Memo. No. 1205

ANALYSIS OF THE STRUCTURAL DEVELOPMENT OF PRODUCTION AND CONSUMPTION FOR WHEAT, RICE AND COTTON IN THE ARAB REPUBLIC OF EGYPT

By

Dr. HOSNY HAFEZ ABD EL RAHMAN

JUNE, 1977

CAIRO

SALAH SALEM ST. NASR CITY
ANALYSIS OF THE STRUCTURAL DEVELOPMENT OF PRODUCTION AND CONSUMPTION FOR WHEAT, RICE AND COTTON IN THE ARAB REPUBLIC OF EGYPT

BY

HOSNY HAFEZ ABDEL RAHMAN

BUDAPEST

1976
1. Objectives and antecedents of the investigation

Although considerable industrialization has been accomplished in course of the last more than two decades, the national economy of the Arab Republic of Egypt remains predominantly an agricultural one. In a direct or indirect manner, 70 per cent of the employed population are provided in agriculture. Two fifth of the national income as well as about 80–85 per cent of the exports are the results of agricultural production.

In a consequence of the slow increase of agricultural production and of the rapid growth of the population, more and more agricultural products are to be imported each year by the country. The Arab Republic of Egypt needs mainly to import bread-grains, vegetable oils, fodder, meat and dairy products. The most compelling are, however, the shortages of wheat and flour. Rice is also an important commodity for both domestic consumption and exportation. No difficulties were met so far by Egypt in respect with the exportation of rice.

Cotton is of a decisive importance within the agriculture of the Arab Republic of Egypt since it represents more than 70 per cent of total export returns and occupies almost one fifth of the cultivated acreages. Cotton yarns of the Egyptian long-staple variety are purchased – mainly in consequence of their particularly good quality – for long years ago by several countries just as by the United States of America, by the Soviet Union and by Hungary, among others. Cotton plays such an important role in the Egyptian economy that it is impracticable to disassociate it from any consideration of the Egyptian future development, political or economical.

The present study involves one of fundamental economical problems of Egypt. The subject is extremely important nowadays,
because of the growing in the population and the improvement of the living standards as well as generally the economical stability of the country depend highly upon the development of wheat, rice and cotton production to satisfy the domestic demand and exports.

The subject of this study is the production, the consumption and foreign trade of wheat, rice and cotton in the Arab Republic of Egypt concerning the years from 1952 to 1971 and also 1980, 1985 and 1990.

The objectives of the study are complex:
- retrospective investigation of the trends of wheat, rice and cotton production and consumption for long time series,
- the assessment of the scale of expectable demands and the demonstration of opportunities for their satisfaction, taken the export and import of the respective commodities also into consideration,
- the outlining of development trends and possibilities in order to promote the implementation of consumption and commercial policies.

I think that the importance and the topicalness of the selected subject are obvious and therefore neither the significance of the study nor the elaboration of recommendations based on conclusions drawn thereof and serving for several development and planning purposes are repeatedly to be asserted. Studies meeting diverse scientific requirements which reveal the situation as well as long-term calculations are indispensable supports for development and planning activities. Researches carried out in respect with this matter promote the exploration relationships existing between different economic phenomena, the estimation of tendencies manifested in changes having taken place, and based upon all these also the identifi-
cution of development trends possible at diverse stages of the progress of national economy. All these aspects may arise the concern of people controlling and managing economy. This is fully comprehensible since generally several historically established and inherited disproportions as well as the shortage of production factors are mainly impeding progress in countries on the way of development.

In spite of the fundamental importance of the subject treated, however, studies prepared in this aspect are but scarcely available. Production and domestic demand projections of the commodities under consideration had been studied by the FAO and the Institute of National Planning in Egypt. That study was depended upon the information collected in the 1964/1965 Household Budget Survey /cross-section analysis/ that was carried out by the Egyptian Central Agency for Public Mobilization and Statistics.

Major differences between the above mentioned study and the present study can be formulated as follows:

- I come to certain generalizing conclusions through the investigation of not one single year only but of two entire decades,
- projections are made not only for the years 1980-1985 but for a longer period until 1990,
- the development space is not considered as one period but it is divided into four subperiods,
- in addition to, I also estimated the expenditure elasticities from the family budget data and applied other methods, too,
- the scope of my study is broader and more detailed /dealing e.g. not with cereales in general but with wheat and rice in particular/ than that of the other studies.
The common characteristic of all the three agricultural commodities in question /i.e. of wheat, rice and cotton/ is that they play an important role in the foreign trade of Egypt. The critical relationship between the development of agricultural production and the growth of the population represents the dominant factor of Egyptian economy. Since 1952 the population of the country increased by more than 50 per cent and the share and the number of urban population abruptly progressed. At the same time, however, cropland increased but slightly and opportunities for its future extension are also limited or require great investment.

2. Methodology, information basis and time-range of the study

Investigation possibilities are determined by the antecedents outlined above, by the objective selected and by the actual conditions prevailing in the Arab Republic of Egypt. I was thoroughly careful that investigations should be
- carried out in a well defined logical order and,
- based upon the suitable methods.

