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Articles

THE ECONOMICS OF THE IRON AND STEEL INDUSTRY IN EGYPT*

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1 – The Importance of the Industry

The iron and steel industry in Egypt is a relatively new arrival on the industrial scene. But it has been growing rapidly. It is essentially composed of six fairly big firms owned by the State. The position of these firms was as follows in 1969-70 :

Name	Value of Fixed assets (Million pounds)	Value of production (m.Pounds)	Number of workers	First Year of Operation
The Egyptian Iron and Steel Co.	92	24	10,052	1958
The Egyptian Copper Work	8.6	11.4	4,343	1935(Steel production in 1952)
The Delta Steel Mills	3.4	5.5	2,066	1947
The National Metal Industries Company	1.9	4.8	1,954	1949
El Nasr Steel Pipes and fitting	6	3.7	1,472	1962
El Nasr Foreign's Co.	8.8	2.7	1,619	1964
El Nasr Castings Co.	0.9	1.5	1,378	1955
Total	121.6	53.6	22,884	

Source : Ministry of Industry, The Egyptian General Organisation for Metallurgical Industries. Yearbook 1969-70, Cairo, (In Arabic).

(*) The author is grateful to Mr. Al-Motaz Mansour of the U.N. Economic and Social Office in Beirut, for his very helpful comments and criticism.

Yet, the importance of the iron and steel industry cannot be measured only by its direct employment, wages and value of output. This is due to the fact that this industry is a key industry, and the creation of it is bound to induce the creation of a large number of statellite industries.

This industry has very high linkage effects. The linkage effects domenstrate the degree of interdependence of the iron and steel industry with other industries. They include both forward and backward linkage effects. The forward linkage effects show the proportion of the industry's total output that goes to other industries, and not to final demand. The backward linkage effects show the proportion of the industry's output which is purchased from other industries.(1)

Chenery and Watanabe(2) show, in their study of the degree of interdependence of various industries, that the iron and steel industry has the highest combined backward and forward linkage effects. The purchases from other industries, or the backward linkage effects, form 66% of the value of total production of the industry. While the sales to other industries, or the forward linkage effects, represent 78% of the total demand for the industry's output.

These figures, though related to industrialized countries, may be used as an approximate measure of the role of the iron and steel industry during the industrialization process.

However, we can show roughly the linkage effects of the iron and steel industry in Egypt by listing industries or sectors which supply the steel industry with its inputs, and those which purchase their materials from the iron and steel industry.

In Egypt, the iron and steel industry draws its iron ore, limestone and dolomite from local mines. These mines are run by the iron and steel industry itself. It gets its coke from the coking industry which depends on imported coal. The number

(1) For more details, see A.O. Hirschman, The Strategy of Economic Development, New Haven, Yale University Press, 1966, Chapter 6.
(2) Ibid, pp. 105-113.

of people engaged in the iron ore mining only amounts to 1385; wages amount to L.E. 102,000(1).

The users of the iron and steel products include a large number of industries and establishments. They include manufacturers of tools, machinery, motor vehicles, railway wagons, ships, household durables, buildings etc(2). This group of industries include 296 establishments, employ 74 thousand persons, pay wages of L.E. 5 million. The value of their production amounts to L.E. 42 million(3). The above figures serve to show roughly the forward and backward linkage effects of the iron and steel industry in Egypt.

Moreover, the main requirements of the industry exist in the country and in reasonable amounts. There are large reserves of iron ore in Aswan and the Western desert (Baharya Oasis). It is only coal which is imported. As more hydro-electricity is being generated from the Aswan High Dam, and after the discovery of large deposits of natural gas, the industry is going to depend more on these cheap sources of power. These sources will partly replace coal imports in the future.

The size of market for several steel products is fairly adequate. It will grow at a faster rate when the rate of industrialization and development is resumed again to its pre 1967 level.

2 — Consumption of Steel

Consumption of steel is composed of a large number of steel products. These products are not for final consumption but go into the manufacture of a large number of goods, which are in the main, capital goods. The main consumers of steel are the following : transport, building and construction, engineering, mining, gas, electricity and water, household durables, food-canning.

(1) Central Agency for Mobilization and Statistics, Census of Industrial production (quarterly), 1970 - 71, Cairo, 1972.

(2) These industries depend partly on imports for some of their iron materials and components. Yet, the reliance upon local sources of supply has been increasing.

(3) Ibid.

Therefore, the demand for steel is diversified, and almost every industry uses iron and steel whether directly or indirectly. They use it directly as a raw material, or indirectly in the form of machinery and tools. However, industries differ widely in the amounts which they consume; similarly large differences in consumption for any industry depend on whether it is in a developed or a developing country.

For example, in the latter countries, the building industry tends to be the dominant consumer of steel. The building industry in Egypt consumed 45% of the total in 1969-70.[1] The proportion is only 18% in the industrialized countries. It is also noticed that when a developing country is a big producer of oil or gas, an important proportion of steel goes to pipelines (table 1).

The volume of consumption of steel in a country is related to the rate of growth of the economy, and especially, to the rate of growth of the main consuming industries.[2] So the periods of rapid economic growth are charactèrized by a fast rate of steel consumption. This trend is obvious in developing countries embarking on ambituous industrialization programmes.

In Egypt, the consumption of steel has been increasing very fast (table 2). In 1950-52, the average annual consumption was 260 thousand tons; it amounted to 326 thousand tons in 1960, or it increased by 36%. In 1965, consumption reached almost 800 thousand tons; it increased by 145% over 1960 level. The period 1960-65 covered the first five year industrialization programme in Egypt. Consumption of steel reached a record in 1966, but it fell in 1967 and 1968 due to the 1967-war. Yet, consumption of steel began to rise again in 1969 and 1970 when it reached a new record of 0.9 million tons in the latter year.[3]

(1) Ministry of Industry, The General Organization of Metallurgical Industries, Yearbook 1969/70, p. 37 (in Arabic).

(2) O.E.C.D., The Iron and Steel Industry (in 1970 and trends in 1971), Paris, 1971, pp. 12-15.

(3) The consumption figures include all steel consumed whether in its crude, processed or highly sophisticated forms such as machinery and transport equipment of all sorts.

Furthermore, over 50% of the iron and steel consumed in Egypt, nowadays, is covered by local production. The degree of self-sufficiency has been increasing all the time. The proportion of consumption covered by local production increased from 4% in 1950, to 37% in 1957, to 46% in 1960, to 54% in 1964, and to 60% in 1968/69.(1) It is expected that by 1975/76 (when the new iron and steel complex is completed) total production is going to exceed total consumption, leaving a part to be exported.

However, when we say that total production equates or exceeds total consumption, this, of course, does not mean that the country stops importing steel products entirely. In the case of the steel industry, it is not only difficult to produce all steel products locally, but it is also uneconomic to do so. Even the industrial countries, still rely on imports for certain steel products, though they are net exporters of steel. This is because steel products are so diverse; for some of these products the local demand is so small that it does not justify local production.

So it is reasonable to say that while the steel production is increasing rapidly in developing countries, these countries must concentrate more on the production of steel products which enjoy a fairly large market. They ought to continue to rely on imports for the many other steel products which are consumed in small amounts. This method will not only avoid production at high cost, but it will also avoid establishing a large number of costly rolling mills in developing countries.

3 — PRODUCTION

Steel products are numerous and any one developing country should not produce all or most of them at once. The burden of capital requirements is great, and the market for many of these products is limited. Needless to say, experience and skills are limited. So it is advisable for any country to concentrate on

(1) Economic Commission for Europe, "Iron and Steel Industry", Industrialization and Productivity. Bulletin No. 13, 1969, table 14, p. 82; The General Organization for Metal Industries, Yearkook, p. 19.

production of a few steel products, and to add more of them as the market expands later on.

Moreover, the steel industry should be established by stages. The first stage involves the creation of a non-integrated plant. It includes a small rolling mill to process certain products such as concrete bars, tubes, heavy and light sections. The mill depends on imported crude steel such as blooms, billets and slabs.

The second stage includes the establishment of a small electric furnace to smelt local and imported scrap and to supply the rolling mill with its requirements of steel. In this case, we have a semi-integrated plant which comprises an electric furnace and a rolling mill. In the third stage, we have a fully integrated plant. It includes rolling mills, steel converters, and also blast furnaces which smelt iron ore.

Thus the development of the steel industry is carried out through backward integration. As the industry starts by producing final steel products (concrete bars, tubes, etc.) from imported steel. Later on a small electric furnace is created alongside the rolling mill. Finally, a blast furnace is added to smelt local or imported iron ore.[1]

In Egypt, the creation of the steel industry started in 1947 when the Delta Steel Mills built a small plant to produce concrete bars for the building industry. The plant included a 3 ton electric furnace and a rolling mill to process the steel billets. The factory has been depending on local and imported scrap. So the steel industry started by the two stages together. But only one kind of finished steel was made. More electric furnaces were added later on. The Delta Steel Mills now has 6 electric furnaces of capacities ranging between 3 tons and 25 tons (table 3).

(1) Developing countries should not start the iron and steel industry by establishing blast furnaces to process local ores and to export pig iron or crude steel. This is because it is easier to export iron ore than pig-iron or crude steel. The export of these products is likely to encounter severe competition from the products of the industrialized countries.

The second steel plant was created in 1949 by the National Metal Industries Co. to produce concrete bars for the building industry. The plant included one rolling mill and one Simens-Martin steel converter of the capacity of 25 tons (table 3). A second rolling mill for light sections was added in 1960, and a second steel converter of 35 tons was added in 1965. This company concentrates on the production of concrete bars.

The third plant belongs to the Egyptians Copper Works of Alexandria: This Company added a small steel plant in 1953 to produce concrete bars. The company now has 3 Simens-Martin steel furnaces, two electric furnaces, and a number of rolling mills (table 3). It depends on imported scrap and pig iron from local and foreign sources.

In 1958, the first fully integrated iron and steel plant began production. This plant belongs to the Egyptian Iron and Steel Company. It smelts iron ore drawn from the Aswan mine. From the autumn of 1973, the plant drawn its ore supplies from the Baharya Oasis mine in the Western Desert, 300 Km. South West of Cairo. The steel plant includes 2 blast furnaces (400 tons/day each), 4 Thomas steel converters (17 tons each) and 2 electric furnaces (12 tons each). The last two furnaces process scrap collected from the rolling mills.

The plant has also a number of different rolling mills which produce various kinds of steel products such as heavy and light sections, reinforced concrete bars, angles, plates, sheets and galvanized sheets. The company produces almost all kinds of semi-finished and finished steel products.

El-Nasr Steel Pipes & Fittings was created in 1961 to manufacture tubes of different kinds. It draws its raw materials from the Egyptian Iron and Steel Co. El-Nasr Forgings Co. was created in 1964. It produces a variety of forged products, such as parts of the body of motor vehicles, railway wagons, tools and hard ware. chains and stampings. It gets its steel from the Egyptian Iron and Steel Company. El-Nasr. Castings Co. is specialized in the production of iron castings such as pipes for water and other purposes.

The Egyptian Iron and Steel Co. is the biggest among the iron and steel companies working in Egypt. In 1969/70, the value of its production was L.E. 24 million, which was almost equal to the value of the combined output of the other 6 companies. The number of workers amounted to 10 thousand, which was also equal to the combined number of workers of the other six companies.

Moreover, when the iron and steel complex is completed in 1975, the plants of the Egyptian Iron and Steel Co. will be integrated in the complex. The productive capacity of the iron and steel industry will be largely increased. The production of pig iron will increase from about 300 thousand tons to 1,750 thousand tons. Moreover, the production of crude steel will increase from 200 thousand tons (table 4) to 1.5 million tons. Also, the productive capacity of the finished steel products will be greatly increased. More details about this project will be given throughout this paper.

PRODUCTION PROCESS :

1 — The manufacture of pig iron (blast furnaces) :
Pig iron is produced by charging the blast furnaces with iron ore pellets, coke and some other materials. Several developments have been introduced into this process in order to reduce the cost of production of pig iron by reducing the cost of fuel.[1]

2 — The manufacture of steel ingots (steel converters) :
There are several processes for the production of steel ingots. The choice of the process is determined by :

a) the type of raw material used, i.e., the chemical composition of iron ore, the abundance or scarcity of scrap etc.;

b) the type of steel required, i.e., ordinary (or general purpose steel) or steel for special uses such as stainless steel, steel for the manufacture of hard-ware, or high-speed tools.

(1) For more details of these developments, see (UNIDO, Iron and Steel Industry, Bulletin No. 5, New York, 1969, pp. 11-12.

We shall give a brief description of the steel making processes with special emphasis on the oxygen (or L.D.) process.

a) The Bessemer process :

This process was invented by Sir Henry Bessemer in 1856. A blast of air(1) was blown through the molten pig iron. Carbon and silicon were burned out by the air, but were restored again by the addition of ferro-manganese or spiegeleisen. This process uses little scrap. It also takes shorter time, which reduces its consumption of fuel when compared with the open-hearth process.(2)

b) The open-hearth process (Simens-Martin) :

This process was invented in 1869. It has the following advantages :(3)

1 — Steel produced is of a more reliable type, as metal can be tested during conversion.

2 — This process uses a lot of scrap, so it is suitable for industrial countries which are rich in it.

c) The Gilchrist and Thomas process :

The two earlier processes could not originally process iron ore which contained a high proportion of phosphorous. As most of the iron ore in the world was phosphoric, so the use of the Bessemer and open-hearth processes was limited.

In 1879, Gilchrist and Thomas discovered that the phosphorous in the iron ore could be absorbed during conversion by the addition of cheap basic material such as limestone. Therefore, both former processes began to use phosphoric iron ore on a large scale. The steel produced is known as basic steel. The basic slag produced is used in agriculture as a cheap phosphoric fertilizer.

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(1) Now it is replaced or supplemented by oxygen.

(2) G.C. Allen, British Industries and Their Organization, London, Longmans, 1959, p. 99.

(3) Ibid, p. 102.

d) The electric-are process :

The use of electric furnaces has become widespread. This type of furnaces smelts scrap only. This process is economic on a small scale, especially when cheap electric power is available.

e) The Oxygen (or L.D.) process :

The discovery of the oxygen process was one of the most important discoveries in steelmaking in the post-war years. In this process, pure oxygen blast is passed through the molten pig iron to oxidize the existing impurities.

This process has the following merits over the existing open-hearth process :

1 — It converts pig iron into steel in a shorter time with the resultant saving in fuel costs.

2 — Its investment and operating costs are lower(1). For example, in a steel plant of a capacity of 500 thousand tons a year, the investment cost per annual ton is estimated at $ 35.70 compared with $ 53.30 for the open-hearth furnace. Production costs are $ 12.80 and $ 21.62 per ton for the two processes respectively.(2)

3 — It uses little scrap, so it is well suited for countries which are poor in scrap such as Egypt.

This process has rapidly replaced the open-hearth process. In the next few years, the oxygen and electric will be processes very likely to be the dominant steel processes in both developed and developing countries. The first process deals with the conversion of pig iron, and the latter with the bulk of scrap.

The developing countries, which are now building steel plants, are in a position to adopt these economic processes. In the meantime, the industrial countries find it difficult and costly to scrap their existing open-hearth furnaces.(3)

(1) UNIDO, Report of the Second Interregional Iron and Steel Symposium, New York, U.N., 1969, p. 93.

(2) UNIDO, Iron and Steel Industry, Bulletin No. 5, New York, U. N, 1969, p. 13.

(3) UNIDO, Report of the Second Interregional Iron and Steel..., p. 41.

In Egypt, the oxygen converters will be used by the large iron and steel complex which will start production late in 1973. It is planned to work at full capacity in 1975. It will include 3 oxygen converters (80 tons each). Thus in the next few years, most of the steel produced in the country will become oxygen steel.

However, the existing steel plants in Egypt include three types of steel converters, namely, Thomas, open-hearth, and electric furnaces (table 3). The Egyptian Iron and Steel Co. has 4 Thomas converters (17 tons each), which process pig iron coming from the blast furnaces. It has also 2 electric furnaces (12 tons each), to process scrap collected from the rolling mills. The remaining steel firms have electric and open-hearth furnaces which depend solely or mainly on scrap for their steel.

3 — The blooming and rolling process (the continuous casting process) :

The continuous casting process is another important development in the technology of blooming and rolling of steel. In this process a continuous stream of liquid steel is poured into a copper mould and cooled by water. When it solidifies it is cut to the required sizes for use in a finishing mill.

This process is superior and more economic when compared with the traditional method of casting ingots. It eliminates the ingot phase and its requirements. Thus it saves the capital cost of making ingots and cogging and rolling them into billets.[1] For example, in a plant of a capacity of 326 thousand tons of billets per annum, the investment cost per annual ton is $ 51.70 by the use of a blooming mill. It is only $ 11.40 by the use of the continuous casting process. Moreover, the production cost of converting a ton of liquid steel into billets, for the same size of plant, is $ 10.87 by the use of a blooming mill and only $ 3.77 by the use of the continuous casting process.[2]

(1) UNIDO, Report of the Second Interregional Iron and Steel..., p. 13 and p. 136; D. Burn, "Steel" in D. Burn, (edit.), Structure of British Industry (Vol. 1), London, Cambridge University Press, 1958, p. 266.
(2) UNIDO, Iron and Steel Industry, p. 14.

This process can be used in place of the existing blooming mill. It can also be used alongside with it, especially when the capacity of the steel converters exceeds the capacity of the existing blooming or slabbing facilities.

However, the continuous casting process is economic on a small scale, and so it suits the small and medium size steel plants. The developing countries establishing steel plants are advised to use continuous casting process alongside oxygen converters.

The continuous casting process will be used in the new iron and steel complex. Six units will be built alongside the existing blooming mills in the old steel factory which belongs to the Egyptian Iron and Steel Co.

4. RAW MATERIALS AND FUEL

The main raw materials used in the manufacture of iorn and steel are : iron ore, coke, limestone, dolomite, scrap and steel alloys. However, the first two are the most important from the point of view of quantity and value of the amounts used.

Iron ore :

Iron ore is not charged directly into the blast furnace. The metal content in the ore may be low. It quite often contains some undesirable impurities. It is, however, more economic to prepare the ore before it is sued. So the ore is subjected to certain processes before it goes to the blast furnace. These processes-which were developed in the post-war years — include sintering and pelletization.(1)

These processes aim at increasing the iron (or Fe) content in the ore. It should not be less than 60 or 65 per cent. Also, certain of the impurities should be eliminated. Moreover, iron ore fines cannot be charged into the furnace. So iron ore must be prepared in the form of small balls (called pellets) of equal shape and dimensions. These preparatory processes have managed to reduce the cost of production of pig iron. This is done by increasing the yield of the blast furnace, and by reducing the amount of fuel consumed.(2)

(1) They are also known by beneficiation of iron ore.

(2) For more details of these processes, see U.N., The World Market for Iron Ore, New York, 1968, pp. 6-12.

In Egypt, iron ore is so far used by the Egyptian Iron and Steel Co., it will also be used by the complex. The company has been depending on the Aswan mine since it began production in 1958. This mine is 800 Km. south of Cairo. It has a reserve of 25 million tons of iron ore. This ore has the following elements :[1]

46% Fe (or iron) content

18% Silicon

2% Phosphorous[2]

This type of ore is relatively poor in its iron content,[3] and has a high proportion of harmful impurities such as silicon and phosphorous. The annual production is 500 thousand tons. The mine is owned and run by the Egyptian Iron and Steel Co. itself.

Iron ore production from this mine was going to stop completely by the end of 1973. The old steel factory and the new complex will depend on the Baharya Oasis mine. It is situated in the Western Desert, 300 Km. south-west of Cairo. This mine has the following advantages over the Aswan mine.

a) The ore has better qualities; it contains 53% Fe content, 7% silicon and 0.5% phosphorous.[4] So it is richer in iron content and has lower proportions of harmful impurities.

b) The new mine has an assured reserve of 120 million tons.

