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THE ECONOMICS OF TRACTORS IN EGYPTIAN AGRICULTURE

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GENERAL BACKGROUND

The great progress in present world agricultural production is due to the great care given for finding the most efficient methods required for agricultural production. The use of agricultural mechanization in advanced countries has resulted in increasing agricultural production, decreasing agricultural costs, increasing the efficiency of the agricultural laborer and raising his standard of living. This is because the mechanical equipment replaced man and animal in agricultural operations. In that way, man has been liberated from being enslaved to the land under unhuman conditions.

In underdeveloped countries such as Egypt which try to keep up with the advanced countries in using modern technology, we find that agriculture still depends on human and animal power. But agriculture in these countries still uses the methods which were prevalent a very long time ago. Any expected development in the Egyptian agricultural methods should be aided by modern agricultural tools. What makes this of even greater importance is that the Egyptian economy still depends on agriculture: The share of agricultural production is about 31% of the total national income (Al-Hossary, 1979). Moreover, the agricultural sector provides the raw materials necessary for many important industries.

Modern agricultural equipment was first introduced to the Egyptian farmer in the second quarter of this century. However, the method of introducing these tools was carried out in a haphazard way. It was not at all a scientifically studied or organized method. This haphazard method resulted in introducing tractors and equipment which were unfit for the conditions of agriculture in Egypt. As well, tractors were often misused by farmers for operations such as turning the irrigation sakias (Archimedean screws), or pulling the "Norag" in threshing operations.

This paper deals with the economics of tractors in Egyptian agriculture. Tractors play a principal role in carrying out all the main agricultural operations. Such operations may often be carried out with greater efficiency and lower cost by tractor than with traditional human or animal power.

CHAPTER I: Theoretical Benefits of Tractorization

The benefits of mechanization are derived from five sources: Increases in cropping intensity, better yields, changes in cropping patterns, timeliness and cost savings. In the following, discussion is confined to tractors only as they are the most important agent of agricultural mechanization, especially in the present stage.

1. Cropping Intensification

Cropping intensity means total yearly cropped area over area under cultivation. In semi-arid and arid lands like Egypt, irrigation makes possible double cropping. This produces two critical periods in the annual cropping calendar. Proponents of tractorization stress the importance of timeliness of seedbed preparation. They argue that only through greater power availability, which permits rapid and timely seedbed preparation, will the full benefits of double cropping be realized. On the other hand, opponents to tractorization are not convinced of the need for tractors to achieve high cropping intensity. Many areas in Japan, Taiwan and even in Egypt have achieved double and even triple cropping long before the advent of tractors. In India also, the bullock powered farms have achieved 200% intensities in Mondal and Prasad.[1] But, it should be noted also that the negative relation between intensity and farm size is steeper for bullock than tractor farms. That is, tractors do enable large sized

Present conditions in Egyptian agriculture, especially the shortage of labor at peak times and its high cost, has doubled the need for mechanical power, particularly tractors, to maintain high cropping intensity.

2. Yields

Yields are given in quantities per hectare (metric tons per feddan or hectare). It should be noted that even if non-tractorized farms do attain the identical cropping intensities of tractorized farms, the delay in planting may cause losses at harvest time. Furthermore, the proponents of tractorization think that seedbeds prepared with mechancial tillage give better germination. This is especially true for heavy clayey soils such as are found in Egypt. The mould board plough can be of great benefit as it disintegrates and turns up the soil to a depth of 25 centimeters. This allows greater root penetration, helps in aerating the soil, and buries crop residues. This operation can not be carried out as effectively by the bullock drawn plow. Table 1.1 illustrates the average yield (metric ton per feddan) in the years 1972-74. It also shows yields projected till the year 1985, with the expected increases being partly due to mechanization.

3. Cropping Pattern

There are two parts to this source of benefits. All of us recognize that the introduction of a tractor may release land previously used for fodder, since draught animals are no longer required. In Egypt Dr. A. Al Gabaly (1977) showed the necessity of gradually getting rid of the working animals because of competition between man and animal on the limited agricultural area. This is partly because of the fact that Egypt has no natural grasslands. It is also due to the fact that full term clover and catch crop clover take up 2.8 million crop feddans (see Table 1.1). There is

TABLE (1-1)

AREA, YIELD OF MAJOR CROPS ON OLD LANDS 1972-74 AVERAGE, AND PROJECTED 1985.