As a first step, I studied in my dissertation the economic importance of wheat, rice and cotton for my country, the development of their production, the changes taken place within commodity structure and in geographical arrangement. After having gained some knowledge upon the structure of the population, upon the domestic consumption of the commodities in question, upon their respective prices and upon those of their substitutive commodities, I extended my investigations to the estimation of domestic demands for wheat, rice and cotton. Then I
treated the export-import problems exerting an influence upon the balance of demand and supply. The effect of export and import upon domestic consumption was demonstrated as reflected through rice and cotton exports and through the import of wheat. In the following phase I undertook the discussion of equilibrium problems in the demand and supply balance of the products.

Since each development can, as a matter of course, be well founded if based upon objective reality, I paid particular attention to the analytical methods in respect with cultivated acreages, yields, total production, foreign trade and demands.

In course of elaborating my study, I applied the following methods and performed the following investigations:

/1/ Trend calculations justified by the following aspects:
- the present level of economic statistics in Egypt rendered an opportunity for their application,
- the development tendencies of production, foreign trade and per capita consumption can be estimated with due certitude,
- the knowledge of trends is useful in general for projections of the production and in particular if conditions are changing relatively slowly.

/2/ Regression analysis was applied for the estimation of demands and I applied the linear and logarithmic model based upon the principle of least squares for this purpose.

/3/ I ordinated Engel-curves to three different types of functions:
- to the linear regression between the arithmetic values of per capita consumption of the commodities under consideration and the total per capita expenditures,
- to the linear regression between the logarithms of per capita consumption and total per capita expenditures, and
- to the non linear regression.

By applying these three functions, I calculated expenditure-elasticities for both urban and rural population.

/4/ I investigated also the correlation existing between time as independent variable and cultivated areas, yields, total production, import and export, per capita consumption as well as per capita income as dependent variables. In addition, I analyzed the correlation between per capita consumption as dependent variable and prices of the product, that of the substitutive product and per capita income as independent variables.

/5/ I applied also the F-test used in the analysis of variance.

/6/ The demand function expresses the relationship between per capita consumption as dependent variable and the factors having an influence upon it as independent variables. In the present study, the independent variables are the prices of the commodities concerned, those of their substitutive commodities and the per capita income. The application of demand function was a tool for estimating the price, income and cross-elasticities.

Elasticity is an important tool of planning, it expresses the consumer response degree for changing price of the com-
modity, income and expenditure. From an econometric point of view the problem of price response in the planning context is particularly difficult, first because medium to long-term price responses are more important than short-term, and second because cross-price elasticities are at least as important as own-price elasticities.

/7/ An exponential model of growth was applied in projecting the development of population since it approximates most accurately the reality. Investigations described in the present study were mainly related with the proportions existing between the increase of the population and of the national income and the increase of per capita income and of the prices, and were in close connection with commercial and agricultural policies as well.

/8/ I investigated jointly the growth of per capita income and income elasticity in order to estimate the future quantity of per capita demand. The so calculated result I multiplied with the expectable number of population over the projected period to derive the aggregate estimates of demand for wheat, rice and cotton.

/9/ I relied myself also upon international comparisons and in this sense I have to indicate comparative analysis also as a particular method. International comparison just calls the attention to such interrelations which cannot be estimated in studies based upon domestic informations.

The correct selection of methods applied, of the functions expressing diverse relationships or of other mathematical formulas is of extraordinary importance. Criteria of choice of suitable functions were the following:
- statistical accuracy,
- economic criteria, and
- the simplicity of computations.

The investigation techniques and methods to be applied were limited by available informations. For the study of the structural development of production and foreign trade, the data were selected from the following sources:

- Data published for the period from 1952 to 1971 by the Department for Agricultural Economics and Statistics of the Agricultural Ministry in Cairo.
- Production Yearbooks of the FAO.
- The annual statistical reports of the Central Agency for Public Mobilization and Statistics in Cairo.
- Statistical data in respect with foreign trade published by the Statistical Department of the Ministry of Economics in Cairo.
- Time series data concerning the quantity and prices of the commodities in question, their substitutive commodities, the income and the growth of population were selected from the market statistics.
- Prices of the commodities under consideration are the arithmetical mean of monthly published retail prices which I corrected with the implicit consumption-price index. The prices of the substitutive commodities were either estimated at an explicit manner or with the price-relations of the respective commodity and its substitutive one.
- The records of the Department for Economics and Statistics of the Agricultural Ministry and the publica-
tions of the Central Agency for Public Mobilization and Statistics upon food consumption and consumers' prices as well as the annual reports of the Ministry of Planning in Cairo on economic growth serve as data basis for the calculation of domestic demands - which I expressed in per capita kilogram as dependent variable.

- I used in my dissertation the statistical data of a household budget survey carried out for 1964-1965 by the Central Agency for Public Mobilization and Statistics for the estimation of income parameters and mainly of expenditure elasticity coefficients. This survey was preceded already in 1958-1959 by a similar sample conducted by the Central Statistical Committee in Cairo. By means of the cross-section investigation I intended to demonstrate the development of expenditures for wheat and rice consumption among the urban and rural population.

The time ranges of this study were determined as follows:

The projection of production and consumption was proceed-ed from the data of several time series so that the entire period was divided into four subperiods: from 1952 to 1971, from 1971 to 1980, from 1980 to 1985 and from 1985 to 1990. In case of the first subperiod /1952-1971/, I used the actual data while calculations for the future were made on the basis of theoretically expectable data.