(1) The Industrial Development Centre for Arab States (IDCAS), A survey of the Iron and Steel Industry in the Arab States, Cairo, 1970, chapter 3, p. 24 (in Arabic).

(2) Phosphorous content should not exceed 0.2%.

(3) The iron content is as follows in the ores of the following group of countries :
Algeria (52-56), Angola (64-65), Venezuela (63-68), India (55-69), Australia (60-67), France (30-32), W. Germany (27), Spain (48-53), Sweden (52-61), and U.K. (20-34). See U.N., The World Market for Iron Ore, 1968, Table 18, pp. 26-30.

(4) IDCAS, ibid. chapter 3, p. 24.

c) It is much nearer to the steel factories. This will reduce the cost of transport.

All these advantages will certainly help in reducing the cost of pig iron production.

Annual production of iron ore is expected to rise to 3.5 million tons; part of it will be exported. The ore will be carried to the factories by railways, which have been built between the new mine and the factories.

Coke :

All types of fuel are now being used by the iron and steel industry. Coke is being used in the blast furnaces for the reduction of iron ore. The amount used per ton of pig iron has been falling all the time, due to innovations in the iron and steel industry. Moreover, coke has been supplemented by gas and liquid fuel which are relatively cheaper.

The use of electric power has been increasing especially in electric furnaces and rolling mills. This source of power is important in countries which are poor in coal and oil but rich in cheap hydro-electric power, such as Egypt.

In Egypt, there is local coal. The iron and steel industry depends on imports for its coal. Originally, the steel industry had to import coke up to 1963, when the coke industry began production. The coke plant gets its coal from abroad. It produces about 330 thousand tons,(1) mostly (300 thousand tons) taken by the Egyptian Iron and Steel Co.

A ton of coke is sold to the steel company at L.E. 16. This price is considered high by the user company. The price of imported coke is about L.E. 13 per ton C.I.F. Alexandria. So the price of home-produced coke is about 20% higher than the price of imported coke. Moreover, the coke company is pressing hard to raise its selling price to L.E. 25 per ton, or by about 56%. The new price, if it is achieved, will be 90% above the world price.

(1) Capacity of the coke plant will be enlarged to meet the expected big-demand from the iron and steel complex.

The ocke company is complaining that it is nuable to cover its costs. The reason is that the coke company is unable to make full use of its coke-oven gas. Only a small part of this gas is sold to the Egyptian Iron and Steel Company, which uses it in its blast furnaces. Another small part is used by a small ammonia plant producing fertilizers. But the bulk of the coke-oven gas is wasted.(1)

Unless this gas is fully used, for example, in the manufacture of nitrogenous fertilizers and as a fuel in other industries, the cost of coke will remain high. In this case, there is a possibility of raising the selling price of coke which will appreciably raise the cost of pig iron.(2)

5. COSTS OF PRODUCTION

Broadly speaking, costs of production are classified into the following groups :

1 — Raw materials and supplies; it may include the cost of power and fuel.

2 — Labour; it includes all wages and related payments, but it does not include the wages of the maintenance staff.

3 — Capital charges; it includes depreciation, labour and materials for maintenance, the normal remuneration of capital and miscellaneous charges, such as short-term interest and insurance charges.

As the iron and steel industry is a heavy industry, so the weight of the capital charges is large. Table 5, shows that

(1) In Europe, coke-oven gas is facing a severe competition from the cheap natural gas. So the coking industry, is facing the problem of selling its gas at suitable prices. Moreover, its loss of revenue is so great that it could not offset it by raising the price of coke. (OECD, Problems and Prospects in Coking Industry, Paris, 1972, pp. 11-12.

(2) The cost of coke constitutes 25% of the total cost of production of pig iron. Every ton of pig iron requires a ton of coke. However, coke consumption is expected to fall to 600 Kg. when the iron ore from the Baharya mine. is used.

its share amounts to about 60% of total production costs for a steel plant of the size of 50 thousand tons per annum. It rises to about 66% for the larger sizes. If maintenance charges are added to capital charges the latter's share will rise to about 70% of the total cost of production. The share of raw materials (including fuel) and labour is only 30%.

It should be pointed out, however, that the example of the cost structure given by table 5 above is related to the cost of finished steel products. In this case, the size of capital charges is relatively great compared with the lower stages of production such as crude steel or pig iron. The cost structure of pig iron manufacture of the Egyptian Iron and Steel Company is approximately as follows :[1]

Cost Item	%	Cost item	%
Iron ore and other materials	20	Wages	19
Coke	25	Capital charges	24
Fuel	8	Miscellaneous	5
		Total	100

These figures show the big share (53%) of the raw material (including coke) and fuel in the stage of pig iron manufacture.

Level of production costs :

The level of production costs of the Egyptian iron and steel industry is relatively high for the following reasons :

1 — Higher Costs of investment. It is estimated to be 25%, at least, above the European level.[2]

2 — Higher costs of infrastructure which are carried out by the steel factories. The Egyptian Iron and Steel Co., for example, had to build roads, houses, power stations, railway tracks, and the like. The New Iron and Steel Complex will also be burdened by a big share of similar infrastructure projects. For example, the

(1) Figures supplied by the company.
(2) This is mostly due to : 1) transport costs of machinery and
2) high interest rates on loans.

total cost of the project is estimated at L.E. 310 million; of which L.E. 208 million will be allocated to the expansion of the iron and steel capacity. The remaining L.E. 102 million, or about one-third of the total cost of the complex, will be spent mostly on related infrastructure projects.

3 — The use of lower quality iron ore (44% Fe content)(1) with a high phosphorous content (2%).

4 — The high cost of coke. The selling price of local produced coke of L.E. 16 per ton is about 20% higher than the price of imported coke.

5 — The use of small scale plants. This applies to all the existing iron and steel plants, and to all stages of production, namely, pig iron, crude steel and finished steel. We shall deal with this problem in detail later on.

6 — The existence of high rate of unused capacity in the rolling mills. In the existing steel plants, all blast furnaces and steel converters are working at full capacity. The finishing stages of steel making with a high degree of unused capacity, as we shall see later. This is due mostly to the shortage of crude steel because of inadequate productive capacity of it. However, all factories are now extending their steel capacity. Besides, the creation of the large iron and steel complex.

Factors leading to lower costs in future:

On the other hand, there are positive factors which are going to work for lower costs of production of iron and steel in the near future. These factors include :

(1) This proportion of iron content in the Egyptian ore is lower than the iron content in the ores of many countries (see footnote p. 17). But it is higher than in some industrial countries such as Britain, W. Germany and France. But these countries depend mostly on imports of rich ores. Moreover, if these countries use poor ores, the expected rise in the cost of ore, will be compensated by : 1) higher productivity of labour, and 2) greater economies of large production.

1 — The use of relatively better iron ore from Baharya oasis, which is richer in Fe content (53%) and has little phosphorous (0.5%) in it. This will help in reducing the cost of transport, the cost of beneficiation of iron ore, and the cost of coke and fuel. The consumption of coke per ton is expected to fall from 1000 Kg. to 600 Kg or by 40%(1).

2 — The use of larger production units by the complex. This includes all production stages, namely, pig iron, crude steel and finished steel.

3 — The use of up-to-date technology which includes the introduction of oxygen converters and continuous casting process. This will reduce both the capital and operating costs.

A part of this expected fall in the cost of production will not be achieved if the new complex works with a large degree of unused capacity. The higher the degree of utilization of production units of the complex, the lower will be the cost of production. The problem of unused capacity will be dealt with later on.

6. SIZE OF PLANT AND ECONOMIES OF SCALE :

We mentioned above that the level of the cost of production in partly affected by the size of plant. Generally speaking, as the size of plant increases the unit cost of production tends to fall as shown by table 5. This table illustrates the components of the cost of production, and the variations in each component at different scales of production.

It shows that the cost of production of a ton of finished steel falls from $ 209 at a capacity of 50 thousand tons, to $

(1) In the main O.E.C.D. countries, a ton of pig iron requires 500 to 550 Kg, except in Japan where it requires 430 Kg. only. However, the rate of coke consumption depends on : 1) modernization of iron making factories, 2) nature of iron ore, and 3) the quality or coke available. (O.E.C.D. Problems and Prospects in the Coking Industry in the O.E.C.D. Countries, Paris, 1972, p. 21).

159 at a capacity of 250 thousand tons, or by 25%. As capacity rises to 500 thousand tons, unit cost falls by 35% over the original small scale of production. When capacity reaches a million tons the fall in cost is 39%. It is obvious that while a bigger size of production permits a fall in cost, most of this fall is achieved at the size of half a million ton.

Moreover, most of the fall in unit cost of production, in the scale of 500 thousand tons. is due to the fall in investment and labour costs. The decline in capital costs is 29% (and 32% for capital and maintenance charges), while the fall in labour cost is 75%. The drop in the cost of raw materials and fuel is very little. It is only 10% for the respected sizes.

In general, the amount of raw materials and fuel increases almost in the same proportion as the increase in production.(1) If there is a minor fall in the cost of raw materials, it is mostly due to bulk buying and shipping, and to reduced waste in handling.(2) There is also a possible saving in fuel. As the capacity of the blast furnace is increased its volume increases faster than its wall area; so there is little loss in radiation.(3) So the saving in the cost of fuel is more obvious in the case of large blast furnaces.

The big saving in labour costs, mentioned above, is due to the fact that the modern steel plants use continuous processes, automated machines, and lately the computer. Therefore, most of the labour engaged is of a supervisory nature. Their number becomes independent of the size of operations, and remains unchanged or changes a little as the scale of production increases(4). So when the scale of operations is enlarged the labour cost per unit of output declines substantially.

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(1) U.N., "Problems of Size of Plant in Industry in Under-Developed Countries," Industrialization and Productivity, Bulletin No. 2, 1959, p. 9.

(2) U.N., "Plant Size and Economies of Scale," Industrialization and Productivity, Bulletin No. 8, 1964, p. 56.

(3) D. Burn, "Steel" in D. Burn (edit.),- Structure of British Industry (Vol. 1), p. 264.

(4) U.N. "Plant Size and Economies of Scale", Industrialization and Productivity, Bulletin No. 8, p. 57.

As the iron and steel industry is composed of several production stages or processes, so it is interesting to examine the minimum economic size of each stage, and so the magnitude of the economies of scale and the scale of production which gives most of these economies.

1 — The stage of pig iron making (blast furnace) : The production of pig iron is only economic when it is done on large scale. In the present state of technology, a blast furnace producing less than 800 tons a day (or 240 thousand tons a year)(1) is considered a small furnace, from 800 to 1,500 tons a day a large furnace.(2)

Furthermore, economies of scale are to be obtained with every increase in the size of the furnace until it reaches 1.3 million tons a year(3). But even if the size of the market is large enough to match this big furnace. It is considered risky and hazardous for an integrated plant to depend for its pig iron on one blast furnace only. As the blast furnace gets out of commission periodically for month or so to be re-lined, and frequently during the day to supply batches of the metal.(4) So there must be more than one furnace, two for instance, each of a capacity of 65 thousand tons a year.

The capacity of the blast furnaces in the Egyptian Iron and Steel Co., is 400 tons a day (or 120 thousand tons a year) for each. So both of them are considered very small, and so the economies of large scale

(1) The industrial year is only 300 days; the rest is lost in stoppage for maintenance and repair. Yet the industrial year can be extended by squeezing the days of repair. But this is not good in the long run, as it cuts short the life of machines.

(2) UNIDO, Report of the Second Interregional Iron and Steel Symposium, p. 124.

(3) UNIDO. Iron and Steel Industry, Bulletin No. 5 New York, 1962, p. 20.

(4) D. Burn, op. cit., p. 264.

production are not achieved.[1] The new blast furnaces are larger, each of a capacity of 1000 tons a day (or 300 thousand tons a year). So they are considered medium size furnaces. Therefore, a part of the economies of large scale production is achieved.

2 — The stage of steel making (steel converters) : The predominant process for the manufacture of steel nowadays, is the oxygen process. This process is only economic if it is performed on large scale; of at least 700 thousand tons year. Moreover, it is very uneconomic if the scale of production is below 350 thousand tons a year[2]. On the other hand, the electric are furnaces are economic on a small scale provided that there is cheap electric power.

In Egypt, the existing Thomas converters in the Iron and Steel Co., are of a capacity of 50 thousand tons a year for each.[3] So they are very small. But the new oxygen converters, which are now under construction, are of a capacity of about 350-400 thousand tons a year for each converter. So the new converters can be considered relatively more economic.

3 — The stage of semi-finished and finished steel (the rolling mills) :

Generally speaking, the rolling process includes the production of flat and non-flat products. The non-flat products can be produced economically on a relatively smaller scale. Machinery used is flexible and can be adapted to produce different products. A rolling mill producing shapes usually has a high degree of flexibility. Also, a rolling mill producing concrete bars of an annual capacity of 30 thousand tons can be as economic as a rolling mill 10 times larger[4]. The

(1) However, small blast furnaces are economic provided that there are two conditions : a) rich iron ore and b) cheap coke. Both these conditions do not exist in Egypt.

(2) UNIDO, Report of the Second Symposium..., p. 124.

(3) For more details of capacities of the existing steel converters of all companies, see table 3.

(4) UNIDO, Report of the Second Interregional Iron and Steel Symposium, p. 124.

production of tubes is also economic on a small scale and does not present any problems in this regard.

So one may say that the rolling mills producing non-flat products are mostly economic. For example, the scale of production of concrete bars in all steel companies is economic. It ranges between 30 thousand to 70 thousand tons a year in the producing companies(1).

For flat products, the problem of economies of scale is complicated. This is mainly because the type of machinery used by the rolling mills is inflexible. So a rolling mill producing flat products, i.e., sheets, plates, tin-plate, etc. is only economic on large scale(2).

In Egypt, the rolling mill producing plates in the Iron and Steel Co., of annual capacity of 75 thousand tons, is therefore operating at an un-economic scale. But the strip mill which has a capacity of 300 thousand tons (to be extended to 500 thousand tons in 1975) is certainly operating at an economic scale. Moreover, the expansion in the capacity of all rolling mills producing flat and non-flat products will, undoubtedly, make possible a fuller achievement of economies of scale.

7 — CAPACITY UTILIZATION

In developing countries, the creation of capital intensive industries such as iron and steel, is always accompanied by the appearance of a significant margin of excess capacity. Needless to say that the presence of unused capacity of such a degree will adversely affect costs of production, which are already high. Such a big rise in iron and steel costs will raise the cost of production of the large number of industries using iron and steel products. This will undoubtedly hinder the export potentialities of all these industries.

The presence of such excess capacity in the iron and steel industry can be traced to one or more of the following reasons :

1 — The iron and steel industry is distinguished by the presence of a high degree of indivisibilities. The productive capacity

(1) IDCAS, op. cit., chapter 2, p. 124.
(2) UNIDO, Report of the Second..., p. 125.

of pig iron, crude and finished steel cannot be increased smoothly or continuously. It can only be increased by discontinuous jumps, which are sometimes substantial. This is due to the economies of a big machine, a blast furnace or a steel converter.

2 — The optimium size of plant has been increasing all the time. Moreover, the manufacturers of steel plants produce large units which suit the markets of the industrial countries. The developing countries have to buy these large plants. As there is no technology designed specifically to suit the small needs of the developing countries.

3 — As the demand for iron and steel is increasing rapidly, the capacity of the new plants should be designed with the presence of a suitable degree of excess capacity. So the size of plant selected should be large — but not too large — for the present level of demand. The magnitude of excess capacity will be diminished gradually with every growth in demand until capacity is fully utilized. Then productive capacity should be extended to meet any further growth in demand.

4 — The presence of unused capacity, in all or part of the industry, may be caused by the shortage of raw materials and supplies. A general shortage of raw materials can be due to on of the following factors :

(a) "inadequate supply of indigenous materials;

(b) lack of foreign exchange for importing raw materials;

(c) high cost of raw materials;

(d) uncertain deliveries of raw materials;

(e) prohibitively expensive or poorly organized transport of raw materials;

(f) inferior quality of raw materials;

(g) variations in the quality of raw materials and lack of standardization."(1)

(1) UNIDO, "Industrial Excess Capacity and its Utilization for Export", Industrialization and productivity, Bulletin No., 15, 1970, 9. 66.

In the case of the iron and steel industry in Egypt, there is no overall existence of excess capacity. The excess capacity is only found in some sections of the industry. The other sections of the industry work at full capacity, sometimes intensively by reducing to minimum the time allocated for maintenance and repairs.

Generally speaking, all iron and steel firms complain from the severe shortage of intermediate steel products such as blooms, slabs and billets. This is due to :

1 — The smaller capacity of the existing crude steel production.

2 — The imbalance between the successive stages of production in the industry. In other words, the presence of relatively larger rolling facilities compared with a smaller steel productives facilities.

3 — The shortage of foreign exchange to import the required amounts of crude steel products for the rolling mills.

Table 6 shows the magnitude of unused capacities in the blooming and rolling mills. The degree of unused capacity is 40% for blooms and 70% for slabs. This section of the industry sypplies the rolling mills with the intermediate products which are to be processed into final steel products such as heavy and light sections, angles, wire rods, sheets plates, tinplate, etc.

In the rolling mill section, there is also large unused capacity; 53% for the heavy sections and 35% for the light sections. The strip mill works at one-third of its capacity and depends on slabs of steel imported from the Soviet Union.(1) This mill will, in the near future, get its slabs from the complex.

When the iron and steel complex starts production, it will supply the rolling mills with their requirements of steel. So from this year (1974), the degree of utilization of capacities of

(1) Half the product of this mill is exported to the Soviet Union according to an agreement with Egypt.

blooming and rolling facilities will be gradually increased until they are fully used towards the end of the seventies.

The question remains, however, as to whether there is going to be excess capacity in the industry when the complex is completed by 1975. It is estimated that by 1975 the maximum capacity of pig iron will be 1.75 million tons, and that of steel 1.5 million tons. A surplus of pig iron of 250 thousand tons will be expected to appear; it will be exported to the Soviet Union according to an agreement with it. The remaining pig iron will be used in the production of steel which is expected to be 1.5 million tons.

A part from this amount of pig iron, there is no indication of a possible existence of any significant margin of surplus capacity in the industry. This is due to the fact that consumption of steel has been increasing very fast. It increased from an annual average of 262 thousand tons during 1958-60 to 554 thousand tons a year during 1961-65, and to 774 thousand tons a year during 1966-70[1] (table 2).

Moreover, consumption is bound to increase even further if the development programmes are resumed again at their full scale in the near future. Furthermore, there is a suggestion that consumption of steel is going to exceed production early in 1980's. An extension of productive capacity will then be necessary.

8 — DEGREE OF VERTICAL INTEGRATION :

The iron and steel industry is characterized by the presence of a high degree of vertical integration. This means that each firm is engaged in more than one productive process. This integration may be backward towards the raw material supplies by owning and running iron ore and coal mines. It may also be forward by running plants which are engaged in the production of bridges, ships, railway wagons, locomotives, oilfield equipment, machines of different kinds, tools, etc.

(1) These figures include all steel products : crude, processed and highly sophisticated machinery and transport equipment from local and foreign sources.

