

ECONOMICAL AND ENVIRONMENTAL ASPECTS OF NAVIGATION DEVELOPMENT IN THE NILE

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1. Abstract

The Nile has been recognized as a navigable channel throughout the history of Egypt. Thanks to the Aswan High Dam and barrages, today, the Nile in Egypt is well under control and navigable more than before.

Although, the number of boats cruises the Nile is in a steady increase in the past ten years, navigation still faces problems during the period of low flow. These problems can be solved with the proper planning, management, and maintenance of the navigation channel. Recently, extensive efforts have been initiated towards the development of navigation. These efforts recognize the value of Nile water as a source of irrigation, supply of drinking water, navigation, and recreation. A navigation development project was initiated. The project will focus on the establishing of a permanent navigational channel in the Nile from Aswan to Cairo.

In this presentation, a cost-benefit analysis for navigation development from Aswan to Cairo will yield internal rate of return higher than the discount rate. The analysis of environmental concerns indicates that the positives of the environmental impact outweigh the negatives. Several mitigation measures are proposed to overcome the negatives of the project.

2. Introduction

“Egypt is the gift of the Nile” a statement that made by Herodotus thousands of years ago to reflect the reality of his era. Today, it can be argued that this statement is still valid. No doubt, the Nile throughout the history has been the center stage for the evolving of a nation which depends on the river for its over 90% of its water needs.

Today, the Nile is not only recognized for irrigation, but for navigation as well. Thanks to the Aswan High Dam and the barrages on the Nile that tamed the river and became more navigable than before. As a result, the river fleet has increased sharply in the past few years.

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The increase in the river fleet does not match the existing facilities on the Nile. Still, pilots are not well trained and rely on their basic experience about the river. The modern navigation channel does not exist by any standards. In recent years the Government of Egypt initiated the efforts towards developing the navigation. These efforts will increase the revenue from tourism, and reduce the cost of shipping.

3. The Nile and Navigation

The Nile extends for about 950 km from Aswan High Dam to Cairo. Then, the Nile is divided into two branches, the Rosetta branch and the Damietta branch each branch is about 200 km in length and finally reaches the Mediterranean Sea. Completed in 1971, the Aswan High Dam provides a great barrier of silt and a great control on the flow discharge. Throughout its course, the Nile is well controlled by barrages and locks as in table 1.

The Nile from Aswan to Cairo is divided into four reaches by four main barrages each barrage has a navigational lock control water level and discharge.

Table 1

Name of Structure	Distance from Aswan Dam (km)	Designed Head (m)
Aswan High Dam	-7	90
New Esna Barrage	168	7
Nag Hammadi Barrage	359	4.5
Assiut Barrage	544	4.3
Delta Barrage	953	3.8
Edfina Barrage on Rosetta Branch	1,159	2.7
Zifta Barrage on Damietta Branch	1,046.7	4
Damietta Dam Damietta Branch	1161	2.2

The total drop in bed level from Aswan to the Mediterranean is about 80 m over 1250 km length. Therefore, the Nile has a gentle slope (figure 1) and is a low energy river with a controlled discharge and water level. These facts makes improvement of navigation is feasible.

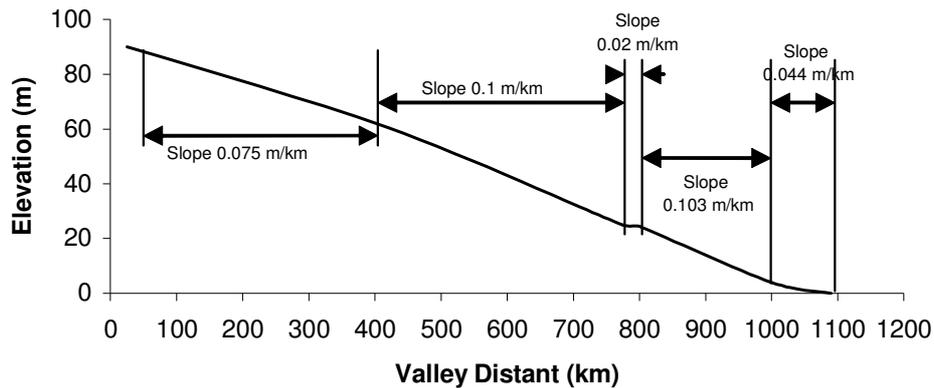


Figure (1)

4. The Nile River Fleet

The river fleet is divided into cargo transport fleet and tourist fleet. According to 1989 figures, the total number of units of barge fleet is about 1300 unit. On the average each unit carries about 600 metric tons. On the other hand, there were 113 hotel boats as of 1992 of different sizes offering 10,574 cabins for a total of 25,050 beds. These hotel boats run normally between Aswan and Luxor with a number of stops at historic sites along the Nile. These boats have the potential to accommodate 40,000 tourists per week. Currently, the number of tourist boats is topping 300 boats with a capacity for accommodating over 60,000 tourists per week.

