high of graduates from Engineering, Sciences, Economics and Commerce and the other remaining fields. The study estimates that a surplus 684 graduates from College of Arts; 496 from College of Islamic Studies and 155 from College of Law is expected between 1978-1981.

While it is estimated that the combined surplus from the Colleges of Arts, Islamic Studies and Law will be 1,335, the shortages in the remaining fields will be 5,357 graduates. As a result of misallocation of the students, shortages will exist in key and vital fields of specialization such as: Engineering, Sciences, Economics and Commerce and Agricultural Engineering. The study estimates that the shortages in Engineering will be 1,910; in Sciences, 1,444; in Economics and Commerce, 1,065; in Agricultural Engineering, 495; in Education, 358; and in Medicine, 85 doctors.

The Expected Output of Graduates from the Intermediate Level of Education Between 1978-1981

The total expected supply of graduates from the intermediate level of education is estimated in this study to be 19,555. As Table XXVI shows, of the total graduates between 1978-1981, 16,473 graduates will come from teachers schools, 1,462 from commerce and accounting, 557 from industrial schools, 610 from agriculture schools and 453 from engineering schools.

By looking to these results, which are derived from the 1977 enrollments, the actual and potential imbalances among the graduates from the various fields become clear. The inadequacies of the past policies of allocating students among fields of specialization becomes more clear by comparing the estimated demand and supply of graduates from the intermediate level between 1978-1981.

On the demand side, the study estimates that the country will need 7,245 teachers between 1978-1981; the estimated supply amounted to 16,473 teachers for the same period. A total of 9,228 surplus teachers will exist between 1978-1981.

While it is estimated that a surplus will exist in the teaching profession, the shortages will be high in all other intermediate fields. The demand for graduates from industrial schools will be 1,695 graduates; while the supply will be only 557 graduates during the same period; that is, the shortage estimated to exist in this profession will amount to 1,138 graduates.

As Table XXVI shows, the estimated supply from intermediate

schools of commerce and accounting, engineering and agriculture will be 1,462, 453 and 610 graduates respectively between 1978-1981. During the same period, the study estimates that the demand for graduates from commerce and accounting, engineering schools and agriculture schools will amount to 2,172, 546 and 891 graduates respectively. The total estimated shortages in commerce and accounting will be 710; in industrial graduates, 1,138; in agriculture graduates, 281; and in engineering graduates, 93.

To sum up, in the intermediate elvel of manpower for the next four years, Libya will have shortages in key professions that are needed badly for the development process in fields of business, industrial engineering and agriculture, amounting to 2,222 graduates. While the shortages are estimated to exist in these key professions, the surplus in the teaching profession is estimated to be 9,228 teachers for the same period.

By analyzing the results of this study, the government can set more appropriate goals and be better prepared to meet the requirements of the economy during the next four years. Unfortunately, previous policies have increased the problem, not only by failing to reduce shortages in key fields, but also by creating a large surplus of teachers. These results again support the significance of the study and suggest its importance as a policy guideline for allocating students to different fields and appropriateness to the needs of the economy.

The Advantages of the New Disaggregated Model over the Very Aggregated Model in Policy Recommendation

This study points out the importance of the disaggregated approach to the manpower and educational planning. The very aggregated Corre-Tinbergen model has been criticized for its aggregation problems. The results of this study support such criticism and demonstrate that in using such aggregated models the results and the recommendations are likely to be misleading.

As shown in Table XXVI, the study estimates that shortages and surpluses will exist in both levels of manpower. While shortages will exist in some fields; surpluses will exist in others. In using the new disaggregated model in manpower with a university degree, the total imported foreign labor is estimated to be 5,357 graduates, that is, 1,910 engineers, 1,444 from Sciences, 1,064 from Economics and Commerce, 495 from Agriculture, 358 from Education, and 85 from Medicine Colleges. The surplus is estimated to be 1,335 graduates; 684 from Arts College, 496 from Islamic Studies and 155 from Law College.

