Financial and Economic Analysis for Agricultural Projects

(West Delta Irrigation Project Case)

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Abstract: The project aimed to increase the water productivity and efficiency. Therefore, the main objective of the current study is to evaluate both the financial and economic viability of installing irrigation water connections and facilities through RC pipelines. The results indicated that the project will need to inject capital till year 4, in that it will be financially sustainable beginning from year 5 of operation. In spite of the fact that the project is not financially viable where IRR (8%) < WACC (10%), it is sustainable in that it is capable of covering cost of operation and is also economically viable (17%). However, it is advised to adopt alternative one where ERR (25%) much exceeds ERR of alternative two (17%) and where IRR (16%) would attract capital investment.
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Introduction:

The West Delta Project is a unique example of the national projects that achieve the economic and institutional reform plans, develop the services provided to the public, raise performance efficiency and promote conservation and rationalization of water as one of the vital natural source that faces huge risks and challenges. One of the key principles upon which the project is founded is that water is a public property of the state. The state grants the right to use it merely for agricultural purposes according to binding contractions that forbid disposing or selling it to a third party. At the same time, the project allows full cost-recovery of the costs of construction, operation and maintenance and grants the private sector an opportunity to contribute to financing as well as operating this kind of projects in return for water delivery charges within an regulatory framework ensuring the implementation of the required criteria of efficiency, adhering to the technical specifications and financial conditions via precise legal frameworks binding all the partnership's parties, i.e. the private sector, stakeholders and the state represented in the Ministry of Water Resources and Irrigation.

Project Components:

The project comes as a component of the framework of the State's plan for horizontal expansion and irrigation improvement projects relevant to the West Delta region. The project includes three major components that are as follows:

The First Component

The first component aims to improve irrigation in Al-Nobariya area that suffers from a discharge shortage to meet the water requirements of present types of cultivation that became double the rates that had been determined when the canal was constructed. The area of this component covers nearly 500 thousand feddans.

The Second Component

The Project's second component targeted to reclaim and cultivate new 170 thousand feddans distributed along the sides of Wadi Al-Natroun-Al-Alamein (100 thousand feddans) and west of Al-Sadat Town (70 thousand feddans).

The Third Component

The third component is the water conservation and irrigation rehabilitation project in a 255 feddans area situated at the sides of Cairo-Alexandria desert road between kilo 50 and kilo 90. The project will be executed in the form of a public-private partnership (1).

1. Study objective:

The project aimed to increase the water productivity and efficiency. Therefore, the main objective of the current study is to evaluate both the financial and economic viability of installing irrigation water connections and facilities through RC pipelines.

2. Methodology of study:

The current study evaluates the whole project based on the financial and economical indicators. The financial indicators can be conducted through the following items:

1- Net Present Value (NPV),
2- Internal Rate of Return (IRR).
3- Pay Back Period (PBP).

The economic indicators can assessed based on the following indicators:

1. Present value of net benefits.
2. Economic Rate of Return (ERR).

However, regarding to the prsent project, there are three basic differences between financial analysis and economic analyses:

Prices:

In the financial analysis, the market prices are applied as reflected in the market, while in the economic analysis shadow prices should be applied.

Taxes are considered expenses to the investor, in terms of the financial analysis, while they should be excluded in the economic analysis, i.e. taxes are not expenses to the society, and they are just money transaction.

Indirect effects are included in economic analysis while they are not included in the financial analysis. Indirect effects are the benefits of the society from generating such a project, i.e. increase the productivity in other areas of West Delta etc.

3. Financial Analysis: It implies an evaluation of the underlying project from the investor's point of view, i.e. reflecting the commercial profitability.

3.1 Basis of the Financial Evaluation: The financial analysis is based on the following;

3.1.1 Investment cost:

The investment cost includes cost of land reclamation, construction works and institutional cost. The investment cost estimated on the basis of the technical data. Cost of land reclamation implies both reclamation and plantation costs and is estimated on the basis of prevailing norms at LE 20,000 per feddan on the basis of gross area (equivalent to LE 28,000 per feddan for the net area).