CROPS	AREA 1000 FEDDANS		YIELD TON PER FED.	
	1972-74	1985	1972-74	1985
NONFORAGE CROPS:				
COTTON (LINT)	1,535	1,700	.30	.37
WHEAT	1,289	1,275	1.38	1.81
MAIZE	1,647	950	1.53	2.15
SORGHUM	484	275	1.71	2.31
RICE	1,061	1,200	2.19	2.62
SUGARCANE	203	280	36.10	45.70
OTHER (2)	653	800	2.19	2.48
VEGETABLES	764	1,170	7.21	10.42
CITRUS	139	170	6.10	10.00
OTHER FRUITS (3)	120	130	5.00	7.25
FORAGE CROPS:				
CATCH-CROP CLOVER	1,230	1,600	12.00	15.00
FULL TERM CLOVER	1,597	1,100	24.00	30.00
MAIZE AND SORGHUM	——	1,100	——	18.00
TOTAL CROPPED AREA	10,722	11,750		
LAND AREA.	5,667	6,600		
CROPPING RATIO	1,9	2,1		

Source: (4) & (5).

no hope in facing the increase in demand of vegetables and other food crops except by reducing the area allotted to animal fodders to half its present area, and by raising the meat and milk animals with much greater efficiency. This means that tractors and other devices such as pumps must replace bullock power in carrying out most of the operations in agriculture. Table 1.1 shows the projected changes in cropping pattern in 1985. According to the table, there will be a decrease in the areas of catch crop clover, full term clover, wheat, maize, and sorghum. Areas of the other main crops will increase.

The second part of cropping pattern effects are again due to timeliness. Tractorization proponents argue that bullock farmers who achieve double cropping may be following a less profitable cropping pattern than tractor farms due to losses in yields caused by delays in planting becoming so great that the most profitable cropping patterns are avoided.

4. Timeliness

One of the benefits of tractors most stressed by its advocates is the gain in timeliness achieved by tractors. Both labor and land productivity are greatly influenced by the timeliness of operation. Timeliness could however be reflected in different ways (other than yields). All farmers may recognize the losses associated with delays in sowing. Furthermore, a tractor can be operated in peak periods from sunrise till sunset without a break by switching operators. Bullocks, on the other hand, require some hours of rest during the day. This fact may be an important reason for a cost advantage of tractors over bullocks. At the same time we must note that the fact that the tractor is faster and stronger than a bullock pair does not guarantee timeliness. We know that the extent of timeliness in operations achievable by a tractor depends on the amount of tractor capacity. Reducing the capacity per unit area has a negative effect on timeliness.

5. Cost Savings

Wayne Dyer has said in this respect that "the Cost savings argument is a catch-all for all other remaining and otherwise not idenitfied changes caused by tractorization."[7] There are several components to this. First, as indicated above, the replacement of bullock operations permits the farmer to avoid the opportunity cost of these operations. Perhaps the most significant saving, however, has to do with labor related inputs. This effect may be both direct, in that actual labor use declines, or indirect in that substantial savings in management costs can be attained. A third component of cost savings involves the decrease in the cost of other services which tractors can supply, such as transport. This decline n the cost of transport may be significant, and not apparent when only cropping changes and yield increases are considered.

CHAPTER II: Demand for Tractors in Egypt

Several studies have dealt with the mechanical power needed to service one feddan in Egypt. Practical experiments have shown that every feddan with two crop rotations needs at least 1.0 hp., of which 0.7 hp. is applied to the field and 0.3 hp. remains as reserve power. This power can be divided among the agricultural services as follows:

--50% of the mechanical power for preparing the land for cultivation.

--25% for operations serving the growing crop.

--25% for harvesting and local transportation.[8]

Calculations by Giles (1975) indicate that in 1971 the availability of energy to Egyptian agriculture was roughly 0.4 hp. per hectare (0.168 hp. per feddan). He also found that there appears to be a dramatic relationship between power and yield up to 0.5 hp. per hectare (0.21 hp./fd),

across countries. Giles also found other countries, such as Taiwan, are like Egypt in obtaining relatively high yields even with low energy inputs. This is due to a high ratio of irrigated to total cultivated land and a high portion of the land being rated first class. Countries studied with available power abive 0.8 hp./ha also have high yields. These tend to be the developed countries which have well developed, modern agricultural sectors.

From my own point of view, the 1.0 hp./fd is too high a goal for the present stage of agricultural mechanization in Egypt. The typical farmer using present methods could not comprehend this amount of mechanical power at the present time. Consequently, I think that 0.33 hp./fd could be considered a reasonable goal for the present time, allowing the projected development in Egyptian agriculture. But Al Hossary (1979) says that according to the studies in Egypt made in collaboration with various world organizations, the horsepower needed for one feddan is approximately a minimum of 0.16 hp./fd, and a maximum 0.20 hp./fd. The Ministry of Agriculture, on the other hand, has estimated required power to be 0.18 hp./fd. Table 2.1 shows the needed number of tractors to be stored to obtain 0.18 hp./fd by 1985, with the following points being taken into consideration:[9]

--The evolution and increase of the quantity and the capacity tractors till 1985 (Table 2.3).