In the following, we are going to show all processes of production and distribution of iron and steel. These processes are as follows :[1]

Process	Product	Plant
1. Mining	Coal, iron ore, and limestone	Mines, quarries, steamships, docks, railroads.
2. Preparation of materials	Coke ore concentrates	Coke ovens "Beneficiation" plants.
3. Smelting	Pig iron	Blast furnaces
4. Refining	Ingot steel	Open-hearth furnaces, Bessemer converters, oxygen converters, electric furnaces.
5. Rolling	Semifinished steel (blooms, billets, bars, slabs, tube rounds, and rods)	Rolling mills
6. Finishing	Finished steel products (sheet, strip, plates, bars, rails, tin-plate, pipe, wire, structural shapes.)	Rolling mills, tin-plate, mill, pipe mills, and a great variety of other finishing mills.
7. Fabrication	Manufactured steel products (ships, woven wire fence, buildings, bridges, oil field equipment.)	Manufacturing plants and contracting offices of all sorts.
8. Distribution		Warehouses and salesmen.

Each firm may perform some of the above-mentioned processes. Yet there is a strong trend towards concentration of more processes under the control of one firm. The integration of processes has certain advantages as follows :

"a) decreased marketting expenses;
b) stability of operations;
c) certainity of supplies of materials and services;
d) better control over product distribution;
e) tighter quality control;
f) prompt revision of production and distribution policies;
g) better inventory control;

(1) Quoted from L.W. Weiss, Economics and American Industry, New York, John Wiley, 1961, p. 271.

h) additional profit margins or the ability to charge lower prices on final products."(1)

Over and above these advantages of vertical integration, there are more advantages which can be obtained by the firm which combines a number of production processes in one place. First, if the firm combines together in one location blast furnaces, steel converters and rolling mills, the hot metal can pass from the blast furnace to the steel converters and from these to the rolling mills. It avoids the cost of reheating the materials.(2)

Secondly, gases and waste heat coming from coke ovens, blast furnaces and steel converters, can be used to provide heat and fuel to the rolling mills, power stations, and the like(3).

Both these advantages of integration of processes will undoubtedly help in reducing the cost of fuel, which represents a high proportion in the total cost of production.

Thirdly, there is a large economy in the transport costs within an integrated steel plant. This is due to the fact that iron and steel products lose part of their weight during the subsequent production processes. For example, only 70 to 75% of steel ingot is made into finished product. The rest is scrap which is recorded and used again in the manufacture of steel.(4)

In Egypt, the iron and steel firms started production by combining two basic processes, namely the smelting of scrap in small electric furnaces and the rolling of crude steel into finished products, mainly concrete bars for building purposes. It was only in 1958, when the Egyptian Iron and Steel Co. started production, that the degree of vertical integration in the industry was increased. The vertical integration extended backwardly towards the source of raw materials (iron ore, limestone and dolomite) passing by the manufacture of pig iron.

(1) Quoted from K. J. Blois, "Vertical Quasi-Integration", journal of Industrial Economics, July 1972, pp. 253-4.

(2) Weiss, op. cit., p. 272.

(3) Allen, op. cit., p. 104.

(4) Burn, op. cit., p. 264.

This firm performs the following processes :

1 — mining iron ore, limestone and dolomite;

2 — preparation of ore ;

3 — smelting iron ore in the blast furnaces;

4 — the manufacture of steel in the steel converters;

5 — the rolling of steel into semi-finished products such as blooms, billets, slabs and bars;

6 — the manufacture of multiple of finished steel products such as heavy and light sections, angles, bars, wire, tin - plate, sheets, plates, rails, etc. The Company does not produce its coke ; it gets it (together with coke oven gas) from the near by coke company.

So we may say that the Iron and Steel Co. is fully integrated especially backwardly. Its operations stop at making a number of finished steel products which can be used directly by a large number of industries such as, building and construction; railway wagons, food canning, house-hold durables, motor cars, electricity generation, tools, etc.

Other firms are highly specialized. They concentrate on only one production stage. For example, the Nasr Co. for Tubes is specialized in the manufacture of different kinds of tubes. It gets its raw materials from the Iron and Steel Co. The Nasr Co. for Forgings gets its raw materials from the Iron and Steel Co., and processes them into parts of car bodies, railway wagons, tools, etc.

So we may classify the iron and steel firms working in Egypt into three groups as far as vertical integration is concerned. The first group is specialized mainly in one production process, namely, the manufacture of tubes, forges, or iron castings. The second group[1] combines plants which are mainly engaged in two successive processes, namely, the manufacture of

(1) This group includes : The Delta Steel Mills, The National Co. for Metal Industries Co. and the Copper Works.

steel from scrap and then rolling it into finished steel products such as reinforced concrete bars. The third group includes the Egyptian Iron and Steel Co. (which will be integrated into the new iron and steel complex).

This company and also the complex are highly vertically integrated especially backwardly. Their activities include the first six production processes in the table above, except the manufacture of coke.

However, the gradual creation of the iron and steel industry, as mentioned above, is natural and suitable for a developing country, like Egypt. It is costly and uneconomic to start the iron and steel industry by creating at once a fully integrated plant, for the following reasons :

First, the capital requirements for mine, blast furnaces, steel converters, and rolling mills, are substantial and beyond the means of many developing countries. Secondly, the scarcity of skilled labour during the early history of the industry. So it is unwise to distribute the small number of available skilled labour thinly on the various stages of production. Thirdly, the market for the various steel products is small at the beginning. It gets bigger under the pace of industrialization.

9 — LOCATION

All steel factories — sxcept the plant of the Copper Co. — are located in the neighbourhood of Cairo. Moreover, the large complex is being built in Helwan, a suburb 24 Km. south of Cairo, where the plants of the Egyptian Iron and Steel Co. are located. So we may say that the iron and steel industry and its extensions are highly concentrated in the Greater Cairo area. It is only the Copper Co. which is located in the port of Alexandria. The merits of these two locations will be examined.

A location near Cairo has the following advantages :

1 — Most of the industries using iron and steel products are heavily concentrated in the Cairo area. So the final steel products, which are mostly coming from the

Egyptian Iron and Steel Co., are consumed by processors a few kilometres away.

2 — A location near Cairo is favoured for its proximity to the labour market, where the neuclus of skilled labour and professional cadres is found.

3 — Raw materials : The basic raw materials are coal, iron ore and scrap. The first is imported via the port of Alexandria. Coal, until now, is carried by railways from Alexandria 200 Km. to the north to the coke company in Helwan.

By 1975, coal coming from Alexandria will be carried by the Nile. This will certainly help in reducing the cost of transport of coal and the cost of coke in the last analysis. Moreover, the use of water transport will reduce the pressure on the congested railways, and make use of a cheap means of transport so far neglected.

Iron ore has been drawn from the Aswan mine, 800 Km. south of Cairo. By the end of 1973, the existing blast furnaces together with the new ones, depend on iron ore from the Baharya mine, 300 Km. south-west of Cairo. The new mine has the following advantages :

a) higher iron content ;

b) lower proportion of harmful impurities; and

c) nearness to the iron and steel factories.

Most of the scrap in Egypt is concentrated in the Cairo area. Yet its supply is not sufficient for the needs of the big users of scrap such as the Delta Co. and the National Co. for Metal Products. These companies depend on scrap for their electric furnaces. They complain from the shortage of local scrap, and have to supplement their requirements through imports. The Egyptian Iron and Steel Co. depends on scrap collected from the rolling mills. It sells the surplus to other users.

From the above, we come to the conclusion that the location of the plants of the Egyptian Iron and Steel Company in Helwan, near Cairo, is favourable in many respects. This is contrary to the criticism which was raised during the fifties, when Helwan was chosen as a place for the new plants. The critics wanted the plants to be located in Aswan besides the ore mine.

This location is unfavourable for the following factors :

1 — Aswan is 1000 Km. away from the port of Alexandria where coal and other materials are imported.

2 — The market for steel is mostly in the Delta, where the industries — old and new — are concentrated especially in Cairo and around it. Moreover, it is cheaper to transport iron ore from Aswan to Cairo than to transport final steel products.

3 — The bulk of the skilled labour and professional persons is concentrated in the Delta. It is costly and troublesome to drag a large number of people to work in the Aswan area.(1)

It is economically and socially desirable to move industry to labour and not the vice versa.

4 — The iron and steel industry depends for its power on oil, gas, electricity and coal. All these sources of energy, except electricity, can be easily obtained from a location near Cairo. Hydro-electricity from the Aswan High Dam is transmitted to Cairo and Alexandria. So the iron and steel plants located in Cairo or Alexandria can get their requirements of electric power transmitted from Aswan. Moreover, the complex will also depend on natural gas discovered in the north of the Delta.

5 — If a location in Aswan had been chosen — just because the ore was there — it would have been impossible to use the better Baharya ores (300 Km. south-west of Cairo).

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(1) The large fertilizer plant (KIMA) in Aswan is facing similar problems. The workers get higher wages and other benefits including cheap accomodation and free travel to Cairo. But they complain of being far away from their homes in the north of the country.

The plant would have continued to use the poor ores of Aswan.

Now we must conclude by a few words about the location of steel plants in Alexandria. This location is favourable for the same reasons as the location in Cairo. Besides, the ease with which exports of steel products can be made in the future.

Conclusions

The creation of the iron and the steel industry in Egypt is justified on several grounds. These include : employment, utilization of local raw materials, saving in foreign exchange, stimulation of other related industries, and finally the appearance of a host of external economies.

Production is highly concentrated in the hands of a few fairly large firms. The production units, at the different stages of production, are mostly small, with the resultant loss of the economies of large scale production. However, the new extensions, especially the iron and steel complex, will include larger production units in all stages of production. Moreover, the new extensions adopt new production techniques, which are likely to give higher yields and to help in reducing production costs.

Production costs are high, but are likely to fall as a result of the use of better iron ore, more modern techniques, and the production on larger scales. However, the mentioned decline in cost is not likely to take place, if production capacities are not fully utilized.

At present, pig iron and crude steel processes are fully utilized, while the rolling mills are operating with large margins of unused capacities. This is mostly due to shortage of steel. However, this problem is likely to be solved when the iron and steel complex is completed in the near future.

Although, the production capacity of pig iron and steel (crude and finished) is now being largely increased, there is no indication of any expected big margin of surplus capacity. This is due to the rapid increase in steel consumption. Moreover, capacity should be designed to meet any growth in demand in the near future. Therefore, any excess capacity which is going to appear when the complex is completed, is likely to disappear a few years later. A new extension in production capacity will be necessary.

All iron and steel plants are concentrated near Cairo, except one in Alexandria. Their location is favourable. Nevertheless, Alexandria should be given a bigger share of any new steel plants to be erected in the future. Alexandria is favoured for the ease and economy in transport costs of steel exports, and imports of raw materials for the industry.

Statistical Appendix

Table 1

Percentage Distribution of Rolled Steel Consumption in Developing Countries (1962-1964)

Country	Railways material	Heavy & light sections	Plates	Sheets	Tubes and fittings	Tin plate	Wire rods
Egypt	12	40	3	9	18	7	–
India	10	38	14	19	n.a.	4	–
Iran	–	46	3	17	26	2	–
Colombia	2	28	4	16	7	6	7
Iraq	3	69	3	9	10	3	–
Brazil	3	30	8	31	3	1	9
Venezuela	–	29	3	10	21	11	5

Source : The European Steel Market, ECE, Geneva, and Statistics of World Trade in Steel, ECE, Geneva (various years).
Quoted by E.C.E. "Iron and Steel Industries", Industrialization and Productivity, Bulletin No. 13, p. 81, table 13.

Table 2

Egypt-Apparent Consumption of Steel
(Expressed in terms of crude steel)
(Thousand metric tons)

Year		Total	Per capita Kg.
1950-52	(average)	260	12.6
1953-55	"	275	12.2
1956-58	"	231	9.7
1958		243	10.0
1959		217	8.6
1960		326	30
1958-60	(average)	262	16.2
1961		373	14
1962		474	13
1963		439	16
1964		693	24
1965		791	27
1961-65	(average)	554	19
1966		825	27
1967		758	25
1968		665	21
1969		702	22
1970		921	28
1966-70	(average)	774	24.6

Source : U.N., Statistical Yearbook (various issues).

Table 3

Certain Iron & Steel Companies Working in Egypt in 1970

Company and plant	First year of production	Blast Furnaces No.	Blast Furnaces Capacity ton/day	Steel converters No.	Steel converters Type	Steel converters Capacity (ton)
1. The Iron and Steel Co.	1958	1	400	2	Electric	12
	1960	1	400			
	1958 } 1966 }			4	Thomas	17
2. The National	1949			1	Simens-Martin	25
Metal Industries.Co.	1965			1	Simens-Martin	35
3. The Delta Steel Mills	1947			2	Electric	3
	1953			1	"	12
	1956			1	"	18
	1970			1	"	25
1. The Egyptian Copper Works	1953			2	Simens - Martin	25
	1970			1	Simens-Martin	50
	1970			1	Electric	25
	1970			1	Electric	5

Source : IDGAS, A Study on the Iron & Steel Industry in the Arab States, Cairo, 1970, chapter 2, pp. 7-8.

Table 4

Production : Pig Iron, Crude Steel and
The main Steel Products (thousand metric tons)

Year	Pig iron	Crude steel (1) ingots	The main steel-products			
			Wire rods	plates (2)	Railway materials(3)	Plain wire
1958	34	28	n.a.	n.a.	n.a.	n.a.
1959	117	112	130	16	28	6
1960	143	136	160	25	32	7
1961	174	156	176	31	25	7
1962	176	188	189	33	41	8
1963	205	194	197	29	48	8
1964	192	177	187	35	66	6
1965	200	179	162	29	94	12
1966	215	195	176	37	110	13
1967	220	200	176	60	132	12
1968	220	190	203	42	155	10
1969	300	190	213	45	148	11
1970	300	227	n.a.	41	n.a.	13

Sources : U.N., Statistical Yearbook (several editions) and U.N., The Growth of World Industry, Vol. II, (several editions).

(1) Crude steel includes crude steel for casting.

(2) Medium 3 to 4.75 mm and heavy plates over 4.75 mm.

(3) Including light and heavy sections.

Table 5

Production Cost of Finished Steel for Different Scales of Production, Latin America (1948 U.S. Dollars)

Components of cost per ton	Capacity of plant (thousand metric tons a year) 50		250		500		1,000	
	Dollars	%	Dollers	%	Dollars	%	Dollars	%
Raw materials	33.84	16	31.26	19	31.26	23	25.68	20
Labour	32.00	15	15.20	10	8.57	5	6.60	8
Capital charges	122.93	59	101.20	64	87.10	65	85.05	67
Maintenance and Miscellaneous	20.59	10	11.11	7	10.57	7	9.83	5
Total cost	209.36	100	158.77	100	137.50	100	127.16	100
Total investment Per ton	492		405		348		340	

Source : U.N., Economic Commission for Asia and far East, Formulating Industrial Development,
Programmes, p. 44. Quoted by U.N., Productivity and Industrialization, Bulletin No. 8, 1964, p. 61.

Table 6

The Rate of Unused Capacity in the Iron and Steel Industry in Egypt (1970) (thousand metric tons a year)

Production Department	Capacity 1	Production 2	Unused capacity 3
Blooms	320	190	40
Slabs	50	15	70
Heavy sections	112	60	47
Light sections	80	52	35
Plates and sheets	57	52	8
Strips	300	100	67
Tin-plate	45	30	34

Sources : 1) Industrial Development Centre for Arab States (IDCAS), A Study of the Iron and Steel Industry in the Arab States, Cairo, 1970, chapter 2, p. 24 (in Arabic).
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A COMPREHENSIVE THREE-LEVEL DEVELOPMENT PLANNING MODEL*

A Practical Decentralization Planning Approach For the Underdeveloped Countries

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ABSTRACT :

The need for well-defined approaches to the problems is as acute as the problems confronting the underdeveloped countries. The various actors in the state of the underdeveloped countries; the politicians, the economics, the administrators, and the sociologists have attempted to see the problems concerned in their own way. It is the aim of this paper to elaborate a decentralization practical approach to national economic planning in underdeveloped countries. An attempt is made here to establish a self-consistent formal planning model by utilizing mathematical programming, input-output, and cost-benefit analysis. Corresponding to the national, sectorial, and project level the model

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proposes and integrated system consisting of a multisectorial model, sectorial models, and a suitable criterion for project evaluation. The interrelationships among the sectors and the feedback between the variables of the whole system are being considered as well. In one version of the model the functional equations consist of variables relating to different points of time, and in this sense the model may be used to formulate a multi-period plan.

The model does not approach the problem of optimal planning from the private point of view, but instead it tackles the problem from the national point of view by ascertaining the role of state in national economic planning. The state intervention is created by the existence of economic, social, and political conditions of the underdeveloped countries. The activities of the private entrepreneur, however, may be affected to follow the policy of the state by a system of incentives and disincentives.

In is not the aim of this paper to claim that the proposed planning approach is applicable in all underdeveloped countries. This is due to the fact that there exists no universally accepted concept of the "underdeveloped countries." However, the model in its general form is flexible enough to be modified for particular application if necessary.

I. INTRODUCTION :

Very broadly, to accelerate economic growth in the underdeveloped countries(1) two ways are possible; Firstly, to increase the productivity of the resources in use by reallocating them in a more efficient manner; i.e. to minimize the waste of the available resources. Secondly, to create new productive capacity by utilizing the idle as well as new productive resources. The first is a reform of the economic structure whereas the second is a capital accumulation process. And while the former does

(1) "An underdeveloped country may be generally defined as a country which due to lack of capital goods and to the low level of knowledge and technical ability of the bulk of its population is unable to provide productive employment for all those who are otherwise able and willing to work. Except when such a country is endowed with exceptionally valuable natural resources, such a state will also result in a low standard of living." Al-Saadi, S.Z. [1], pp. 5-6.

not necessarily require new capital, the latter needs additional capital. It is to be emphasized that the efficient allocation of resources is necessary but not sufficient to achieve the targets of economic development, since this process would stabilize at a certain level of economic activities whereas economic development implies a continuous process of growth over time. However, both processes i.e. the creation of new productive capacity and the efficient allocation of resources are essential in the process of economic development.

Economic development springs from demand for necessities and ever-increasing human wants in relation to the scarcity of the economic resources. Hence the efficient utilization of these scarce resources is the essence of any social and economic development policy. And thus the only rational investment decisions would sustain the pace of development. In practice this fact creates the need to establish certain criteria for investment decisions at different levels of the economy and are to be applied for both private and public enterprises within a consistent framework of a comprehensive national plan.

In underdeveloped countries it is generally accepted that structural economic and social changes are required as preconditions for development. Such changes, however, cannot be carried out by the "weak" private entrepreneurships through the "imperfect" market system. Hence the state has to play a leading role in the course of economic development. In is of course acceptable too that the public and private activities have to be regarded as complementary and interrelated rather than mutually exclusive. But it is the state and not the private entrepreneur who should take the necessary measures and actions (in terms of providing the required level of investment, controlling the process of capital formation, influencing the level of private consumption) against the existing low level of per capita income, per capita saving (investment level), market imperfections, and, in general, the unbalanced structure of the economy. State intervention and actions should not be limited only to forecast the pattern of future development and its prospects but also to promote the economy and stimulating all economic activities in such a way as to increase the national and individual benefits and to reduce the economic and social costs of development.

II. DIFFERENT APPROACHES TO NATIONAL ECONOMIC PLANNING :

To clarify the theoretical basis of the proposed model presented in this paper, it may be useful to recall the economic reasoning, social and political conditions of different approaches to national economic planning. This would implicitly give the necessary justification of our model.