But, an aggregated approach, such as the Correa-Tinbergen model, where the high-level manpower is not disaggregated by fields of specialization, would show a shortage of 4,022 university graduates. This result is misleading: the shortage is 5,357 graduates and not 4,022. The aggregated model in this case would be unable to identify the surpluses in Colleges of Arts, Law and Islamic Studies. The assumption of perfect substitution between high-level manpower in

the aggregated models is clearly unrealistic. The surplus of graduates from Colleges of Arts, Law and Islamic Studies cannot do the job of the engineers, agriculturists and doctors. The aggregated model is unable to break down the required manpower by fields of specialization. The question of what kind of manpower will need to be imported has to be classified by fields of specialization. Using recommendations from the aggregative models could even result in importing high-level manpower from Arts, Law or Islamic Studies. Since the specific needs are not known to the planner, the recommendations from the aggregative model will be misleading.

The usefulness of the application of the aggregative models can also be seen by analyzing the results of this study about the intermediate level of manpower. As a result of the past misallocation of human resources the estimated surplus will be 9,228 in the teaching profession and the shortages in other fields will be 2,222 graduates. Again the aggregated approach would lead to faulty estimates and policies. In the case of intermediate level of manpower, as the results of this study shows in Table XXVI, the aggregated model would estimate a surplus equal to 7,006 graduates. If the recommendations from the aggregated model were followed the problem will be made worse than it was before. However, the disaggregated model estimates that the country needs to import 2,222 graduates from industrial schools, agriculture, engineering and business schools, while pointing out that there will be a surplus of intermediate teachers amounting to 9,228.

The utilization of the teachers surplus will be a major problem for Libya. The problem will increase if the enrollment policy in all

fields of specialization are not adjusted to the needs of the country. The study will recommend a policy to follow so that the shortages and surpluses in all fields may be minimized.

The Estimated High-Level Manpower Needed to Be Imported 1978-1981

As explained in Chapter I, the total imported high-level manpower in Libya was 13,805 with university degree and 5,004 graduates with a certificate from intermediate schools in 1977. The study estimates that an additional 5,357 graduates from university colleges and 2,222 graduates from intermediate level of education will be needed to be imported between 1978-1981.

As Table XXVII shows, the total imported high-level manpower with a university degree will increase from 13,805 in 1977 to reach a total of 18,268 and the total imported high-level manpower with intermediate level of education will decrease from 5,004 in 1977 to a total of 4,404 in 1981.

The structure of the imported high-level manpower is expected to change by 1981. The study estimates that Libya will have a 100 percent domestic high-level manpower with a university degree from Islamic Studies and in graduates of teachers from intermediate teachers schools.

By 1981, the study estimates that the country needs to import a total of 4,202 engineers, 3,864 doctors, 2,587 from College of Sciences, 2,519 from College of Arts, 2,273 from College of Economics and Commerce, 1,196 from College of Agriculture and 349 from Law College. From the intermediate level of manpower, by 1981 Libya will

TABLE XXVII

TOTAL IMPORTED HIGH-LEVEL MANPOWER BY FIELDS OF SPECIALIZATION FOR 1977-1981*

Education Level	Actual Foreign Manpower 1977	Estimated Foreign Manpower Expected to Be Imported 1978-1981	Total Foreign Manpower Estimated to Be in Libya by 1981
1. University Level:			
Medicine	3,779	85	3,864
Arts	3,203	(684)	2,519
Engineering	2,292	1,910	4,202
Economics and Commerce	1,208	1,065	2,273
Sciences	1,143	1,444	2,587
Education	920	358	1,278
Agriculture	701	495	1,196
Law	504	(155)	349
Islamic Studies	55	(496)	0
Total	13,805	5,357	18,268
2. Intermediate Level:			
Teachers School	2,822	(9,228)	0
Commerce and Accounting	876	710	1,586
Engineering School	613	93	706
Industrial School	484	1,138	1,622
Agriculture School	209	281	490
Total	5,004	2,222	4,404

* () indicate the foreign manpower expected to be exported.

Sources: Table I and Table XXVI.

need 1,622 foreign graduates from industrial schools, 1,586 from commerce and accounting, 706 from engineering schools and 490 from agriculture schools.