In addition, there are number of boats cruising the Nile as restaurants and sight seeing in Cairo and few hotel boats runs from Cairo to Aswan during the peak of the season between November and February.

5. Navigation Problems in the Nile

One of the problems that threaten the navigation is the lack of enough water depth for navigation. Since most of Nile water is used for irrigation (about 85%), the water level in the Nile is affected by the irrigation requirements throughout the year. During July and August, the irrigation water requirements are high. While in December and January, the water requirements are low. As a result, water level in the Nile during December and January is the lowest throughout the year and navigation faces real problems during this period unless additional water is released from Aswan High Dam.

In 1977/78 season, an additional release non recoverable 11.5 billion cubic meters of water was released to satisfy the navigation needs. The amount of

water released for navigation was 0.26 billion cubic meters in 1995/1996 and 0.1 billion cubic meter in 1996/1997. This reduction is attributed to the proper management and the need to save water.

The navigation in the Nile is directly related to the flow stage. During the months of December and January, the water requirements for irrigation are minimum (about 60 million m³/day), while, the maximum water requirements reach 250 million m³ /day during July and August figure (2).

Most boats start to face problems when the discharge is less than 100 million m³/day. Boats which have draft higher than 1.5 meter find serious difficulties when cruising as the flow discharge reaches 65 million m³/day. Unfortunately, the peak season for hotel boats and tourism is during the period November – February. This period matches the low discharge period, the issue, which is considered a real threat to the tourism industry.

The proper planning, management and operation of a navigational channel throughout the Nile will avoid Egypt releasing of excessive amount of water for satisfying navigational needs. Thus, the water level required for the navigational channel will match amount of water required for irrigation, industries, and municipalities.

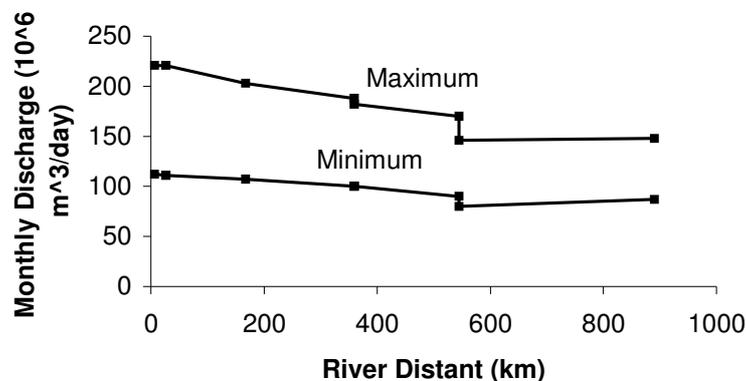


Figure (2)

Besides; there are other problems such as:

1. Lack of experience among boat pilots, they depend on their own experience.
2. Constant change of river morphology results in a change in the level of the river bed.
3. Lack the existence of the proper navigational aids and land marks. Since the Nile River is an alluvial river, the river bed level is in continuous change.
4. The navigational channel is not well defined and maintained on constant basis by dredging.

6. Significance of Navigation in the Nile

At the current time, river transport can not compete with land transportation. The road system is well expanded and in a continuous improvement because the investment in roads is still higher than that in navigation.

By increasing the investment in navigation, new routes will be proposed, permanent navigation channel will be in place and night navigation will be secured. The complete scheme of navigation development will improve the performance of the inland navigation by;

1. Reducing trip time by better management and night navigation, which will result in the saving shipping costs and thus the final price of products.
2. Increasing the loading capacity of cargo boats.
3. Increasing the number of boats on the Nile.

Navigation Development will also lead to the development of existing ports on the Nile, which will create new jobs financed by new businesses based on rural cities. River navigation will boom the business of hotel boats. The hotel boats, which cruise extensively between Aswan and Luxor will increase the income from tourism.

7. Navigation Development Project

The project has two phases. Phase one include Hydrographic survey of the Nile and production of navigational charts at a cost of 11.5 m.L.E. (million Egyptian Pounds). The second phase is the establishment of the navigational channel and the installation of navigational aids, information, and control centers at a cost of 711.440 m.L.E.