The following table illustrates the total investment cost, source of finance and expected life by item which is estimated on the basis of the technical data from the experts.

Table 1: Total Investment Cost.

Investment Costs	Cost (LE '000)	Source of Finance	Expected Life (Years)
Cost of reclamation			
cost of reclamation (70,000 feddan)	1,400,000		
cost of reclamation (100,0000 feddan)	2,000,000		
Total Investment Cost of Reclamation	**3,400,000**		
Phase 1 Construction Works			
LOT 1 Construction Works			
Approach channel (AC) P.S. (4)			
Earth Works	6,881	Local	50
Miscellaneous Works	737	Local	50
Sub Total	**7,618**		
Intake culverts P.S (4)			
Earth Works	2,082	Local	50
Structural Works	2,797	Local	50
Miscellaneous Works	325	Local	50
Sub Total	**5,204**		
Pumping Station # 4			
Earth Works	4,123	Local	50
Structural Works	5,503	Local	50

Investment Costs	Cost (LE '000)	Source of Finance	Expected Life (Years)
Miscellaneous Works	1,621	Local	50
Electro-Mechanical Works	63,530	Foreign	15
Sub Total	**74,777**		
Main Channel P.S. (4)			
Earth Works	17,157	Local	50
Lining	3,454	Local	50
Main Canal structures	231	Local	50
Miscellaneous Works	1,692	Local	50
Sub Total	**22,534**		
Syphon Under El Behary & Railway P.S. (4)			
Earth Works	1,722	Local	50
Structural Works	43,979	Local	50
Miscellaneous Works	822	Local	50
Sub Total	**46,523**		
Feeding Channel to El Rayah El Behary P.S. (4)			
Earth Works	1,550	Local	50
Lining	309	Local	50
Miscellaneous Works	231	Local	50
Sub Total	**2,090**		
New Additional Culvert at KM 38			
Structural Works	4,502	Local	50
Total LOT 1 Construction Works	***163,248***		
LOT 2 Construction Works			
Pumping Station # 3/1			
Earth Works	10,019	Local	50
Structural Works	13,048	Local	50
Miscellaneous Works	2,213	Local	50
Electro-Mechanical Works	65,110	Foreign	15
Sub Total	**90,390**		
RC Pipelines (KM 0-19) P.S. (3)			
Earth Works	156,996	Local	50
Structural Works	1,300,921	Local	50
Miscellaneous Works	43,140	Local	50
Sub Total	**1,501,057**		
Pumping Station # 3/2			
Earth Works	10,019	Local	50
Structural Works	12,460	Local	50
Miscellaneous Works	2,213	Local	50
Electro-Mechanical Works	65,110	Foreign	15
Sub Total	**89,802**		
Pumping Station # 3/6 (for 70,000 feddans)			
Earth Works	9,511	Local	50
Structural Works	6,345	Local	50
Miscellaneous Works	193,934	Local	50
Electro-Mechanical Works	51,666	Foreign	15
Sub Total	**261,456**		
Total LOT 2 Construction Works	***1,942,705***		