Theoretically, two main approaches for economic planning can be distinguished. Each approach reflects a different point of view; i.e. that of the individual consumers, the government as a consumer or as an investor, and of the businessmen. From the private entrepreneur's point of view, economic efficiency and in turn economic planning[2] is to be considered within the framework of the ideal perfect compètition of the market system where the private entrepreneur plays his role freely in response to the consumer's behaviour. In such a system prices reflect not only the importance of the products (goods & services) to the consumers and to the producers, but also when in free-market equilibrium they would maximize both the consumer's utility as well as the producer's profit and as a result a certain pattern of efficient allocation of resource as well as income distribution is settled. Prices would be equal to the marginal utility of the consumer as well as the marginal productivity (cost) of the corresponding factors of production. The growth of the economy will continue as long as the trend of investment always goes up because more profit lead to a higher level of investment, which will channel the available economic resources into the

(2) In this context the concept of "economic efficiency" is defined as to deal with the following problems :

i) The problems of the efficient allocation of resources; this implies the problems of establishing criteria for investment.

ii) The problem of economic growth; this introduced a time dimension into the problem of resources allocation.

iii) Problems associated with the distribution of national output; this means the alleviation of income distribution problem.

Economic planning means a performance of mutually consistent actions aimed at achieving efficient solutions to the problems of growth, allocation of resources, and the distribution of output (income) under the prevailing state of technology and all other economic, social, and political conditions.

production of new capital goods, thus, acting as a motivator for growth.

In contrast to the laissez-faire mechanism, the command "socialist" economy tackles the problem of optimal planning from the extreme opposite direction; i.e. from the national point of view. The justification of this approach is that the concept of economic efficiency has its social, political as well as economic dimensions, and it is not conceivable unless the prevailing non-economic factors are to be taken into account. In practice, this takes the form of abolition of the private ownership of the means of production and the freedom of consumer choice. Economic planning by this approach could be carried out by the state — which is supposed to reflect the national point of view — to draw up a uniform national plan by which certain economic, social and political targets (state preference) are to be achieved. The economic reasoning given to support this approach may be stated as follows : Although there is no freedom of choice in consumption and labour occupation, the efficient allocation of resources — for given growth targets — can be directed by the state instead of the consumers preferences through a method of "trial and error." The prices calculated by the Central Planning Organization (CPO) will perform the task of the prices in the market system(3).

In underdeveloped countries, the price mechanism of the market economy is not efficient to lead the economy towards the frontier of economic efficiency. This is due to many reasons associated with the existence of certain economic, social and political conditions. Nor is it practically possible to suggest that the mechanism of the "calculated" prices of the command socialist economic systems is suitable for the underdeveloped countries, since the positive way of judgment is to consider the facts (conditions) of the underdeveloped countries as they are and not as they should be.

III. Centralization and Decentralization Planning Procedures :

The proposed model owes its origin to Tinbergen's approach of planning by stages, but it cannot be directly related to the

(3) Lange, O. [13].

widely known planning procedures. It has some features which can be explained in view of the practical difficulties rather than good economic reasoning. The shortcoming of the proposed procedure, however, can not be assessed only in comparison with other decentralization planning procedures, but it should also be considered within the prevailing economic, social, and political conditions of the underdeveloped countries.

A multitude of planning procedures have been recently developed to deal with both the market and the socialist economies. For the market economies two main decentralization approaches have been suggested. The first follows the classical Schumpeter's growth model(4) where profit-maximization is assumed to induce the private entrepreneur to play his "decisive" role in the process of development. A mathematically developed version of the model(5) suggests that an optimization programming model is to be applied by the private entrepreneur who is assumed to have a complete knowledge about the changes in market prices, shadow prices, the state of technology, consumer's preferences, and the required supply of factors of production. By this model the leading private firms in the industry would maximize their profit and at the same time allocate their resources efficiently among their activities. This would force the inefficient firms — those with low levels of profit — either to modify their production plans or to get out of business. The micro (firm) model is then developed, at industry and macro level, to an aggregate dynamic programming model by which the growth of the economy and the optimal allocation of the national resources can be achieved. On the national level, the aggregated (macro) model can be used to forecast the effects of alternative fiscal policies implemented by the government(6).

The second approach assumes that the decentralized planning procedure is to start from the national (macro) level down to the entrepreneur (micro) level. Economists have theoretically suggested that rational investment decisions on the micro-level are those satisfying the zero-profit optimality condition(7). It is

(4) Schumpeter, J.A. [14].
(5) Cigno, A. [5].
(6) Cigno, A. [5].
(7) Dorfman, R. Samuelson, P.A., and Solow, R.M. [7].

implicitly assumed that set(s) of shadow prices are to be derived from a national planning model in order to be used afterwards by the private entrepreneur for project evaluation and investment decisions. The national planning model may be formulated as a mathematical programming problem describing the interrelationships of the planned economy so as to maximize (or minimize) a social welfare function subject to a number of economic, political, and technical constraints. The values of the dual variables are, therefore, to be used as efficiency prices for taking investment decisions on the micro level. This notion is being elaborated by A.R.G. Heesterman(8) to deal with the problem of optimal allocation of the national resources in such a way as to reflect both the central (national) point of view as well as the role of prices and cost in a free exchange economy. By using the efficiency (shadow) prices derived from the (national) model, a policy of channelling investment in certain directions leading to the state of economic efficiency may be drawn up.

In the socialist economies, two conventional approaches to the decentralized planning procedures have been established. The first assumes that the CPO is to prepare set(s) of prices and objectives that are to be sent to the responsible bodies at the lower levels of the economic hierarchy in the form of parameters to guide them in constructing their production plans and evaluating their costs. These bodies responsible for the sectorial programmes and enterprise plans have to report back to the CPO stating their optimal production (target) plans and their requirements of resources on the basis of the CPO prices. According to the new information the CPO may introduce new sets of prices and objectives which are to be sent to the responsible economic organizations in order to modify their targets and requirements if necessary. This iterative procedure is to be continued until a satisfactory solution is reached(9).

The second decentralization approach may be outlined as follows : The CPO chooses an initial allocation of the disposable resources — possible from traditional solutions — and sends it to the sectorial and enterprise levels. The CPO's proposals are

(8) Heesterman, A.R.G. [9].

(9) Technically the decomposition methods of a mathematical programming problem fit this procedure. See Dantzig, G. & Wolf, P. [6] and Kronsjo, T.O.M. [12].

to be considered by these bodies in order to draw up their optimal production (targets) plans and, at the same time, they have to estimate the shadow prices of their resources (may be the dual values of their optimization models) and send them to the CPO. On the basis of these shadow prices, the CPO will improve its initial solution, and new allocation of resources and targets may be arrived at. The new solution is to be sent again to the departments concerned and accordingly they have to change their plans and new sets of shadow prices may be derived. This procedure is to continue until a satisfactory solution for both the CPO and all enterprises is reached(10).

IV. A Comprehensive Three-Level Development Planning Model :

Corresponding to the national, sectorial and micro level the proposed planning model consists of a multisectorial optimization model, sectorial 0-1 integer programming model, and an investment criterion for project evaluation. On the national level the model aims to maximize the growth of the economy; to reallocate the available scarce resources — capital and foreign exchange; to determine the production and consumption levels, and to ensure a minimum level of employment. It also permits the possible substitution of competitive imports by domestic output. The multi-sectorial model is assumed to be constructed by the Central Planning Organization to reflect the aims and the economic, social and political constraints restricting the economic development of the country concerned. The structural constraints cover the main macro-relations; i.e. the balanced relations of supply and demand, foreign trade activities, production functions, and resource utilization. At the sectorial level a 0-1 integer programming model is designed to select the projects of the national plan. Different Economic Departments (ED) are assumed to be responsible for constructing and solving the sectorial models. However, these decisions are not separated from the allocation pattern of resources and activities on the sectorial level although project's evaluation is to be carried out outside the sectorial model according to a certain investment criterion.

(10) Kornia, J. & Liptak, T.G. [11].

The planning process of the underdeveloped economy takes a form of iterative procedure. In the first stage the values of the endogenous economic variables on the macro and sectorial level are to be derived by solving the multi-sectorial model and accordingly the projects of the plan (to be evaluated separately) are to be chosen on the sectorial level by implementing the sectorial integer programming model. In the second stage, the effects of the first selection of the plan's projects should be assessed on the macro as well as the sectorial level. The multi-sectorial model should be solved again and new "sectorial" values of the variables may be obtained. Accordingly, the sectorial model is to be modified and solved again, and if a new solution is derived then the multi-sectorial model has to be modified again. The process has to be repeated until no new solution from the sectorial model is obtained. The convergency of iterations has not been mathematically proven. Such a proof remains open; however, from a practical point of view this proof is not necessary since the number of the proposed projects of the plan is finite. Thus one may consider the convergence state of iterations as the state where no new solution is derived by the sectorial integer programming model.

V. 1. General Economic and Technical Assumptions :

The model is based on a number of economic and technical assumptions. The economic assumptions are made in accordance with the general economic structure of the underdeveloped countries. The technical assumptions are related to the input-output analysis and linear programming technique. To make the model as practical as possible rather than purely theoretical, the limitation of the available data would also be considered. Some of these basic assumptions are as follows :

Firstly, capital (investment) is a capacity creating as well as income generating factor and it is the most scarce resource in underdeveloped countries. Likewise, foreign exchange is a scarce factor as well as being a growth limiting factor. Therefore, one of the main aims of the model is to allocate, efficiently, the available capital and foreign exchange among different sectors and projects.

Secondly, the rate of growth of the labour force is assumed sufficient to maintain the rate of growth of output, and as long as there exists widespread unemployment of different types, i.e. labour supply in excess of what can be employed by the available stock of capital, labour should not be considered as a limiting constraint on development. It is also assumed that a certain level of employment is necessary to be secured despite the labour cost. This assumption would serve both in :

(a) Avoiding the most likely social and political disturbances during the plan period.
(b) Increasing demand which has a positive effect on the expansion of the economy, provided that consumption should be within certain limits determined by the plan.

Thirdly, the model maintains general equilibrium between supply and demand through the balance relations among different sectors of the economy, the policy and behaviour relations (i.e. balance of payments, consumption and investment levels). It is thus assumed that prices during the pland period remain unchanged and all goods are estimated at the prices of the base year.

Fourthly, a simple type of production function (capital-output ratios) is to be used(11), and a suitable treatment to improve its estimation is suggested. The production technology of the plan's projects and its effects on the inter-industry system are being considered, i.e. the new technology of the new projects which is supposed to be implemented during the plan's period is to be taken into account.

Fifthly, the model covers a period of about five years because in underdeveloped countries political considerations necessitate that the projects should bear fruit within a relatively short period of time(12).

(11) In this respect, in fact, we do accept the stability of the capital-output ratios at least for the medium term.

(12) "This limitation is not serious in the typical underdeveloped economy, in which capital goods (except for construction) are normally imported, and hence the possibility of achieving given levels of production is practically independent of the sequence of investment". Chenery, H.B. & Kretschmer, K. [4] p. 368.

Sixthly, regarding the investment projects of the plan, it is assumed that they will add new capacity in the same period. However, in practice the gestation period of many investment projects may be longer than the plan's period. In this case the new capacity should be considered in the present period as well as the next period. But initially we might assume that the economy is working at full capacity — the main reason for this assumption is most likely to be the lack of data — but if there are enough data we can consider additional capacity due to the implementation of the projects in the previous period.

Seventhly, in introducing a distinction between competitive and complementary imports the model allows the possible substitution of competitive imports by domestic products.

Eighthly, the income distribution problem is to be dealt with through maintaining a certain level of employment and consumption limits.

V. 2. Definitions and Notations :

(4.2.1.) Endogenous Variables :

C_i^p	is a scalar, C^p is a vector of private consumption of each sector i at the target year;
I_i	is a scalar, I is a vector of investment (by destination) of each sector i at the target year;
M_i	is a scalar, M is a vector of competitive imports of each sector i at the target year;
$\overline{M}_i$	is a scalar, $\overline{M}$ is a vector of complementary imports of sector i at the target year;
X_i	is a scalar, X is a vector of total output of each sector i at the target year;
I_i^o	is a scalar, I is a vector of investment (by origin) of each sector i at the target year;
Pro_{ij}	Project j in the i^{th} sector ;
I_{ij}	is the output of capital goods of i^{th} sector held by j^{th} sector ;
Y	is the national income.

(4.2.2.) **Exogenous Variables :**

C^g_i is a scalar, C^g is a vector of government consumption of sector i at the target year;

E_i is a scalar, E is a vector of exports level of each sector i at the target year;

Px_j is a scalar, Px is a vector of output of each sector j at the base year of the plan;

B is the desired level of net balance of payments ;

L is the minimum level of employment required by all sectors at the target year;

PCa is the existing production capacity (capital stock) at the initial year of the plan;

fc total financial resources (private and government saving plus foreign loans and grants) available for investment (purchasing capital goods) during the plan's period;

$\bar{I}_i$ is a scalar, $\bar{I}$ is a vector of the minimum level of investment of each sector i to be maintained during the plan's period;

$\bar{X}_i$ is a scalar, $\bar{X}$ is a vector of the minimum level of output of each sector i to be maintained at the target year;

FL total foreign loans.

(4.2.3.) **Parameters and Technical Coefficients :**

a_{ij} technical coefficients express the amounts of output of the ith industry (sector) which are required as inputs for one unit of output of the j h industry (sector) ;

C_i is a scalar, C is a vector of the incremental capital-output ratio of each sector i of the economy;

f refers to the total plan's period, e.g. five years;

γ_{ij}	technical coefficients reflecting the proportionate distribution of the output of capital goods of i^{th} sector which is held by j^{th} sector ;
H	is a matrix of sector-wise incremental capital-output ratios;
$am_{,i}$	is value (amount) of complementary imports currently used in producing one unit of output in sector i;
$am_{P,i}$	is value (amount of complementary imports currently used for private consumption of commodities produced in sector i;
$amg_{,i}$	is value (amount) of complementary imports currently used for government consumption of commodities produced in sector i;
s^p	is the propensity to save of the private sector;
s	is the propensity to save of the government sector;
βi	is the elasticity of demand for output of sector i at certain reference points (per capita consumption of the output of sector i and per capita aggregate consumption).

V. 3. The Formulation of the Multi-Sectorial Model Quasi-Static Version)

The mathematical formulation of the proposed multi-sectorial model may be written as follows :

$$(1) \quad \sum_{i=1}^{n} C_i^P + \sum_{i=1}^{n} I - \sum_{i=1}^{n} M_i = \sum_{i=1}^{n} \overline{M}_i = \text{Max.}$$

$$(2) \quad X_{i,t} + M_{i,t} - \geq \sum_j a_{ij} X_{j,t} - \frac{2}{f-1} \geq \sum_j h_{ij\,x\,i,t} - C^P_{i,t}$$

$$C^g_{i,t} + E_{i,t} - \frac{2}{f-1} \sum_j h_{ij} \, Px - \frac{f+1}{f-1} I^*_{;o}$$

(j, i = 1,2 ... n)
(t = the target year)

$$(3) \quad \sum_{i=1}^{n} g_i M_i + \sum_{i=1}^{n} g_i \overline{M}_i - \sum_{i=1}^{n} e_i E_i \leq B$$

$$(4) \quad \sum_{i=1}^{n} \overline{M}_i - \sum_{i=1}^{n} am,_i X_i - \sum_{i=1}^{n} amp,_i C_i^P - \sum_{i=1}^{n} amg,_i C_i^P = o$$

$$(5) \quad \sum_{i=1}^{n} W_i X_i \geq L$$

$$(6) \quad \sum_{i=1}^{n} C_i X_i \leq fc + Pca$$

$$(7) \quad \sum_{i=1}^{n} C_i X_i - \sum_{i=1}^{n} I_i = \sum_{i=1}^{n} C_i P x_i$$

$$(8) \quad C_i^P \geq 0.90 \left(\beta_i \sum_i C_i^P + a_i \right) \quad (i = 1, 2 \dots n)$$

$$(9) \quad C_i^P \leq 1.10 \left(\beta_i \sum_i C_i^P + a_i \right) \quad (i = 1,2 \dots n)$$

$$(10) \quad I_i \geq \overline{I}_i$$

(i = 1,2 ... n)
(not necessarily all i's)

$$(11) \quad X_i \geq \overline{X}_i$$

(i = 1,2 ... n)
(not necessarily all i's)

Initially it is assumed that the objective function of the multi-sectorial model is to maximize national income at the target year of the plan as it is the ultimate aim of economic development, i.e. to maximize Y where,

$$Y = \sum_i C_i^p + \sum_i C_i^g + \sum_i I_i + \sum_i E_i - \sum_i - M_i - \sum_i \bar{M}_i$$

(i = 1,2 .... n = total number of the sectors of the economy) But C_i^g and E_i are assumed to be exogenously determined; therefore the objective function becomes as stated in relation (1). The coefficients of the variable of the objective function are assumed to reflect both the government qualitative policy regarding the desired distribution of the standard of living (per capita consumption) between different social classes, the production structure consequent upon a given allocation of gross capital formation, and imports policy. In practice, the coefficients of the preference function can be chosen so as to reflect the politician's point of view(13). Initially, it is assumed that there is no particular qualitative policy regarding these variables. So all the coefficients are assumed to be one. Other economic targets like the necessity of maintaining certain levels of private consumption and investment are to be dealt with by formulating suitable set(s) of constraints.

System (2) reflects the balance relations of the economy. Here, input-output analysis is used to ensure that output is uniquely determined as a linear combination of multi-sectorial demands given certain technological coefficients and final demand. This implies that the output of the whole economy must, in equilibrium, be equal to the sum of inter-industry (intermediate) demand for inputs plus the sum of "final demands" for output. In contrast to the open "version" of Leontief model where all final demand categories are exogenously determined outside the model, the closed Leontief model — which we follow considers private consumption, investment, competitive imports as endogenous variables, whereas the other final demand categories, i.e. government consumption, exports and net increase

(13) Professor Ranger Frisch [8] believes that a compromise preference function (of different targets) as well as a compromise weight of the coefficients of this function is possible to achieve.

of inventory (if available)[14] are exogenously estimated and hence the output required from domestic production sectors plus the level of competitive imports to meet those types of demands are determined endogenously by the model. Mathematically :

$$X_i + M_i - \sum_{j=1}^{n} a_{ij} X_i - C_i^P - I_i^* = C_i^P + E_i \quad \ldots\ldots (2-a)$$

The transformation process of investment by destination I into investment by origin I* is conceivable by multiplying the sector-wise capital-output ratios by the corresponding level of output. Explicitly :

$$\text{where,} \quad I_j = C_j X_j \quad \ldots\ldots\ldots (2-b)$$

$\overline{X}_j$ is a scalar, $\overline{X}$ is a vector of net increase of output of j^{th} sector. But I_j consists of various types of capital goods and if this structure is given then the proportionality of I_j among these capital goods can be assumed.

$$\text{i.e.} \quad I_{ij} = \gamma_{ij} I \quad \ldots\ldots (2-C)$$

$$\text{clearly} \quad \sum_j \gamma_{ij} = 1$$

By (2 — b) and (2 — C) we get ;

$$I_{ij} = \gamma_{ij} C \overline{X}$$

or

$$I_{ij} = h_{ij} \overline{X}_j \quad \ldots\ldots (2-e)$$

where,

$$h_{ij} = \gamma_{ij} C_j$$

In a matrix notation, relation (2-e) can be rewritten as

$$I^* = H \overline{X}$$

(14) Net change in stock during the plan's period may be assumed to be nil algebrically. At the same time inventory value is generally of no significance in the underdeveloped countries. Thus we omitted inventory from the final demand categories.

Relation (2-e) may, therefore, be rewritten as follows :

$$X_i + M_i - \sum_j a_{ij} X_j - \sum_j h_{ij} \overline{X}_j \quad C_i^P + C_i^g + E_i \qquad (2-g)$$

$$(i, j = 1, = \dots n)$$

For a certain period of time (say five years) relation (2-g) is of a static nature. It implies that investment has to be spent in the target year of the plan(15). This is not a very realistic assumption. In this respect a "quasi-static" approach which is being suggested by A.R.G. Heesterman(16) is more realistic. It considers the dynamic nature of investment over time by assuming a linear time path for investment over time. Mathematically:

$$\sum_{t=o}^{f-1} I_t^* = \tfrac{1}{2}(f+1)\, I_o^* + \tfrac{1}{2}(f-1)\, I_t^* \quad \dots\dots \quad (2-h)$$

By (2-h), (2-e) and (2-a), we derive the "quasi-static" balance relation as stated in system (2).