The projection of the demand for the respective commodities was accomplished by taking the expectable population, per capita income and income elasticity into consideration and was based upon a set of assumptions in respect with the diverse
influencing factors /like per capita income, price changes and demographic trends for the next 20 years/. In addition, I assumed that tastes of the consumers, preferences as price and income elasticity of the commodities in question will remain constant what can be accepted under the conditions prevailing in Egypt for 8-10 years. All these, of course, should be pondered when using projections and new investigations are to be performed if the conditions will change.

3. Major results of the present study

The total area of Egypt is longer than the tenfold of the same in Hungary, but only 2.5 million hectares are used as farmland. There is intercrop competition over the limited land resource in the Egyptian agriculture when compared with Hungary, because of the rapidly increase of population in Egypt is almost the fourfold of the same of Hungary. In the Egyptian agriculture, an irrigated labour is carried out in small individual farm units, only 5 per cent of the acreage is property of the state.

These fundamental conditions do not only determine the potential tendencies of development, but also realize statistical and economical studies from the very outset.

1. With a view to development attention must be paid to the production seasons ruled by natural factors since their changes, and the characteristic of the production structure in the diverse seasons can deliberately be utilized for increasing the output in the desired combination.

Wheat is produced at the greatest scale in the winter season. Cotton and rice are produced mostly in summer season,
and rice again in the Nili season. The importance of the Nili season has diminished substantially as a result of organization of irrigation system upon the completion of the high dam which availed more water for the summer season. Specific outputs and crop structure are also different for the diverse seasons. Development possibilities for the three crops under consideration can also be influenced by the deliberately scheduled rate of greater outputs within the structure of the diverse seasons. The consequence of seasons characteristics is pondered systematically in the present study.

2. The regional differentiation of agricultural production, just like seasonality, covers still considerable reserves. Although the Arab Republic of Egypt is divided administratively into 25 governorates, it is more reasonable, however, to perform regional surveys for:
   - Lower Egypt /Cairo northward to the Mediterranean/, 
   - Middle Egypt /Cairo to Asyut/, and 
   - Upper Egypt /from Asyut southward to the Sudanese border/.

The climatic conditions, production structure and traditions are significantly different in the three regions. Lower Egypt is produced wheat, cotton and nearly all rice, it contains also most of the country's livestock. Fruits and vegetables production are there also considerable. The main crops of Middle Egypt are cotton and fodder. In Upper Egypt, most of the country's onions grows, in addition to grain sorghum and sugar cane. While cotton is produced in the three regions, the most of wheat and rice production is to be found in Lower Egypt.

Referring to the results of the investigations, the conditions of regional differentiation will systematically be treated in the forthcoming points of the study.
3. The main conclusions of the production and consumption of wheat as well as the various things concerning its development are presented as follows:

/1/ First of all, the fact had to be considered that the world wheat production /354 million metric tons in 1971/ is divided among large and small scale producers as well as among exports and imports. Some countries producing wheat in large quantities and also import it, while certain countries having a small share of the world wheat production are at the same time exporters. Hungary would be distinguished within the small group of wheat exporting countries in spite of its modest share of world production, because of several development measures are implemented.

From international comparisons it may be arrived to the following conclusions:

- disproportion between production and domestic demands can equally be observed in countries having more or less important share of world production,

- parallel with the existence of limited excesses, the coverage of shortages becomes more and more pronounced,

- efforts to cover demands as fully as possible of own production can be considered as a several tendency,

- although for diverse reasons and generally everywhere in addition to the development of production - attention is paid to the substitution of wheat consumption, to several conditions affecting the reduction of this consumption and to the deliberate influencing of alimentary customs.

/2/ Corresponding to central dispositions, wheat is grown in all agricultural areas of Egypt. In fact the geog-
raphic distribution of wheat is the most uniform of all crops grown in Egypt. In part, this is because each farmer is required by law to plant about 33 per cent of his total acreage to wheat each year. But in contrast with Lower Egypt where the share of wheat amounts to round 60 per cent of total cropland, this share in Middle and Upper Egypt is only 20-20 per cent.

Considerable changes have fallen place between 1952 and 1971 which are illustrated by the following data:

<table>
<thead>
<tr>
<th>Years</th>
<th>Production (thousand metric tons)</th>
<th>Index: 1952=100</th>
<th>Cultivated Area (thousand hectares)</th>
<th>Index: 1952=100</th>
<th>Yield (metric tons per hectare)</th>
<th>Index: 1952=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>1952</td>
<td>1089</td>
<td>589</td>
<td>-</td>
<td>1.849</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>1729</td>
<td>567</td>
<td>96</td>
<td>3.052</td>
<td>165</td>
</tr>
<tr>
<td>Lower Egypt</td>
<td>1952</td>
<td>594</td>
<td>-</td>
<td>348</td>
<td>-</td>
<td>1.706</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>1018</td>
<td>332</td>
<td>95</td>
<td>3.064</td>
<td>180</td>
</tr>
<tr>
<td>Middle Egypt</td>
<td>1952</td>
<td>243</td>
<td>-</td>
<td>114</td>
<td>-</td>
<td>2.141</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>325</td>
<td>103</td>
<td>90</td>
<td>3.171</td>
<td>148</td>
</tr>
<tr>
<td>Upper Egypt</td>
<td>1952</td>
<td>252</td>
<td>-</td>
<td>127</td>
<td>-</td>
<td>1.980</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>386</td>
<td>132</td>
<td>104</td>
<td>2.928</td>
<td>148</td>
</tr>
</tbody>
</table>

/3/ From all these, it can be established that in spite of decreasing cultivated acreage, wheat production amounted by 59 per cent as a result of increasing yields. Shifts observable in the diverse regions were divergent from the acreage. The yields surpassed highly the national average in Middle Egypt and thus it is well comprehensible that the increase was the most rapid in Lower Egypt where yields in 1952 the lowest. While the cultivated acreage were reduced in Lower and Middle Egypt, in consequence of the extension of irrigation, the cul-
tivated land and also at a modest rate yields increased at the same time in Upper Egypt.

