

# DELTA BARRAGES AND EGYPTIAN ECONOMY IN THE NINETEENTH CENTURY

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## I. INTRODUCTION

**I**N ECONOMIC DEVELOPMENT planning as well as in planning for industrial and social modernization in developing countries, the mutual relation between the agricultural and the non-agricultural sectors and their relative importance in development investment, are both old and new problems, and still remain to be generalized in a refined theory. The developing countries, those which have commenced modernization of their industrial structures and economic systems much later than the highly developed nations, are almost without exception agricultural societies. Their economic development requires the introduction and development of a non-agricultural sector, such as manufacturing and transportation. Almost all of the developing countries are in fact now making or implementing economic development plans of just such a kind. The chief problem in drafting and implementing such a development plan is how much weight should be given to the economic, social, and technological modernization of the existing agricultural sector, and how the necessary capital can be obtained. The solution to these problems remains elusive and unclear at the present moment, making it necessary to apply the results of case studies of successes and failures in the past to the concrete conditions of each developing nation. Since the nineteenth century, there are several countries whose attempts at modernization of their economic and industrial structures were started later than others, yet whose subsequent experiments with economic development have proven successful to some extent. These countries can be classified into two main groups: the first are those nations which follow the way of capitalistic economic development; the second consists of those nations which set out on the way of socialist economic development through "revolutions."

Here we take up Egypt, whose efforts in the area of economic development go back to the beginning of the nineteenth century. Its orientation suggested that it would follow the capitalistic way. However, Egypt at that time failed in her attempt at economic development due to domestic factors and international circumstances, and came under the yoke of colonial domination by England. Only after World War II and especially after Nasser's revolution of 1952 did Egypt establish its own political system as a truly independent nation. In striving to develop its own self-supporting economy, Egypt is one of the typical developing countries in the contemporary world.

Egypt may then be described as both a developing country of the nineteenth and the twentieth centuries. In the nineteenth century, as an underdeveloped country, Egypt failed in economic development. One asks whether Egypt's present experiment with development will succeed or fail and what direction it will take. In this paper, however, we deal only with Egypt as a nineteenth century underdeveloped nation, and try to analyze how she failed in her efforts to modernize and ended up as a colony.

## II. EGYPT AS A NINETEENTH CENTURY UNDERDEVELOPED NATION

It is generally recognized that Egypt, while under the control of the Ottoman Empire, received the first impetus to modernization from Napoleon's invasion of the country from the end of the eighteenth century to the beginning of the nineteenth century. Scientists accompanying Napoleon's army conducted vast investigations during their short stay in Egypt. Among the suggestions made by them were, for example, the modernization of the land tenure system, the reformation of the taxation system, and adjustment of the irrigation system, any of which might have greatly affected the economic development in Egypt. It is worth noting that the key leader of the modernization of Egypt was Muhammad Ali, who was not a native Egyptian, but an Albanian who had come to Egypt as a commanding officer of the troops sent to Egypt by the sultan, Turkey. It can be said that it was precisely because Muhammad Ali's regime was an alien transplant with no relation to existing domestic forces that he was able to establish the ruling authority over the peasants (*fallahs*) and the land as well as the land-tax collecting system, after violently expelling the powerful tax farmers (*multazim*), such as *Mamlūks*,<sup>1</sup> who had maintained their own power through the tax farming system (*iltizām*). Muhammad Ali's agricultural policy, developed on the basis of his centralized and powerful domination over the land and *fallahs*, has been extensively researched by Helen Anne B. Rivlin [12].

Of the agricultural policies adopted by Muhammad Ali, those which this paper will emphasize are the introduction of the government monopoly over agricultural goods, the cultivation of long-staple cotton, and, related to the latter, the reformation of the irrigation system. The government monopoly system of agricultural products covered everything from main commercial and primary crops like wheat, rice, cotton, and indigo, to staple food crops upon which the *fallahs* depended.<sup>2</sup> Muhammad Ali did not permit free sales by the *fallahs* who cultivated and harvested them. The government bought them at officially fixed prices and sold them to exporters and local merchants. Beginning in the 1810s, this system was introduced first in the area where Muhammad Ali had eliminated *Mamlūk*

<sup>1</sup> Offspring of former slaves who occupied the leading positions in the Egyptian society in the eighteenth century.

<sup>2</sup> Manufactured goods processed from the raw material crops were also included in the monopoly.

*multazim*, who had resisted his domination. The system was supported by Muhammad Ali's firm centralized control over the land and *fallahs*.

Muhammad Ali, who made it possible to collect the land-tax directly hoped also to profit from marketing and exporting agricultural products by instituting a government monopoly. The essence of the system was that he did not pay the entire official buying price to the *fallahs*, but subtracted the land-tax in advance, and if a surplus was left, he paid the *fallahs*. The system, therefore, also served to make tax collection more efficient. It was thus that the government monopoly of agricultural products played an important role in establishing the financial power necessary to Muhammad Ali's regime. The *fallahs*, of course, were forced to endure great sacrifices in order for the system to be formed.

Table I shows the Egyptian budget for 1833 when it would appear that

TABLE I  
BUDGET OF 1833

Revenues	Purses	%
Land-tax	225,000	44.6
Duty on date palm trees	4,000	0.8
Capitation tax	70,000	13.8
Profit on agricultural products <sup>a</sup>	90,000	17.8
Profit on manufactures <sup>b</sup>	21,500	4.3
Customs and municipal duties	26,524	5.3
Corn tax at Cairo	36,000	7.1
Others	32,621	6.5
Total	[sic] 505,145	100.0
Expenses		
Military expenses <sup>c</sup>	222,505	52.9
Principal functionaries	39,800	9.5
Coptic scribes and other employees	20,000	4.8
Cost of manufactures and wages of the workmen, etc.	21,600	5.1
Expenses for the construction of manufactories, dikes, bridge, etc.	18,000	4.3
Remittance to Constantinople	12,000	2.9
Articles brought from Europe	15,000	3.6
Secret expenses, missions, presents at Constantinople, etc.	16,000	3.8
Purchases of cashmeres, cloths, silk, jewels, etc.	14,000	3.3
Others	41,550	9.9
Total	[sic] 420,505	100.0

Source: [2, pp. 44-45].