Investment Costs	Cost (LE '000)	Source of Finance	Expected Life (Years)
Grand Total Phase 1	**2,105,953**		
Phase 2 Construction Works			
LOT 3 Construction Works			
Pumping Station # 3/3			
Earth Works	10,019	Local	50
Structural Works	12,259	Local	50
Miscellaneous Works	2,093	Local	50
Electro-Mechanical Works	55,266	Foreign	15
Sub Total	**79,637**		
Pumping Station # 3 / 4			
Earth Works	10,019	Local	50
Structural Works	12,259	Local	50
Miscellaneous Works	2,093	Local	50
Electro-Mechanical Works	55,266	Foreign	15
Sub Total	**79,637**		
RC Pipelines (KM 19-48) P.S. (3)			
Earth Works	165,320	Local	50
Structural Works	1,486,313	Local	50
Miscellaneous Works	47,850	Local	50
Sub Total	**1,699,483**		
Total LOT 3 Construction Works	***1,858,757***		
LOT 4 Construction Works			
Syphon of El Bustan Drain, Cairo-Alex. Road P.S. (3)			
Earth Works	1,858	Local	50
Structural Works	34,330	Local	50
Miscellaneous Works	424	Local	50
Sub Total	**36,612**		
Pumping Station # 3/5			
Earth Works	10,019	Local	50
Structural Works	12,259	Local	50
Miscellaneous Works	2,093	Local	50
Electro-Mechanical Works	55,266	Foreign	15
Sub Total	**79,637**		
Pumping Station # 3/7 (for 100,000 feddans)			
Earth Works	1,723	Local	50
Structural Works	7,002	Local	50
Miscellaneous Works	82,041	Local	50
Electro-Mechanical Works	65,666	Foreign	15
Sub Total	**156,432**		
RC Pipelines (KM 48-77) P.S. (3)			
Earth Works	165,320	Local	50
Structural Works	1,486,313	Local	50
Miscellaneous Works	47,850	Local	50
Sub Total	**1,699,483**		
Total LOT 4 Construction Works	***1,972,164***		
Grand Total Phase 2	**3,830,920**		
Total Construction Works	**5,936,873**		

Investment Costs	Cost (LE '000)	Source of Finance	Expected Life (Years)
Institutional Cost	**2,300**		
Contingency (10%)	**933,916**		
TOTAL COST	**10,273,090**		

Source: Technical data from the experts.

Only 33.3% of all related P.S. (4) investment cost items is allocated to the project, as per the technical experts. 10% contingency is allowed to take into account any changes in investment cost.

The project is expected to be implemented in a period of seven years (year -3 to year 4) during two phases. The disbursement done in based of the technical plan related to cost item as phase 1 of the project which covers the period year -3 to the year 1 and includes cost of land reclamation. Phase 1 of the project consists of the construction works, cost of rehabilitation and institutional cost; while phase 2 covers the period year 1 to year 4 and includes phase 2 of construction works. The table below indicates disbursement of investment cost by year:

Table 2: Disbursement of Investment Cost.

Year	Cost (LE '000)	Weight (%)
Year -3	1,004,561	10%
Year -2	1,525,092	15%
Year -1	2,890,913	28%
Year 1	1,003,803	10%
Year 2	1,454,237	14%
Year 3	1,734,915	17%
Year 4	659,568	6%
Total	**10,273,090**	**100%**

Source: Technical data from the experts.

3.1.2 Net Cash Flow: The annual net cash flow (revenue – operation cost) is based on constant prices over a period of ten years with foreign exchange rate of US$ 1 = LE 5.4.

* The two major sources of income are identified as follows;

- Net returns to be resulted from cultivating two sets of land areas:

70,000 feddans

100,000 feddans

Total revenue, cost and net revenue are estimated on the basis of the agronomist data as follows:

Table 3: Gross Revenue and Net Revenue in the typical Year (Cultivation of 70,000 feddans) (LE '000).

Crop	Gross Revenue	Operation Cost	Net Revenue
Winter crops			
Wheat (ardab)	35,280	17,500	17,780
Oat (ardab)	6,250	3,800	2,450
Bean (ardab)	6,300	2,500	3,800
Bersem (ton)	28,000	14,000	14,000
Sugar beans (ton)	7,560	4,200	3,360
Other crops	4,900	2,500	2,400
Total Winter Crops	**88,290**	**44,500**	**43,790**
Summer crops			
Maize (ardab)	15,400	7,000	8,400
Beans (ardab)	35,000	16,800	18,200
Seism (Kishla)	2,835	2,100	735
Sun flours (ton)	3,150	2,100	1,050
Maize (ardab)	12,250	7,000	5,250
Other crops	14,000	7,000	7,000
Total Summer Crops	**82,635**	**42,000**	**40,635**