--Calculation of the value of equipment on the basis of an inflation rate of 10% per year.

The demand for tractors in Egypt is related to the expansion plan for agricultural mechanization set by the Ministry of Agriculture. This plan includes the following three main stages:

1. During the first stage, animals are to be excluded from working in the fields. They are to be replaced by tractors, small

TABLE (2-1)

THE IDEAL STRATEGIC AMOUNT (IN QUANTITY AND VALUE!) TO BE STORED.

	MINIMUM	ESTIMATED	MAXIMUM	NO.	AVG. UNIT'S PRICE IN £.	TOTAL VALUE IN £.
HORSE POWER PER FEDDAN	0,16	0,18	0,22			
TOTAL NO. OF TRACTORS TILL 1985	33 000	37 000	45 000			
NO. OF TRACTORS TO BE STORED 1979	3 500	4 300	4 900	2500	6 000	15 000 000
" " " 1980	3 600	4 200	5 000	2500	6 500	16 250 000
" " " 1981	3 500	4 000	5100	2 600	6 700	17 420 000
" " " 1982	3 600	4 000	5300	2 650	6 900	18 285 000
" " " 1983	4200	4 500	5500	2 750	7000	19 250.000
" " " 1984	4200	4 800	5900	3 000	7100	21 300 000
" " " 1985	5100	5500	7100	3 500	7200	25 200 000
TOTAL NO. (1979-1985)	27 700	31300	38 800	19 500		131 705 000

Source: Ibid

TABLE (2-2)

THE NUMBER OF TRACTORS NEEDED TILL 1985 (QUANTITY, CAPACITY AND VALUE)

YEAR	NO. OF TRACTORS NEEDED		TOTAL	HORSE POWER NEEDED.				TOTAL VALUE OF TRACTORS IN £E.
	FOR REPLACE.	FOR EXPANSION		LESS THAN 50 HP.	51-60	61-70	MORE THAN 70 HP.	
1978	1900	2500	4400	320	934	2948	198	22 500 000
1979	1600	2 700	4300	360	848	2838	254	25 800 000
1980	1700	2500	4200	380	776	2730	294	27 300 000
1981	1500	2500	4000	420	660	2560	360	26 800 000
1982	2000	2000	4000	440	620	2520	420	27 600 000
1983	2900	1600	4500	480	690	2790	540	31 500 000
1984	3400	1400	4800	530	694	2928	648	34 080 000
1985	4700	800	5500	550	825	3300	825	39 600 000

Source: Ibid

: TABLE (2-3)

THE EVOLUTION OF THE QUANTITY, THE CAPACITY AND THE VALUE OF TRACTORS TILL 1985.

YEAR	NO. OF TRACTORS	AVG. OF HP.	AVG. TRACTOR'S PRICE IN L.E.
1961/1965	13 607	45	1200
1969	16 962	45	1546
1970	17 500	48	1864
1974	18 597	55	3255
1977	21 000	58	4950
1980	28 700	60	6500
1985	37 000	65	7200

Source : Ibid

agricultural tools and electric power. Acording to the plan of the Ministry, this stage comes to an end in 1985.

2. The second stage begins from 1985 and runs until 1990. During this stage, agricultural mechanization is to be used for many operations which need a great number of laborers, such as hoeing and harvesting of grain and rice.

3. The third stage begins in 1990 and continues until 2000. During this stage, mechanization of all operations is to be achieved.

The number of tractors needed until 1985, which is the end of the first stage, is estimated in Table 2.2. The Ministry of Agriculture has managed to get some loans and foreign aid which is intended to enable farmers to buy the tools and tractors required. Some of these loans are:[10]

--$32 million from the International Bank for Reconstruction and Development (the World Bank).

--$1.7 million gift from the American Agency for International Development (AID).

--$5 million gift from the Japanese AID organization.

Table 2.3 shows the evolution of the quantity, the capacity and the value of tractors for the years 1978-1985. The statistics include the number of tractors required every year to meet the expansion plan and to replace old ones. Shown also is the power required by the expansion plan.

The Egyptian farmer needs tractors mainly for ploughing and seedbed preparation. Secondarily, tractors may then be used for transport. However, some studies estimate that 30% of the working time of tractors is spent for ploughing, the other 70% for pulling trailers and for threshing. With respect to ploughing, the Egyptian farmer generally prefers the chisel plough (breaker) to any other plough because it resembles the animal plough, and because it does not need a special skill for operating or adjusting it. The demand for the tractors by the farmers is affected by:

--The quantity and quality of the supply.

--the market price.