System (3) reflects the foreign trade balance. In most underdeveloped countries, the balance of payments imposes a constraint on investment programmes for development. If the imports level decreases, the gross national product will accordingly decrease unless investment is directed to import substitutions and to increase exports level. In order to avoid bottlenecks in the economy during the period of the plan and to explore the scope of substituting competitive imports by domestic products, imports are assumed to be of two types; competitive and complementary imports. Competitive imports are assumed to be homogenous with products of the corresponding domestic sectors and thus they could conceivably be replaced by increasing the level of domestic output. Complementary imports are those required during the period of the plan, where it is not possible to produce them locally. Thus complementary imports used for government consumption are assumed to be exogenous.

(15) In relation (2-g) the capacity creating effect of investment is taken into account, and if we are interested only in the change of the variables over two points of time say t, t + 1 then this relation can be considered as a dynamic one.

(16) Heesterman, A.R.G. [9], pp. 91-92.

Exports are assumed to be determined exogenously on the basis of the following :

(i) the trend of exports in previous years;

(ii) the demands of the foreign markets and the possible change of prices at the foreign markets during the period of the plan;

(iii) the official foreign trade agreements with other governments.

For the desired level of net balance of payments (B) three cases are possible :

(i) If $B > o$, then B is the maximum deficit allowed;

(ii) If $B < o$, then B is the minimum surplus which must be achieved;

(iii) If $B = o$, then we have an equilibrium state i.e. total exports plus net income from abroad and foreign loans are equal to total imports plus net income to abroad.

System (4) is the definition constraint of the non-competitive imports.

System (5) expresses the employment "social target" constraint. One of the main aims of the economic plans in under-developed countries is to ensure a certain level of employment. This constraint (objective) may be in some sectors a binding one because of the necessity of avoiding any social or political disturbances resulting from the existence of widespread unemployment (real or disguised). The formulation of this constraint does not mean that the model considers labour as having no social cost, which may be true in some cases, but the approach of the model to the employment problem is to appreciate the social and political conditions for the success of the plant's implementation rather than for a purely theoretical consideration.

Equation (6) deals with the capital requirements. Total capital available to finance investment projects of the plan should be exogenously estimated, and its allocation among different sectors is based on sectorial capital-output ratios in addition to the other constraints. Total financial resources (fc) are assumed to be determined by the propensity to save and by the economic and political capacity of getting foreign loans.

Equation (7) is the definition constraint of investment. It is derived from its basic relation as follows :

$$I_i = C_i \ (X_i - PX_i)$$

and

$$\sum_{i=1}^{n} C_i X_i - \sum_{i=1}^{n} I_i = \sum_{i=1}^{n} C_i PX_i$$

where,

$$\sum_{i=1}^{n} C_i PX_i = PCa$$

Systems (8 to 11) are behaviouristic constraints related to the minimum level of private consumption, investment and output variables during the plan's period. The economic justification of these constraints is the fact that the present allocation of production and resources in the underdeveloped countries is far from being efficient. Thus it is necessary to avoid the possibility of having a situation where the level of these variables at the target year would be below their levels at the basic year. This situation would create many economic, social, and political problems[17]. From the technical point of view, these constraints should not be introduced in order to force the behaviour of the model in such a way that the level of certain variables would follow a certain path of growth. The whole system should not be overdetermined. In particular systems (8 & 9) are related to private consumption. It is originally based on the assumption that the level of private consumption from the output of sector i may be considered as a linear function of total private consumption via the elasticity of demand :

(17) This implies a certain qualitative policy where it is possible either to consume in the present and postpone investment later on, or to consume and invest simultaneously. The latter case is being followed and this entails a certain level of saving.

i.e. $$C_j^P = \beta_j \sum_i C_i^P + a_j$$

where,

a_j is a constant at the same reference points corresponding to sector i.

But this treatment may make the model very rigid(18). A more flexible assumption is to assume that the consumption pattern is able to vary within about 10% of the range of either side of the Engel curves as we have stated in (8 & 9)(19).

System (10) is introduced in order to ensure a certain level of capital accumulation during the period of the plan, i.e. it is necessary to determine the lower bound of investment at the target year which should be at least equal to the level of the base year. This set of constraints is also required to tackle the situation where certain amounts (values) of investments are being already implemented as a part of the costs of projects during the previous period.

System (11) states that the production level of each sector of the economy should be at least the same level as that of the base year. The rate of output growth, however, is to be determined endogenously by the model.

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(18) This relation is a linear approximation of the following non-linear function :

$$C_i^P = k \frac{(C_i)}{N} \alpha i$$

at a reference (forecast) point $\left(\frac{\sum_i C_{i,o}^P}{No} , \frac{C_{o,i}^P}{No} \right)$.

where,

N is population

αi expenditure elasticity for sector i (commodity i) estimated for cross section and time series of consumer behaviour.

See Bruno, M. [2] and Simpson, D. [15].

(19) See Bruno, M. [2] and Simpson, D. [15].

V. 4. THE FORMULATION OF THE SECTORIAL MODEL :

For each sector of the economy (i.e. for i where i=1, 2... n), the mathematical formulation of the 0-1 integer model may be written as follows :

$$(1) \quad \sum_{j=1}^{r} (SMP)_{ij} \ Pro \qquad = Max.$$

$$(2) \quad \sum_{j=1}^{r} d_{ij} \ Pro_{ij} \qquad \leqq X_i$$

$$(3) \quad \sum_{j=1} m_{ij} \ Pro_{ij} \qquad \geqq M_i + \bar{M}_i$$

$$(4) \quad \sum_{j=1}^{r} h_{ij} \ Pro_{ij} \qquad \geqq L$$

$$(5) \quad \sum_{j=1}^{r} q_{ij} \ Pro_{ij} \qquad \geqq E$$

$$(6) \quad \sum_{j=1}^{r} k_{ij} \ Pro_{ij} \qquad \leqq I_i$$

$$(7) \quad Pro_{ij} = o \text{ or } 1$$

$$(i = 1,2 \ldots n)$$
$$(j = 1,2 \ldots r)$$

The sectorial model is of 0-1 integer programming type and it is assumed to be used by different economic departments (ED) corresponding to different sectors of the economy in order to select the plan projects from a proposed list. Before applying the sectorial model, each department should evaluate all proposed projects according to a certain investment criterion. In this context social marginal productivity (SMP) is being suggested as a yardstick for evaluating each of the proposed projects in each sector. SMP concept may be defined as the effect of increasing one unit of investment (capital) on several dimensions of the economy as the national balance of payments and total output[20]. The values of SMP's are then to be used as the coefficients of the variables of the objective function of the sectorial model which is to be maximized. Each variable of the objective function represents a proposed project. (equation (1)).

Different types of constraints are being considered. These are related to the following economic relations :

(i) Total output of the selected projects of each sector of the economy should not exceed total output of the corresponding sectors which is endogenously determined by the multi-sectorial model. Practically such a constraint is not necessary because of the existence of the capital constraints[21]. This relation is expressed by equation (2).

(ii) Total imports of the selected projects in each sector of the economy should not exceed the permitted level of imports of the corresponding sector (equation(3)).

(iii) Total exports of the selected projects in each sector of the economy should be at least equal to the total level of exports of the corresponding sector. (equation (5)).

(iv) Equation (4) states that total employment of the selected projects in each sector of the economy should be at least equal to the corresponding level of employment which is endogenously determined by the multi-sectorial model.

(v) Total investment (capital requirements) of all selected projects should not be more than total investment allocated to the corresponding sector by the multi-sectorial model.

(20) This definition coincides with Chenery's definition (Chenery, H.B. [3]) whereas in A.E. Kahn [10] the SMP is defined as the marginal unit of investment to national product only. Professor J. Tinbergen in his definition to the national welfare implies the same meaning of our definition. Tinbergen, J. [16].

(21) This point is to be clarified in section (V. 6. (ii)).

V. 5. PLANNING MECHANISM :

The planning process suggested here is of two stages. In the first stage the multi-sectorial model is to be constructed and solved by CPO; therefore, the values of output, private consumption, gross capital formation, the number of employees and a first approximation of the allocation of the available resources (capital and foreign exchange) among all sectors of the economy are determined. These values represent the desired changes in output, private consumption, investment, imports and employment level, which has to be achieved, during the period of the plan. Then after deriving these values the CPO will instruct the corresponding ED's to use these values as either upper or lower bounds of their corresponding constraints of the sectorial models. In this stage the planning process is carried out not only on the macro and sectorial levels, but also at the project level, at which the ED's should evaluate each proposed project according to the SMP criterion. Then the sectorial model can be applied for each sector in order to select a number of projects.

The implementation of each selected project — determined by the final solution of the sectorial model — will affect the path and the rate of growth of the economy. The net increase of output, investment, imports and employment will contribute to the expansion of the economy by affecting intermediate demand, imports, the level of employment and of course the level of investment and private consumption. So in the second stage the CPO will take all these effects into account and improve the first solution obtained from the multi-sectorial model at the first stage according to the changes brought about by the implementation of the selected projects during the plan's period. Thus the multi-sectorial model should allow :

(i) Changes in coefficients of the technology matrix (input-output ratios) by taking into consideration the new technology of the selected projects. This means that the values of the intermediate demand would change as a result of, implementing the projects of the plan. Consequently the level of private consumption, total output and its allocation among the corresponding sectors would be changed. This modification makes it possible to take into account the effect of the new technology used by the selected projects.

(ii) The increase of imports and exports obtained from the first stage will affect the values of the economic variables the second stage as follows :

(a) In the case of a deficit, if the values of the exports level are greater than the level of imports, the deficit gap will be reduced and this of course would improve the balance of payments. But if the values of imports are greater than exports then the gap becomes wider and this would worsen the balance of payments.

(b) In the case of a surplus, i.e. the values of exports are greater than imports, then the lower limit should be raised into a higher new level and this of course has a positive effect on the balance of payments, whereas if the values of imports are greater than exports, then the new lower limit will be less than the first stage.

(iii) The first approximation of capital-output ratios will be adjusted according to actual figures of output and capital of the selected projects.

V. 6. ON THE MATHEMATICAL STRUCTURE OF THE MODEL :

(i) **The multi-sectorial model :** The number of the endogenous variables of the model as it has been stated in section (V. 4) is greater than the number of total constraints. From a mathematical point of view this means that some of the activities (total number of the variables minus the number constraints) will have zero value. From the economic point of view this situation may be unrealistic because unless an economic justification is explicitly given, in terms of constraints, all economic activities should be always positive. This situation requires the following mathematical modification which will reduce the number of the variables without affecting the structure of the model.

Using the definition constraint of the non-competitive imports (system (4)) the objective function can be written as follows :

$$\text{Max} \sum_{i=1}^{n} C_i^p + \sum_{i=1}^{n} I_i - \sum_{i=1}^{n} M_i - \left(\sum_{i=1}^{n} a_{m,i} X_i + \sum_{i=1}^{n} a_{mp,i} C_i^p + \sum_{i=1} a_{mg,i} C_i^g \right)$$

In the second and the consequent iterations the incremental capital-output ratios, input-output coefficients of the interindustry system and input-output coefficients of the complementary imports are to be adjusted to $\bar{C}_i \bar{a}_{ij}$, and $\bar{a}_{mj}$ respectively.

(ii) **The sectorial model :** In practice it is possible that we may face the situation where in order to satisfy the optimality conditions of the sectorial model it might be necessary not to choose a certain proposed project which is more or less near the efficiency frontier as determined by the model itself. Such a situation may arise due to two reasons :

(a) the nature of the integer type problem where most likely some of the available resources would be wasted;

(b) the limited number of the proposed projects.

Both reasons are beyond the planner's control. With regard to the first one, since the variables take the integer values of either zero or one then from a mathematical point of view there is no alternative. Concerning the second reason, in reality the number of the proposed projects is really limited, in fact in some cases the number of the proposed projects is so small that there is no need even to compare between them looking for the most efficient one. However, to deal with such problems we may change the direction of the constraint related to the sectorial output level. Economically this is justified by the existence of the investment capacity constraint on the sectorial level as well as on the micro-level. Actually there is no harm in producing more output — provided no extra capital is required — or in other words by changing this constraint the model restricts the activities of the total number of projects of each sector to maintain a minimum level of output. This would be consistent with the behaviour output constraint of the multi-sectorial model. Therefore, the constraint of the sectorial model would be :

$$\sum_{j=1}^{r} d_{ij}\, Pro_{ij} \geqq X_i$$

instead of

$$\sum_{i=1}^{r} d_{ij}\, Pro_{ij} \leqq X_i \quad \text{(where } i = 1,2 \ldots n)$$

In contrast to the multisectorial model, the exports and imports constraints of the sectorial model are dealt with separately. The economic reason for this treatment is the need to maintain a certain level of exports and not to exceed a required level of imports. But as an alternative, one may suggest that both constraints could be added such as the following :

$$\sum_{j=1}^{r} (m_{ij} - q_{ij})\, Pro_{ij} \leqq M_i + \bar{M}_i - E_i$$

Mathematically this may be useful because it reduces the number of the constraints and therefore it would increase the degree of freedom for each variable to take different values. But from the economic point of view the algebraic values of both exogenous constraints (imports and exports), and the coefficients of the variables $(m_{ij} - g_{ij})$ may not lead to satisfying our basic assumptions regarding the desirable levels of exports and imports.

V. 7. A MULTI-PERIOD VERSION OF THE MODEL :

The multi-sectorial model of one period could be converted to a multi-period model which would help in deriving the annual values of the endogenous variables involved, i.e. to formulate a detailed annual plan. The practical problems are the only restrictions which may prevent the application of the multi-period model instead of the multi-sectorial "quasi-static" model. These problems can be summarized as follows :

(i) The number of the variables and the constraints will increase five times (in case of the five year's plan) and this may make the task of solving the model rather difficult by the available "computer" capacity.

(ii) The application of the multi-period model requires the annual values of the exogenous variables. This is not really a serious problem as long as the aggregate values of the exogenous variables are usually derived from the annual estimates.

The multi-period model can be constructed by adding only another set of constraints to link two successive periods by dynamic relations of investment and the existing capacity during the annual periods of the plan. This dynamic relation can be defined as follows. Total investment at the end of period (t) should be greater than or equal to the level of production capacity at the end of the same period minus production capacity at the end of the previous period, i.e. :

$$\sum_i I_i = \sum_i Ca_{i,t} - \sum_i Ca_{i,t-1} \qquad \dots (a)$$

where,

Ca is a scalar, Ca is a vector of production capacity of the i^{th} sector.

but,

$$Ca_{i,t} = C_i X_i \ (t) \qquad \dots (b)$$

where,

C_i is a scalar, C is a vector of capital-output ratio of the i^{th} sector.

$X_{i,t}$ is a scalar, X is a vector of output of i^{th} sector at period t.

similarly,

$$Ca_{i,tt-1} = C_i X_i \ (t-1) \qquad \dots (c)$$

by, (b) and (c) we get

$$Ca_{i,t} - Ca_{i,t-1} = C_i \ (X_{i\,(t)} - X_{i\,(t-1)})$$

or,

$$I_{i,t} = C_i \ (X_{,t} - X_{i,t-1})$$

and,

$$\sum_i I_{i,t} = \sum_i C_i \; (X_{i,t} - X_{i,t-1})$$

at time t = 1, we have

$$\sum_i X_{i,t-1} = PCa$$

where,

PCa is the production capacity of the economy at the initial year of the plan.

During the whole period (i.e. t = 1, 2, 3, 4, 5) we have,

$$\sum_i C_i X_{i,t} \leqq PCa + \sum_i I_{i,t}$$

The objective function, balanced relation, and foreign trade constraints may be mathematically written as follows :

ii) The balanced constraints :

$$\text{to maximize} = \sum_{i=1}^{n} C^P_{i,t} + \sum_{i=1}^{n} I_{i,t} - \sum_{i=1}^{n} M_{i,t}$$

$$- \left(\sum_{i=1}^{n} a_{mi} X_{i,t} + \sum_{i=1}^{n} a_{mpi} C^P_i + \sum_{i=1}^{n} a_{mgi} C^P_i \right)$$

$$(t = 1,2 \;\ldots\ldots\; 5)$$

ii) The balanced constraints :

$$M_{i,t} + X_{i,t} - \sum_{j=1}^{n} a_{ij} X_{j,t} - C^P_{i,t} - \sum_{j=1}^{n} hi_j X_{j,t} \geqq C^g_{i,t} + E_{i,t}$$

$$(i = 1,2 \;\ldots\ldots\; n)$$
$$(t = 1,2 \;\ldots\ldots\; 5)$$

iii) Foreign trade constraint :

$$\sum_{i=1}^{n'} g_i M_{i,t} + \sum_{i=1}^{n} a_{mi} X_{i,t} \leq B + \sum_{i=1}^{n} a_i E_i + \sum_{i=1}^{n} a_{mpi} C^P_{i,t}$$

$$+ \sum_{i=1}^{n} a_{mgi} C^P_{i,t}$$

$$(t = 1,2 \dots 5)$$

V. 8. Some General Remarks on the Model :

Firstly, the linearity assumption among the variables of both the objective function and the contraints may not in some cases reflect reality where relations are non-linear. The only justification of this assumption is the practical difficulty of both formulating and solving the model.

Secondly, with regard to the gestation period the model has a shortcoming and this is caused by practical difficulties arising especially when deriving the initial values of investment of the projects under construction. However, a suitable modification for the constant values of the sectorial model may be adequate to deal with this problem.

Thirdly, the sensitivity of the multi-sectorial model could be easily tested by changing the parameters (coefficients) of the investment constraints (i.e. incremental capital-output ratios), and by changing the value of the exogenous variables the impact of these variables on the pattern of growth can be shown.

Fourthly, the application of the sectorial model — for each sector of the economy —, depends on the assumption that there exist many alternatives for proposed projects, and a complete list of them is to be ready. In practice in some sectors e.g. services, this may be difficult to achieve.

Fifthly, some practical problems; (i) in the case where it is proposed to expand an existing project rather than building a separate new one; this problem can be dealt with by revaluating the old project with its new expansion and can be considered as any other proposed project. In such a case the only measure to be taken when applying the sectorial — model is the modification of the values of the exogenous variables which are to be used in the sectorial model, e.g. :

$$X_i \text{ is to be } X_i + P\bar{x}_i$$

where,

$P\bar{x}i$ is total output of the old project to be yielded during the period of the plan.

ii) Some of the projects have been under construction before the implementation of the plan. In this case there is no point in evaluating the project again, but it is necessary to substract imports required by those projects from the imports values which are derived endogenously by the multi-sectorial model. Capital is also to be subtracted and labour and export values are to be considered at the stage during which we estimate them exogenously.

iii) Some projects will be completed after the Plan's period. In this case we have to add to the endogenous values of total sectorial imports, total sectorial capital and to the exogenous values of labour and exports all the values of the corresponding variables of the proposed project.

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EVALUATION OF SOIL CONSERVING POLICIES BY COMPARING PERIODIC LAND PRODUCTIVITY CLASSIFICATIONS

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Introduction

Land Productivity classification of the Egyptian cultivated acreage is periodically carried by the Department of Agricultural Economics and Statistics of the Ministry of Agriculture. Three different classifications are available since land productivity classification was firstly carried in 1960. The classification was repeated for the second time in 1965, then in 1970 for the third time. Land productivity classification is carried in two stages. Egyptian countries, within the first stage, are classified into five classes according to average productivity of cultivated acreage for a given crop computed for the last five seasons preceeding classification. The superior class (A) is ranked (5), compared to a rank of (4) for class (B), (3) for class (C), and so on.