<sup>a</sup> Agricultural products are cotton, indigo, flax, opium, sugar, rice, honey, wax, senna, rose water, linseed, lettuces, and saffron.

<sup>b</sup> Manufactures are cotton goods, stuffs, and silk goods. Profit on hides, and on sale of mats, natron, and soda at Alexandria is included in "Others"

<sup>c</sup> Military expenses include army expenses, 120,000 purses; budget of the navy, 60,000 purses; pay of the irregular Turkish cavalry, 6,500 purses; pay of the Bedouin Arabs, 5,000 purses; military school, 1,500 purses; ship building, 15,505 purses; and material of war, 14,000 purses.

Muhammad Ali employed his government monopoly system most effectively. In terms of revenue, the land-tax mainly subtracted in advance from the official buying price of the monopoly system amounted to 44.6 per cent of the total revenue, while the profit on agricultural products, apparently from the monopoly, accounted for 17.8 per cent. These two items alone occupied 62.4 per cent, or a majority of the total revenue. Of the other taxes, the capitation tax was the most significant. Most of the Egyptian annual revenue at this time, it will be noted, was derived from agricultural production. Consequently, it can be presumed that the government monopoly of agricultural products assumed the most important role here.

With regard to annual expenditures, the outstanding characteristic is that the major portion, 52.9 per cent, was occupied by military expenditures. Eighteen thirty-three was the time of the First Syrian Campaign (1831-33). Egypt's dispatch of troops to Syria was the direct cause. From the beginning of the 1810s until 1840, Egypt conducted five big military campaigns. In effect about half of these 30 years was a war situation. Accordingly, military expenses dominated a great portion of the annual expenditures, not only in 1833, but throughout the whole period of Muhammad Ali's dominance. Muhammad Ali had not only to strengthen his financial base in Egypt but also to comply with requests from his source of legitimacy, the Ottoman capital. Sometimes, however, he found it necessary to resist to the extent of taking up arms against the suzerain in order to strengthen his own position. Consequently, the Muhammad Ali era "resolves itself into a number of alternating periods of warfare, during which the resources of the country were strained practically to the breaking point, and periods of peace, during which the boundless energy of the Pasha was engaged in strengthening and developing the economic organization of the country in preparation for the next struggle" [4, p. 42]. In sum, resources were generally used unproductively. The army which supported these military actions consisted of conscription of the *fallahs*. As the army size was proportionately huge for Egypt at that time,<sup>3</sup> it tended to put pressure on agricultural production, and increase the burden on the *fallahs'* lives.

As for other items of expenditure, a large part went to the cost of manufactures including wages and the building costs of factories, dikes and bridges. This was because Muhammad Ali constructed many government factories and irrigation works. It is well known that developing countries might be able to attain rapid success in their industrialization by building and operating government factories. Muhammad Ali also invested a part of the profits derived from the agricultural sector he monopolized into the building of factories to meet military demands, in textiles, sugar and related industries, etc. He also employed laborers and

<sup>3</sup> In 1833 an average of 100,000 men or 4 per cent of a population estimated at 2,500,000 had been withdrawn from agriculture to serve in Muhammad Ali's armed forces [12, p. 211]. According to another source, it is estimated that in 1821, the population was 4,230,000 [1, p. 136]. And even for that population, 100,000 soldiers composed a high average of about 2.4 per cent.

made an effort to keep the factories in operation. Characteristically, expenses for building factories, cost of manufactures and labor payment, etc., dominated a fairly large portion of revenue throughout the whole Muhammad Ali era, and not just in 1833. The question to be asked is whether this industrialization policy in Egypt at that time was successful or not. The consensus seems to be that Muhammad Ali's industrialization policy failed to attain its initial aims. Certainly the reasons for failure were the same social, economic, and technological defects common to underdeveloped countries. But what must be noted is that Muhammad Ali was surrounded and influenced by foreign "adventurers seeking to further their own interests and personal gains" [12, p. 106]. This phenomenon, too, is not uncommon in underdeveloped countries.

Table I indicates that on the basis of available information budget revenues and expenditures in 1833 were balanced. One presumes that a slightly favorable balance might have been expected, but, in fact it did not turn out that way. The actual figures of the settlement of accounts for 1833 are not certain, but it is clear that the arrears on the *fallahs* and the land-tax, etc. by the previous year constituted a fairly large amount. Moreover, it has been indicated that when Muhammad Ali drew up his budget in 1833, he reassessed the land and raised the land-tax only to produce again a large amount of tax arrears [11, p. 59] [12, pp. 129-130]. It is reported that a deficit of £1 million was left, the army and officials were in arrears and that Muhammad Ali had to make up for the situation by selling agricultural products stocked in the store houses (*shūnahs*) of the government [8, p. 3].