To sum up, the study estimates that shortages in all fields of high-level manpower other than Islamic Studies and intermediate teachers (where surpluses are estimated will exist) will exist up to 1981. The dependency on foreign high-level manpower in Libya is unavoidable before 1981. This is because nothing can be done with the existing 1977 enrollment in the university and intermediate levels which are the main sources of supply of high-level manpower. In Chapter IX, the study will recommend an enrollment policy to be followed by the government starting from 1979, which if followed, will enable the country to meet the expected increments in demand for high-level manpower starting from 1982 and to recommend an additional enrollment to supply graduates to substitute for foreigners so that the goal of Libyanization of Libya will be accomplished by 1992 as will be explained in Chapter IX.

As shown in Table XXVIII, the results of this study estimates that of the total increments in demands for high-level manpower with a university degree 8,299 (18.7 percent) will come from Engineering College; 8,276 (18.7 percent) from Sciences; 6,971 (15.7 percent) from Economics and Commerce; 6,823 (15.4 percent) from Education; 4,520 (10.2 percent) from Arts; 4,042 (9.1 percent) from Agricultural Engineering and the remaining fields as shown in Table XXVIII. Using these results together with the ratio of the foreigners by field of specialization in 1977, the study recommends that the highest priority should be given to College of Engineering. This is because the

TABLE XXVIII

INCREMENTS IN DEMAND FOR HIGH-LEVEL MANPOWER (1978-1985), PERCENT OF FOREIGNERS AND PERCENT OF ENROLLMENT BY FIELDS OF SPECIALIZATION, 1977

Educational Speciality	Increase in Demand 1978-1985	Percent	Percent of Foreigners (1977)	Percent of Enrollment (1977)
University Level:				
Engineering	8,299	18.7	71.5	11.5
Sciences	8,276	18.7	60.1	6.8
Economics and Commerce	6,971	15.7	45.6	13.7
Education	6,823	15.4	47.6	12.3
Arts	4,520	10.2	53.0	18.5
Agricultural Engineering	4,042	9.1	63.2	6.3
Law	2,653	6.0	38.0	14.0
Islamic Studies	1,548	3.5	6.0	10.0
Medicine	1,175	2.7	88.8	6.7
Total	44,307	100.0	59.3	99.8
Intermediate Level:				
Teachers school	12,648	39.9	10.8	86.3
Commerce and Accounting	7,393	23.3	31.2	6.2
Industrial school	6,995	22.0	36.5	2.6
Agricultural school	3,147	9.9	21.2	2.7
Engineering school	1,555	4.9	61.8	2.2
Total	31,736	100.0	15.5	100.0

Sources: Tables I, XX and XXI.

highest increment in future demands (18.7 percent) is expected to be for graduates from Engineering College and that the foreigners represented 71.5 percent of the total engineers working in Libya in 1977.

The second highest priority, the study recommends, is to be given to College of Sciences. As shown in Table XXVIII, the second largest future demand is expected to be for graduates from College of Sciences. This high future demand together with the high ratio of foreigners in this field, which amounted to 60.1 percent in 1977, support the conclusion of the study to give second high priority to College of Sciences.

The increment in demand for graduates from College of Economics and Commerce which accounted for 15.7 percent comes in third place. This large demand, together with 45.6 percent of the foreigners among the graduates working in Libya in 1977, are used to recommend that College of Economics and Commerce should be given third priority. Using the estimated increment in demands and the ratio of foreign manpower in each field, the study recommends that Colleges of Educatioln, Arts, Agricultural Engineering, Law, Islamic Studies and Medicine should be given fourth, fifth, sixth, seventh, eighth and ninth priorities respectively.

In the high-level manpower with intermediate certificate, the results of the study show that 39.9 percent of increments in demand will come from teachers schools, 23.3 from commerce and accounting, 22.0 percent from industrial schools, 9.9 percent from agricultural schools and 4.9 percent from engineering schools. These ratios of expected increments in future demands together with the ratios of the foreigners in each field which ranges from 61.8 percent in engineering

schools to only 10.8 percent in teachers are used by this study and it is recommended that first priority should be given to teachers schools, second priority to industrial schools, third priority to commerce and accounting schools, fourth priority to agricultural schools and fifth priority to intermediate engineering schools. The ratio of the recommended enrollments by fields of specialization and a comparison of the past and future allocation policy will be explained in Chapter IX.