This is repeated for the leading Egyptian field crops, namely wheat, barley, horse beans, lentils, lupines, homos, sugarcane, cotton, onions, clover peanuts and fenugreek. Over all rank of the county is computed in the second stage, where its ranks for different crops are weighted by their acreage computed as a percentage of the county's total crop area. Counties afterwards are classified according to their overall ranks into five classes, with class (A) being the superior one, class (B) being the second one, and so on[1]. Results of the 1965 and 1970 land productivity clssification for the Egyptian cultivated acreage are presented in Appendix Tables (1) & (2).

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(1) Ahmed Z. Sheera, Economic Classification of Cultivated Acreage in Egypt, Cairo : Dep. of Ag. Econ. & Stat. Ministry of Ag., April 1959. pp. 9 - 26.

Egyptian cultivated acreage, in view of the fact that the economy is mostly agricultural and in face of invulnerable restrictions imposed on its expansion, is the most vital determinant of agricultural production.(1) Cultivated acreage, during the twentieth century has almost remained constant.(2) Yet, population has been rapidly increasing at very high rates. Soil conversation policies, in these regards, are of vital concern to the welfare of both the society in general and the rural population in particular. Various governmental agencies, notably the ministries of agriculture and irrigation, are held responsible for formulation and administration of Egyptian soil conserving policies. Increasing, or at least maintaining the productivity of the already cultivated acreage is the ultimate goal of those policies. Periodic land productivity classification can, in these regards, be used to check the adequacy of those policies in achieving their goal.

Productivity changes as exists from Land Classifications Acreage of Improved Productivity : Data presented in Table (1) show Egyptian cultivated acreage distributed according to productivity classes as of 1970. Meanwhile, acreage of various productivity classes of 1970 were re-distributed according to their original classes of 1965 classification. An overall view indicates significant improvement in land productivity, where acreage of class (A) increased from 1.1 million feddans in 1965 to 2.2 millions in 1970. Acreage of other classes, on the other hand, were subject to noticeable reduction, where that of class (B) decreased from 1.6 million feddans to 1.4 millions as of 1965 and 1970

(1) M.M. El-Zalaki, **An Analysis of the Organization of Egyptian Agriculture and its Influence on National Economic and Social Institutions**, (Ph. D. Thesis), Dep. of Ag. Econ., U.C., Berkeley, 1940, pp. 269-276, see also Yehia Mohi El-Din, **Egyptian Agriculture : A Case of Arrested Develop.** (Ph.D. Thesis), Dep. of Ag. Econ., Univ. of Wisconsin, Madison, 1966.

(2) The Egyptian government, since the late fifties has been conducting an ambitious policy of land reclamation. Reclaimed land within the last two decades, amounts to nearly 912,000 feddans. However productivity of most of this acreage is still far behind the already cultivated. There still exists a wide room for improving its productivity. This matter, is however, confronted by rather complicated technical, administrative, economic, and social obstacles.

respectively. Acreage of class (C), as well as that of class (D), as of the 1970 classification were found to be smaller than those of 1965. Acreage of class (C), within the sixties, decreased from 2.2 to 1.3 million feddans, whereas those of class (D) were found to remain almost unchanged amounting to nearly 900 thousand feddans.

Most of the improvement, however, is concentrated in lower Egypt, Giza, Fayoum, and Beni-Sweif governorates of Mid Egypt, and a limited number of counties in Upper Egypt, namely Assiut, Abnoub, Luxor, and Aswan, (Fig. 1.). Acreage that was classified as (B) in 1965 and moved to the superior class (A) in 1970, amounts to nearly 1.1 million feddans, covering the cultivated acreage of the counties of Berket El-Sabeh, Toukh, El-Adwa, Abu-Tig, Abnoub, Assiut, Mit-Ghamr, Minia-El-Kamh, Kewesna, Benha, Ashmoun, El-saf, El-fashn, El-Santa, Tanta, Shebien-El-Kanater, Kaliub, Zifta, Zagazig, Aga, El-Ayat, Beba, Shebien-El-Kom, El-Khanka, El-Kanater-El-Khieria, and Hehia. Acreage that was classified as (C) in 1965 whereas improving to (A) in 1970 includes the cultivated acreage of Abu-Kebier and Belbies counties amounting to nearly 125 thousand feddans. Acreage improved from (C) to (B) in 1965 and 1970 classifications respectively amounts to 903 thousand feddans approximately, extending over the cultivated acreage of counties of Koutour, El-Mahala-El-Koubra, Kelien, El-Mansoura, Dierb-Negm, Giza, Kom-Hamada, Abu-Hamad, Imbaba, El-Wasta, Biela, El-Senbelaween, Bosh, Fayoum, and El-Bedrashien. Acreage improved from the fourth class (D) to the preceeding one (C) amounts to nearly 184 thousand feddans including the cultivated acreage in the counties of Senouris, Rosetta, Luxor, and El-Delengat. Acreage whose productivity has improved during the sixties from the lowest class (E) to (D) covers an area of almost 65 thousand feddans, including the cultivated acreage in Tamia and Aswan counties, (Fig. 1).

Improvement in land productivity previously discussed is the net resultant of various policies conducted for soil conservation. Some of these policies, however, are directly related to soil fertility, i.e. improving the physical, chemical, and biological characteristics of the cultivated acreage. Improving irrigation and drainage conditions, using subsoilers, and addition of lime

Table (1) — Land Productivity Classification : Acreage of Various Classes of the 1966-70 Classification According to their Initial Classes in the 1960-65 Classification.

Cultivated Acreage according to 1960-65 Classification	Cultivated Acreage According to 1966-70 Classifications A		B		C		D		E		Total
	Fed.	%	Fed.	%	Fed.	%	Fed.	%	Fed.	%	
A	892,007	41.1	195,077(3)	13.6	41,175(5)	3.0	—	—	—	—	1,128,259
B	1,133,508(1)	52.3	337,715	23.5	96,935(6)	7.2	—	—	—	—	1,568,158
C	124,545(2)	5.7	903,245(4)	62.9	1,031,886	76.2	167,898(8)	19.2	—	—	2,227,574
D	—	—	—	—	184,166(7)	13.6	643,040	73.5	102,421(10)	73.7	929,627
E	—	—	—	—	—	—	64,531(9)	7.3	31,736	22.8	96,267
Newly Est- Counties	19,310	0.9	—	—	—	—	—	—	4,766	3.5	24,076
Total	2,169,370	100.0	1,436,037	100.0	1,354,162	100.0	875,469	100.0	138,923	100.0	5,973,961

(1) Includes counties of Berket El-Sabeh, Toukh, El-Adwa, Abu Tig, Abnoub, Assiut, Mit Ghamr, Minia El Kamh, Kwesna, Benha, Ashmoun, El-Saf, El-Fashn, El-Santa, Tanta, Shebien El-Kanater, Kallub, Zifta, Zagazig, Aga, El-Ayat, Beba, Shebien El-Kom, El-Khanka, El-Kanater El-Khieria, and Hehia.

(2) Includes counties of Abu Kebier and Belbies. (3) Includes counties of Fareskour, Abu Tisht, Gerga, El-Balyiana, Akhmiem, and Tema. (4) Includes counties of Koutour, El-Mahala El-Koubra, Kelien, El-Mansoura, Dierb Negm, Giza, Kom Hamada, Fiwa, Abu Hamad, Imbaba, El-Wasta, Biela, El-Senbelaween, Bosh, Fayoum, and El-Baderashien. (5) Includes the counties of Sohag. (6) Includes the counties of El-Minshah and Shoubra Khiet, (7) Includes the counties of Senouris, Rossette, Luxor and El-Delingat. (8) Includes the counties of Ismailia, El-Manzala, Esna and Kom Ombo. (9) Includes the counties of Tamia and Aswan. (10) Includes the counties of Abu El-Matamier and Alexandria.

Source : Compiled and computed from Appendix Tables (1) and (2).

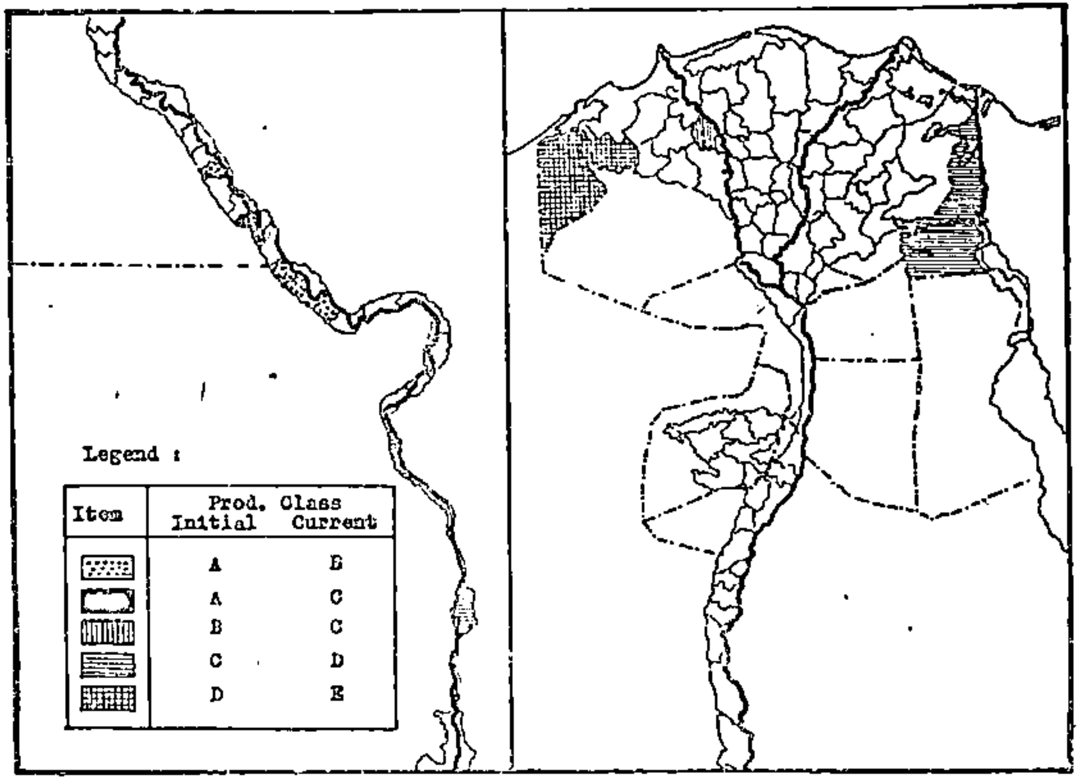
are examples that can be cited in this regards.[1] Other development policies, such as better transportation, better seeds, pest control,... etc, may have indirect effects on land productivity. Huge investment outlays were allocated to agricultural production within the sixties for execution of projects included in the first two five years plans. Improvement of land productivity can, therefore, be attributed to those plans.

Acreage of Deteriorated Productivity : A more critical insight, however, indicates that in spite of that overall improvement, productivity of a sizable part of the cultivated acreage was subject to severe deterioration. This deterioration covered an area of nearly one-half million feddans. The degree of deterioration within that area differed, however, from one location to the other. In other words, an acreage of nearly 195 thousand feddans, namely those of the counties of Fares-hour, Abu-Tesht, Gerga, El-Balyiana, Akmiem, and Tema, deteriorated from the superior class (A) to the second one (B). Deterioration in productivity of the cultivated acreage of Sohag county amounting to 41 thousand feddans, was rather evident, where it was classified in 1970 as class (C), while it was included within the superior class (A) in the 1965 classification. Acreage deteriorated within the sixties from class (B) to (C) amounts to nearly 97 thousand feddans, covering the cultivated acreage of both El-Minshah and Shoubra-Khiet countries. Cultivated acreage of the counties of Ismaielia, Elmanzala, Esna, and Kom-Ambo, covering an area of almost 168 thousand feddans deteriorated within the sixties from class (C) to (D). Acreage deteriorated from (D) in 1965 to (E) in 1970 amounts to nearly 102 thousand feddans, covering the cultivated acreage of Abu-El-Matamier, and Alexandria countries, (Fig. 2).

Most of the deteriorated acreage, however, is located in Upper Egypt, covering almost all counties of Sohag governorate,

(1) The Ministry of irrigation is entitled the function of formulation and administration of irrigation and drainage policies. The Ministry nowadays, is conducting an ambitious program for draining all of the cultivated acreage. This program is being supported by international organizations such as the International Band and the Food Program of the U.N. Other agricultural development programs are carried by the Ministry of Agriculture.

Fig. (1) — Land Productivity Classification : Acreage of Improved Productivity According to Location and Extent of Improvement.



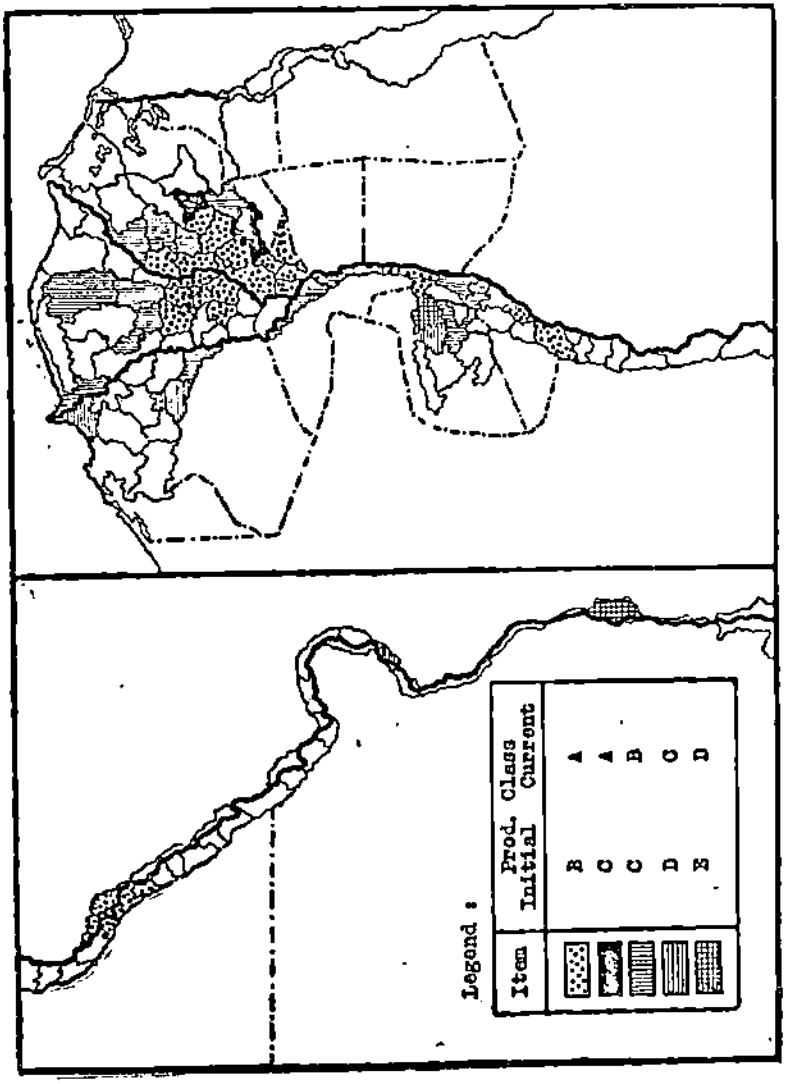
Source : Table (1).

Esna country of Quena governorate, and Aswan county of Aswan governorate. This area is of vital importance for the Egyptian economy, since production of sugar cane and one of the main exportable crops, namely onions, is concentrated within its cultivated acreage. Deterioration took place following transformation of its irrigation from the basin system to the perennial one. Basin irrigation was applied in this area almost seventy centuries ago, i.e. since the pharaonic epoque. It was excluded from perennial irrigation, which was firstly introduced to Egypt since the early decades of the nineteenth century. The area was kept under basin irrigation to safeguard the country against Nile floods, where it was used to reserve huge water supplies during flood peaks. Completion of the High Dam permitted transforming its irrigation to the perennial system. However, it seems that the project was not throughly investigated, which was in turn reflected in deteriorating the productivity of most of the cultivated acreage of the area. Therefore, there exists a dire need for reinvestigating the design and excution of the project, to determine the reasons underlying this condition, and to take the necessary arrangements for avoiding such deterioration.

The balance of the deteriorated area is located in Lower Egypt, almost nearly the Mediterranean (Fig. 2). Factors related to its deterioration are likely to be related to its dire need for drainage. In fact, following the completion of the High Dam irrigation supplies became more available. Farmers were accustomed to use larger quantities of irrigation supplies. This fact coupled with that of increasing rice acreage to almost one million feddans annually with no sufficient drainage system are held responsible for raising the water table of the cultivated acreage, which may, in turn, complicate the problem of salinity.

Measurement of the Effects of Productivity Changes-**Criterion of Measurement :** There exists no well known criterion for measuring the effects of change in land productivity on cultivated acreage. This acreage is classified, according to land productivity, into five classes, namely (A), (B), (C), (D) and (E) respectively. Productivity of acreage classified as (A) differs from 5.0 to 4.3, compared to 3.5 to 4.2 for class (B), and 3.4 to 2.7 for class (C). Cultivated acreage classified as (D)

Fig. (2) — Land Productivity Classification : Acreage of Deteriorated Productivity According to Location and Extent of Deterioration.



Source : Table (1)

is of productivity differing from 1.9 to 2.6, compared to 1.0 to 1.8 for class (E)[1]. Accordingly, average productivity amounts to 4.65 for class (A), 3.85 for (B), 3.5 for (C), 2.25 for (D), and 1.4 for (E), (Table 2). Acreage classified as (C) represents the medium class. Therefore, it can be considered as the standard class. Productivity of other classes can be converted to represent acreage of standard productivity, i.e. can be converted to acreage of class (C). In other words, one feddan of class (A) produces 1.52 times as much as that of class (C), compared 1.27 for class (B), 0.74 for (D), and 0.46 for cultivated acreage classified as (E), (Table 2).

Effect of improved productivity can, therefore, be measured as an equivalent to an increase of the cultivated acreage in terms of standard acreage. This in turn requires measuring both the improved acreage, and degree of improvement measured as the difference in productivity for the initial and current classes. Multiplying this difference by improved acreage gives the effect of improvement measured in terms of standard feddans. Effect of deterioration can also be measured by the same way. However the change in productivity in this case will be negative.

Table (2) — Land Productivity Classification : Range of Productivity classes, Average Productivity, and Transformation of Average Productivity of different classes to Standard Productivity.[1]

Classes of Prod. Class.	Range of Prod.	Average Prod.	Average Prod. As a Percentage of Standard prod.
A	4.3—5.0	4.65	1.52
B	4.2—3.5	3.85	1.27
C	2.7—3.4	3.05	1.00
D	1.9—2.6	2.25	0.74
E	1.0—1.8	1.40	0.46

(1) A feddan of the third productivity class was considered as a standard feddan, productivity of other classes were converted to indicate productivity of each class in terms of third class feddans.

(1) Sheera, Op. cit., p. 26.

Effect of Improved Productivity on Egyptian Cultivated Acreage : Improving the productivity of one feddan such that it is classified as (A) instead of (B) is equivalent to increasing its productivity by 0.25 of that classified as (C), compared to 0.52 standard feddan in case of improving it from (C) to (A). On the other hand, improving a feddan from class (C) to (B) is equivalent its productivity by 0.27 feddans of class (C), compared to 0.26 and 0.28 standard feddans if this feddan was improved from (D) to (C) and from (E) to (D) respectively, (Table 3). Multiplying these rates by improved acreage in each case gives the effect of productivity improvement in terms of standard feddan. Available data indicate that Egyptian soil conserving policies during the sixties resulted an increase in the cultivated acreage equivalent to that derived from extending the cultivated acreage by nearly 657,986 feddans of standard productivity.