Crop	Gross Revenue	Operation Cost	Net Revenue
Winter vegetables			
Tomatoes (ton)	252,000	84,000	168,000
Peas (ton)	8,400	3,500	4,900
Beans (ton)	15,750	6,300	9,450
Squash (ton)	11,760	6,300	5,460
Egg plants (ton)	10,080	5,250	4,830
Other vegetables	21,000	8,400	12,600
Total Winter Vegetables	**318,990**	**113,750**	**205,240**
Summer Vegetables			
Tomatoes (ton)	58,800	35,000	23,800
Potatoes (ton)	73,500	29,400	44,100
Cucumbers(ton)	31,500	14,700	16,800
Water melons (ton)	11,760	6,300	5,460
Cantaloupe (ton)	10,780	5,600	5,180
Squash (ton)	5,600	2,800	2,800
Other vegetables	21,000	11,200	9,800
Total Summer Vegetables	**212,940**	**105,000**	**107,940**
Fruits			
Oranges (ton)	61,600	28,000	33,600
Grapes (ton)	77,000	38,500	38,500
Apples (ton)	28,000	14,000	14,000
Peaches (ton)	54,600	14,000	40,600
Bananas	35,000	17,500	17,500
Other fruits	31,500	14,000	17,500
Total Fruits	**287,700**	**126,000**	**161,700**
Total	**990555**	**431250**	**559305**

Source: Results of the disciplinary (agronomist & economist) team.

Table 4: Gross Revenue and Net Revenue in the typical year (Cultivation of 100,000 feddans)(LE '000).

Crop	Gross Revenue	Cost of Operation	Net Revenue
Winter crops			
Wheat (ardab)	50,400	25,000	25,400
Oat (ardab)	9,000	5,400	3,600
Bean (ardab)	9,000	3,600	5,400
Bersem (ton)	40,000	20,000	20,000
Sugar beans (ton)	10,800	6,000	4,800
Other crops	7,000	3,500	3,500
Total Winter Crops	**126,200**	**63,500**	**62,700**
Summer crops			
Maize (ardab)	22,000	10,000	12,000
Beans (ardab)	50,000	24,000	26,000
Seism(Kishla)	4,050	3,000	1,050
Sun flours (ton)	4,500	3,000	1,500
Maize (ardab)	17,500	10,000	7,500
Other crops	20,000	10,000	10,000
Total Summer Crops	**118,050**	**60,000**	**58,050**
Winter vegetables			
Tomotoes (ton)	360,000	120,000	240,000

Peas (ton)	12,000	5,000	7,000
Beans (ton)	22,500	9,000	13,500
Squash (ton)	16,800	9,000	7,800
Egg plants (ton)	14,400	7,500	6,900
Other vegetables	30,000	12,000	18,000
Total Winter Vegetables	**455,700**	**162,500**	**293,200**
Summer Vegetables			
Tomatoes (ton)	84,000	50,000	34,000
Potatoes (ton)	105,000	42,000	63,000
Cucumbers(ton)	45,000	21,000	24,000
Water melons (ton)	16,800	9,000	7,800
Cantaloup (ton)	15,400	8,000	7,400
Squash (ton)	8,000	4,000	4,000
Other vegetables	30,000	16,000	14,000
Total Summer Vegetables	**304,200**	**150,000**	**154,200**
Fruits			
Oranges (ton)	88,000	40,000	48,000
Grapes (ton)	110,000	55,000	55,000
Apples (ton)	40,000	20,000	20,000
Peaches (ton)	78,000	20,000	58,000
Bananas	50,000	25,000	25,000
Other fruits	45,000	20,000	25,000
Total Fruits	**411,000**	**180,000**	**231,000**
Total	**1415150**	**616000**	**799150**

Source: Results of the disciplinary (agronomist & economist) team.

However, it is expected that reclaimed land will reach typical yield / productivity in year 4.

* The operation, costs of the irrigation system installation are estimated on the basis of prevailing norms are including;
  - Maintenance cost;
  - Running expenses;
  - Institutional and administrative expenses;

* Land tax is based on 2% of net revenue of agricultural land.

The following financial cash flow statement summarizes the annual net cash flow of the whole project. A residual value is estimated at year 11 to reflect the value of the project for the upcoming years (i.e. infinite life of the project) and is then discounted at the opportunity cost of capital. It is estimated as follows.