### III. THE DEVELOPMENT OF THE IRRIGATION SYSTEM AND DELTA BARRAGES

Among the agricultural policies that Muhammad Ali put into effect after the first part of the nineteenth century were the introduction of the cultivation of long-staple cotton and the improvement of the irrigation system in order to diffuse and settle the cotton cultivation. The introduction of cotton cultivation, begun in the 1820s in order to replace the previous main profitable export product, Egyptian wheat, was to significantly influence not just the structure of Egyptian agriculture, but the entire economy. The Egyptian *fallahs* had had long experience in cotton cultivation, though it had been admittedly only on a small scale until Muhammad Ali's decision to make it a major product was implemented in the 1820s, at which time this variety of long-staple cotton was discovered and selected from among the traditional varieties.<sup>4</sup> The cultivation of long-staple cotton was soon spread widely, given its comparatively advantageous buying price and other favorable conditions accorded it under the government monopoly of agricultural products. The statistics for cotton production are lacking, but export

<sup>4</sup> It was the French textile engineer Louis Alexis Jumel, who had come to Egypt as director of the projected spinning and weaving mill, who discovered a bush type of cotton which he recognized as being superior in length and strength of fibre [11, p. 28].

figures are available and are useful. From 944 quintals in 1821, cotton exports rose to 35,108 quintals in 1822, and zoomed to 259,426 quintals in 1823.<sup>5</sup> Thereafter, until about the middle of the 1830s, a constant level of about 100,000–200,000 quintals was maintained, with drops to around the 50,000 quintal level every few years.

Egyptian agriculture is an irrigation agriculture, relying almost totally on the Nile. Consequently, the irrigation system and the agricultural production structure are intimately linked with one another. The Egyptians, in order to make use of the annual flooding by the Nile, long ago developed what is called a “basin irrigation” system,<sup>6</sup> consisting of dikes surrounding the areas of cultivated land and forming basins into which the flood waters of the Nile accumulate and are retained for certain days during which the land absorbs the water. After silt, an organic fertilizer, settles on the bottom and the excess water is drained, the basin area can be sowed.

Since the Nile floods annually from the middle of July to October, the basin irrigation relying on the flood water could be implemented only once a year. This in turn meant that Egyptian agriculture under the basin irrigation could only produce one major crop (winter crop) a year. Egyptian winter crops consist of wheat, barley, beans, and some green vegetables. Sowing took place from October through November, and harvesting from March through April of the following year. After that, until the Nile rose and the basin irrigation was completed again, practically all of the cultivated land remained fallow because they could not irrigate the land. Summer plants, such as cotton, could be planted on lands where facilities for retaining irrigation water were provided at the time of the low Nile with protection from flooding, although such lands were very scarce.

It was impossible under the basin irrigation system to propagate the cultivation of long-staple cotton, a summer crop, in place of the hitherto profitable export crop, wheat, a winter crop. It was necessary for them to change the very basis of the basin irrigation system itself so that during the low Nile, the land would still have irrigation water, and during the high-water period, it would not be flooded. In other words, it was necessary to shift to a new and different “perennial irrigation system,” which would allow crop growing throughout the year. Under the conventional basin irrigation system, where water was introduced to the basins during the flood period when the water level was high, it was inconsequential if the canals were shallow. However, in order for water to be supplied to the canals during the low Nile, the canals had to be dug deep. (These deep canals were referred to as “summer canals.”) At the same time, the canal dikes were strengthened to prevent the cultivated land from flooding during the high-water period. In this way, water was supplied to the canals even during the low-water period by lift irrigation using lifting apparatus and during the flood period, flow

<sup>5</sup> [11, p. 34]. The figure for 1821 is sometimes given as 99 quintals [12, p. 337, n. 24].

<sup>6</sup> One theory has it that the system is 7,000 years old. See [15, p. 299].

irrigation could be practiced without the lifting devices. Thus in areas where summer canals were excavated, water for irrigation was available all the year round, making possible the planting of both winter and summer crops.

The shift to the perennial irrigation system using summer canals was started in the early 1820s. Existing shallow canals were deepened, or where necessary, new summer canals were dug. In this way, the perennial irrigation system developed and expanded. Given the level of technology at that time, a great amount of labor was required to dig the summer canals. In principle, this was provided by forced labor or *corvée*. Also, it required a fairly considerable expenditure to install the water-wheels (*sakias*), the most important lifting apparatus. Accordingly, Muhammad Ali not only encouraged *fallahs* to install them, but also erected many *sakias* at his own expense for *fallahs'* use.<sup>7</sup>

During the time of Muhammad Ali, the digging of summer canals took place mainly in the delta district of Lower Egypt, and by the middle of the 1830s, perennial irrigation had been introduced quite extensively in the delta agricultural district. Given this background, the cultivation of long-staple cotton was expanded and developed, and cotton production steadily increased—a fact reflected in the increase of cotton exports. As may be seen from Table II, five year

TABLE II  
EXPORTS OF LONG-STAPLE COTTON FROM EGYPT  
(5 YEARS' AVERAGE)

Year	Quintals
1821-25	127,006
1826-30	150,719
1830-35	147,273
1836-40	218,186
1841-45	232,784

Sources: [12, p. 337, n. 24] [4, p. 262]  
[11, p. 34].

averages of long-staple cotton exports were about 150,000 quintals until 1835, but totaled over 200,000 quintals thereafter.

Perennial irrigation on the basis of summer canals involved only the deepening of the canals to accommodate changes in the water level of the Nile. A great amount of labor power was required not only for digging the deep summer canals, but also for dredging and cleaning them every year. As the summer canal network was extended, the amount of labor required for dredging and cleaning also increased. When annually increasing numbers of *corvée* for irrigation operations were added to the toll taken by military conscription and government factory drafting of *fallahs*, one can easily imagine the difficulties caused to normal agricultural activity. The wider the land area under perennial irriga-

<sup>7</sup> It is said that in 1840 there were 50,000 *sakias* in the Lower Egypt Delta, of which Muhammad Ali built at least 38,000 [2, p. 12].

tion expanded and made farming operations possible and necessary throughout the year, the more difficult it became to separate large numbers of *fallahs* from agricultural works. In order to further extend the cultivation of long-staple cotton, which had become such an important export product for Egypt, it was urgent that perennial irrigation continue to develop while the amount of labor required for dredging and cleaning somehow be cut down.