--The size of the landholding and required type of cultivation.

Persons demanding tractors can be divided into:

--Larger landholders who want tractors primarily for doing agricultural operations on their own land.

--Other landowners who want tractors primarily for hiring out ot other farmers.

--Non-landowners who make the investment as a way of involving themselves in the agricultural sector.

CHAPTER III: Supply of Tractors in Egypt

The supply of agricultural tractors in Egypt comes from one of two sources:

--Local manufacture or assemblage.

--Import.

1. Local Manufacture and Assemblage

The local manufacture of tractors in Egypt, as in other less developed countries, depends on the extent of the interference by the state through imposing suitable protecting customs duties and in providing other encouragement. Domestic tractor manufacture would be unlikely without such government intervention.

In Egypt, Dr. Gazarine (1979) states that because of the degree of world industrial competition, strong association with one of the world companies has become the only guarantee for the success of domestic manufacture of tractors and for keeping up with the fast pace of technological change.[11] Generally speaking, the manufacture and assemblage of tractors in Egypt has passed through the following steps:

1. Manufacture of tractors in Egypt began in 1961 with a contract between the Yugoslavian I.M.R. Company and El-Nasr Company primarily for the manufacture of automobiles. Some 3,000 tractors per year in the 50-56 hp. range were also to be produced, along with some 3,000 additional engines. Actual assemblage began in 1962. . Thirty percent of the components of the tractors were planned to be of local manufacture after the first three stages of the project.(The project included six stages of one year each.). In 1970, the project stopped for four years as Yugoslavia had then changed its foreign trade regime to a free currency system: The investments in Egypt were unable to supply the required hard currency. Eventually El Nasr Company started to assemble the Yugoslavic tractors in a temporary way. In 1978-79, the company found supplies to assemble approximately 1,000 Yugoslavic tractors.

2. In 1971, when the cooperation with Yugoslavia had come to a standstill, El Nasr Company signed a contract with Romania to assemble the Romanian 65 hp. UTOS-65 tractor. In 1972, production actually started and continues to the present. These tractors are characterized by their low prices. In 1978-79, the company obtained sufficient inputs for assembling approximately 500 of the Romanian tractors.

3. In order to insure the future of tractor manufacture in Egypt, El Nasr Company sought to establish a joint venture with a multinational tractor manufacturer. Companies offerring to participate in such a venture were: International Harvester, Deutsch, Fiat, Fiat, Massy Fergison, and Uzin Export-Import (Romania). On June 15, 1976, Massy Fergison was chosen. The shares of the participants were to be as follows:[12]

--Massy Fergison 20% ($4 million).

--El Nasr Company 40% ($8 million).

--Nasr Social Bank 15% ($3 million).

--The Arabic Company for Investment 25% ($5 million).

Before the inauguration of the project, the Arabic Company for Investment withdrew for political reasons. This made the other foreign parties uncertain about the adequacy of the contributed foreign currency. Presently, the situation is being re-evaluated. Negotiation with another company is possible if agreement is not reached with Massy Fergison.

4. In 1977, with the help of an American AID loan, El Nasr Company imported the components of 2,300 tractors through a tender issue among the world companies. Massy Fergison was chosen, and assembling and marketing of these tractors was begun.[13]

Table 3.1 points out the local production of tractors through the period June, 1966 until 1978. From it we can see that the total number of tractors assembled and manufactured during this period amounted to 13,764 tractors with 50-60 hp. The highest figure for production was in 1975-76 assisted by the cooperation of Romania; the figure was 2,500 tractors with 65 hp. each. This figure decreased to 1,000 tractors with 65 hp. in the following year. Cooperation with Yugoslavia, the U.S.A. and Romania commenced in 1977-78. Because of this the figures began again to rise. The total number produced for 1978-79 was 1,259 with powers 56, 62 and 65 hp.

2. The Import of Tractors

In Egypt import of all kinds of tractors from any country is permitted, even second hand ones. This import is carried out in great numbers through many organizations such as the General Agricultural Cooperative Society, the agencies of foreign companies, the El Nasr Company for manufacturing

TABLE (3-1)

THE LOCAL PRODUCTION OF TRACTORS FROM THE YEAR 66/1977 TILL 1978.