CHAPTER IX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of the study, including the objectives of the study, and the data used in the analysis. Findings and conclusions drawn from the findings will also be presented, followed by recommendations. Part of the model is modified to derive the required enrollments in both the university and intermediate levels by field of specialization and will be presented in this chapter.

Summary of Objectives

The objectives of this study, as stated in Chapter I, are:

1. To forecast the high-level manpower requirements for the Libyan economy during the period (1978-1985).
2. To estimate the supply of the high-level manpower in the next four years (1978-1981).
3. To estimate the high-level manpower needed to be imported between 1978-1981.
4. To estimate the required enrollment in each field of study and in each class within the field that is needed to supply the expected demand from each field between 1978-1981.
5. To estimate separately the number of teachers and doctors needed between 1978-1981.
6. To suggest feasible goals for the Libyanization of Libya: the

study will recommend that each year (1983-1993) ten percent of foreign manpower with a university degree and 20 percent with an intermediate certificate could be replaced by Libyans.

In an attempt to satisfy these objectives, data were collected by the author from its original sources in Libya and analyzed through the use of the new simple disaggregated model that has been introduced in this study. The data collected contain complete information about the number of workers with a university degree and intermediate certificate classified by fields of specialization and their distribution among the various economic sectors. Data about the expected rate of growth of each economic sector have been taken from the EDP (1976-1980) document, which contains reliable data for this study, including the estimated rate of output for each economic sector during the EDP (1976-1980). These data have been estimated by the Ministry Planning and are used in this study to estimate the required high-level manpower by field of specialization.

Summary of the Findings

The study findings are summarized as follows:

1. Between 1978-1985 the increments in demand by various economic sectors will reach a total of 44,307 new graduates from the university level and 31,736 graduates from intermediate level. Accordingly, the total demand for high-level manpower by the Libyan economy will increase from 55,855 in 1977 to reach a total of 131,898 in 1985 with a rate of increase during the period of study (1978-1985) of 136.1 percent.
2. Of the total increments in demand for high-level manpower with

a university degree which amounted to 44,307 graduates, a total of 8,299 (18.7 percent) will be for graduates from Engineering College; 8,276 (18.7 percent) from Sciences; 6,971 (15.7 percent) from Eocnomics and Commerce; 6,823 (15.4 percent) from Education; 4,520 (10.2 percent) from Arts; 4,042 (9.1 percent) from Agricultural Engineering; 2,653 (6.0 percent) from Law; 1,548 (3.3 percent) from Islamic Studies and 1,175 (2.7 percent) from Medical Colleges.

3. The increment in demand for high-level manpower with intermediate certificate is estimated to be 31,736 graduates. Of the total 12,646 (39.9 percent) will be for graduates from teachers schools; 7,393 (23.3 percent) from commerce and accounting; 6,995 (22.0 percent) from industrial schools; 3,147 (9.9 percent) from agricultural schools and 1,555 (4.9 percent) from engineering schools.
4. The study finds that a surplus of 441 graduates from Islamic Studies and of 6,405 teachers with intermediate teachers certificate are anticipated in 1981.
5. Although surpluses are anticipated in these fields, large shortages are anticipated in most of the other fields.[1] The study estimates that by 1981 the country will need to import 18,277 graduates with a university degree which are estimated to be as follows: a total of 4,202 engineers; 3,864 doctors; 2,586 from Economics and Commerce; 1,278 from College of

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[1] Shortages are defined as the excess of the increments in demand over the expected supply from the existing 1977 enrollments during the period of study (1978-1981).

education; 1,196 from College of Agriculture and 349 from College of Law.

6. The study estimates that by 1981 the country will need to import a total of 4,404 graduates from intermediate level of education broken down by fields as follows: a total of 1,622 from intermediate industrial schools; 1,586 from intermediate commerce and accounting; 706 from intermediate engineering schools; and 490 from intermediate agricultural schools.
7. The analysis of the results of the study demonstrates that the highly aggregated Correa-Tinbergen model, where the high-level manpower and the students enrollments are not disaggregated by fields of specialization, is of little use in planning education and high-level manpower. This point was demonstrated in Chapter VIII of this study. The results show that the aggregated model is unable to calculate the shortage or surplus by field of specialization and showed that in using this model any recommendations are likely to be misleading and may worsen the problem.

