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Research Article

Effect of Construction Overflow Weir Across Euphrates River in the Chibayish Marshes Region

[1]Alaa H. Alshami, [2]Haitham A. Hussein and [2]Mohammed A. Ibrahim
[1]Civil Engineering Department, AlFarabi University,
[2]Civil Engineering Department, Alnahrain University, Baghdad, Iraq

Abstract: Developing integrated marches management for restoration of the southern marshes in Iraq require adequate reliable plan. The aim of this study is developing the Chibayish region. In this study, economic feasibility and cost analysis for constructing embankment across Euphrates River and overflow weir are conducted. These structures are used to regulate the Euphrates River during the flood season and the deficit period and improve the quality of water in central marshes. In addition, this feasibility study examines the effect of establishing the controlling regulator on increasing the area of cultivation of the Malha irrigation project and improving the livestock with fish capturing in the region. The economic analysis and feasibility calculations showed that the time of payback period is equal to 7 years after 3 years from the construction time and the rate of the benefit cost B/C is equal to one when the discount rate is equal to 22%. By these results we can consider the project to be economically feasible and can improve the income of local people at Chibayish Marshes region.

Keywords: Chibayish marshes region, cost analysis, economic feasibility, irrigation and drainage system, sensitivity analysis

INTRODUCTION

Every construction project should give benefits for the investor. These benefits consist of profit, business development, resources utilization, job opportunities, etc. Profits are achieved in long period and should have an accurate investment forecast so that the investors can still have the willingness to invest their money. Effective and efficient use of land not only reduces the routine expenditures but also exchange into income source (Firmansyah *et al*., 2006). The economic feasibility study of a project is an estimate of the potential profitability of that project, or a study that measures the expected benefits from a certain project relative to its cost (Johnson and McCarthy, 2001). Project feasibility study is used to get the alternatives of optimal land use that give the highest profits. Feasibility study analysis also gives information about the value of investment and the benefits that investors will get. Definite return of investment can be seen from feasibility study. Commonly, Net Present Value (NPV), Internal Rate of Return (IRR) and Payback Period are values used by investor to consider if this project is feasible or not (Firmansyah *et al*., 2006). Abou-Zeid *et al*. (2007) presented an overview of feasibility study procedure than been used in public sector in some Arab countries along with their inconsistency items, advantage and disadvantage. A pilot experimental study was conducted for 91 highways public project in Egypt. The study showed a great inconsistency in the procedures used for different projects. Blank and Tarquin (2005) showed problems and controversies with cost benefit analysis application to public project appraisal. This study consists of five parts, which there are distinguished public goods, key assumptions to public project appraisal, discount rate issues, the main rules of cost benefit analysis and a background of project choice. Generally, there are no standard procedures to carry out the feasibility study, especially for public projects, in Arab countries (Abou-Zeid *et al*., 2007). Massive expenditures on infrastructure projects need to be weighed against the expected benefits resulting from these projects to the public and the national economy. Therefore, economic feasibility studies need to be conducted prior to the construction of infrastructure facilities (Hyari and Kandil, 2009).

The aim of this study is to study the economic feasibility to know whether the construction of the controlling overflow weir is beneficial for increasing the area of cultivation of the Malha irrigation project, improving the livestock and fish capturing in the Chibayish Marshes region.

The purpose of construction Al Chibayish overflow weir across the Euphrates River is to help water to enter

Corresponding Author: Haitham A. Hussein, Civil Engineering Department, Alnahrain University, Baghdad, Iraq, Tel.: +9647702662997