The total estimated cost of the project amounts is 723 m.L.E. (Million Egyptian Pounds) and time duration for the completion of the project is 60 months. The process can be summarized as follows:

Phase I

- 1- Hydrographic Survey and Production of Navigational Charts
 - Establishment of Geodetic Network based on WGS84
 - Hydrographic survey of the River
 - Defining the shore line of the river
2. Production of River Bed Contour Maps and Navigational Charts

Phase II

1. Establishment and the operation of the navigational channel
2. Installation of aids to navigation which includes; Water marks and land marks
3. Establishment of control centers
4. Establishment of navigation traffic system

5. Establishing a system for maintenance and continuous follow up on the navigational channel

8. Project Cost and Revenue

The cost of the project includes the maintenance of the navigational channel and the update of hydrographic survey. The benefits gained include the benefits from the cargo fleet, which is estimated at 507,000 m.L.E. and the benefits from tourism boats which is about 176.4 m.L.E.

The benefits gained from the cargo fleet are based on the followings:

Operational period is 300 days.

Trip duration will be reduced from 10.7 days to 4.6 days.

Size of cargo fleet is 1300 units each can carry 600 tons.

Assuming fees of 0.01 L.E. per ton per km (the current fees is 0.007 L.E. per ton)

The benefits gained from the tourism boats are based on the followings:

Operational period is 300 days

The Number of boats is 300 boats accommodate 60,000 tourists per week.

Assuming fees of 70 L.E. per tourist per trip

Table 2 shows the results of the benefit cost analysis at a discount rate 12%

The benefit cost ratio is 3.47

The net present value is 1,870,363,812 L.E.

The internal rate of return is 37.13%, which is higher than the discount rate as shown in Figure 3.

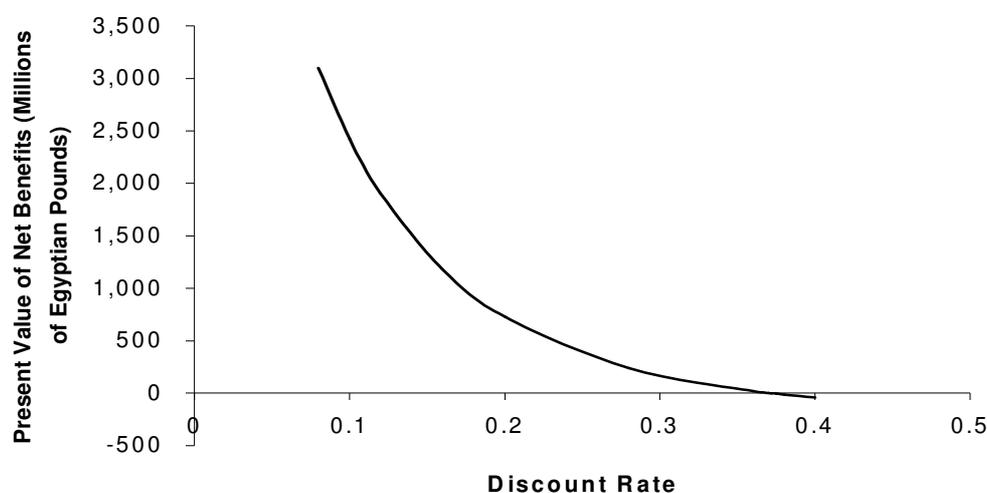


Figure (3)

Table (2)

Years	Cost in L.E.		Operation and Maintenance	Total Cost		Total Benefit	Cash Flow	Discount Rate	Present Value in L.E.	
	Construction			L.E.					Total Cost	Total Benefit
1	216,882,000			216,882,000			-216,882,000	0.892857143	193,644,642.86	0.00
2	180,735,000			180,735,000			-180,735,000	0.797193878	144,080,835.46	0.00
3	108,441,000			108,441,000			-108,441,000	0.711780248	77,186,161.85	0.00
4	108,441,000			108,441,000			-108,441,000	0.636518078	68,916,215.94	0.00
5	108,441,000			108,441,000			-108,441,000	0.567426856	61,532,335.66	0.00
6		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.506631121	29,301,112.22	346,231,708.21
7		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.462349215	26,161,707.34	309,136,463.76
8		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.403883228	23,358,667.27	276,013,798.00
9		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.360610025	20,855,952.92	246,440,891.07
10		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.321973237	18,621,386.53	220,036,509.89
11		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.287476104	16,626,237.98	196,461,169.54
12		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.256675093	14,844,855.34	175,411,758.52
13		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.229174119	13,254,335.12	156,617,641.53
14		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.204619813	11,834,227.79	139,837,179.94
15		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.182696261	10,566,274.81	124,854,624.95
16	11,500,000			69,335,200	683,400,000	683,400,000	614,064,800	0.163121662	11,310,073.05	111,477,343.70
17		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.146644341	8,423,369.59	99,533,342.59
18		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.130039559	7,520,865.70	88,869,055.89
19		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.116106777	6,715,058.66	79,347,371.33
20		57,835,200		57,835,200	683,400,000	683,400,000	625,564,800	0.103666765	5,995,588.09	70,846,867.26
Total	734,440,000		867,528,000	1,601,968,000	10,251,000,000	10,251,000,000	8,648,032,000		770,748,904.17	2,641,113,716.18