The Conclusions of the Study

In this study, the structure of high-level manpower and the ratios of foreigners to total employment in each field of specialization were analyzed. Since the main source of supply of high-level manpower comes from the Libyan educational system, the study has analyzed the structure, the trends and the policies of enrollment at the university and intermediate levels of education and the ability of the educational

system to supply the high-level manpower required by the various economic sectors. After analyzing the results, the study concludes that:

1. The increments in demand for high-level manpower are significantly different among different specializations. These differences range from 8,299 engineers to 1,175 doctors in the university level and from 12,646 teachers to 1,555 intermediate engineers in the intermediate level.
2. The study concludes that the past government method of allocating students among different fields at the university level is not what the economy needs. As shown in Table XXVIII, the largest increments in demand are for engineers and graduates from Sciences College. Accordingly, to meet these demands, Colleges of Engineering and Sciences should be given the highest priority in allocating students. While this is the case, the government allocated only 11.5 percent to College of Engineering and 6.8 percent to College of Sciences which were the fifth and the eighth priority in 1977. The first and second priorities were given to Colleges of Arts and Law where they should have given only the fifth and seventh priority.
3. The study concludes that the past government method to allocate students among fields at the intermediate level is not what the economy will need in the future. As explained in Chapter VIII, a surplus of 6,406 teachers with intermediate certificate is anticipated between 1978-1981 and a shortage of 2,222 is anticipated in the remaining intermediate fields. This is because of the inadequate method used by the

government which led to the allocation of 86.3 percent of the total intermediate students to teachers schools.

4. The inadequate method used by the government to allocate students among different fields, if it continues, will lead to intensified shortages in some fields and to surpluses in others. The misallocation of students among different fields has been due to the lack of economic guidelines which are needed in such a policy.

In this study the future high-level manpower needs by the economy, the high-level manpower distribution among economic sectors, and the expected growth rate of each economic sector between 1978-1985 are used to develop policy guidelines for allocating students among different fields, as will be explained next.

Recommendations of the Study

The recommendations of the study are the following:

1. To secure the supply of the required skills with a university degree to meet the expected increment in demand between 1982-1985, the study recommends that a total of 49,669 students should be allocated among the universities colleges between 1978-1981.

   As shown in Table XXIX of the total recommended enrollments, 11,568 (23.3 percent) should be allocated to College of Economics and Commerce; 9,010 (18.1 percent) to Sciences College; 8,475 (17.1 percent) to Engineering; 6,026 (12.1 percent) to Education; 4,950 (10.0 percent) to Agricultural College; 3,980 (8.0 percent) to Arts; 3,281 (6.6 percent)

TABLE XXIX

REQUIRED ENROLLMENT IN THE UNIVERSITY COLLEGES
AND INTERMEDIATE SCHOOLS
1978-1981

	Required Enrollment				Total Enrollment	Percent of Total	Percent of Total
	1978	1979	1980	1981			1977
University Level:							
Economics and Commerce	2,154	2,625	2,815	3,974	11,568	23.3	13.7
Sciences	1,463	1,912	2,446	3,189	9,010	18.1	6.8
Engineering	1,581	1,966	2,464	2,464	8,475	17.1	11.5
Education	1,344	1,432	1,583	1,667	6,026	12.1	12.3
Agriculture	874	1,080	1,338	1,658	4,950	10.0	6.3
Arts	738	883	1,061	1,298	3,980	8.0	18.5
Law	648	764	872	997	3,281	6.6	14.0
Islamic Studies	291	331	379	433	1,434	2.9	10.0
Medicine	226	233	243	243	945	1.9	6.7
Total	9,319	11,226	13,201	15,923	49,669	100.0	100.0
Intermediate Level:							
Teaching Schools	2,054	2,117	2,183	2,251	8,605	33.3	86.3
Industrial	1,190	1,565	2,075	2,751	7,581	29.4	2.6
Commerce and Accounting	1,052	1,300	1,622	2,039	6,013	23.3	6.2
Agricultural Engineering	443	543	665	812	2,463	9.5	2.7
Intermediate Engineering	226	266	312	367	1,171	4.5	2.2
Total	4,965	5,791	6,857	8,220	25,833	100.0	100.0

to Law; 1,434 (2.9 percent) to Islamic Studies; and 945 (1.9 percent) to Medical Colleges.