Table (3) — Land Productivity Classification : Improvement of Productivity of Cultivated Acreage Measured in terms of Standard Feddans.

I			V	
Improved Acreage (Fed.)	(1) Initial Prod. Class	(2) Current Prod. Class	(3) Improv. in Prod. (S.F.)	(4) Effect of Prod. Imp. (S.F.)
1,133,508	B	A	0.25	283,377
124,545	C	A	0.52	64.763
903,245	C	B	0.27	243,876
184,166	D	C	0.26	47,883
64,531	E	D	0.28	18,069
Total	—	—	—	657,968

(1) Initial productivity class as exists in 1960-65 classification.

(2) Current productivity class as exists in 1966-70 classification.

(3) Computed as the difference between initial and current productivities.

(4) Computed in terms of standard feddans, i.e. acreage that is classified as third class, by multiplying column (V) by column (1).

Source : Compiled and computed from Tables (3) and (4).

Effect of Deteriorated Productivity on Egyptian Cultivated Acreage : Data presented in table (4) show the effect of productivity deterioration on Egyptian cultivated acreage computed in terms of standard feddans. Productivity of a feddan deteriorated from class (A) to (B) is equivalent to reducing cultivated acreage by 0.25 feddans of standard productivity, compared to 0.52 when it deteriorates from (A) to (C), and to 0.27 when it deteriorates from (B) to (C). Deterioration of a feddan from class (C) to (D) is equivalent to reducing the cultivated acreage by 0.26 feddans of standard productivity. Multiplying these rates by deteriorated acreage gives the effect of productivity deterioration on the Egyptian cultivated acreage, (Table 4). Computations indicate that Egyptian conserving policies during the sixties have unfavorably affected the cultivated acreage. Such unfavorable effect is equivalent to reducing the cultivated acreage by nearly 140 thousand feddans of standard productivity.

Table (4) — Land Productivity Classification : Deterioration of Productivity of Cultivated Acreage Measured in terms of Standard Feddans.

I			V	
Deteriorated Acreage (Fed.)	(1) Initial Prod. Class	(2) Current Prod. Class	(3) Deterioration in Prod. (S.F.)	(4) Effect of Det. Prod.
195,077	A	B	0.25	48,769
41,175	A	C	0.52	21,411
96,935	B	C	0.27	26,172
167,898	C	D	0.26	43,653
Total	—	—	—	140,005

(1) As exists in 1960-65 classification.

(2) As exists in 1966-70 classification.

(3) Computed as the difference between the initial and current productivities.

(4) Computed by multiplying Col. (1) by (V).

Source : Compiled and computed from Tables (3) and (4).

Summary and Conclusions

Egyptian cultivated acreage, in a view of an economy that is mostly agricultural and in face of invulnerable restrictions imposed on its expansion, is the most vital determinant of agricultural production. Soil conservation policies are, therefore, of vital concern to the welfare of both the society and the rural population. Increasing, or at least maintaining productivity of already cultivated acreage is the ultimate goal of those policies. Periodic lend productivity classifications can, in these regards, be used to check the adequency of those policies in achieving their goal.

Redistributing acreage of different classes of the 1965 land productivity classification according to those of the 1970 one reveals a significant improvement in land productivity. Most of the improvement is concentrated in Lower and Mid Egypt. Improvement in land productivity is the net resultant of various policies conducted for soil conservation. Some of these policies affect directly the physical, chemical, and biological characteristics of the cultivated acreage. However, other policies, such as those of pest control, may have indirect effect on land productivity.

A more critical insight indicates that, in spite of that overall improvement, productivity of a sizable part of the cultivated acreage was subject to noticeable deterioration. This deterioration extended over an area of nearly one-half million feddans of the cultivated acreage. Degree of deterioration, as well as that of improvement, differs from one location to the other. Most of the deterioration was found to be concentrated in Upper Egypt, i.e. within the acreage of basin irrigation prior to the completion of the High Dam. Available evidence indicate that such deterioration resulted from transforming the irrigation of this area to the perennial system. This advocates the hypothesis that the project was not throughly investigated. There exists a dire need for reinvestigating the design and excution of the project.

Productivity of medium class was considered as a standard, and those of other classes were computed with respect to it.

This facilitated computing the difference of land productivity for the 1965 and 1970 classification. Multiplying these differences, which are likely to be positive in case of improved productivity and negative in case of deterioration, by improved or deteriorated acreage resulted the effect of soil conserving policies on cultivated acreage computed in the form of equivalent acreage of standard productivity. Egyptian soil conserving policies during the sixties resulted an increase in the cultivated acreage equivalent to that of increasing the cultivated acreage by nearly 657,968 feddans of standard productivity. These policies, however, have meanwhile resulted a reduction in the cultivated acreage equivalent to almost 140 thousand feddans of standard productivity.

Appendix Table (1) — Land Productivity Classification : Egyptian Cultivated Acreage Classified According to Productivity as of 1961-65.

Class	Range of Productivity	Number of Counties	COUNTRIES	Cultivated Acreage (Fed.)	%
A	5.0–4.3	28	Kafr Shoukr, El-Badary, Sedfa, Matia, Samlout, Kafer El-Ziat, Maghagha, Minia, El-Kousia, Dirout, Damietta, Sohag, Bassun, Fareskour, El-Shouhada, Beni-Mazar, Manfalout, Abu Tisht, Talla, Menouf, Malawi, Gerga, El-Bagout, Abu-Kerkas, Dier-Mawas, El-Baliana, Akhmiem, Tema.	1,113,819	18.7
B	4.2–3.5	38	Berket El-Sabeh, Toukh, El-Adwa, Abu-Tig, Abnoub, Assiut, Sakoulta, Tahta, Dessouk, Mit-Ghamer, Mina El-Kamh, Quesna Benha, Ashmoun, El-Saf, El-Fashn, Awlad Touk, El-Mishg, El-Santa, Tanta, Shabien, El-Kanater, Kaliub, Smasta El-Wakf, El-Marakha, Zifta, Samanoud, Zagazig, Naga Hamadi, Aga, El-Mataria, El-Aiat, Beba, Shebien El-Koum, El-Ghanka, El-Kanater El-Khairia, Shoubra Khiet, Hehia, Beni-Sweif.	1,601,693	26.8
C	3.4–2.7	38	Koutour, El-Mahala El-Koubra, Kalien, Itay El-Baroud, El-Manzala, El-Mansoura, Belbies, Dierb Namg, Giza, Qena, Kom Hamada, Fowa, Kafr El-Shiekh, Dekirnes, Sherbin, El-Mahmoudia, Talkha, Abu Hamad, Abu Kebier, Kafr Saker, Imbaba, El-Wasta, Esna, Biela, El-Senbelawien, Madi, Sidi-Salem, Damnhour, Fakous, Ismailia, Bouch, Fayoum, Armant, Deshna, Kom Ombo, Belkas, El-Badrashien, Ahnasia.	2,227,789	37.3

Table (1) — Continued

Class	Range of Productivity	Number of Counties	COUNTRIES	Cultivated Acreage (Fed.)	%
D	2.6–1.9	18	Etsa, Fayed, Kafr El-Dawar, Senouris, Rossetta, Kous, Idfu, Abu Komos, Abu El-Matamier, Ibshawai, El-Hussienia, Kafr Saad, Alexandria, El-Kanater, Luxor, Hosh Essa, El-Delengat, Tel El-Kebir.	929,627	15.6
E	1.8–1.9	4	Bourolos, Tamia, Aswan, Ayneba	96,267	1.6
Total	—	—	Egyptian Cultivated Acreage.	5,969,195	100.0

Source : Dep. of Ag. Econ. & Stat., **Economic Classification of Egyptian Cultivated Acreage** (1961-65), Cairo : Ministry of Agricultures, 1965.

Appendix Table (2) — Land Productivity Classification : Egyptian Cultivated Acreage Classified According to Productivity as of 1966 - 70.

Class	Range of Productivity	Number of Countries	COUNTRIES	Cultivated Acreage (Fed.)	%
A	5.0–4.3	50	Berkt-El-Sabeh, Tela, Shebien El-Kom, El-Shouhada, Kafr Shouker, El-Kanater-El-Khaireia, Minia, El-Kamh, El-Bagour, Benha, Toukh, Dier-Mawas, El-Adwa, Dierout, Sedfa, Kafr El-Zayiat, Menouf, Kaliub, Shebien-El-Kanater, El-Ayat, Abu-Kerkas, Minia, El-Kousia, Damietta, Ashmoun, Maghagha, Malawi, Abnoub, El-Badari, Mit-Ghamer, Kwesna, Zagazig, Beba, Zifta, Aga, Abu Kebier, Belbies, El-Fashn, Beni Mazar, Samalout, Matai, Menfalout, Basiun, El-Santa, Tanta, Hehia, El-Saf, El-Khanka, Abu Tig, Assiut, Gehina.	2,169,370	36.3
B	2.4–3.5	32	El-Mansoura, Beni-Sweif, Samsata, El-Wakf, Abu Tisht, Imbaba, Akhmiem, Sakoulta, Tima, Nagh Hamadi, Fiwa, Giza, Boush, Abu Hamad, El-Mataria, El-Maragha, Koutour, Klien, Tahta, Fareskour, El-Wasta, El-Baliana, Kom Hamada, El-Mahala El-Koubra, Biela, Dierb Nagm, Gerga, Samanoud, Dessouk, El-Senbalawen, El-Badrashien, Fayoum, Awlad Touk.	1,436,037	24.0
C	3.4–2.7	23	Ety-El-Baroud, Elkas, Sohag, Damanhour, El-Mishah, Rossetta, El-Mahmoudia, Sidi-Salem, Talkha, Ahnasia, Shoubrakhieet, Kafr El-Shiekh, Dkernis, Sharbin, Fakous, Armint, Madi, Kafr-Saker, Deshna, El-Delengat, Senouris, Luxor, Kena.	1,354,162	22.7

Table (2) — Continued

Class	Range of Productivity	Number of Countries	COUNTRIES	Cultivated Acreage (Fed.)	%
D	2.6–1.9	16	Etsa, Kom-Ambo, Housh Essa, Ebshwai, Esna, Idfu, Kafr-Saad, El-Tel El-Kebier, El-Manzala, El-Hussienia, Kous, Abu Homos, Kafr El-Dawar, Ismailia, Tamia, Aswan.	875,469	14.7
E	1.8–1.0	5	Abu El-Matamier, El-Borolos, Alexandria, Suez.	138,923	2.3
Total	—	—	Egyptian Cultivated Acreage	5,973,961	100.0

Source : Dep. of Ag. Econ. & Stat. **Economic Classification of Egyptian Cultivated Acreage**, (1966-70), Cairo : Ministry of Ag., 1970.

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AN ECONOMIC ANALYSIS OF STATE FARM CREDIT IN EGYPT, 1960-1970

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INTRODUCTION

Capital is very important factor indetermining the kind, amount and quality of a society's total production. In modern agriculture farm operators are using more and more non-farm inputs. These inputs include machinery, feeds, fertilizers, insecticides, herbicides, gasoline, hyrbid seeds, feed additives, etc. Hence capital has been used to increase the productivity of labour in farming.

Increasing use of capital in farming has been facilitated by the adoption of yield increasing technology. The new technology is thus concerned with an intensive use of capital on farms. Although the adoption of technology generally lowers per unit costs of production, it increases total capital costs per farm.

Capital in agriculture comes from three main sources, from landlords, from farm operators and from farm credit. In other words capital flow to agriculture stems from savings or credit. The credit source gives rise to capital directly through borrowing.

In many underdeveloped countries the savings level tends to be low. In these situations capital formation is difficult since the major portion of income is consumed for current necessities.

The principal sources of farm credit in Egypt, especially in the last decade, are government agencies and the co-operative

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agricultural credit system. These sources make loans available to farm operators in one or more form.

Objectives of the Study

The general purpose of the study is to shed light on public finance of agriculture in Egypt during the sixties. The specific objectives are to :

1 — Determine the trends of both costs of agricultural production and farm credit and indicate the relationship between farm credit and the costs of agricultural production.

2 — Examine the distribution of farm credit according to the length of time.

3 — Examine the distribution of farm credit among in kind credit and cash credit.

4 — Investigate the pattern of the distribution of farm credit among the farming areas (governorates).

5 — Examine the pattern of the distribution of farm credit among agricultural products.

Sources of Data

Data used in the analysis were obtained from :

1 — The Agency of Agricultural Economics and Statistics, Ministry of Agriculture.

2 — The Central Agency for Public Mobilization and Statistics.

3 — General Organization for Agricultural Co-operative Credit.

The Relationship between farm Credit and farm Production.

Simple correlation between the total value of farm credit and the total value of farm production during the study period was examined. The correlation coefficient was 0.92 and was highly significant. The coefficient of determination was 0.85. This means that 85 percent of vaniation in the value of farm production may be explained by the veriation in the value of farm credit.

Trends of the Costs of Production and Credit in Agriculture :

The following two equations indicate the general trends of the costs of production in agriculture and farm credit respectively during the period 1960-1970.

$$1 - Y = 143.07 + \underset{(3.1)}{18.8}\, x^{*}$$

$R = 0.9 \quad R^2 = 0.81 \quad R'^2 = 0.80$

Where Y indicates the costs of agricultural production in L.E. millions and x indicates years.

$$2 - Y = 39.7 + \underset{(0.96)}{4.7}\, x^{*}$$

$R = 0.86 \quad R^2 = 0.75 \quad R'^2 = 0.72$

Where Y represents the value of farm credit in L.E. millions and x represents years.

The above two equations indicate that while the annual increase in the costs of agricultural production was L.E. 18.8 millions and represented 7.6% of the average costs of agricultural production for the study period which was L.E. 246.7 millions, the annual increase in the farm credit was L.E. 4.7 millions and represented 7.2% of the average of farm credit value during the study period which was L.E. 65.5 millions.

Table (1) shows the ratio of farm credit value to the value of costs of agricultural production during the period 1960-1970. The table shows that the ratio of farm credit to the costs of production in agriculture or the public finance ranged from 23.7% in 1960/61 to 29.9% in 1963/64. However the average ratio of the public finance to agriculture to the costs of agricultural production was 26.6% during the study period. This means that farmers provided 73.4% of the costs of production in agriculture on the average for the study period.

* The statistics were significant at 0.01 level.

Table (1)

Ratio of Farm Credit to the Costs of Agricultural Production, Egypt, 1960-1970

Years	Farm credit / Cost of Agricultural Production
	%
1960/61	23.7
1961/62	24.0
1962/63	29.0
1963/64	29.9
1964/65	28.6
1965/66	27.4
1966/67	27.6
1967/68	24.0
1968/69	24.0
1969/70	27.0
Average for the period	26.6

Table (2)

Percentage of short, Medium and long term Credit to total Farm credit, Egypt, 1960-1970

Year	Short term credit %	Medium term credit %	Long term credit %
1960/61	96.82	3.13	0.05
1961/62	97.82	2.15	0.03
1962/63	96.0	3.9	0.1
1963/64	94.7	5.3	0.0
1964/65	96.1	3.9	0.0
1965/66	98.3	1.3	0.0
1966/67	97.4	2.6	0.0
1967/68	97.1	2.9	0.0
1968/69	92.2	2.8	0.0
1969/70	97.7	2.3	0.0

Short, Medium, and long term Credit

Table 2 shows, the percentage distribution of farm credit during the period 1960-70 according to the length of time. The discloses that the short term credit (redeemable over a period not exceeding 14 months and designed mainly to finance sowing and harvesting operations) represented the most important form of farm credit during the sixties. However the medium term credit (redeemable in 10 years to finance mainly the purchase of machinery and cattle) represented only about 3% on the average of the total value of farm credit during the study period. The long term-credit (for the reclamation and developments of lands) was insignificant. The insignificance of the long term credit could be explained by the fact that the government is carrying out all the reclamation and development of lands and not the individuals.

Table, 3 indicates the percentage of the farm credit used to finance the purchase of machinery during the period 1960-70.

Table (3)

Percentage of Farm Credit used to finance Machinery Purchase, Egypt, 1960-1970

Year	Percentage of farm credit used to finance machinery purchase
1960/61	0.0
1961/62	0.119
1962/63	0.025
1963/64	0.0
1964/65	0.0
1965/66	1.52
1966/67	1.09
1967/68	0.679
1968/69	0.341
1969/70	0.746

The table also indicates that loans devoted to machinery purchase was very small.

The Distribution of Farm Credit among in Kind Credit and Cash Credit

Table 4, shows the percentage distribution of farm credit value during the period 1965-1970 among in kind credit and cash credit. The table discloses that the average percentage of in kind credit to the total value of farm credit during the period 1965-1970 was about 65% and that about 35% on the average of the total value of farm credit during the same period was given in the form of cash credit.

Table (4)

The Percentage Distribution of Farm Credit Value among in kind Credit and Cash Credit, Egypt, 1965-1970

Year	In Kind credit %	Cash Credit %
1965/66	60.2	39.8
1966/67	64.0	36.0
1967/68	67.4	32.6
1968/69	67.7	32.3
1969/70	64.9	35.1
Average for the period	64.8	35.2

The Distribution of Farm Credit among The Farming Areas (Governorates)

Table 5 shows the average percentages of farm credit appropriated to the farming areas during the period 1961-1970.

The governorates which obtained relatively high average percentages of the total value of farm credit are El Behera, El Dakahlia, El Minya, El Sharkia, El Gharbia and Kafr El Sheikh. They obtained on the average 12.54%, 11.89%, 9.33%, 8.79%, 8.69% and 7.23% respectively of the total value of farm credit during the period 1961-1970. Meanwhile the governorates which obtained relatively low average percentages of the total value of farm credit are El-Wadi El-Guedid, Port-Said, El-Suez, El-Ismailia and Alexandria. They obtained on the average 0.033%, 0.035%, 0.036%, 0.41% and 0.76% respectively of the total value of farm credit during the period 1961-1970.

Table (5)

The Average Percentages of Farm Credit Appropriated to Governorates, Egypt, 1960-1970.

Governorates / Years	1961/62 %	1962/63 %	1963/64 %	1964/65 %	1965/66 %	1966/67 %	1967/68 %	1968/69 %	1969/70 %	Average %
Cairo	2.67	2.41	1.77	1.43	1.30	1.17	1.65	0.45	0.39	1.47
Alexandria	0.87	1.06	1.28	0.66	0.39	0.47	0.57	0.77	0.84	0.76
Port Said	—	0.03	0.04	—	—	—	—	—	—	0.035
El Suez	0.02	0.04	0.06	0.06	0.05	0.03	0.02	0.01	—	0.36
Damietta	1.16	1.19	1.70	1.52	1.40	1.70	1.35	1.11	1.20	1.37
El Dakahlia	10.71	10.81	11.42	10.69	11.40	12.43	12.61	12.24	14.75	11.89
El Sharkia	8.21	7.80	8.31	7.28	8.00	9.27	9.26	9.99	11.01	8.79
El Kaluibia	3.8	2.52	2.64	2.63	2.90	2.96	3.01	2.63	2.33	2.74
Kafr El Sheikh	6.60	6.08	6.56	9.94	6.81	6.58	7.26	7.04	8.20	7.23
El Gharbia	10.02	8.79	9.84	8.22	7.36	8.71	9.10	7.99	8.35	8.69
El Monofia	5.86	4.76	4.86	4.79	4.48	5.40	5.57	5.77	5.46	5.21
El Behera	11.34	13.33	12.96	12.72	12.88	13.56	12.41	11.73	12.01	12.54
El Ismailia	0.43	0.49	0.53	0.42	0.35	0.44	0.40	0.36	0.31	0.41
El GszSa	1.54	1.73	2.24	1.73	1.82	1.47	1.16	0.95	0.84	1.49
Beni Suef	3.84	3.71	5.03	5.87	4.88	3.68	3.88	4.30	4.36	4.39
El Fayum	3.16	3.55	2.87	3.34	4.63	4.46	4.02	4.23	4.93	3.90
El Minya	10.96	10.65	9.34	8.77	9.31	8.66	8.38	8.50	9.40	9.33
Assiut	7.12	6.31	4.98	5.60	6.63	5.43	5.04	8.60	6.53	6.24
Sohga	4.32	5.11	3.86	4.94	6.72	5.78	5.82	5.60	5.91	5.33
Quin	6.63	6.52	6.35	6.14	5.97	5.2	5.56	7.40	7.50	6.36
Aswan	1.45	3.13	3.43	3.22	2.72	2.60	2.09	3.20	3.02	2.84
El Wadi El Gedid	—	—	0.02	0.02	—	0.02	0.04	0.06	0.04	0.035

Table 6 indicates the percentages of the cultivated land, the contribution to the total value of farm production and the appropriated farm credit by governorate during the year 1966 (pre/war year).