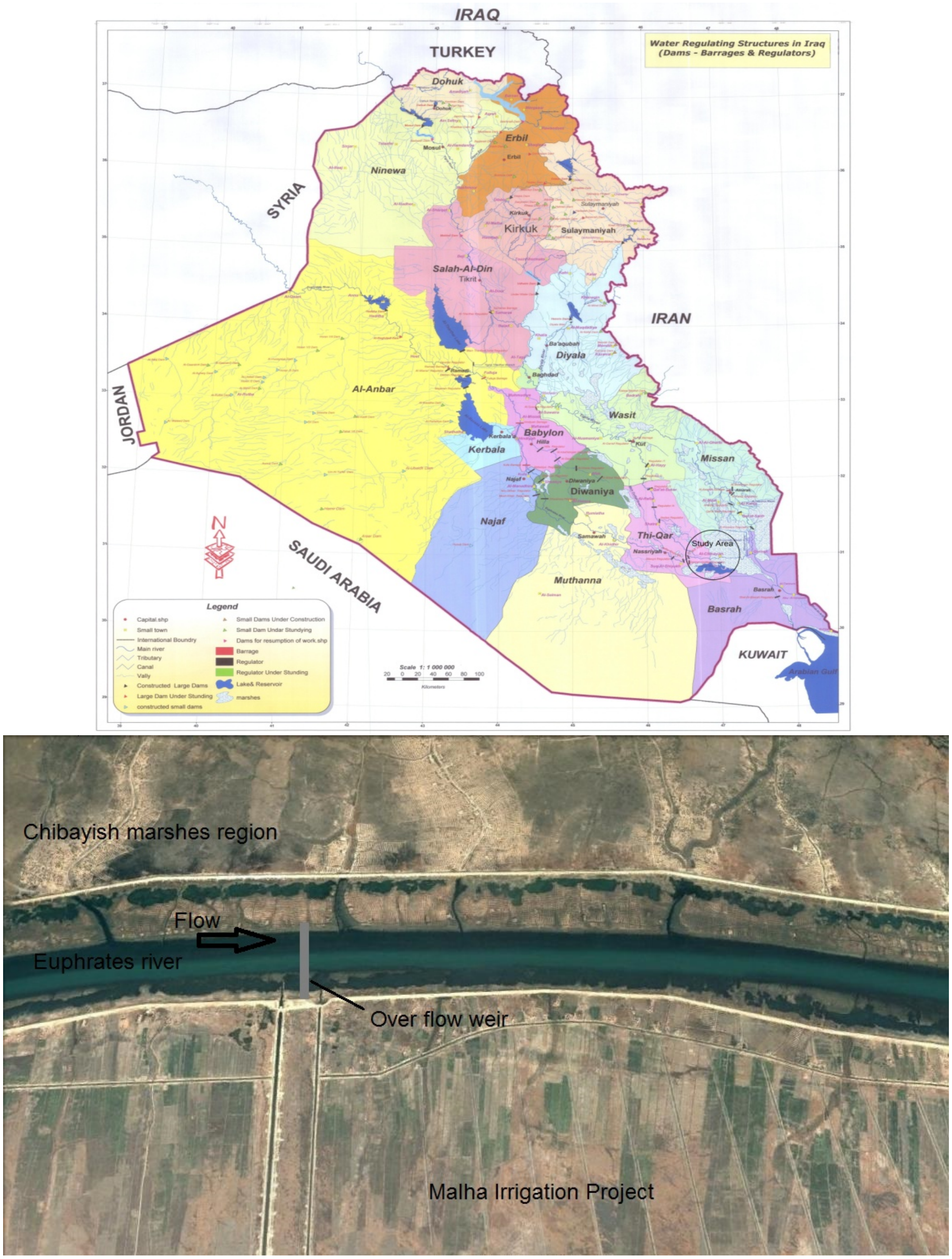


Fig. 1: Study area at Iraqi map and location of over flow weir across Euphrates River

from the Euphrates River at upstream overflow weir to the Central marshes then the water enters from Central marshes to the Euphrates River at downstream overflow weir. By this operation the mixing of water will happen and the water will be directed to the intake of the Malha irrigation project. In addition, the overflow weir will be controlling the Euphrates River during flood and also in the deficits in the Euphrates River. Figure 1 shows the Iraqi map (MOWR, 2006b) and location of the overflow weir across Euphrates river.