((Net Cash Flow – Depreciation) / WACC) / (1+WACC)

Annual net cash flows are discounted at Private Opportunity Cost of Capital, i.e. WACC. WACC is estimated at 10%.on the following basis;

- Debt Equity Ratio is 1:1.
- Interest rate (ib) at which investor would borrow money is 13% per annum.
- Interest rate on long terms deposit (id) is 10% per annum.
- Business risk (r) 6;
- Risk premium (ß) is 1,5;
- Annual inflation rate (f) is 6%.

WACC at constant prices is therefore estimated as follows:

= [ib * D/I + [(id + (r * ß) * E/I] – f
= [13% * 0.5 + [(10% + (6% * 1.5) 0.5] – 6%
= 6.5% + 9.5% - 6%
= 10%

3.2 Financial Evaluation**:**

The key financial indicators are net present value (NPV), internal rate of Return (IRR) and Pay back Period (PBP). These indicators are estimated in order to verify the financial viability of the underlying project as follows:

Table 5: Financial Indicators

Item	Value
NPV (LE'000)	- 1,240,013
IRR	8%
Pay Back Period (PBP)	More than 10 years

Financial cash flow statements:

It is very important to estimate the cash flow statements based on the results in phase one; i.e. total cash flow statements that reflect phases one and two as could be seen in table 6 bellow.

Table (6): Financial cash flow Statement (LE '000).

years	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Inflow													
Revenue through cultivation													
reclaimed area (70,000 feddan)				247,639	495,278	742,916	990,555	990,555	990,555	990,555	990,555	990,555	990,555
reclaimed area (100,000 feddan)				353,788	707,575	1,061,363	1,415,150	1,415,150	1,415,150	1,415,150	1,415,150	1,415,150	1,415,150
Total Reclamation Revenues	*0*	*0*	*0*	*601,426*	*1,202,853*	*1,804,279*	*2,405,705*	*2,405,705*	*2,405,705*	*2,405,705*	*2,405,705*	*2,405,705*	*2,405,705*
Total Cash Inflow	**0**	**0**	**0**	**601,426**	**1,202,853**	**1,804,279**	**2,405,705**	**2,405,705**	**2,405,705**	**2,405,705**	**2,405,705**	**2,405,705**	**2,405,705**
Cash Outflow													
Investment Costs													
Cost of land reclamation													
cost of land reclamation (70,000 feddan)	350,000	420,000	630,000										
cost of land reclamation (100,0000 feddan)	500,000	600,000	900,000										
Total Cost of land reclamation	**850,000**	**1,020,000**	**1,530,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHASE 1 Construction Works													
LOT 1 Construction Works													
Approach Channel (AC) P.S. (4)		7,250	369										
Intake Culvert P.S. (4)		1,041	4,055	108									
Pumping Station # 4		3,935	49,341	21,501									
Main Channel P.S. (4)		7,022	10,456	5,055									
Syphon under El Behary & Railway P.S. (4)			34,706	11,817									
Feeding Channel to El Rayah El Behary P.S(4)			1,782	308									
New Additional Culvert at KM 38		237	2,971	1,294									
Total LOT 1 Construction Works	*0*	*19,485*	*103,680*	*40,083*	*0*	*0*	*0*	*0*					
LOT 2Construction Works													
Pumping Station # 3/1	2,621	18,718	69,051										
RC Pipelines (KM 0-19) P.S. (3)	60,042	300,211	600,423	540,381									
Pumping Station # 3/2		6,990	82,812										
Pumping Station # 3/6 (for 70,000 feddans)		20,352	241,104										
Total LOT 2Construction Works	*62,663*	*346,273*	*993,389*	*540,381*	*0*	*0*	*0*	*0*					
Grand Total Phase 1	**62,663**	**365,758**	**1,097,068**	**580,464**	**0**	**0**	**0**	**0**					
Phase 2 Construction Works													
LOT 3 Construction Works													
Pumping Station # 3/3				5,275	73,921	441							
Pumping Station # 3/4					5,275	73,921	441						