2. To avoid shortages and secure the supply of graduates from intermediate schools to meet the increment in demand between 1982-1985, the study recommends that a total of 25,833 students should be allocated to intermediate schools.

As shown in Table XXIX of the total allocation to intermediate schools, 8,605 (33.3 percent) should be allocated to teachers schools; 7,581 (29.4 percent) to industrial schools; 6,013 (23.3 percent) to commerce and accounting; 2,463 (9.5 percent) to agricultural schools; and 1,171 (4.5 percent) to intermediate engineering schools.

3. To Libyanize the high-level manpower with a university degree, the study recommends that 10 percent of the foreign high-level manpower with a university degree, which is estimated by this study to be equal to 18,268 by 1981, could be repatriated and replaced by national high-level manpower. This is a reasonable and flexible assumption.

To accomplish the goal of Libyanization of high-level manpower with a university degree, the study recommends that the government should plan to allocate the following number of students each year starting from 1979 to 1988. A total of 563 students should be allocated to Medical Colleges; 560 to Economics and Commerce; 529 to Engineering; 378 to Sciences; 327 to Arts; 204 to Agriculture; 155 to Education and 66 to Law College. If the recommendation of this study is taken into consideration, the government could repatriate starting from

from Sciences College; 252 from Arts; 227 from Economics and Commerce; 128 from Education; 120 agricultural engineers and 36 graduates from Law College.

4. To Libyanize the high-level manpower with intermediate certificate, the study recommends that 20 percent of the existing foreign manpower with intermediate certificate could be repatriated each year.

Since nothing can be done with the existing enrollments, the author suggests that the 20 percent of foreign labor planned to be released should start by 1983. To have new graduates from the intermediate field to substitute for the planned 20 percent of departing foreign labor in 1983, the recommended enrollments in each field should start by 1979 because it takes four years to graduate from intermediate level.

This method is used for all fields and the recommended enrollments are estimated to be equal to 4,384 students during the next four years. This means that for Libya to be able to meet all of its own intermediate level of manpower needs, the government should allocate 463 students to industrial schools, 364 to commerce and accounting, 163 to engineering schools and 106 to agricultural schools each year between 1979-1982. This recommendation is realistic, and the author believes that the government could allocate an additional 1,096 students to the intermediate level each year in the next four years and Libyanize the intermediate manpower by 1987.

5. The participation rate of females in the labor force is very low compared to most other countries. This low rate of participation is due largely to the low education level of females. Female enrollment represents only 17.7 percent of the total university enrollments and zero percent in the intermediate level other than teachers schools. In teachers schools, the female enrollment represented 59.1 percent in 1977. The researcher believes that for most females in Libya only the teaching profession is preferred. The main factors that limit the female participation rate in the labor force are: education level, religious factors, customs and cultural factors.

In a study entitled "Determinants of Female Labor Force Participation: The Case of Libya", Ali El-Huni (1978) finds that family headships, education level, family size, age of the children and age of the woman are the most important factors in determining women's participation in the labor force, factors that are shared with most parts of the world.

The large enrollment of females in the intermediate teachers schools indicate the preference of the teaching profession by women. Accordingly, the researcher recommends that the government should encourage the enrollment of females in these schools as well as in the Colleges of Education, Arts and other related university fields where the women can use their degrees for teaching in different levels of education.

Limitations of the Study

The limitations of the study are summarized as follows:

1. In the application of such a model to some other countries, the availability of data could be a very limiting factor. Although the data are available in detail in Libya because of the kind of education and economic systems in Libya, this may not be true in some other countries.
2. The constant technical coefficients assumption, even though it is realistic in Libya and is expected to be in some other under-developed countries where the use of technology is limited and foreigners represent a high ratio of the high-level manpower, could not be used in a country where these factors do not exist and the productivity of labor is changing over time.
3. In Libya the limitations of the study are determined by the oil revenue. The oil price determination is an exogenous one. The assumption of availability of financial capital in Libya, even though it is realistic in the present, may not be in the future. A decrease in the oil revenue may lead to a cut in expenditure of some sectors and hence the planned growth rate may not be achieved, thereby affecting the results of the model.
4. Any forecast of this kind is, of course, bound to be uncertain. Estimates of economic growth over long periods are necessarily tentative and it is hard to judge their implications for employment. But since there is no other available

alternative and the problem of corrdinating education, manpower and economic sectors needs to be solved, the attempt should be made. Of course, all such estimates should be regularly revised as new evidence becomes available.