Thus far, two types of technology had been adapted to the big seasonal change in the water levels of the Nile. Basin irrigation made it possible to crop once a year by making use of a small part of the flood water. On the other hand, perennial irrigation by means of deep summer canals and water lifting devices made it possible to cultivate even when the Nile was low. Accordingly, under the system of basin irrigation, cropping was limited to winter crops once a year; yet, perennial irrigation with its summer canals, owing to the very fact that it required increasingly large amounts of labor to maintain and develop the system, also brought its own built-in bottleneck for further expansion. As a next step, the time had come for shifting to a modern perennial irrigation system. The excess water would have to be accumulated in reservoirs during the flood season, from where it could be drawn during the low-water period; and the low Nile would be dammed by barrages to raise its water level. Only through employing such an efficient and positive technology could a further expansion of the land area under perennial irrigation be achieved.

The first step involved studies of the construction of barrages: Delta Barrages, to be built on each branch of the Nile at the point where it separated into the Rosetta and Damietta. It was expected that by raising the water level during low-water periods through the use of the Delta Barrages, and supplying water to the summer canals of the whole delta by means of three main canals, it would not be necessary to keep the summer canals so deep. Furthermore, since the water would flow through the summer canals at greater speeds, the settling and accumulation of silt could be prevented, with the result that dredging and cleaning operations could be considerably reduced, while at the same time the area of perennial irrigation could be expanded.

These plans to construct barrages and improve the irrigation of the delta agricultural region were not conceived of originally by Muhammad Ali, but had already been proposed by scientists accompanying Napoleon's army during its invasion of Egypt at the turn of the century [15, p. 633]. When Muhammad Ali began the construction of irrigation structures at the fork of the Nile in 1833, he was without question following the suggestions of these French scientists. Plans had been subsequently re-examined two or three times, until in 1845 what was known as the Delta Barrage Plan, consisting of barrages on each of the diverging branches, was finally carried out and the construction works began. The French influence was of course very great [10, p. 81] [12, p. 236]. To construct barrages required an advanced technology. It was unavoidable for Egypt of the time to depend on the technological aid of the highly-advanced countries, as it is for all the developing countries of contemporary times.



To sum up: Egyptian agriculture, which had to develop as an irrigation agriculture almost totally dependent on the Nile, with its annual swelling and receding, shifted from the stage of basin irrigation and its single annual winter crops to perennial irrigation on the basis of summer canals. This led to the introduction of summer crops in addition to winter crops, increased land utilization, and resulted in a rise in land productivity. Furthermore, the transition of Egyptian agriculture through the construction of dams and barrages to that under the modern perennial irrigation, led to even further expansion of agricultural production, and was a very natural and indigenous development. The direction Egypt took may be said to have been quite inevitable, and would doubtlessly have been irreversible even if the proposals and aid of the foreign technicians had been lacking. It is no exaggeration to say that for Egypt of that time, an almost totally agricultural society with abundant agricultural resources, the amelioration and modernization of the lives of the numerous *fallahs* and the agricultural production structure, not to mention the overall economy, was contingent upon how this development was to be pursued. Involved here were questions of when and how to introduce what kind of foreign technological aid, and, if necessary foreign capital aid (although ultimately Muhammad Ali did not accept any such capital aid from foreign countries). Among Egyptian modernization plans, it was the pursuit of this course of development that had to be of top priority, or at least to be taken as the basis for industrialization and modernization in the non-agricultural sector.

Of the experiments in Egyptian modernization implemented by Muhammad Ali from the early to middle part of the nineteenth century, most industrialization efforts, like the construction of government factories, ended in failure. Only those elements which followed the above-mentioned developmental direction survived, and ultimately had a great effect on Egyptian modernization.

The nature of the above will become clearer in the following pages, when it is contrasted with the plans and implementation of the railroad and the Suez Canal, as well as with the related introduction of foreign capital.

#### IV. THE RAILROAD, THE SUEZ CANAL CONSTRUCTION PLANS, AND THE DELTA BARRAGES

As indicated above, the direction in which the irrigation system was planned to develop inevitably required the construction of Delta Barrages. Accordingly, a five year plan at the cost of 1,550,000 pounds was established.<sup>8</sup>

At approximately the same time that the construction plans for the Delta Barrages were being considered, two other plans were also being examined. One was a railroad construction plan, and the other was a proposal for excavating

<sup>8</sup> There are several opinions concerning the estimated cost. The one given here is taken from the report by John Bowring [2, p. 60].

the Suez Canal. The railroad plan envisioned the construction of a railroad from Alexandria on the Mediterranean coast to Suez on the Red Sea, and passing via Cairo. The Suez Canal, as is already well known, was to connect the Mediterranean and the Red Sea by a navigable canal. Both of these plans were intended to produce a shorter and faster route than the previous link between Europe and Asian countries, such as India, which required passing by the Cape of Good Hope. The new Mediterranean-Red Sea-India route was to be through Egypt by way of railroad or canal. If these two plans had been effectively realized, they naturally would have greatly benefitted Egypt. The Delta Barrages construction plan had grown out of internal demands, stemming from the development of Egyptian agriculture, while the idea of a railroad and/or canal was the brainchild of the European powers which needed more rapid access to Asia to acquire or exercise control over colonies or to make investment more profitable. There ensued a power struggle over Egypt, due to its strategic location: England, interested in the railroad construction plan, and France and Austria, main advocates of the Suez Canal plan, contended with each other.

The cost of constructing a railroad between Alexandria and Suez via Cairo was estimated at approximately £2,400,000. For construction of the Suez Canal, Egypt initially guaranteed an investment of £1,280,000.<sup>9</sup> Each of these large scale construction plans, including the Delta Barrages construction plan, was a considerable financial load for Egypt, whose revenue was approximately £3,000,000 at that time.<sup>10</sup> Even granted that these three plans were to produce extremely large profits for Egypt, and that their realization was urgently required, and, although they were all ultimately to be implemented, it would seem that more careful consideration should have been given to the proper distribution of the construction period in order not to overload Egyptian finances.