years	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
RC Pipelines (KM 19-48) P.S. (3)				174,285	424,934	773,015	327,249						
Total LOT 3 Construction Works	*0*	*0*	*0*	*179,560*	*504,129*	*847,377*	*327,690*	*0*					
LOT 4 Construction Works													
Syphon of El-Bustan Drain,Cairo-Alex Road				929	20,955	14,728							
Pumping Station # 3/5				5,275	73,921	441							
Pumping Station # 3/7 (for 100,000 feddans)				10,362	145,204	867							
RC Pipelines (KM 48-77) P.S. (3)				135,959	577,824	713,783	271,917						
Total LOT 4 Construction works	*0*	*0*	*0*	*152,524*	*817,904*	*729,818*	*271,917*	*0*					
Grand Total Phase 2	**0**	**0**	**0**	**332,084**	**1,322,034**	**1,577,195**	**599,607**	**0**					
Institutional cost	575	690	1,035										
Contingency	91,323	138,645	262,810	91,255	132,203	157,720	59,961						
Total Investment Cost	**1,004,561**	**1,525,092**	**2,890,913**	**1,003,803**	**1,454,237**	**1,734,915**	**659,568**	**0**	**0**	**0**	**0**	**0**	**0**
Operation Costs													
(a) Land Cutivation													
cost of reclamation (70,000 feddan)				431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250
cost of reclamation (100,000 feddan)				616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000
Total Operation Cost of Reclamation	*0*	*0*	*0*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*
(b) Construction Works													
LOT 1 Construction Works				3,265	3,265	3,265	3,265	3,265	3,265	3,265	3,265	3,265	3,265
LOT 2Construction Works				38,854	38,854	38,854	38,854	38,854	38,854	38,854	38,854	38,854	38,854
LOT 3 Construction Works				37,175	37,175	37,175	37,175	37,175	37,175	37,175	37,175	37,175	37,175
LOT 4 Construction Works				39,443	39,443	39,443	39,443	39,443	39,443	39,443	39,443	39,443	39,443
(d) Institutional cost				46	46	46	46	46	46	46	46	46	46
(e) Land Tax				12,855	25,711	38,566	51,422	51,422	51,422	51,422	51,422	51,422	51,422
Total Operation Cost	**0**	**0**	**0**	**1,178,889**	**1,191,744**	**1,204,600**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**
Total Cash Outflow	**1,004,561**	**1,525,092**	**2,890,913**	**2,182,692**	**2,645,981**	**2,939,515**	**1,877,024**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**	**1,217,455**
Net Cash Flow (NCF)	**-1,004,561**	**-1,525,092**	**-2,890,913**	**-1,581,266**	**-1,443,129**	**-1,135,236**	**528,681**	**1,188,250**	**1,188,250**	**1,188,250**	**1,188,250**	**1,188,250**	**1,188,250**
Cumulative Net Cash Flow	**-1,004,561**	**-2,529,654**	**-5,420,568**	**-7,001,834**	**-8,444,963**	**-9,580,199**	**-9,051,517**	**-7,863,268**	**-6,675,018**	**-5,486,769**	**-4,298,519**	**-3,110,270**	**-1,922,020**

Source: Results of financial study analysis.

Table(7):Economic cash flow statements(LE '000).

years	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Inflow													
Revenue through cultivation													
reclaimed area (70,000 feddan)				267,060	534,119	801,179	1,068,239	1,068,239	1,068,239	1,068,239	1,068,239	1,068,239	1,068,239
reclaimed area (100,000 feddan)				381,533	763,067	1,144,600	1,526,134	1,526,134	1,526,134	1,526,134	1,526,134	1,526,134	1,526,134
Total Reclamation Revenues	*0*	*0*	*0*	*648,593*	*1,297,186*	*1,945,779*	*2,594,372*	*2,594,372*	*2,594,372*	*2,594,372*	*2,594,372*	*2,594,372*	*2,594,372*
Additional productivity (institutional)				427,296	427,296	427,296	427,296	427,296	427,296	427,296	427,296	427,296	427,296
Total Cash Inflow	**0**	**0**	**0**	**1,075,889**	**1,724,482**	**2,373,075**	**3,021,668**	**3,021,668**	**3,021,668**	**3,021,668**	**3,021,668**	**3,021,668**	**3,021,668**
Cash Outflow													
Investment Costs													
Cost of land reclamation													
cost of land reclamation (70,000 feddan)	332,500	399,000	598,500										
cost of land reclamation (100,0000 feddan)	475,000	570,000	855,000										