STUDY AREA

The overflow weir is located on the Euphrates river between central marshes Lat. (30° 50$'$ N) Long. (46° 45$'$E) with an area equal to 35 thousand ha. Hammar marshes is located Lat. (30°35'N) and Long. (46°25'E) with an area equal to 35 thousand ha (MOWR, 2006a). The water in the central marshes will be regulated from the downstream with series of projected water regulators structures along the canal that run from north to south until the Euphrates River.

PHYSICAL AND ECOLOGICAL FEATURE OF THE MARSHES

Central marshes: Central marshes comprise of a vast complex of mostly permanent fresh water with scattered area of open water to the west of the river Tigris and to the north of the river Euphrates. The marshes are fed by both rivers and the maximum flooding covers an area of about 3000 km^2, almost all of the effective areas are covered in tall read- beds of parasites and Typha. The marshes are boarded to the north and east of cultivated planes with extensive rice fields and sugar cane polders. Portion of the central marshes which are known or thought to have been of special importance for wildlife.

Al-Hammar marshes: Al Hammar marshes surrounding marshes and neighboring of temporary inundation comprise some of 3500 km^2 of almost continues wetland habited south of the river Euphrates and west of the Shutt al Arab. The marshes itself is the longest lake in the lower Euphrates approximately 120 km long up to 25 km wide. It is boarded in the north by the Euphrates river in the west by the southern desert and in the east by the Shatt al Arab. The lake is entropic and generally shallow with maximum depth almost 1.8 m at low water level and in early winter end about 3.0 m. High water level in late spring long parts of the littoral zone dry and during period of low water and banks and island appear in many places. The main source of water in the Euphrates which flow along the northern edge of the marshes and joint the Tigris at Qarmat Ali where the combined flow between Shatt Al Arab. However, the lake may also receive a very substantial amount of water from Tigris Via central marshes and there is permeability also some recharges. Some ground water portion of this vast wetland which are known to be special wildlife.

SCOPE OF RESEARCH

Increasing the cultivation area in the chibyish region: Al Malha project is located on the right side of the Euphrates River in Thi-Qar province see Fig. 1 plan and location of Malha project. The area of this project is a drain from the Hammar marshes and the area used for cultivation is equal to 45000 Dons, the cropping pattern suggests that the cultivation area is for Winter crops (Wheat, Barley, Barseam, Broad Beans) with total intensity equal to 75% and Summer crops (Maize, Summer vegetable, Rice) with total intensity equal to 18% and the perennial which are mostly fodder with 14% intensity. The amount of the water requirement is calculated by using the revised pen-man method and on the basis of the Al-Nassiyriah metrological station which is close to the site area of the project. The format of calculation of the Eva-transpiration ET_0 is shown in Fig. 2 as a sample for January (FAO, 1977).

The maximum water duty requirement is 0.605 *L/s/hec* for April which is used as the discharge for the water requirement to Al-Malha project and is equal to 8.324 m^3/s at the intake of the main canal of the project area. The monthly discharge and volume of water required for the cropping pattern is shown in Table 1.

Increasing the activity of the fish capturing: In Iraq, fishing efforts are considered to be relatively low, detailed data on the number of fish are lacking but it is reported that fishing has always been far less important than agricultural, reed collecting and buffalo farming. The total population of marshes before drainage has been estimated between 35000 and 500000 (USAID, 2006) including men and women, old and young. Assuming 5% of these numbers were engaged in fishing on full time equivalent basis, then there may be about 20000 fishers in the marshes land fishery at its peak.