However, a mere look at the spacing of the three projects implemented by the Egyptian authorities suggests the extreme lack of prudence. The Delta Barrages begun by Muhammad Ali in 1845, were at last, after a long delay and after three changes of rulers in Egypt, officially announced to be set for operation in 1861.<sup>11</sup> Though the construction of the Delta Barrages was not yet complete, Abbas initiated construction of the railroad in 1851. Continued under his successor, Saïd, the railroad assured a link between Alexandria, Cairo, and Suez and was completed in 1857, actually prior to the completion of the Delta Barrages. What is more, Saïd, immediately upon succeeding to the throne in 1854, granted

<sup>9</sup> The estimated railroad construction costs at the time of planning are not available. The figures given here are actual cost estimates from the following sources: [8, p. 6] [9, p. 411] [16, p. 11]. For the Egyptian investment plan for the Suez Canal project, see [5, p. 14].

<sup>10</sup> Unless otherwise specified, the Egyptian pound is considered to be equivalent to the pound sterling.

<sup>11</sup> Muhammad Ali retired in June 1848, and his eldest son, Ibrahim, succeeded him. Ibrahim died only 6 months after his succession. Abbas, a grandson of Muhammad Ali, succeeded him. Upon his death in 1854, he was succeeded by Saïd, the second son of Muhammad Ali. Saïd died in 1863, and was succeeded by Ismail, a grandson of Muhammad Ali.

the Suez Canal concession to de Lesseps with a promise to invest in the Suez Canal Company, in spite of the fact that neither the Delta Barrages nor the railroad were yet completed. In 1858, when the railroad construction works were completed but the Delta Barrages were not, the Suez Canal Company was declared constituted with a deceptive addition in the Egyptian subscription.<sup>12</sup> Work started and the canal was completed in 1869.

Why did the Egyptian rulers seek to implement these plans so rapidly and recklessly? At least two answers have been offered to the question. One has it that the change in rulers brought about a change in preferences: Abbas, who liked the British tended to favor the essentially English railroad construction plan, while his successor Saïd, favoring France as a result of his personal friendship with de Lesseps, gave his assent to the French favored Suez Canal plan [4, p. 113]. The other explanation is that Muhammad Ali, out of consideration for the international situation affecting Turkey, Britain and France in Egypt, that is, in view of the balance of foreign powers prevailing in Egypt, gave priority to the Delta Barrages plan, while Abbas favored the railroad plan. According to this explanation, when Muhammad Ali started to construct the Delta Barrages, it was thought that ". . . his object in seeming to be occupied on this vast undertaking is merely to gain time, and to have a pretext for declining either to make a railroad, or to undertake a work which has frequently been urged upon him by the Austrian and French Governments, the junction by means of a canal of the Mediterranean and Red Sea" [13, n. 66]. As to why Abbas, who succeeded to the throne, especially favored the railroad construction plan by the British to the exclusion of the Suez Canal plan by the French:

"The pasha [Abbas' title] explained that when he came to power, he found every administration of the country directly or indirectly in the hands of the French, that having by little and little reduced their power, gradually replacing the principal French officers employed by his grandfather [Muhammad Ali], he had brought upon himself the continual attacks of the French consul general, as well as of individuals of that nation; that not only had he been abused and written against, but that, as he had reason to suppose, intrigue had recently been set on foot at Constantinople with the object of actually driving him from the Pashalic of Egypt, and of replacing him by another member of the family supposed to be more favorable to French interests; . . . For himself it had from the first been his anxious desire to be always on the best possible terms with, and to serve to his outmost, the government of England; and in return he had hoped to have the support of its cabinet, and consequently of its representative at the Porte . . . the pasha is prepared to make a regular and efficient railway between Alexandria and Cairo. . . . He was not going to make railroads for his own accommodation, or because

<sup>12</sup> The capital of the Suez Canal Company was fixed at £8,000,000 out of which Egypt promised to invest 16 per cent or £1,280,000. When the subscription was opened, only 71.6 per cent participation was subscribed. To constitute the company, de Lesseps inscribed the remaining 28.4 per cent all in Saïd's name without his acknowledgement [4, p. 114]. Thus the amount of Egyptian investment increased from £1,280,000 to over £3,550,000.

the Egyptian treasury has any surplus funds to employ in such operations, but because our [British] government has expressed a wish to that effect, and for the purpose of improving the overland communication and so facilitating the intercourse between England and its Indian possessions. In return he hoped and expected to have the support of Her Majesty's Government at Constantinople, and its protection in case of need against the obvious designs of the French on Egypt . . .". [13, Appendix]

It was possible that the change of rulers may have brought about a change of policy due to differences in their personal preferences. It might also be the fact that, in the face of complicated international circumstances, Egypt, a small and weak nation, had to be sensitive to the opinions of the powers. This writer has not yet seen data like the above explaining the reason why Egypt agreed to the Suez Canal plan and promised to invest in it following the materialization of the railroad plan. However, such a hypothesis would suggest that the pro-French Saïd, in order to restore the balance of big powers within Egypt, which might have been thrown into disequilibrium by acquiescence in the British railroad plan, granted the French Suez Canal plan.