9. Environmental Concerns

Developing and improving navigation in the Nile will stimulate the recreational cruises and shipping cargo through the Nile. Therefore, it is expected that the number of boats in the Nile will continue to increase in few years that follow the completion of the project. No doubts, this increase will impact river regime, water quality and land use.

Recreational uses will improve public awareness about preserving and maintaining the Nile River water quality, and improve and develop waterfront in the rural and urban areas to improve the scenery and services accessibility. Navigation development will improve the management of navigation in the Nile by reaching optimum design of ships to carry maximum capacity at minimum draft. Thus, reducing or eliminating amount of water released for navigation and saving water to be used for irrigation. Creation of navigation control center will improve the safety of Nile navigation and reduce cases of grounding and collisions.

The most serious threat to the environment in the Nile River is the possible leakage of shipped material and wastes in the Nile. This threat can be overcome by; increasing the number of waste dumpsites along the Nile banks, banning on shipping of hazard material, and improving standards of ships can eliminate these threats.

The number of facilities required for serving the boats will be increased as a result in the increase in the number of boats. This will result in the loss of fertile agricultural lands. At some point of time, when the navigation channel and facilities reach the point of full capacity, it might be feasible to apply the permit system, where, certain number of trips is allowed to cruise in every reach. The permit system can be an acceptable and feasible in the case of recreational uses because: 1) it is based on the supply and demands in the business of hotel boats, 2) it will lead to maintaining fair prices and services for the supplier and the user of the services, and 3) it prevents the failure in the hotel boats accommodation prices as a result of not balancing between the supply and demand.

The following is a summary table shows the positives and negatives impact of the project and how to overcome the negatives:

Table (3)

Type of Impact	Positive	Negative	Possible Solutions
Direct Impact	<ul style="list-style-type: none"> • Saving water by minimize or eliminate water released for navigation only. 	<ul style="list-style-type: none"> • Possible leakage of shipped material. 	<ul style="list-style-type: none"> • Improving standards of boats. • Banning on shipping of hazards material.
	<ul style="list-style-type: none"> • Improving safety standards for ships as a result of the creation of information center that will provide proper control on boats. 	<ul style="list-style-type: none"> • Possible leakage of wastes on the river. 	<ul style="list-style-type: none"> • Extra measures in the design of sewage tanks and waste treatment. • Increasing the number of the inlets of waste dumpsites on shores.
Indirect Impact	<ul style="list-style-type: none"> • Using the Nile by tourist boats as a recreation facility will: <ul style="list-style-type: none"> • enhance the efforts of improving the water quality • Improve of the waterfront in rural areas. • Reduce the reliance on shipping by ground and thus reducing the consumption of fuel and emission of gases. 		
Cumulative Impact		<ul style="list-style-type: none"> • Possible bank failure because of repetitive action of wave forces. 	<ul style="list-style-type: none"> • Protection of banks at critical sites.
		<ul style="list-style-type: none"> • Increasing the number of tourist boats will increase the number of docks which will results in loosing of fertile lands on river banks. 	<ul style="list-style-type: none"> • Controlling the no. of cruises permission per reach.

10. Conclusions

The controlled Nile in Egypt presents an outstanding condition for navigation. Improvement of navigation in the Nile will; 1) increase the cargo load shipped by the river, 2) increase tourism boats, and 3) minimize or eliminating the amount of water released for navigation solely. These outcomes of the navigation development will yield profits. A benefit cost analysis indicates that the project will yield benefit cost ratio of 3.47 and internal rate of return 37.13%. The environmental issues related to navigation were highlighted. It has been shown that the positive environmental impact of the project outweighs the negatives, Also, mitigation measures are proposed to avoid the negatives.

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