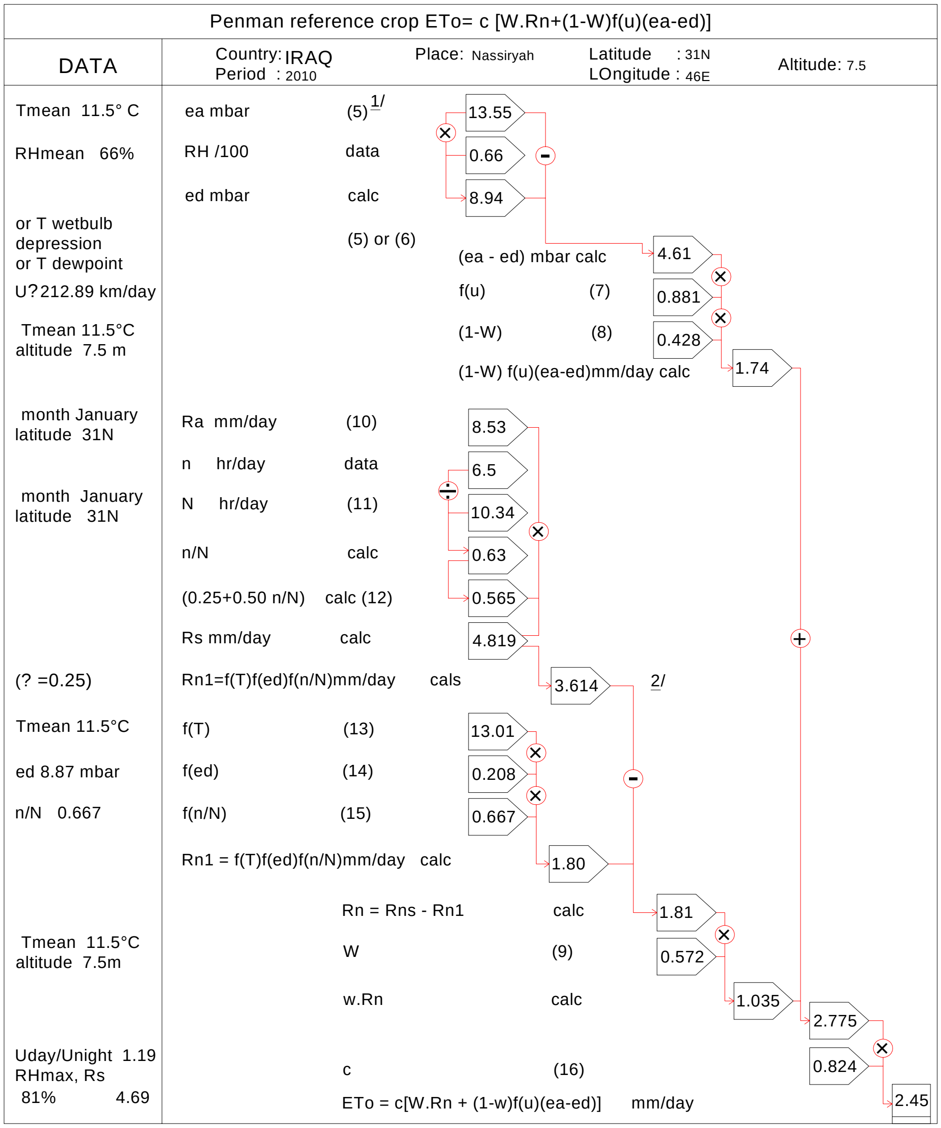
As an average, this translates to a pre drainage fishermen density of 2.2 fisherman/km^^{2} (UNEP, 2005), with annual caches of 12000 to 15000 tons per year, corresponding to catch per unit area per year of about 15 kg/ha. During February 2004, fishermen reported that catch rates are about 10 times lower than the pre drainage catch rates. Respondents claimed to catch between 150 and 400 kg/day prior to drainage and often being able to fill their boats with fish.

Current catches range from 2.4 kg/day for some respondents up to 17-25 kg/day. Estimates of current fishing pressure are similar before drainage with both water level and fishermen numbers decreasing similar promotion. Department of fisheries staff estimates that around 3000 fishermen are now working in the marshes. This corresponds to a fishermen density of 2.3/km^2 of 1297 km^2 water area estimated by United Nation Environment Program (UNEP). Fishermen are concentrated in the small areas, where higher number are at the top of north-south section of the prosperity river. Densities were also high near Al-FAHOOD village on Abu Zarig marshes at the Chibayish fish market over 50% of the represented fish were Common carp and Crucean carp.