YEAR	NUMBER	TYPE	HORSE POWER	COUNTRY
1966/67	895	Nasr 5001	50 hp.	Yugoslavia
1967/68	731	Nasr 5001 + Nasr 60	50 hp + 56 hp.	Yugoslavia
1968/69	484	Nasr 60	56 hp	Yugoslavia
1969/70	1071	Nasr 60	56 hp	Yugoslavia
1970/71	1050	Nasr 60	56 hp	Yugoslavia
1971/72	937	Nasr 60 + Nasr 65	56 hp + 65 hp.	Yugos. and Romania
1972/73	1143	Nasr 60 + Nasr 65	56 hp + 65 hp	" and "
1973/74	1259	Nasr 60	65 hp.	Romania
1974/75	1435	Nasr 55 + Nasr 65	54 hp. + 65 hp.	Italy and Romania
1975/76	2500	Nasr 65	65 hp.	Romania
1976/77	1000	Nasr 65	65 hp.	Romania
1977/78	793	Massy vergison 255	62 hp.	USA
	306	Nasr 60	56 hp	Yugoslavia
	160	Nasr 65	65 hp.	Romania
TOTAL	13764			

Source: (14)

cars and directly by individuals. Import is allowed through balanced currency, the formal rate of currency. In spite of the great numbers of imported tractors, the specifications and standards for their use have not yet been fixed. Horsepower needed for different crops under the local conditions have also not yet been fixed. Imported tractors are subject to a low rate of customs duties, and cooperative societies are exempted altogether. Table 3.2 presents the quantity and financial value of tractor imports from 1968 to 1977. It shows that the total number of imported tractors diminished every year untill 1973, when it amounted to 1,500 tractors only compared with 3,719 tractors in 1968. The figure began to rise once again in 1974 until 1977, when it was 6,061.

The factors affecting the supply of tractors can be summed up as follows:

1. The predicted increase in the area of the cropped land from 10.722 million feddans in 1972-74 to 11.75 million in 1985, along with any increases from newly reclaimed land.
2. The expected increase of the capacity of agricultural mechanization amounting to 0.45 hp./ha in 1985 from 0.40 hp./fd in 1975.
3. Tractors of the 61-70 hp. class will still represent 60% of the total demand. Consequently the side of supply should save this number in the market.
4. The readiness of foreign companies specialized in the manufacture of tractors to be shareholding partners in assembling and manufacturing tractors in Egypt. This depends on the Open Door economic policy and the willingness of other countries to allow direct foreign investment in Egypt.

TABLE (3-2)

THE EVOLUTION OF THE IMPORT OF TRACTORS IN QUANTITY AND IN FAINANCIAL VALUE DURING THE PERIOD 1966-1977.

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
TOTAL VALUE IN MILLION L.	4,46	3,98	2,85	3,26	3,67	3,75	5,85	8,97	13,59	24,85
TOTAL No. OF TRACTORS.	3719	3162	1901	1632	1670	1500	1.952	2850	3398	6061
LESS THAN 40 HP.	—	—	600	—	—	—	1	3	3	65
41-50 HP.	3719	2858	124	121	10	26	3	73	235	4
51-60 HP.	—	174	1027	1153	604	335	562	1639	1353	1777
61-70 HP.	—	150	150	150	986	1089	1273	961	1691	4201
71-80 HP.	—	—	—	—	—	—	110	141	40	4
81-100 HP.	—	—	—	3	—	—	3	3	—	3
MORE THAN 100 HP.	—	—	—	—	—	—	—	—	15	4
TRACK-LAYING TRACTOR	—	—	—	205	70	50	—	30	61	3

Source : (15)

CHAPTER IV: The Present Situation of Farm Tractorization

1. Cost of Agricultural Operations in Egypt

Table 4.1 shows us the evolution of average cost of manual labor, machine power and animal power per feddan for the major crops in Egypt. Analyzing the figures, we find that required cost of manual labor has risen greatly for all the studied crops. For cotton, the cost of manual labor rose from LE 21.8 in 1972 to LE 82.47 in 1979, a rise of 378% in eight years. As for wheat, the cost of manual labor per feddan rose from LE 6.68 to LE 26.7 during the same period, a rise of about 400% for the same period. Concerning rice, the cost of manual labor rose from LE 12.8 to LE 48.14 during the same period, a rise of 395 %. For sugarcane, the cost of labor rose from LE 20.03 to LE 101.87 during the same period, or 462%.

Although the necessary cost for producing the same above mentioned crops on one feddan using machine power also increased, this increase was due to many factors, such as the expansion of operations achieved by using the farm machines on the same unit area. This caused a rise in the cost of machine power per feddan.

As for manual labor, we find that wages increased while hours employed remained unchanged. Manual labor hours should decrease as a result of the increased use of machinery.

The rate of cost increase of animal power was less than that of manual labor and mechanical power. The yearly average increase ranges between 28.6% for cotton and 17% for horsebeans, with the exception of sugarcane which showed a yearly increase of 55%.

To sum up, the rapid rise in labor costs due to labor shortage indicates that mechanization should proceed as rapidly as possible.