/4/ The acreage under wheat in Egypt was reduced between 1952 and 1971 by about 4 per cent, from 589 thousand to 567 thousand hectares. The reduction of the cultivated acreage can be considered as a long lasting tendency resulted partly by the general decrease of agricultural cultivated land, and partly by the utilization of agricultural acreage. Accordingly, the 567 thousand hectares sown in 1971 would diminish to 503 thousand hectares for 1980, and by developing new land, it would presumably increase to 533 thousand hectares for each of the years 1985 and 1990. Thus in cause of the next round two decades, the acreage under wheat will presumably be diminished by 6 per cent, in spite of the fact that as a result of centrally measures everything was done for the slowing down or impeding of this progress.

/5/ Average annual increase in the yield per hectare of wheat in Egypt was about 38 Kilograms during the period 1952-1971. It amounted to be about 41 Kilograms in Lower Egypt, 33 Kilograms in Middle Egypt and 35 Kilograms in Upper Egypt in the same period. In my precautions estimations, having considered the present economic situation of Egypt and its expectable evolution, an about 38 Kilograms annual increase in the yield per hectare is used for long term projections.

/6/ The level of wheat production is a function of the acreage under wheat and the yield per unit of area. Wheat production increased by 59 per cent from 1952 to 1971, that means, it surpassed the quantity of 1.7 million metric tons in 1971.
This same level can be expected until 1980 since the reduction of acreage under wheat counterbalance the slow increase of yields. For 1985 and 1990, however, a total wheat production of 1.9 and 2.0 million metric tons respectively can be expected.

/7/ Over the period 1952/1953 - 1971/1972, wheat consumption in Egypt is a function of wheat price, per capita income and substitute prices of other cereals and vegetables to wheat. The linear and logarithmic models were used in connection with all items. The wheat price elasticity was about - 0.134, this means that, 10 per cent increase /or decrease/ in the wheat price causes 1.34 per cent decrease /or increase/ in the consumption of wheat. The appropriate income elasticity of demand was found to be 0.453, this brings out that, 10 per cent increase /or decrease/ in the income causes 4.53 per cent increase /or decrease/ in the wheat consumption. It was also possible to utilize the demand equation by using the price coefficients of other commodities /rice and potatoes/ in deriving the cross elasticities. The sign of the elasticity coefficient apart from its value indicates the nature of the relation between the consumed commodity and other commodities. Since the sign is positive, this brings out that the rice and potatoes are substituting commodities to the wheat.

/8/ The estimates of expenditure elasticities from the Egyptian family budget survey data involved the postulation of appropriate functions expressing the relationship between per capita consumption of wheat, wheat flour and prepared bread in wheat equivalent, and per capita total expenditure. The Engel curves fitted for this purpose were adjusted according to three different types of functions: a linear arithmetic relation, a double-log relation and non-linear regression. The analysis of
family budget data shows that the appropriate expenditure elasticity coefficients for wheat equivalent are about 0.12 and 0.46 in urban and rural areas respectively in 1964/1965. This brings out that, 10 per cent increase /or decrease/ in the per capita total expenditure causes 1.2 per cent and 4.6 per cent increase /or decrease/ in per capita consumption of wheat equivalent in urban and rural areas respectively. The divergence between the coefficients in urban and rural areas is understandable due to the fact that, the rural diet differs significantly from the urban diet in terms of grain components.

/9/ According to the exponential growth of the population, rural - urban composition of population as well as the improving conditions of wage-earnings, total direct human consumption of wheat and wheat flour in wheat equivalent increased from about 1.4 million metric tons in 1952/1953 to about 3.9 million metric tons in 1971/1972, simultaneously, the per capita consumption raised from 62 to 112 Kilograms.

The number of urban population will surpass for 1980 that of the rural population and for 1990 it expectably will reach at 30 millions /from the total 53 millions/. Also the elasticity coefficients, in accordance with the expectable development of incomes and expenditures indicate the further increase of wheat and wheat flour consumption. All these together put the increase of production, the extension of foreign trade, the circumspect distribution of the available stores, the deliberate influencing of consumer's requirements and the economical utilization into prominence.

As my calculations show the per capita consumption of wheat equivalent will further increase and will amount to 125, 132 and 138 Kilograms for 1980, 1985 and 1990 respectively.
By multiplying the projected per capita demand by the estimated population over the projected period, it can be derived the aggregate estimates of demand for wheat. Correspondingly Egypt should need in accordance with my estimates 5.2, 6.2 and 7.3 million metric tons of wheat equivalent for 1980, 1985 and 1990 respectively.