The table shows that while El Behera represented about 12% of the total cultivated land in Egypt and contributed about 11% to the total value of farm production, obtained about 13% of the total value of farm credit.

However El Dakahlia, El Minya, El Sharkia, El-Gharbia and Kafr El Sheikh represented about 11%, 7%, 11%, 7% and 7% of the total cultivated land in Egypt and contributed about 9%, 8%, 10%, 7% and 6% to the total value of farm production and obtained about 11%, 9%, 8%, 7% and 7% of the total value of farm credit respectively.

While lower Egypt governorates represented about 60% of the total cultivated land and contributed about 61% to the total value of agricultural production, obtained about 57% of the total value of farm credit. Like-wise the middle Egypt governorates represented nearly 21% of the total cultivated land and contributed about 21% to the total value of agricultural production, and obtained about 21% of the total value of farm credit. However the upper Egypt governorates represented about 19% of the total cultivated land and contributed 18% to the total value of agricultural production and obtained almost 22% of the total value of farm credit.

The Distribution of Farm Credit among Agricultural Products

While cotton contributed about 14% to the total value of agricultural production in 1966 cotton producers obtained about 49% of the total value of farm credit. However zea maize, wheat, rice and sugar cane contributed to the total value of agricultural production in 1966 about 8%, 7%, 5% and 2% and the crop producers obtained about 13%, 10%, 9%, and 6% respectively of the total value of farm credit, table 7.

Table (6)

The Percentages of Cultivated Land, the Contribution to the total Value of Agricultural Production and Appropriated Farm Credit by Governorate, Egypt, 1966

Governorate	Cultivated land %	Contribution to the total value of Agricultural production %	Appropriated Farm credit %
Alexandria	0.5	0.7	0.39
El Behera	12.4	11.1	12.88
E Gharbia	7.1	7.4	7.36
Kafr El Sheikh	7.4	6.1	6.81
El Dakahlia	10.5	9.2	11.40
Damietta	1.8	1.5	1.40
El Sharkia	10.8	10.4	8.00
El Ismailia	1.0	1.2	0.35
El Suez	0.1	0.2	0.05
El Monofia	5.3	8.1	4.48
El Kaliubia	3.2	4.9	2.90
Cairo	0.2	0.4	1.30
Lower Egypt	60.3	61.1	57.32
El Giza	3.0	5.0	1.82
Beni Suef	4.4	4.0	4.88
El Fayum	5.7	4.7	4.63
El Minya	7.4	7.6	9.31
Middle Egypt	20.5	21.3	20.64
Assiut	5.3	5.6	6.63
Sohag	5.4	5.4	6.72
Qina	5.9	5.4	5.97
Aswan	2.6	1.4	2.72
Upper Egypt	19.2	17.6	22.04

This means that the largest part of farm credit value was devoted to a limited number of traditional agricultural products : cotton, maize, wheat, rice and sugar cane while the portion of farm credit value devoted to vegetables, fruits and livestock products was very small.

Table (7)

The Percentages of contribution to the total Value of Agricultural Production and appropriated credit by Agricultural Products, Egypt, 1966

Agricultural Product	Contribution to the total Value of Agricultural production %	Appropriated credit %
Cotton	13.8	48.7
Zea maize	8.3	12.6
Wheat	7.4	10.1
Rice	4.7	9.4
Sugar-cane	1.5	6.1
Beans	2.4	1.2
Onion	0.9	0.5
Ground nuts	0.4	0.2
Other agricultural products	60.6	11.2

Table 8 indicates the loans per feddan and the ratio of loans to costs of production for the main field crops during the period 1960-1970. Cotton producers obtained L.E. 16 in terms of loans per feddan on the average during the study period. This represented about 25% of the costs of producing cotton.

Likewise wheat, Zea maize, rice, and onion producers obtained L.E. 6.3, 5.2, 6.7 and 7.6 respectively in terms of loans per feddan on the average during the study period. These loans represented about 18%, 18%, 14%, and 12% of the costs of producing wheat, zea maize, rice and onion respectively.

Table (8) Loans per Feddan and the Ratio of loans to Costs of Production for the main Field Crops, Egypt 1960 - 1970

Field Crops	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	Average
Loans per feddan L.E.	6.1	6.0	11.6	14.6	16.0	18.3	22.1	22.1	20.2	24.1	16.1
Cotton											
Loans : Costs of production %	13.4	12.0	22.3	26.5	27.7	28.2	30.9	31.6	28.6	32.7	25.4
Loans per feddan L.E.	2.9	3.0	8.6	5.7	8.7	7.0	9.6	7.2	6.6	7.5	6.7
Rice											
Loans : Costs of production %	8.2	7.7	21.6	14.3	19.4	13.5	17.1	12.6	11.1	12.5	13.8
Loans per feddan L.E.	0.33	1.3	1.3	1.5	1.4	2.7	2.6	3.3	2.8	1.9	1.9
Beans											
Loans : Costs of production %	1.4	6.0	5.4	6.3	5.4	9.2	8.4	12.3	8.8	6.0	6.9
Loans per feddan L.E.	1.1	1.3	1.5	1.2	0.8	1.02	2.3	2.0	2.3	1.9	1.6
Ground nuts											
Loans : Costs of production %	4.7	4.4	5.2	3.9	2.6	2.5	8.5	5.01	5.8	4.6	4.7
Loans per feddan L.E.	1.6	2.1	3.3	2.1	5.4	10.8	7.9	2.9	26.2	13.9	7.9
Onion											
Loans : Costs of production %	3.7	4.9	7.7	4.2	11.5	20.0	13.0	14.1	32.3	17.4	11.9
Loans per feddan L.E.	4.3	4.8	4.2	3.2	4.2	6.1	6.6	6.8	5.6	5.9	5.2
Zea Maize											
Loans : Costs of production %	18.8	20.0	17.1	13.2	15.8	20.8	21.5	21.3	13.8	14.5	17.7
Loans per feddan L.E.	4.1	7.1	4.6	5.8	5.8	9.3	6.7	6.8	5.0	7.3	6.3
Wheat											
Loans : Costs of production %	14.4	24.7	16.0	19.5	18.8	24.9	17.1	17.1	12.5	18.6	18.4
Loans per feddan L.E.	0.33	1.3	1.3	1.5	1.4	2.7	2.6	3.3	2.8	1.9	1.9
Sugar cane											
Loans : Costs of production %	1.4	6.0	4.5	6.3	5.4	9.2	8.4	12.3	8.8	6.0	6.9

However farm operators obtained about L.E. 1.9, 1.9, 1.6 in terms of loans per feddan on the average during the study period for beans, sugar cane and ground nuts respectively. Loans represented 6.9%, 6.9% and 4.7% of the costs of production of beans, sugar cane and ground nuts respectively.

When table 9, which discloses the average percentage distribution of loans according to farm practices for the main field crops for the period 1965-1970, was examined it was found that insecticides and pest control loans represented about 40% of the total value of loans given to cotton producers. Also about 28% of total value of loans given to cotton producers was to finance harvesting practices. However fertilizers loans represented 27% of total value of loans given to cotton producers.

For rice fertilizers loans represented more than 50% of the total value of loans given to producers. Likewise harvesting and seeds loans represented about 23% and 21% respectively of the total value of loans given to rice producers.

Table (9)

The Average Percentage Distribution of Loans according to Farm Practices for the main Field Crops, Egypt, 1965 - 1970

Farm Practice	Cotton %	Rice %	Zea maize %	Wheat %	Onion %	Beans %
Seeds	4.6	21.4	4.1	23.3	19	67.7
Fertilizers	27.0	54.6	93.6	75.7	64.3	31.4
Insecticides	20.1	0.1	0.7	0.1	11.3	0.6
Harvesting	28.1	22.6	1.4	0.8	2.2	0.2
Pest Control	20.2	1.3	0.2	0.2	3.2	0.1

For zea maize fertilizers loans represented about 94% of the total value of loans given to crop producers.

For wheat fertilizers and seeds loans represented about 76% and 23% respectively of the total value of loans obtained by the producers.

For onion, producers obtained about 64% and 19% of the total value of loans in terms of fertilizers and seeds respectively.

Seeds and fertilizers loans for beans producers represented about 68% and 31% respectively of the total value of loans given to them.

Summary and Conclusions

It is known that credit is one of the more important tools that farm operators use to balance, expand and intensify the factors of production. Furthermore, non-farm inputs means more farmer's needs to credit. Also, when farmers have low incomes, they have less of savings to finance the farm business. The study was carried on to examine the expansion of one of the main sources of farm credit in Egypt, i.e., the state farm credit.

The study revealed that there is a high correlation between total farm production and the available state farm loans.

While costs of production in agriculture increased annually by 7.6% of the average during the period 1960-1970, state farm loans increased annually by 7.2% of the average during the same period. Likewise, the ratio between state farm loans and the costs of agricultural production was 2.6% on the average during the study period. This means that farm operators have to provide on the average 73.4% of the costs of production in agriculture. It seems that this will be a burden to farmers when they are faced with low levels of incomes and they have to meet the necessities of their life.

The study showed that the short term credit represented the most important form of farm credit during the sixties. The medium term credit represented only about 3% on the average of the total value of farm credit during the study period. The long term credit was insignificant. The loans devoted to machinery purchase was very small.

The study revealed that the average percentage of in kind credit to the total value of farm credit during the period 1965-70 was about 65% and that about 35% on the average of the total value of farm credit during the same period was given in the form of cash credit.

State farm credit distribution among the different farming areas (governorates) during the year 1966 (pre-war year) was examined. While lower Egypt governorates represented about 60% of the total cultivated land and contributed about 61% to the total value of agricultural production, obtained 57% of the total value of farm credit. Yet middle Egypt governorates represented nearly 21% of the total cultivated land and contributed about 21% to the total value of agricultural production and obtained about 21% of the total value of farm credit. However upper Egypt governorates represented about 19% of the total cultivated land and contributed 18% to the total value of agricultural production and obtained almost 22% of the total value of state farm loans.

Also state farm loans distribution among agricultural products was examined. However in 1966 while cotton contributed about 14% to the total value of agricultural production, cotton producers obtained about 49% of the total, value of farm credit.

Zea maize, wheat, rice and sugar cane contributed to the total value of agricultural production in 1966 about 8%, 7%, 5% and 2% and the crop producers obtained about 13%, 10%, 9% and 6% respectively of the total value of farm credit.

This means that the largest part of farm credit is devoted to a limited number of traditional agricultural products : cotton, maize, wheat rice and sugar cane while the portion of farm credit devoted to vegetables, fruits, and livestock products is very small.

Farm operators obtained in terms of loans per feddan on the average during the period 1960-1970 L.E. 16.1 for cotton, L.E. 6.3 for wheat, L.E. 5.2 for zea maize, L.E. 6.7 for rice, L.E. 7.6 for onion and L.E. 1.9 for beans. However, state farm loans represented about 25%, 18%, 17%, 14%, 12% and 7% of the costs of producing cotton, wheat, zea maize, rice, onion and beans respectively.

State farm loans were used mainly to finance insecticides and pest control for cotton, to finance fertilizers for wheat, zea maize, rice and onion and to finance seeds for beans.

SOME BASIC PROBLEMS OF ECONOMIC PLANNING IN DEVELOPING COUNTRIES

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1 — After gaining their political independence, these countries face the enormous task of attaining economic independence on a solid basis. It is related to a number of stupendous tasks which culminate in the complete economic and structural changes in these countries. In this process the question that arises is how this has to be done. Many have thrown overboard the classical bourgeois theories in economic development and have turned to planned economic principles to get out of this wretched situation brought about by colonial domination often lasting centuries.

2 — There was a time when planning was denigrated and described as characteristic of an authoritarian regime, but today most bourgeois economic theorists are of the view that planning is a neutral instrument whose specific characteristic in the various countries correspond to this political orientation of the governments concerned. In our view, this is wrong. Planning is a social and historical category the effectiveness of which depends on the existence of certain social relations. This means that a real economic plan, which does not come into conflict with the objectively prevailing economic laws, can only be materialized if there is an absolute preponderance of the state sector of the economy in a democratic country which consistently serves the interests of the broad masses.

Apart from the character of the state, the following points determine the character of planning and efficiency :

(i) a well disciplined economic administrating organization;

(ii) the position attained in social and economic development of the country concerned ;

(iii) its international position in general and in certain integrated economic communities in particular.

3 — Since the beginning of the fifties, developing countries have begun with some national planning (I am not referring to the so-called plans of the former colonial powers for these countries). The national planning efforts show varying results and conditions according to the varying relations in inputs or expenditures made. The differences in the results depend on the different solutions of fundamental questions like the national and the colonial question, the resulting position vis-a-vis their former colonial powers and imperialism in general, the agrarian question and finally the social issue in these countries.

When today we view the planning system of these countries where there are possibilities in effective planning (I have in mind developing countries of socialist orientation), one can see a number of fundamental mistakes. Essentially they are as follows :

(i) There is no real comprehensive system of economic planning which encompasses all stages of the social reproduction process.

(ii) There is no uniform system of planning and plan communication that includes all stages and levels of an economy.

(iii) Planning is usually carried out as financial planning (budget estimation). Physical balancing in terms of physical resources is scarcely or insufficiently included.

(iv) They usually separate plan drafting and plan implementation. Planning ends with plan formulation. The unity involved between plan drafting and implementation and control is not appreciated. The formulated plan is seen as something like a «magical formula» that is almost realized automatically, i.e., the plan is not raised to the level of a directive having legal force.

4 — The mistake or shortcomings mentioned have an ideological background. They are mainly based on an erroneous view that planning is a neutral instrument realized independently of socio-economic relations and that theories in planning can be con-

sidered as detached from concrete conditions. As a consequence of factors arising out of past connections of developing countries with advanced capitalist countries and because of the actual fact that a large number of the inteligentsia have received their education and training in the latter countries making them look more towards their former mentors, there are still relatively a lot of ideological and theoretical influences. Under their direct and indirect guidance, economists and planners in developing countries attempt to realize planning (programming) which has been elaborated for the economies of developed capitalist countries (e.g. planning models of Harrod/Domar, Tinbergen and others).

5 — A second cause which has its origin in ideology is nationalism in some developing countries. This is expressed in two tendencies (in connection with our problem of planning), especially in the Arab countries and has a history that one may not underestimated.

(i) They over-stress some of the national peculiarities and decline to draw conclusions based on experiences of other countries which carry out planning. When, however, they are faced with a contradiction, oné sees that their present knowledge has its origin in the experiences of others and gathered under totally different conditions which are now supposed to serve them here. The result is that they are unsuitable for these theories.

(ii) Nationalism appears in planning in the shape of «Arab socialism». This is supposed to be socialism based on a fundamentally different philosophical outlook. This view greatly hinders drawing lessons from socialist theories.

6 — This must not be taken to mean that the socialist system of economic planning as practized currently in the European socialist countries can be or should be copied in developing countries (the progressive ones included). Planning, as already mentioned, is a social category and as such is related to the concrete social conditions of the particular country where it is to be realized. This again does not mean that in the basic elements of the system, there cannot be some analogies or identities. The variability is in the degree of decentralization or centralization of decision making.

7 — The specific basic elements and characteristics of a developing country where an effective system of planning is to be realized, i.e., the degree of centralization or decentralization, result from the specific socio-economic and political conditions of the country concerned and depend on :

(i) the position reached in economic development generally (position of the productive forces) ;

(ii) the power relations between the various socio-economic formations (the state or public sector, the cooperative sector and here especially its social character generally, the sector of small commodity producers and the private capitalist sector) ;

(iii) human relations which express the power relations and that they are stable

(a) as relations between people and state,

(b) as relations between man and man especially in production,

(c) the relations of man with the means of production especially his attitude to work,

(d) the state of education and training of a worker and the standard of education and training in general,

(e) the existence of progressive mass organizations, especially the existence of progressive parties which include the avant-garde of society and has a mass basic and it is possible for it to determine the direction of development and enforce its realization.

8 — Apart from the social criteria, one may not leave out of consideration the organizational-technical problem. There is a close connection between centralization, decentralization and the system of indicators. The relation is of quantitative and a qualitative nature. The number of indicators required (as information and as a directive) rises with the degree of centralization and decreases with decentralization. The qualitative relation is the reverse, i.e., the quality of the indicators used must rise with increasing decentralization and it has to assume the character of an incentive.

9 — The present stage of development in developing countries requires a good deal of centralization. This is all the more necessary since the given possibility is consistent with a relatively limited complexity of the given economy. In this way a relatively less difficult comprehensive survey can be obtained of the reproduction process including its internal and external interrelation or inter-dependences. At the moment the realization of centralization deemed necessary in economic planning is made difficult. As a consequence the given possibility is limited because of insufficient build up of a reliable system of statistical information.

10 — The current two-level system of planning in developing countries cannot be maintained but has to be replaced by a uniform system which encompasses all levels and can be considered as a unit of economic and enterprise planning. Based on the actual fact that the economy is a cybernetic system, planning must also be based on cybernetic methodology. In principle it has to encompass all the partial systems of the aggregated whole system. From this standpoint, by planning we mean,

(a) the strategy applied in order to attain some aims or results and

(b) the totality of the aims and results of the partial and the aggregated or the whole system.

11 — Planning in developing countries, like any real and effective planning generally has to be a unity between

(a) long-term prognostic estimation of future development stages stretching from a period of 15 to 25 years,

(b) a concrete perspective plan stage of about 5 or 7 years,

(c) a short-term plan period with all the concrete tasks fixed for the plan year.

Prognostic estimation has the following tasks :

(i) research in international economic development within a system of international division of labour to which the country belongs,

(ii) research in international trends in development in demand according to the typical export products of the country concerned, the development of eventual substitutes, i.e., research in international trends in the development of productive forces,

(iii) research in the natural conditions of the country and the resulting production possibilities,

(iv) based on research, a programme has to be worked out fixing the necessary changes in the structure after taking into consideration the current economic structure of the country concerned,

(v) apart from these economic structural changes, there has to be a prognosis of social structural changes which are necessary in order that the economic surplus could be productively used, i.e., for realizing the prognostic programme.

(vi) further, there has to be a prognosis in the sphere of current sociological problems and the resulting changes which are a consequence of social and economic structural changes or conditions for these changes (population figure, its social and professional relations, demands on professional groups, conclusions drawn for education and training in view of the changes, cultural and materials needs of the population etc.).

As a generally valid plan axiom, also for the developing countries, it has to be stated that perspective plans are specifications of long-term prognoses without making it an arithmatical fraction. In this way, results of prognostic estimation are continually and critically examined and modified. This applies to short-term and perspective plans as well.