No matter how irresponsible the Egyptian rulers might have been, and regardless of how weak the Egyptian position in international relations was at that time, this writer remains unconvinced by the above explanations of how these large-scale projects, so influential in the economic construction of Egypt, were achieved. In relation to the earlier-mentioned government monopoly system of agricultural products, it should be added that the policy of expanding agricultural production, especially the cultivation of long-staple cotton, undoubtedly underwent a change during this period. As we mentioned previously, the government monopoly of agricultural goods served as an important base of support for the finance of Egypt by Muhammad Ali during the first half of the nineteenth century. Yet, the collapse of the monopoly system was due not just to the fact that internal conditions within Egypt were making it increasingly difficult to maintain this system. It also stemmed from external factors, notably the concluding of a Commercial Treaty in 1838 between England and Egypt's suzerain ruler Turkey. The treaty, designed to implement free trade between the two powers, was an attempt to break Muhammad Ali's hold on Egyptian agricultural distribution, which he enjoyed thanks to the government monopoly he had instituted [12, p. 183]. Muhammad Ali, in response to this, instituted a reform of the land system [12, pp. 64-65] in order to facilitate the control of large amounts of agricultural produce, and resorted to violent interference with private attempts to transport agricultural products [12, pp. 186-87]. Thus, by seeing to it that agricultural products could be bought only by the government, as was previously the case, Muhammad Ali felt that he would be able to effectively maintain the government monopoly system until the first part of 1840s.

It was under such circumstances that the Delta Barrages plan was realized, bringing with it the introduction of a modern irrigation system to the Delta agricultural areas as well as enlargement of crop area for summer crops such as

long-staple cotton. Though the figures in the plan were themselves far too high,<sup>13</sup> it must have been expected that the completion of Delta Barrages would help increase the profits from the government agricultural monopoly and save maintenance costs in areas such as labor costs for dredging and cleaning the canals. It was quite logical for Muhammad Ali in 1845 to undertake the Delta Barrage project judging that it would cost less than either the railroad or the Suez Canal projects and yield larger profits. Even if the Delta Barrages plan had been disadvantageous relative to the other two projects, it was right that it should be given priority. In the case of the railroad and the Suez Canal plans, Egypt at that time had to rely almost entirely on advanced countries for their construction as well as for subsequent maintenance work; moreover, both plans were essentially requests from foreign powers. By contrast, the Delta Barrages plan could be said to be inevitable from a domestic point of view, and was likely to have a far more direct and significant influence on the agricultural production system of the country than either of the other two projects.

However, the government agricultural monopoly, sustained by the power of Muhammad Ali's strong personality, could not be maintained for long. Muhammad Ali, whenever necessary, had carried out inspection tours personally throughout the country to supervise the government monopoly system. These became less frequent, however, as he weakened with the years. "He cannot support the motion of a steamer more than ten hours; he gets fatigued, ride he cannot, nor can he go in a carriage" [11, p. 67, n. 3]. No sooner did Muhammad Ali withdraw from the scene than the government monopoly system collapsed. By January of 1848, in fact, "peasants could sell their produce to whom they wanted" [11, p. 67]. Abbas, who came to power in 1849, tried to restore the government monopoly over agricultural products, but in vain, and in 1854 its abolishment was finally proclaimed [11, p. 68].

The collapse of the government agricultural monopoly must have made Egyptian rulers feel they no longer stood to gain further monopoly profits by expanding summer crops. As a result, they tended to underestimate the profitability of Delta Barrages, which were already under construction. Under these circumstances, it would have by no means been strange for the rulers of Egypt to seek other ways to recoup their apparently lost profits. As this frame of mind happened to coincide with the international developments surrounding Egypt, the natural result was interest in the railroad and Suez Canal construction projects.

Surely a factor leading to undertaking and investing in the railroad and Suez Canal projects was the growing disillusionment with the prospects of future profits to be made from the Delta Barrages, and the consequent disinterest in trying to develop the agricultural sector. However, construction work on the

<sup>13</sup> For example, it was estimated that the crop area for summer crops in the Delta areas would total 3,800,000 feddans upon completion of the Delta Barrages [12, p. 235]. However, even during the period 1891-1900 when the Delta Barrages were in full use, the crop area of the summer crops never in fact exceeded 1,520,000 feddans [14, p. 167].

Delta Barrages, already underway, could not be stopped. The work continued, although it took far more time than expected, the Barrages being ostensibly completed at last by 1861. Nevertheless, due to the shoddy work, it became clear that they would not be able to withstand the water pressure when the floodgate was closed. Reinforcement work was necessary, but none was done, and for a long while thereafter, the Delta Barrages remained almost in disuse.

## V. EGYPTIAN DEPENDENCE ON FOREIGN CAPITAL AND FINANCIAL COLLAPSE

It is known that in spite of the considerable costs of public works and military operations, Muhammad Ali made it a rule not to rely on foreign capital. In the year 1840 it is reported: "Egypt has no national debt of any sort. . . . No pecuniary charge upon time to come has been left by the follies or the necessities of time gone by; . . . If they reap little from the savings of their forefathers, so have they no incumbrance from their extravagancies" [2, p. 47]. As for post-humous evaluations of Muhammad Ali, there is the following: "Not the least of Mohamed [*sic*] Ali's claim to greatness is the fact that, despite the enormous sums spent during his reign . . . in his ambitious attempt to introduce large-scale industry into this country, he left the country free from debt" [5, p. 12].

However, as we have indicated earlier, this does not signify that Egyptian finance under Muhammad Ali's reign was always sound. Furthermore, the advanced countries themselves were not indifferent toward Egypt as a target for investment. In 1833 when Muhammad Ali could not pay the salaries of his soldiers and government officials because of expenditures for the First Syrian Campaign, M. de Cadalvene, a Frenchman, offered Muhammad Ali a loan of one hundred million francs at 5 per cent, to be repaid in thirty-six years. Muhammad Ali, however, refused the offer, and sold the crops accumulated under the government monopoly system; thus he was able to tide over the financial difficulty [8, p. 3]. In any event, although Muhammad Ali did leave the Delta Barrages uncompleted, and though they did become a factor in later financial difficulties, he did not leave any debts.