/10/ By confronting the projected demand with the projected production, it becomes entirely obvious that if the expectations will come true, the wheat imports will increase. Correspondingly the 2.2 million metric tons of wheat imports in 1971/1972 will presumably rise to 3.5, 4.3 and 5.3 million metric tons for 1980, 1985 and 1990 respectively.

/11/ From the described facts, it can be understood that autarchy in wheat supply will lessen, and everything should be done for easing this situation. In addition to other general development of agriculture, which exerts an influence also upon wheat production, the reduction of harvesting and storage losses, the development of the wheat distributing system, concrete implementing of the substitution of wheat and opportunities for the counterparting of the buying up of wheat are also to be considered.

4. In course of my investigations concerning the production development and exports of rice, it could be established that:

/1/ World rice production amounted to about 309 million metric tons in 1971. Thereof the share of the USA was about 1.0 per cent, that of Egypt was 0.8 per cent, 0.5 per cent the same of Soviet Union and 0.2 per cent of Hungary.
Hungary covers its demands with rice of good quality. Rice production is implemented there in well defined regions which are but scarcely utilizable for other crops. This crop is produced also in production system which provides for favourable water-use, for the necessary quantity and complex structure of inputs as well as for the accomplishment of the respective tasks in optimum time.

/2/ Rice production in Egypt confined to the more northerly areas of the Delta, which consists of five governorates /Dakahlieh, Kafr El Sheikh, Behira, Sharkieh and Gharbieh/, and are responsible for about 92 per cent of the total production of the country during the period from 1952 to 1971. Therefore investigation results concerning the other governorates may be neglected.

/3/ For the major rice producing governorates as well as for the average of Egypt it could draw the following conclusions:
<table>
<thead>
<tr>
<th></th>
<th>production</th>
<th>acreage</th>
<th>yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>thousand tons</td>
<td>Index: 1952=100</td>
<td>thousand hectares</td>
</tr>
<tr>
<td>Egypt</td>
<td>1952</td>
<td>517</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>2534</td>
<td>490</td>
</tr>
<tr>
<td>Dakahlieh</td>
<td>1952</td>
<td>140</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>624</td>
<td>446</td>
</tr>
<tr>
<td>Kafr El Sheikh</td>
<td>1952</td>
<td>110</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>626</td>
<td>569</td>
</tr>
<tr>
<td>Behira</td>
<td>1952</td>
<td>101</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>445</td>
<td>441</td>
</tr>
<tr>
<td>Sharkieh</td>
<td>1952</td>
<td>64</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>432</td>
<td>675</td>
</tr>
<tr>
<td>Gharbieh</td>
<td>1952</td>
<td>78</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>208</td>
<td>267</td>
</tr>
<tr>
<td>Other</td>
<td>1952</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>199</td>
<td>829</td>
</tr>
</tbody>
</table>

/4/ On the basis of 1952 to 1971 average, the acreage under rice in Egypt was about 339 thousand hectares, whereof summer crop was estimated by 335 thousand hectares and Nili varieties amounted by 4 thousand hectares. The acreage under rice in Egypt increased from 157 thousand hectares in 1952 to 478 thousand hectares in 1971, i.e. it was risen by 204 percent. The Egyptian cultivated acreage of rice varies more from year to year than the acreage of any other crop, because of variations in the availability of water for irrigation and of changes in crop pattern.
A further 9 per cent increase of the rice acreage can be prognosticated until 1980 that sown areas amounting thereby to 521 thousand hectares, and for 1985 they will increase to 558 thousand hectares practically. There is no possibility for further augmenting of the acreage mainly because of shortage in acreage to be drawn under cultivation. Thus the sown areas of rice can be extended by 17 per cent between 1971 and 1985, because of provision of food for a rapidly growing population, horizontal expansion including measures to expand arable land by reclaiming new areas and the water need will become available for rice after the completion of the high dam.

Based on the data embracing two decades finished with 1971, the conclusions can be drawn that the average annual increase of rice yields was about 60 Kilograms for the whole Egypt, being at the same time 34, 117, 11, 32, 77 and 136 Kilograms in Dakahlieh, Kafr El Sheikh, Beheira, Sharkieh, Gharbieh and other governorates respectively.

In my estimates, the average annual increase of rice yields will remain in Egypt 60 Kilograms also in the future. This is, of course, a pessimistic estimate and, as I shall refer to it in the forthcoming, even more can be achieved than that.

Rice production in correspondence with changes taken place both in cropland and yields increased by 390 per cent from 1952 to 1971. The production of paddy rice will rise from about 2.5 million metric tons in 1971 to about 3.0, 3.4 and 3.6 million metric tons in 1980, 1985 and 1990 what corresponds to 2.1, 2.4 and 2.5 million metric tons of milled rice respectively.
Milled rice output of paddy rice is about 68.8 per cent in Egypt, being higher than the same in Hungary. The refinement of the end-product would diminished this ratio, but for the time being there should no endeavour be needed in Egypt in this respect. The refinement of the end-product quality would reduce both consumption and exports.

/S/ In Egypt, rice is used almost entirely for direct human consumption; only a negligible proportion is used for manufacturing purposes. According to the growing in population, total direct human consumption of milled rice rose from 328 thousand metric tons in 1952/1953 to about 1.1 million metric tons in 1971/1972. The annual per capita consumption grew in course of the same period from 15 to 33 Kilograms.