EVOLUTION OF THE AVERAGE COST OF MANUAL LABOR, MACHINE POWER AND ANIMAL POWER PER FEDDAN FOR THE MAJOR CROPS IN EGYPT.

(Table 4.1)

In Egyption pound.

AVERAGE YEARS.	..COTTON			WHEAT			RICE			SUGAR CANE			MAIZE			HORSE BEAN		
	Cost per fedd.			Cost per fedd.			Cost per fedd.			Cost per fedd.			Cost per fedd.			Cost per fedd.		
	LABOR	ANIMAL POWER	MACHIN. POWER	LABOR	ANIMAL POWER	MACHIN. POWER	LABOR	ANIMAL POWER	MACHIN. POWER	LABOR	ANIMAL POWER	MACHIN. POWER	LABOR	ANIMAL POWER	MACHIN. POWER	LABOR	ANIMAL POWER	MACHIN. POWER
1972	21 800	3320	4580	6680	4070	3920	12 180	4 150	7430	22 030	5840	8910	10 430	3920	2410	6890	3520	2520
1973	24 390	2640	4960	7240	3650	4490	13320	4 230	7370	23 030	5800	9050	11 360	3830	2590	9230	3420	1850
1974	30 980	3350	5530	8700	4060	5130	16 330	4 110	8800	33 610	9910	9 480	13 650	4330	3530	8310	3020	3830
1975	39 640	3370	6520	13 250	3470	9620	21 960	5 100	10 390	50 370	11 020	10 960	18 230	4430	4000	13 180	4140	5740
1976	50 150	5900	7720	14 800	3800	11 790	29 330	7 680	12 540	66 250	16 480	13 640	22 970	5700	4 690	16 930	3 400	6 410
1977	58 730	5220	10080	18 840	4 780	12 300	33 850	7 840	13 150	75 830	22 400	16 730	26 600	7 490	7 710	19 180	4 290	7 830
1978	68 200	4530	13 780	24 640	5 710	13 830	34 700	8 730	15 420	86 180	23 150	15 030	36 520	5 430	13 580	24 230	4 750	8 390
1979	82 470	7 600	12 370	26 700	8 110	16 090	48 140	8 250	17 420	101 870	25 720	18 400	39 510	8 830	10 130	28 480	4 780	12 680

Source : Ministry of Agriculture , Department of Agricultural Economics and Statistics. Agricultural Economic Bulletin. Several issues, Egypt.

2. Characteristics of Agricultural Production in Egypt

The rise of wages and the scarcity of farm labor, expecially in peak season, are two of the main causes of the recent increased rate of mechanization. However, the application of madern agricultural mechanization has encountered some obstacles, resulting from certain characteristics of agricultural production in Egypt. Briefly speaking, the most important of these are:

(1) The landholdings are small and fragmented. The farms of five feddans or less represent 93% of the total. Those having one feddan or less are 39% of the total. The average over all farm sizes is approximately 1.5 feddans. This has led to a wasting of efforts, time and energy. It has also meant the impossibility of using modern methods.

(2) Farmers do not follow the rules of modern crop rotation. This, of course, hinders the carrying out of mechanization.

(3) The high prices of agricultural equipment and the lack of sufficient capital and credit to allow the farmer to buy it. Moreover, the average agricultural unit is too small for the farmer to justify buying and owning these tools, especially the number of farmers who hold five feddans or less, which is 93% of the total.

(4) Much agricultural equipment has become out of order due to the lack of maintenance and repair, and because of misusing it. Also there is a lack of funds for the timely purchase of spare parts. All this is due to the lack of technical experience in the agricultural cooperatives and the lack of sufficient management experience generally.

(5) The spirit of cooperation is not mautre in the Egyptian countryside. The means of guidance for encouraging collective operations are not enough.

(6) The mechanical service stations and repair centers for agricultural equipment are not sufficient.

(7) The importers of farm equipment lack incentives for importing spare parts. They are only interested in selling the equipment in order to get the highest profit for the least effort.

(8) The applied research of farm machinery is still confined to individual types of equipment and thus is unable to indicate the technologies which suit farm conditions in Egypt.

(9) The local industries of agricultural tools depend on imitation rather than creation. Moreover, they use very poor raw materials.

(10) Importers introduce tractors and agricultural tools which do not suit the conditions of agricultural production in Egypt. This may lessen the efficiency of these tools and in some cases may lead the farmers to discontinue operating them. This may also give farmers a bad opinion of modern agricultural equipment.

(11) The operation of procuring tractor parts in Egypt is a costly one.The tractor whose parts are procured locally is more expensive than the imported one.

(12) Technical training standards for agricultural mechanization in Egypt are low. Moreover, what specialists there are often emigrate to the neighbouring oil rich countries.