years	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Investment Cost of land reclamation	**807,500**	**969,000**	**1,453,500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PHASE 1 Construction Works													
LOT 1 Construction Works													
Approach Channel (AC) P.S. (4)	0	6,887	350	0	0	0	0	0	0	0	0	0	0
Intake Culvert P.S. (4)	0	989	3,852	103	0	0	0	0	0	0	0	0	0
Pumping Station # 4	0	3,738	46,874	20,426	0	0	0	0	0	0	0	0	0
Main Channel P.S. (4)	0	6,671	9,934	4,803	0	0	0	0	0	0	0	0	0
Syphon under El Behary & Railway P.S. (4)	0	0	32,971	11,226	0	0	0	0	0	0	0	0	0
Feeding Channel to El Rayah El Behary P.S(4)	0	0	1,693	293	0	0	0	0	0	0	0	0	0
New Additional Culvert at KM 38	0	225	2,822	1,229	0	0	0	0	0	0	0	0	0
Total LOT 1 Construction Works	*0*	*18,511*	*98,496*	*38,079*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
LOT 2Construction Works													
Pumping Station # 3/1	2,490	17,782	65,598	0	0	0	0	0	0	0	0	0	0
RC Pipelines (KM 0-19) P.S. (3)	57,040	285,201	570,402	513,361	0	0	0	0	0	0	0	0	0
Pumping Station # 3/2	0	6,641	78,671	0	0	0	0	0	0	0	0	0	0
Pumping Station # 3/6 (for 70,000 feddans)	0	19,335	229,048	0	0	0	0	0	0	0	0	0	0
Total LOT 2Construction Works	*59,530*	*328,959*	*943,719*	*513,361*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Grand Total Phase 1	**59,530**	**347,470**	**1,042,215**	**551,441**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Phase 2 Construction Works													
LOT 3 Construction Works													
Pumping Station # 3/3	0	0	0	5,011	70,225	419	0	0	0	0	0	0	0
Pumping Station # 3/4	0	0	0	0	5,011	70,225	419	0	0	0	0	0	0
RC Pipelines (KM 19-48) P.S. (3)	0	0	0	165,571	403,687	734,364	310,887	0	0	0	0	0	0
Total LOT 3 Construction Works	*0*	*0*	*0*	*170,582*	*478,923*	*805,008*	*311,306*	*0*	*0*	*0*	*0*	*0*	*0*
LOT 4 Construction Works													
Syphon of El-Bustan Drain,Cairo-Alex Road	0	0	0	883	19,907	13,992	0	0	0	0	0	0	0
Pumping Station # 3/5	0	0	0	5,011	70,225	419	0	0	0	0	0	0	0
Pumping Station # 3/7 (for 100,000 feddans)	0	0	0	9,844	137,944	823	0	0	0	0	0	0	0
RC Pipelines (KM 48-77) P.S. (3)	0	0	0	129,161	548,933	678,093	258,321	0	0	0	0	0	0
Total LOT 4 Construction works	*0*	*0*	*0*	*144,898*	*777,009*	*693,327*	*258,321*	*0*	*0*	*0*	*0*	*0*	*0*
Grand Total Phase 2	**0**	**0**	**0**	**315,480**	**1,255,932**	**1,498,336**	**569,627**	**0**	**0**	**0**	**0**	**0**	**0**
Institutional cost	546	656	983										
Contingency	86,758	131,713	249,670	86,692	125,593	149,834	56,963						
Total Investment Cost	**954,334**	**1,448,838**	**2,746,368**	**953,613**	**1,381,525**	**1,648,169**	**626,590**	**0**	**0**	**0**	**0**	**0**	**0**
Operation Costs													
(a) Land Cultivation													
cost of reclamation (70,000 feddan)				431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250	431,250
cost of reclamation (100,000 feddan)				616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000	616,000
Total Operation Cost of Reclamation	*0*	*0*	*0*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*	*1,047,250*
(b) Construction Works													
LOT 1 Construction Works				3,102	3,102	3,102	3,102	3,102	3,102	3,102	3,102	3,102	3,102
LOT 2Construction Works				36,911	36,911	36,911	36,911	36,911	36,911	36,911	36,911	36,911	36,911
LOT 3 Construction Works				35,316	35,316	35,316	35,316	35,316	35,316	35,316	35,316	35,316	35,316
LOT 4 Construction Works				37,471	37,471	37,471	37,471	37,471	37,471	37,471	37,471	37,471	37,471
(d) Institutional cost				44	44	44	44	44	44	44	44	44	44
Total Operation Cost	**0**	**0**	**0**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**
Total Cash Outflow	**954,334**	**1,448,838**	**2,746,368**	**2,113,707**	**2,541,619**	**2,808,263**	**1,786,684**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**	**1,160,094**