/9/ Rice consumption in Egypt is very greatly affected by the price of rice and to a lesser extent by the price of other cereals. The price elasticity of rice was about - 0.457, which means that, if all other factors may be supposed to remain unchanged, then a unit change in price is associated with an inverse of 0.457 unit change in the amount demanded, or in other words when the price decreases /or increases/ by 10 per cent, the amount consumed increases /or decreases/ respectively by 4.57 per cent. In addition to its own price, the consumption of rice is also influenced by the scale of per capita income and even by the relative prices of macaroni and potatoes. Other things being equal, 10 per cent increase /or decrease/ in the per capita income causes 4.55 per cent increase /or decrease/ in rice demand. On an average, 10 per cent decrease /or increase/ in the price ratio of rice to macaroni causes 3.89 per cent increase /or decrease/ in the demand of rice. Potatoes is also a substitutive commodity of rice.
/10/ The analysis of family budget data shows that the appropriate expenditure elasticity coefficients for rice are about 0.415 and 0.505 in urban and rural areas respectively in 1964/1965. This means that a 10 per cent increase /or decrease/ in the per capita total expenditure causes 4.15 and 5.05 per cent increase /or decrease/ in per capita consumption of rice in urban and rural areas respectively. The divergence between the coefficients in urban and rural areas is due to the fact that the rural diet differs from the urban diet in rice consumption.

/11/ Per capita consumption of milled rice is estimated to be about 37, 39 and 40 Kilograms in 1980, 1985 and 1990 respectively, and total direct human consumption is expected to reach 1.5, 1.8 and 2.1 million metric tons in the same years respectively.

/12/ The Egyptian exports of milled rice amounted to 607 thousand metric tons in 1971/1972 which will decrease to 564, 549 and 330 thousand metric tons in 1980, 1985 and 1990 respectively. The decrease of rice exports may be explained with both, the increasing domestic demand and competition in the international market at a time of very low prices. Although the above indicated exports are expectable according to my calculations, yet the alternative of the full domestic consumption of rice produced can mentioned whereby wheat imports could considerably be diminished, but also the substitution problem of failing export returns would also arise.

/13/ It is worth to pay distinguished attention among the further development reserves of rice production to the propagation of safely high-yielding varieties resistant to
diseases, to the application of water-saving irrigation of other crops in the rice producing governorates and to the regulation acreages sown by crops competing for the use of water-supplies. The interests of both domestic consumption and exports require that production costs having been low so far should not raise if possible.

5. Major conclusions which can be drawn from the analysis and prognostics of cotton production are the following.

/1/ The world production of cotton lint has been estimated at some 12.2 million metric tons in 1971 and that of Egypt was 0.5 million metric tons in the same year. The United States produced about 2.28 million metric tons on 4.6 million hectares and the Soviet Union produced 2.38 million metric tons on 2.8 million hectares. Less attention was paid in the USA for the yields, rather productivity was emphasized the Soviet Union, on the other hand, Soviet Union is a good example for the advantages of intensive utilization of the acreage and of high yields.

It is well known that cotton plays a leading role in the Egyptian's economy, as it is represented about 25 per cent of the value of agricultural production and 72 per cent share of total exports. With the objective of raising its qualities maintaining its reputation in spinning circles around the world and stabilizing its position in the face of competition with synthetic fibres.

/2/ Egyptian cotton production developed in course of the two decades investigated as follows:
<table>
<thead>
<tr>
<th>Years</th>
<th>Production thousand metric tons</th>
<th>Index: 1952=100</th>
<th>( \text{Acreage} ) thousand hectares</th>
<th>Index: 1952=100</th>
<th>Yield thousand metric tons</th>
<th>Index: 1952=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Egypt /production include scarto/</td>
<td>1952</td>
<td>446</td>
<td>-</td>
<td>826</td>
<td>-</td>
<td>0.539</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>510</td>
<td>114</td>
<td>642</td>
<td>78</td>
<td>0.796</td>
</tr>
<tr>
<td>Long staples</td>
<td>1952</td>
<td>201</td>
<td>-</td>
<td>405</td>
<td>-</td>
<td>0.495</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>201</td>
<td>100</td>
<td>290</td>
<td>72</td>
<td>0.693</td>
</tr>
<tr>
<td>Long medium</td>
<td>1952</td>
<td>60</td>
<td>-</td>
<td>117</td>
<td>-</td>
<td>0.511</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>155</td>
<td>258</td>
<td>176</td>
<td>150</td>
<td>0.884</td>
</tr>
<tr>
<td>Medium</td>
<td>1952</td>
<td>176</td>
<td>-</td>
<td>304</td>
<td>-</td>
<td>0.579</td>
</tr>
<tr>
<td></td>
<td>1971</td>
<td>243</td>
<td>138</td>
<td>175</td>
<td>58</td>
<td>0.816</td>
</tr>
</tbody>
</table>

+Egyptian cotton varieties are classified into three groups by staple length:
- Long staples /over 1 3/8 inches/
- Long medium /over 1 1/4 inches/
- Medium /over 1 1/8 inches/

As can be shown, cotton production was augmented by 14 per cent in a period when sown areas decreased by 22 per cent and the yields improved by 48 per cent. Therefore, it can be established that a land-sowing development which also increased specific yields proved to be correct although this tendency was modified and rendered more sophisticated by the situation of foreign trade and by several other factors having divergent impact upon it.