In order to find the quantity of fishes in tons per year, we use the following data:

- The south central marshes are considered to be more effective in the Chibayish region
- The area flooded for this part is equal to 899 km^2 according to CRIM (2008)

FORMAT FOR CALCULATION OF PENMAN METHOD



1/ Nembers in brackets indicate Table of reference (FAO,No.24,1977).
2/ When Rs data are available Rns = 0.75 Rs.

Fig. 2: Chart of calculation of the Evap-transpiration (ET_0) for Malha irrigation project in Chibayish region

Table 1: Monthly discharge and volume of water required for the cropping pattern

Month	Discharge m^3/s	Volume million m^3
October	4.50	12.10
November	3.14	8.14
December	2.37	6.35
January	3.00	8.04
February	5.28	12.78
March	7.45	19.95
April	8.31	21.55
May	4.77	12.78
June	5.38	13.94
July	5.5	14.62
August	4.66	12.49
September	4.73	12.25
Total		155

The water duty for Al-Malha irrigation (existing) is equal to 1.32 *L*/*s*/*hec* and in the head of the canal = 1.32/0.9 = 1.47 *L*/*s*/*hec*; Actual area cultivated is equal to 8000 *Dons*; Hence the discharge = 1.47×8000×(4×1000) = 2.94 m^3/s; Total quantity of water used in the winter season (Wheat and Barley) and the summer season (rice) is equal to 2.94×365×24×3600 = 92.72 *Million* m^3; Net water required is equal to 155-92.72 = 62 .3 *Million* m^3

- The production is considered to be equal to 15 kg/hec
- Total production per year is equal to 1350 ton/year
- The amount is low as compared to the production amount between (1950-2005) which is equal to range between 5000-30000 ton per year (FAO, 1977)
- Total amount income of fish per year is equal to 2700 million *ID* (Iraqi Dinar)*/year*

Increasing livestock and dairy products: Milk productivity from water buffalo is very low and is about five kilograms in Hammar and Al Chibayish which may be because the forage. Buffalos are milked once a day in the evening upon return from pasture beyond the settlement. Cattle provide 6 kg of milk in Hammar and Al Chibayish daily. These low yields are largely related to the amount of food given to animals. Sheep are shorn once a year for their coarse wool which is sold for about 1000 ID/kg. Sheep in the marshes reproduce three times every two year on average. Owners sell the male when they weigh about 30 kg for slaughtering. Females are kept for breeding. Buffalos and Cattle reproduce every ten months.

The livestock procedure has been relatively successful with their traditional system of low input, output per head despite less per animal productivity. Return of investment in livestock is not low in most traditional livestock systems. Animals are held because they usually provide high and secure economic return relative to other investment options. Depending on the species, returns are realized in the form of milk, meat, dung for fuel, manure hides, skins, wool and hair. Livestock are often the most important and secure form of investment and saving available. Livestock do not necessary require land ownership as investment or saving. Livestock provide security and can draw on for food purchases, family emergencies, ceremonies and social events.

The net profit realized from kilograms of live weight for Buffalo, Cattle and Sheep are 1275 ID, 1166 ID and 1674 ID respectively.

The explicit objective of the task is to raise income in the marshes through improved livestock and daily production as a part effort to develop strategies to restore the Iraqi Marshes, which includes: The construction, the overflow weir and the proposed regulator which can improve the situation and controls the water between Euphrates River and Hammar and Central Marshes.

METHODS AND CALCULATIONS

The economic analysis of the construction of the weir and the regulator on the existing embankment with 100-meter width in the Chibayish can be achieved by calculating the cost of all items of the project and the benefits gained during the life production of the project.