(13) The wide variety of tractors and equipment in Egypt has meant high maintenance costs.

(14) Available electric power is used for lighting and consumptive use primarily. As yet, it is not seriously applied to agricultural production.

(15) Farm roads are of low quality, especially among the fields. They are not paved and they are not suitable for tractors and other equipment.

(16) The high rate of illiteracy in the countryside hinders the thought of the farmer and lessens the farmers' ability to understand the idea of evolution and change in the field of agricultural production.

3. Tractor Use in the Egyptian Agriculture

According th the official statistics, there were 29,352 tractors in Egypt as of 1979. Of this number, 8,400 belong to state farms and agricultural cooperatives. The remaining 20,942 tractors are owned by citizens and the private sector.[17]

Of the total 29,352 tractors, 21,000 are less than 10 years old. The total number of tractors in a satisfactory state is estimated to to 19,000. If this is the number available for serving agricultural operations, this then amounts to one tractor for every 144 hectares of arable land, or about 288 hectares of cropped land. On the surface, this ratio is a reasonable one, showing a high rate of tractor use in Egypt. But in fact many studies have shown that tractors are used in the fields only 30% of the time, the balance for transportation and other operations. Consequently, the real rate for using tractors is about one tractor for every 479 hectares of arable land. In other words, appropriate tractor use could greatly expand the land area actually served. This indicates that the Egyptian farmer is not aware of the appropriate uses of tractors and other agricultural equipment. Transportation could be carried out by other means such as the light lorries.

Current government policy aims at increasing the number of tractors in agriculture (see Table 2.3, Chapter 2), and introducing mechanization to the Egyptian farmer. Therefore, the sums allotted for the purchase of tractors rose from LE 8 million in 1979 to LE 16 million in 1980. THe banking system also has facilitated the steps and conditions of giving loans to farmers for agricultural equipment. It is now allowed

for holders of as little as five feddans to borrow from the bank. The farmer is required to make a down payment of 25% of the purchase price. Repayment is then through yearly installments.

Imam, says that historically the tractor of 40 hp. minimum has been the first and main step in mechanization; next is 60 hp.. In fact, there are very few tractors larger than 60 hp. in Egypt. According to this, modern tractors are too expensive for the small farmer. But more important, he has not sufficient use for it to justify its purchase economically.[20] In more developed countries like the United States, we find that as farms become larger pressure increases for larger equipment. This is graphically reflected in the pattern of tractor sales in the United States during the past decade. In 1970, approximately three tractors in the 40-100 hp. range were sold for each tractor of more than 100 hp.. By 1979, however, more tractors of over 100 hp. were sold than under. Also, investments in machinery increased along with increases in average farm size.[21]

Generally speaking, the Egyptian farmer prefers to use the chisel plough (breaker) than other types. The reasons for this are "similarity" to the traditional animal drawn (wooden) plough and ease of introduction to conservative farmers. Lastly, we can say that at present more than 50% of the cropped area in Egypt is ploughed by tractors.

CHAPTER V: Conclusions and Suggestions

1. The Current Situation of Tractors in Egypt

Before getting to the suggestions and recommendations, let us review quickly the current situation of tractors in Egypt. From this we can conclude what is to be supposed and what is to be followed.

The types and models of the tractors in Egypt vary. Currently there are 36 different models in use. This is the result of changing economic and political conditions.[22] Because of this, there have been many difficulties with maintenance and in the provision of spare parts. The percentage of the tractors out of order at a given time has ranged from 10% to 30% of the total. The manufacture of tractors in Egypt has been based on assembling imported parts along with some which are locally made. No factory has been constructed for the integral production of all tractor parts.

If we look at the conditions of agriculture in Egypt, we find that they vary in the methods used. Besides the various traditional farms there are some farms using modern agricultural mechanization which is developed to some extent. Other characteristics of agriculture in Egypt have been previously mentioned in Chapter 4.

Current and future tractor needs can be assessed through looking at past trends in cropped land and the number of tractors. In 1974, there were 5,667,000 feddans of arable land and 10,722,000 feddans of cropped area, along with a total of 21,000 tractors (see Table 2.3). This equates to one tractor for every 270 feddans of arable land, or one for 510 feddans of cropped area. As for the expected rate in 1985, it is predicted that there will be 6,600,000 feddans of arable land, 11,750,000 feddans of cropped, and an expected 37,000 tractors (Table 2.3). This is a ratio of one tractor for every 178 feddans of arable land or one for each 317 of cropped.