/3/ The annual increase of the yield average per hectare of cotton lint in Egypt was about 15 Kilograms during
the period 1952-1971, and the annual increase of the yield per hectare of cotton lint varieties; Long staples, Long medium and Medium was about 13, 24 and 9 Kilograms respectively in the same period. Supposing the constant prevalence of the present acting factors for a long-term, expectable yields per hectare may achieve in accordance with my calculations 0.927 tons for 1980, 1.001 tons for 1985 and 1.073 tons for 1990.

/4/ In function of acreage under cotton and of the yields, the quantity of cotton lint-production shows an upward rising tendency: it could amount to 642, 757 and 811 thousand metric tons for 1980, 1985 and 1990 respectively.

/5/ The per capita income affects the domestic demand of cotton. The appropriate income elasticity coefficient of cotton lint is 0.38, this brings out that, 10 per cent increase /or decrease/ in the per capita income causes 3.8 per cent increase /or decrease/ in the per capita demand of cotton lint in Egypt.

/6/ The domestic demand of cotton lint is determined by the government policy, which generally gives priority to the requirements of the domestic textile industry over exports as it is considered one of the most important manufacturing industries in Egypt. The domestic demand of cotton lint varieties increased in line with the expansion of the number and productive capacity of textile factories in Egypt. The domestic demand of cotton lint varieties rose from 69 thousand metric tons in 1952/1953 to 206 thousand metric tons in 1971/1972. The per capita demand of cotton lint in Egypt increased from about 3.2 Kilograms in 1952/1953 to about 6.0 Kilograms in 1971/1972, and it can reach at about
6.5, 6.8 and 7.1 Kilograms in 1980, 1985 and 1990 respectively. The aggregate domestic demand for cotton lint is expected to reach 272, 319 and 375 thousand metric tons in 1980, 1985 and 1990 respectively.

/7/ Cotton is by far the most valuable cash crop grown in Egypt. Cotton exports proceeds are the major source of earnings foreign exchange for financing the importation of capital goods and for the implementation of several conceptions of short or long term. Calculated on the basis of production and domestic demand, the 304 thousand metric tons of cotton lint exports in 1971/1972 would reach at 370, 438 and 436 thousand metric tons in 1980, 1985 and 1990 respectively. Thus the expectable increase of cotton exports, could promote the development process of agriculture.

/8/ In connection with cotton exports, it should be noted that the fluctuation of world-market prices sensibly affects the economy of Egypt. The dynamic development process of domestic textile industry based upon cotton production renders at the same time the possibility of product export continually and safely. The process of products export mostly eliminates the effect of raw cotton price fluctuations and also offer additional opportunity of income gaining and of employment for population. Consequently further through investigations are needed in order to the accurate determination of a cotton utilization being more advantageous.

/9/ Cotton fibres of the long-staple variety have been called the white gold of Egypt. The annual increasing of Long-staple cotton lint export amounts to about 2.3 thousand metric tons, the same of Long medium cotton lint to 3.8 thousand
metric tons, while the annual decreasing of Medium variety estimated to be about 5.7 thousand metric tons during the period 1952-1971. From that figures, it turns out that in favour of the exports, the cotton production of Long medium should be increased since the dynamic improvement of its specific yields opens further reserves in the sphere of both production and commercial relations.

The share of Long staple cotton within the total domestic demand which represented about 3 per cent in 1952/1953 increased in recent years to 16 per cent for 1971/1972. Similarly, the domestic demand for Long medium-staple cotton which shared in 1952/1953 with 4 per cent within the total domestic demand increased its share to 21 per cent for 1971/1972. The domestic demand for Medium-staple cotton /the shortest type of Egyptian cotton/ registered a high rate of increase of the total with about 84 per cent in 1952/1953, but diminished to 76 per cent in 1971/1972.

/10/ The development of cotton production is a complicated process since it is equally influenced by foreign trade conditions, by the competition among diverse commodities for cropland acreage and by the needs of processing industries. In respect with the long term determination of acreage under cotton, also the cereals-cotton ratio can be considered. More explicitly; the increase of cereals production to the detriment of cotton would diminish the import of wheat, or one part of food imports be covered from export returns resulted by the maximum extension of cotton. According to diverse investigations and to my calculations, it is purposeful to envisage the maximum acreage of cotton. Acreage under cotton may be estimated to about 693 and 756 thousand hectares for 1980 and 1985
respectively. A greatest extension than that can only be im-
plemented through the modification of the present system and
thus, I think that the acreage of cotton cannot at all or can
but slightly be increased after 1985 /the estimates of FAO re-
commend 840 thousand hectares for cotton acreage/.

/11/ For promoting cotton production, certain other
relationships are also worth to be considered:

The acreage under cotton was distributed for Lower, Middle
and Upper Egypt by 65, 22 and 13 per cent respectively. No sig-
ificant modifications can be expected in this respect even in
the future, but since the decisive part of cotton production
is concentrated in Lower Egypt therefore the increase of yields
as well as the competition among diverse commodities effected
by water, and cost-income conditions are thereof a particular
importance.

A further reserve for the progress of cotton production
is represented by the selection of crop preceding the main
field product. It is true that under irrigation cotton can be
produced for 3-4 years on the same territory, but it is also
an unambiguous fact, because cotton can bring much longer and
stronger lint as after any other preceding crop.