Yet, when railroad construction was added to that of the Delta Barrages, and when further investment was promised for the Suez Canal project, and when, moreover, it turned out that the investment amount for the Suez Canal Company had been increased as much as three times the original estimate, Egypt naturally had little recourse but to rely on foreign loans. Abbas not only borrowed about £400,000 from the Peninsular and Oriental Company, a British shipping company [8, p. 6], for construction of the railroad, but left £2,700,000 in debt when he died [8, p. 7]. At the end of 1858, when the Treasury was nearly empty, Saïd, in order to meet immediate needs, had to issue treasury bonds [8, p. 41]. When requested to pay 100 out of 500 francs per stock as a first investment payment to the Suez Canal Company by April of 1860, Egypt was unable to pay the total sum on its own. It was necessary to borrow 28,000,000 francs

from two Paris banks, Charles Latif et Cie and Comptoir d'Escompte (the actual amount borrowed was 22,500,000 francs). Of this sum, 12,250,000 francs went to the Suez Canal Company [8, pp. 46-47].

There were two kinds of debts which Egypt began to have from this time on. The first was what was called a floating debt, derived from the issuing of treasury bonds. It was, in other words, an unfunded debt for which permission from Turkey, Egypt's suzerain country, was not necessary. The other type was a funded debt, consisting of foreign capital obtained by issuing foreign loans in the stock markets of Paris and London. For this, permission from Turkey was necessary.

The debts prior to about 1860 were mainly of the former type. Within a short time, treasury bonds were maturing monthly and weekly, and the Treasury was soon unable to cash the matured bonds, making it necessary to seek funding through the latter type of debt. As early as 1862, in order to pay accumulated floating debts Egypt was forced to issue real state foreign loans.

Thus the rush of foreign capital into Egypt started just after Egypt's position as a long-staple cotton producer rose in the international cotton market benefiting from the American Civil War [6], and continued from 1862 to 1873 [8, pp. 256-57 and others]. The bulk of the Egyptian loans had been contracted to pay off the floating debts, and Egyptian finance literally fell into a vicious cycle of borrowing money in order to pay off debts.

Some seek to explain the large size of the Egyptian debt by the rulers' desire for personal enrichment or their fondness for large-scale modernization projects [4, pp. 108-10], but it is not that simple. The main reason is rather that the Egyptian rulers were tempted by the foreign investors, who said that Egypt could also profit by receiving foreign loans since "England—the State most heavily burdened with debt—is the wealthiest and the most industrialized in the world."<sup>14</sup>

The vicious cycle of borrowing money in order to pay off debts could only mean eventual bankruptcy. With the last foreign loan issue in 1873, Egypt could no longer issue the same kind of foreign loans. As a last resort, Egypt sold her own stocks in the Suez Canal Company to England for £3,980,000, which was ultimately like throwing water on desert sand. By April 1876, the Egyptian Treasury had not the slightest prospect of being able to pay matured treasury bonds, and declared itself bankrupt by proclaiming; "The payment of the bonds and assignments falling due in April and May is deferred three months" [7, No. 8].

## VI. REEVALUATION OF THE DELTA BARRAGES

In 1876, when Egypt actually declared itself bankrupt, British, French and other creditors began withdrawing their credit. The British and French creditors

<sup>14</sup> Words of M. de Cadalvene, who proposed a long-term loan to Muhammad Ali in 1833 [8, p. 4].

mutually adjusted their interest, and plans for redeeming debts were determined in the Decree of November 18, 1876 [7, No. 2 (1879)]. In order to allow Egypt to properly implement this plan, creditors set up an Anglo-French Dual Control system, by which they were able to keep a close eye on Egyptian financial conditions.

Egypt had to go to considerable extremes to carry out redemption of the debt according to the plan. As a result, the country was soon in financial difficulty again, and tried to rebuild its finances by issuing foreign loans again (Domains loan of 1878). Before these measures could take effect, however, nationalistic riots broke out (1878) under the leadership of Colonel Arabi, supported by discontented government officers and soldiers, whose salaries had either not been paid or had been delayed. These riots soon developed into the Alexandria riot of 1882, and resulted in numerous deaths and casualties [3, p. 287].

Britain, convinced that only force could restore order in Egypt, dispatched troops and held Egypt under its military control. This in effect abolished the system of Dual Control and thereafter, Britain alone assumed responsibility for the Egyptian economy, its finances and redemption of debts.

This disaster was inevitable since the redemption plan, proclaimed in the Decree of November 18, 1876, while leaving Egyptian agriculture unchanged, was in effect intended to withdraw credit in the surest, most reliable, and most profitable way; in other words, in a way designed to effect a total plunder of Egypt. The British, now responsible for the Egyptian debt, must have felt a keen desire to revise the redemption plan by deflating the creditors' desires on the one hand and rebuilding and developing the agrarian Egyptian economy on the other hand. In order to reform and develop agricultural production in Egypt, the irrigation system had to function. The rulers and times may have changed, but the importance of the Delta Barrages still remained unchanged. The Barrages, which had been initiated by Muhammad Ali himself, and essentially completed in 1861, only to remain in almost disuse because of shoddy construction, were now to become a major focus of British responsibility, and undergo reevaluation.

The Delta Barrages had not been totally disregarded or left unattended after 1861. "There was a large establishment of superannuated and incompetent men, who for years had done little besides drawing their pay" [7, No. 2 (1890)]. After 1872, the Rosetta branch barrage had been partly used [14, p. 166]. However, in 1883, when Colin Scott Moncrieff, who was sent from England as the chief officer in charge of irrigation in Egypt, made an inspection, he reported that "the work had been so long neglected that timbers were rotton [*sic*], iron was rusted, there were no appliances or tools" [7, No. 2 (1890)]. With the assistance of W. Willcocks, who had had previous experience with irrigation works in India, Moncrieff carried out experimental reinforcement work at minimal cost, and by showing that the Delta Barrages could be entirely utilized once they were fully reinforced, he convinced the powers to appropriate £1,000,000 for this purpose. This £1,000,000 was a portion of an approximately £9,000,000 which Egypt was forced to issue in 1885 again as the Guaranteed loan [7, No. 6], and it was



the first, out of a series of foreign loans issued by Egypt after 1862, to be used directly in providing a basis for agricultural production.