In 1979 ERA 2000, Inc. conducted a study of agricultural mechanization in Egypt and found that:

> "Currently, Egypt has only one operable farm tractor for each 475 feddans of cropped area. This translates into roughly 20 hp. per feddan of cultivated land area, less than half the level already achieved by the more advanced developing countries."[23]

They concluded that although there has been an increase in the number of tractors used for agricultural operations, this increased number is still too few and does not meet actual needs, particularly given, as we have previously mentioned, that about 70% of the tractor power is used for off field operations.

Two hypotheses should be taken into consideration when we think of the future expected needs for tractors:

--The first hypothesis is a minimum one which imagines that the development of agriculture is confined to its minimum limits.

--The second hypothesis states that an agricultural development plan should be carried out in order to achieve the greatest amount of food security. To put this hypothesis into practice, the number of tractors should increase at a yearly rate of 6.4%.[24] Consequently, the future needs of agriculture in Egypt will be as follows:

1977	1980	1983	1990	1995	2000
3500	3950	4850	5950	7300	9000

One should not separate the supply of tractors needed and the supply of agricultural equipment as a whole. Chapter 2 mentioned that the Ministry of Agriculture in Egypt estimated horsepower requirements. Other studies made by the Higher Committee for Developing Mechanical Agriculture in Egypt found that the capital needed for serving 1000 feddans with mechanical power is approximately LE 100,000. This covers the cost of tools and tractors necessary for carrying out crop production.

Hence, each feddan requires LE 100 to meet Ministry targets. If we take into consideration that the supposed lifetime of the tools is 10 years, we find that the annualized cost is about LE 10 per feddan. Bearing in mind that a feddan in Egypt is cultivated twice a year, the

seasonal cost is LE 5 per feddan. This sum is not unreasonable. The agricultural banks should finance machinery purchases by spreading repayment over the life of the equipment, using this depreciation rate of 10 years.[25]

To sum up, agricultural mechanization has actually begun in Egypt and a large number of tractors are already in use. It remains that those tractors should be used in the best way: Not only for ploughing, irrigating, and threshing, but as well in all other agricultural operations. This will result in both labor and animal cost savings. It will also help in achieving the other benefits which were discussed in Chapter 1.

2. Conclusions and Suggestions

It should be noted that we cannot separate between the recommendations concerning the use of tractors in Egypt and agricultural mechanization in general. The following points sum up my suggestions.

(1) Concerning supply:

(a) New models of tractors should be manufactured, assembled and imported. Parts should be supplied in sufficient quantities. Efficiencies can be achieved if the weight of tractors is reduced so as not to affect the soil impaction. At the same time their power should be increased. Tractors should be selected to suit the conditions of agriculture in Egypt which may be different from those of the countries producing the tractors.

(b) The local factories should design their tractors themselves. They should imitate foreign factories. In manufacturing the tractors and accompanying parts, our factories should use raw materials with technical characteristics suited to the working conditions in Egypt.

(c) The policy of assembling tractors should not be under the control of foreign finance, so that only one model is produced. Efficiencies will result from reducing the number of models in use.

The most important being supply of the spare parts and decreased maintenance costs. Training and working facilities may then be more efficiently organized.

(2) Service centers should be constructed. These centers should be supplied with a variety of tractors to meet the needs of the farmers for different kinds and horsepower capacities, which best suit individual farm needs. Services should be given in return for reasonable fees.

(3) An adequate number of technicians should be trained to carry out equipment maintenance according to sound scientific principles. This can be realized through good practical training and through giving incentives for the various types of technical work for agricultural operations. This can be particularly well carried out in the service centers and the agricultural cooperatives.

(4) Research and experiment centers should be constructed to guide tractor import and to perform research on designing and adapting agricultural machinery to the conditions of Egypt.

(5) Organizations of agricultural policy analysis should be developed in order to be more effective. The expansion in the use of the tools and tractors and the achievement of the expected development cannot succeed unless the farmers are convinced. In this way only, the farmers can willingly develop the means and methods of farming.

(6) Tractors and their spare parts should be exempt from the customs duties and any other additional taxes in order to help farmers get them at affordable prices. This requires the ministries in charge (such as the Ministry of Agriculture and that of Economy and Industry) to reevaluate existing laws in this regard.

(7) The rate of interest taken by the banks on the loans for tractors and imported agricultural tools should be reduced to be the same as that given to the state.

(8) There should be a balance between the number of tractors and the number of service workshops, as well as the amounts of spare parts. There should be no gap between work and maintenance.

(9) The ideal number of the farm tractors should be ascertained. Their depreciation should be estimated in number of years and working hours.

(10) Tractors should be used for the greatest part possible for field agricultural operations during their supposed lifetime.

(11) Data should be collected on the number of the tractors fit for work and the number in current use, to help estimate future requirements. Future needs also may be estimated by considering current and future agricultural projects. These results should indicate a suitable strategy for manufacturing and assembling tractors in Egypt.

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