Cotton acreage could be increased by augmenting the ra-
tio of two year crop rotation and also by the extension of
the three year crop rotation. The cotton share in the two
year rotation is 25 per cent of the total harvested area,
for the three year rotation this figure is only 16.7 per cent.
More profound comparisons should be performed in respect with
crop rotations. Many of the Egyptian farmers prefer the three
year rotation to the two year rotation, since it would involve
the augmented number of crops offering greater safety and sa-
tisfying also the demands of the family thereby.
6. The present investigations indicate a modest development in wheat, rice and cotton production equally. If no significant changes would occur in the supposed conditions, then the progress could be even much greater than estimated above. Without tending to completeness of the exposition based on the analysis and projections in the present study I should like to call the attention in the following points to certain economic relationships or conditions which in my opinion play an important role.

/1/ First of all, water-use mentioned already several times is to be treated. This is the most critical limiting factor of the long term development of agricultural production since it can easily be supposed that manual labour force of the demanded quantity will available also in the future at the necessary dates and supply of the production with fertilizers and other chemicals can be implemented too while water supplies is only of limited volume. In consequence of the decisive importance of water, further more intensive research work would be needed and perhaps even more important than this would be the introduction of the already known water-saving techniques in a broader sphere of production. If for example, inundated irrigation would be replaced with sprinkler operated at night or dropping irrigation would be applied or irrigation would be combined with foil-coverge than two- or threefold of the present acreage under irrigation could be irrigated by the same quantity what means with other words that cultivated acreage can be extended.

It is extremely important that all efforts should be made to avoid overuse of water. The conversion from animal to mechanical power in water-lifting would need to be accompanied
by new institutional arrangements which would help control water use and would create incentives to avoid wasting water.

/2/ Reserves offered by the extension of international labour division cannot be fully utilized by Egypt at present because of partly the great transportation distances and partly the shortages of outfits. Still, it should be pondered how the development of labour division in the Arabian world or in a broader sphere would affect Egyptian cotton, wheat and rice production.

/3/ The use of fertilizers and manure will expectably increase at a modest rate mainly because of new territories have been drawn under cultivation as well as in order to produce higher yields of fruits and vegetables. The use of fertilizer improves the propagation of higher yielding varieties. The system of fertilizer supply just as the organization of credits and advisory services need further development. No state subsidies are granted for fertilizers but as a consequence of the raise of prices, this problem should more thoroughly be investigated. The overwhelming major part of fertilizer used are domestic products presenting thereby certain facilities for economic influencing. The decisive part of fertilizer used contain of nitrogen and just in order to obtain a more advantageous structure of active agents also the assortment of fertilizers should be imported.

In recent years fertilizers were apportioned to the producers and even the diverse crops were ranked according to preference. In order to promote the development of Egyptian agriculture, however, commercial methods should have been put into the front for the future, since no other inputs interest directly such a great influence upon the outputs as fertilizer do.
/4/ The most important sources of energy for Egyptian agriculture are human force and that of draught animal power. The systematic decrease of draught animal power would result in the decreasing of further acreages for fodder growing and rendering the extension of cultivated acreages for wheat, rice and cotton possible. The extension of livestock husbandry should, of course, also be considered for the future and thus the acreages decreased could serve as a basis for feeding. In my calculations I envisaged a slow-rate development of mechanization but I think also that in the spheres of water-lifting to the surface, of soil cultivation and of transporting chemical agents to the fields, a more rapid mechanization would be justified to envisage. The prominent role of mechanization would be in this case to promote, by means of soil cultivation, the production of higher yields and to correspondingly change the structure of the energetic basis of Egyptian agriculture.

/5/ The development at a more rapid rate than envisaged in my projections, could be promoted if the factors increasing production would be taken into consideration in a complex manner, and they would jointly be asserted in the production of chemicals, fertilizers, new varieties, tools, equipments and machines, labour force, buildings, store houses, and other storage capacities, transports means, water, etc./.

/6/ Although in course of my studies, I referred already several times to the different production structure of the three great regions, still — and just in consequence of experiences gained in Hungary — I have to call attention also to the vertical division of labour. In order to promote a development of more rapid rate, namely, more intensive research
work should be performed in respect with the accord, the timely relationships and the mutual concern of agricultural production, processing, light industry, domestic and foreign trade, production means manufacturing and commercial concerning the three commodities studied. This problem is also therefore worth of consideration in Egypt, since in case of the shortage of capital, integration may always but very slowly evolve.

7. It can be established that the techniques applied in the present study as well as their logical construction and also joining analysis with projections just as the methods applied proved to be correct. Perhaps it would not be too pretentious to draw the conclusion that the elaboration of other analyses and projections of similar nature could highly contribute to the more thorough acknowledgment of the real economic situation in Egypt and the possible orientation of the agenda could also be indicated thereby.

Although statistical methods are predominant in respect with the investigations performed, but that is a consequence equally of the conditions prevailing in Egypt of the informations available and the tasks set for the study. In this sense, my research work cannot be considered to be complete, but I don't think that this is a deficiency since economic conceptions as well as the diverse economic theories are always in connection with the computation of relationships existing the diverse variables and thus with the diverse quantitative methods. The results of the studies performed, even if they enrich only at a small extent the practice of Egyptian science may well contribute to the production development in Egypt, and may also confirm the relations between the two countries, Egypt and Hungary.