The barrage reinforcement work started in 1887. Including the repairs on the attached principal canals, the work was completed in June 1890 [7, No. 3]. Total costs, including survey expenses, were adequately covered by the estimated amount of £1,000,000 [7, No. 2 (1890)].

Table III shows the results of Delta Barrages irrigation from the time when

TABLE III  
THE USE OF THE DELTA BARRAGES

Year	Ordinary Discharge m <sup>3</sup> /sec.	Barrages Hold up to R.L.m.	Area of Summer Crops Matured 1,000 Fed.
-1871	64	10.00*	250
1872-1883	200	12.50	600
1884-1890	310	13.00	1,200
1891-1900	410	14.00	1,520

Sources: [14, p. 167] [15, p. 405].

\* Mean level of water in summer season without using the Barrages.

they were in partial use to the time when they were in full use. Prior to 1871, the barrages were in disuse. Partial use of the Rosetta branch barrage after 1872 raised the water level in the summer season by 2.5 meters, and resulted in a substantial increase in area of summer crops matured in the Delta area. During the years 1884-90, when the experimental reinforcement work was carried out by Colin Scott Moncrieff, water levels were further raised by 0.5 meter. After 1891, when the work was completed and the Delta Barrages came into full use, the water level rose to 4 meters, and the area of summer crops matured increased five times over its area in the period prior to 1871.

Concerning the economic effects of the partial use of the Delta Barrages during the experimental reinforcement work, Colin Scott Moncrieff had the following to say about cotton: "The mean cotton exports for the five years 1880-84 amounted to 2,750,171 kantars per annum, while for the five years ending 1889 they amounted to 3,084,064 kantars. Here is a mean annual difference of 333,893 kantars, which, at the moderate price of P.E. 250 per kantar, comes to £E. 834,732 annual benefit to the country."<sup>15</sup> Even the experimental reinforcement work produced an annual economic effect sufficient to cover almost all the expenses for the full-scale reinforcement work.

It is worth questioning once again why the Delta Barrages, which were of considerable importance for Egyptian agricultural production and the Egyptian economy itself, were not in full use for a period of 30 years after initial completion in 1861. Apparently, the reason lies in the fact that after the retirement

<sup>15</sup> [7, No. 2 (1890)], P.E.100=£E. 1.

and death of Muhammad Ali, who had highly evaluated the use of the Barrages and initiated their construction, his successors did not sufficiently appreciate the need for adequate irrigation as a basis for agricultural production, and in fact, did not give much consideration to agriculture at all. Muhammad Ali had of course planned and started the Delta Barrages in order to make his government monopoly system more profitable, and is not to be given unqualified praise. At the same time, it cannot be said that if the Delta Barrages had been completed and fully operated earlier, the modernization and industrialization of Egypt would have progressed smoothly. Yet, it cannot be denied that one of the most important and necessary requirements for an overwhelming number of agrarian countries aiming at modernization and industrialization such as Egypt at that time, is to give priority to agricultural development as the basis of its economy.

Completion of the reinforcement work of the Delta Barrages, and their coming into full use did not mean that a truly modern irrigation system for Egyptian agriculture had been achieved. This was only the first step. Shortly after the completion of the Delta Barrages, the construction of Aswan Dam was started, to be completed in the beginning of the 20th century. Thus, a system was established whereby it was possible to hold a part of the Nile's flood waters and to discharge them at the low Nile periods. Other barrages were constructed in various parts in Egypt in addition to the Delta Barrages. The latter were designed to hold the discharged water, to raise the water level, and bring the water to canals. With these, a modern perennial irrigation system was almost completed.

## REFERENCES

1. BAER, G. *Studies in the Social History of Modern Egypt* (Chicago: The University of Chicago Press, 1969).
2. BOWRING, J. *Report on Egypt and Canada* (London: W. Clowes and Sons, 1840).
3. CROMER, EARL OF. *Modern Egypt*, Vol. 1 (London: Macmillan, 1908).
4. CROUCHLEY, A. E. *The Economic Development of Modern Egypt* (London: Longmans, Green and Co., 1938).
5. ————. *The Investment of Foreign Capital in Egyptian Companies and Public Debt* (Cairo: Ministry of Finance, 1936).
6. EARLE, E. M. "Egyptian Cotton and the American Civil War," *Political Science Quarterly*, XII, 1926.
7. *Egypt* No. 2 (1879)  
No. 2 (1890)  
No. 3 (1892)  
No. 6 (1885)  
No. 8 (1876)
8. HAMZA, A. M. *The Public Debt of Egypt 1854-1876* (Cairo: Government Press, 1944).
9. ISSAWI, C. *The Economic History of the Middle East 1800-1914* (Chicago: The University of Chicago Press, 1966).
10. LANDES, D. S. *Bankers and Pashas* (London: William Heinemann, 1958).
11. OWEN, E. R. J. *Cotton and the Egyptian Economy 1820-1914* (London: Oxford University Press, 1969).

12. RIVLIN, H.A.B. *The Agricultural Policy of Muhammad Ali in Egypt* (Cambridge: Harvard University Press, 1961).
13. ————. "The Railway Question in the Ottoman-Egyptian Crisis of 1850-1852," *Middle East Journal*, Vol. 15, No. 4 (Autumn 1961).
14. WILLCOCKS, W. *Egyptian Irrigation*, 2nd Edition (London: E. & F. N. Spon, 1899).
15. WILLCOCKS, W., and CRAIG, J. I. *Egyptian Irrigation*, 3rd Edition (London: E. & F. N. Spon, 1913).
16. WILSON, A. *The Suez Canal* (London: Milford, 1933).