years	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Net Cash Flow (NCF)	-954,334	-1,448,838	-2,746,368	-1,037,819	-817,138	-435,189	1,234,984	1,861,574	1,861,574	1,861,574	1,861,574	1,861,574	1,861,574
Cumulative Net Cash Flow	-954,334	-2,403,172	-5,149,540	-6,187,358	-7,004,496	-7,439,684	-6,204,700	-4,343,127	-2,481,553	-619,979	1,241,595	3,103,168	4,964,742

Source: Results of financial study analysis.

The afore-mentioned table clarified that the investment proposal is not financially viable due to;

- Net present value is negative;
- WACC (Private Opportunity Cost of Capital) is much greater than IRR;
- PBP is longer than ten years.

4. The Economic Analysis:

4.1 Basis for economic evaluation:

The economic analysis is concerned by the viability of the project from the society's point of view, i.e. national profitability. In this respect, three key issues are considered and adjusted to convert financial evaluation into economic evaluation:

- Distorted financial prices are corrected to reflect shadow prices. Two sets of prices are corrected;
- Prices of equipments and pumps are adjusted, i.e. excluding custom duties and sales tax, with accounting coefficient of 0.95;
- Prices of exportable agricultural goods are adjusted (shadow prices) on the basis of export prices (FOB price), at a coefficient of 1.09.
- Land tax is excluded, i.e. land tax is a money transaction and not an expense to the society.
- Indirect benefits are added, in that the value of increase in productivity is added to the benefits. They are estimated at LE 427,296 thousand, on the basis of average increase in yield per feddan by 5%, i.e. land density is 1.6.

Adjusted financial statement, i.e. economic cash flow statement is shown in table (7) below;

4.2 Economic Indicators:

Annual net benefits are therefore adjusted and estimated to be discounted at the social discount rate, i.e. 10% to be compared with the adjusted investment cost. Economic Rate of Return is estimated in order to test the economic viability of such a project.

Economic evaluation of the project reveals that it is viable with ERR exceeding Social Discount Rate where present value of net benefits is positive as follows;

Table 8: Economic Indicators

Item	Value
NPV (LE '000)	3,772,654
ERR	17%

It is obviously that ERR exceeds IRR. This implies that the second alternative is rather economically viable; however, it is much less viable than the first alternative. However, its economic returns exceed its financial returns, in that the project has a positive economic impact, where its returns to the society exceed direct financial and returns to the investor.

5. Conclusion:

The project will need to inject capital till year 4, in that it will be financially sustainable beginning from year 5 of operation. In spite of the fact that the project is not financially viable where IRR (8%) < WACC (10%), it is sustainable in that it is capable of covering cost of operation and is also economically viable (17%). However, it is advised to adopt alternative one where ERR (25%) much exceeds ERR of alternative two (17%) and where IRR (16%) would attract capital investment.

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