In conclusion, high-level manpower is the most precious and critical resource of a country. In Libya, shortages in all fields were common in 1977. Foreigners represented 59.3 percent of high-level manpower with a university degree and 15.5 percent of those with an intermediate certificate. The ratio ranged in some fields from 10.8 percent in intermediate teachers schools to a high of 88.8 percent in the medical profession. Accordingly, due to national pride and national security, as well as economic reasons, the country should plan to have sufficient national high-level manpower to implement its development plans. This study is hoped to be a useful step in that direction.

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APPENDIX

TABLE XXX

PERCENTAGE OF STUDENTS PASSING, REPEATING AND DROPPING FROM THE UNIVERSITY AND INTERMEDIATE LEVELS*

Educational Speciality	First Year			Second Year			Third Year			Fourth Year			Fifth Year		
	α_1	β_1	λ_1	α_2	β_2	λ_2	α_3	β_3	λ_3	α_4	β_4	λ_4	α_5	β_5	λ_5
University Level:															
Engineering	86.0	12.7	1.3	86.6	11.7	1.7	89.0	10.3	0.7	92.0	7.3	0.7	98.6	0.7	0.7
Sciences	81.0	8.3	10.7	85.0	9.3	5.7	90.0	8.0	2.0	99.0	1.0	0.0			
Economics and Commerce	67.4	18.3	14.3	72.3	16.7	11.0	84.0	14.7	1.2	76.0	15.0	9.0			
Education	88.7	3.6	7.7	89.3	7.7	3.0	93.7	6.0	0.3	99.7	0.3	0.0			
Arts	85.7	6.3	8.0	90.4	7.3	2.3	89.0	8.3	2.7	100.0	0.0	0.0			
Agricultural Engineering	75.0	14.3	10.7	81.4	9.3	9.3	91.3	7.0	1.7	95.0	5.0	0.0			
Law	77.0	13.7	9.3	64.7	28.0	7.3	82.3	15.7	2.0	76.4	18.3	5.3			
Islamic Studies	81.7	9.0	9.3	83.7	10.0	6.3	89.3	9.7	0.7	100.0	0.0	0.0			
Medicine	81.0	8.3	10.7	72.0	21.0	7.0	98.0	2.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Intermediate Level:															
Teachers School	82.3	7.0	10.7	85.6	3.7	10.7	81.4	18.3	0.3	96.3	1.7	2.0			
Commerce and Accounting	94.4	5.3	0.3	92.3	4.7	3.0	95.6	3.7	0.7	91.0	8.7	0.3			
Industrial Engineering	86.5	8.5	5.0	91.3	1.5	7.2	97.0	2.3	0.7	85.7	12.0	2.3			
Agricultural Engineering	95.4	1.3	3.3	94.0	4.7	1.3	96.3	3.0	0.7	99.7	0.3	0.0			
Intermediate Engineering	90.6	6.7	2.7	93.4	5.3	1.3	80.3	18.7	1.0	100.0	0.0	0.0			

* α = passing percent; β = repeating percent; and λ = dropping percent.

Source: The Ministry of Education, Statistical Bulletin, 1977.

TABLE XXXII

THE PROJECTED STUDENT ENROLLMENT OF THE
COLLEGE OF ECONOMICS AND COMMERCE
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	1,781				
1979	2,154	1,273			
1980	2,625	1,539	1,063		
1981	2,815	1,876	1,285	950	722
1982	3,974	2,012	1,566	1,148	873
1983		2,842	1,918	1,400	1,064
1984			2,373	1,714	1,303
1985				2,121	1,612

TABLE XXXII

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF SCIENCES
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	1,142				
1979	1,463	960			
1980	1,912	1,229	868		
1981	2,446	1,607	1,112	789	782
1982	3,189	2,055	1,453	1,011	1,001
1983		2,679	1,858	1,308	1,295
1984			2,423	1,689	1,673
1985				2,203	2,181

TABLE XXXIII

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF ENGINEERING
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Required Graduates
1978	1,281					
1979	1,581	1,224				
1980	1,966	1,510	1,173			
1981	2,464	1,879	1,447	1,117		
1982		2,354	1,800	1,379	1,028	1,014
1983			2,255	1,715	1,268	1,251
1984				2,149	1,578	1,556
1985					1,977	1,950

TABLE XXXIV

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF EDUCATION
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	692				
1979	1,344	644			
1980	1,432	1,250	610		
1981	1,583	1,333	1,184	572	571
1982	1,667	1,474	1,262	1,110	1,107
1983		1,551	1,395	1,183	1,180
1984			1,469	1,308	1,305
1985				1,377	1,373

TABLE XXXV

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF AGRICULTURE
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	708				
1979	874	531			
1980	1,080	656	456		
1981	1,338	810	546	438	417
1982	1,658	1,004	696	542	515
1983		1,247	863	669	636
1984			1,069	829	788
1985				1,027	976

TABLE XXXVI

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF ARTS
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	623				
1979	738	562			
1980	883	666	538		
1981	1,061	796	638	479	479
1982	1,298	957	762	568	568
1983		1,170	916	679	679
1984			1,121	816	816
1985				998	998

TABLE XXXVII

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF LAW
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	585				
1979	648	568			
1980	764	629	426		
1981	872	741	471	403	308
1982	997	847	556	446	341
1983		968	635	526	402
1984			726	600	459
1985				687	525

TABLE XXXVIII

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF ISLAMIC STUDIES
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	257				
1979	291	218			
1980	331	247	200		
1981	379	281	227	180	180
1982	433	321	258	204	204
1983		367	295	232	232
1984			338	265	265
1985				303	303

TABLE XXXIX

THE PROJECTED STUDENT ENROLLMENT OF
THE COLLEGE OF MEDICINE
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Required Graduates
1978	218					
1979	226	206				
1980	233	213	152			
1981	243	220	157	149		
1982		229	162	154	149	149
1983			168	159	154	154
1984				165	159	159
1985					165	165

TABLE XL

THE PROJECTED STUDENT ENROLLMENTS FOR TEACHERS SCHOOLS 1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	1,995				
1979	2,054	1,534			
1980	2,117	1,579	1,601		
1981	2,183	1,628	1,649	1,300	1,252
1982	2,251	1,679	1,700	1,338	1,289
1983		1,731	1,752	1,380	1,329
1984			1,807	1,422	1,370
1985				1,467	1,413

TABLE XLI

THE PROJECTED STUDENT ENROLLMENTS FOR INTERMEDIATE INDUSTRIAL SCHOOLS 1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	935				
1979	1,190	765			
1980	1,565	974	710		
1981	2,075	1,283	903	740	635
1982	2,751	1,698	1,190	970	832
1983		2,251	1,575	1,278	1,096
1984			2,088	1,692	1,449
1985				2,243	1,923

TABLE LXII

THE PROJECTED STUDENT ENROLLMENTS FOR
INTERMEDIATE COMMERCE AND
ACCOUNTING SCHOOLS
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	950				
1979	1,052	819			
1980	1,300	1,010	780		
1981	1,622	1,249	961	814	741
1982	2,039	1,558	1,188	1,003	913
1983		1,958	1,482	1,240	1,129
1984			1,863	1,548	1,409
1985				1,945	1,770

TABLE XLIII

THE PROJECTED STUDENT ENROLLMENTS FOR INTERMEDIATE AGRICULTURAL SCHOOLS 1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	364				
1979	443	359			
1980	543	437	345		
1981	665	536	421	335	334
1982	812	656	516	407	406
1983		802	632	498	497
1984			772	610	609
1985				746	744

TABLE XLIV

THE PROJECTED STUDENT ENROLLMENTS
FOR INTERMEDIATE ENGINEERING
SCHOOLS
1978-1985

Year	First Year	Second Year	Third Year	Fourth Year	Required Graduates
1978	191				
1979	226	181			
1980	266	213	205		
1981	312	251	242	165	165
1982	367	295	285	195	195
1983		346	335	229	229
1984			393	269	269
1985				316	316

VITA[2]

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