Cost analysis: In order to find the feasibility of the construction of the weir, it is necessary to find the rate of 1 m^3 used in the project. In other words, to find the accumulation cash flow during the life production of the project it is necessary to find the cost of the items of the projects. The items of the project are:

- Agricultural activities for irrigation
- Fishing capturing activities
- Livestock and dairy activities

The cost can be divided into the following:

- Capital cost
- Running cost (yearly cost)

The capital cost included the following:

- Cost of irrigation and drainage system
- Cost of purchasing the fingering
- Cost of purchasing the animals

And the running cost included the following:

- Maintenance cost
- Operation staff cost
- Replacement cost
- Cost of machines used for agricultural purpose
- Cost of production requirement

Cost of irrigation and drainage system:

- This cost is based on the design of the Malha project by the study and design center (Ministry of water resources) including the irrigation and drainage system and irrigation structures based on the quantities of earth excavation, earth filling and number of structures.
- Land leveling cost.
- Cost of ancillary work which consists of construction building for the period of construction of the project.

Cost of livestock: The livestock of the animals in the Chibayish region are consisting mainly from Buffalo and sheep. The expected number purchasing for three years equal to 6000 for buffalo and 40000 for sheep.

Cost of purchasing the fingering: There are currently nine to ten operating private sector hatcheries near Babylon, Kut and Baghdad that produce the grass and silver fingering distributed advanced fingering to the south for 300 ID per fingering, this price is hugely inflated because there is no competition, the governmental hatchery produces fingering for 7-9 ID per fingering.

- Initially for coal, there was three to five million fingering. However, the program was able to restock only approximate 3000000 fingering.

Table 2: Number of agricultural field machines

No.	Agricultural machines	No, first year	No. second year	No. third year
1	Tractor (DT-75)	12	24	36
2	Tractor Anntar 70	12	24	36
3	John Dear Harvester	5	10	15
4	Four furrow plough	12	24	36
5	24- Disk morrow	12	24	36
6	Land plan	12	24	36
7	Seed Drill	5	10	15
8	Ridged	3	6	9
9	Cultivator	3	6	9
10	Mower	2	4	6
11	Ditcher	13	26	39

- In this research, the private cost of fingering is equal to 300 ID per fingering and the total number of fingering is equal to 3000000
- The total capital cost equals to 3000000×300 = 9.0 million ID

Distributed capital cost as main item: The main capital costs are:

- Irrigation system
- Drainage system
- Hydraulic irrigation and drainage structures
- Land leveling
- Cost of machines
- Cost of ancillary work
- Cost of livestock and dairy production
- Cost of purchasing the fingering
  - The total capital costs are estimated to be equal to 63005.25 million ID
  - The percentage of the foreign currency is equal to 14% from the capital investment cost
  - The capital cost is distributed in 3 years as period of construction

Running cost: This cost should be paid each year in order to operate the project continually without any problems and keep the project with best productivity (Kulkarni *et al*., 2004). The cost consists of the following:

- Cost of the staff operation for the project
- Maintenance cost of the project starting from the beginning of operation up to the end life of the project (50-year)
- Cost of electricity
- Replacement cost for the parts needed to be replaced during the life production of the project which includes the land leveling, machines operation for agricultural purpose and site vehicles
- Cost of production requirements which is considered the cost of mechanical of–agricultural activities as shown in the Table 2, cost of seeds(field crops and vegetable), cost of fertilizer, cost of pesticide and cost of land and water rate (in Iraq is free of cost)
- Cost of existing agricultural production
- Cost of the net requirement of the production

Total project cost: The total project cost is consisting of the total cost of the yearly cost and the capital cost of the project and this cost is presented in the Table 3.

Benefit from the project development: The benefit of the agricultural production is achieved by increasing the intensity of the cropping pattern and increasing the yield of the production, by using technical management such as: The mechanical cultivation, experimental farm, improved livestock production and also improving the fishing activities by using the advanced method of the breading and increasing the quality and quantity of the fish capturing. All these activities can be obtained by constructing the regulator to develop the situation of water in quantity and quality.

The price of the product of the agricultural production can be divided in two categories:

- Strategic crops which considers the rate price according to the international rate (CIF) such as wheat, barley, maize, in addition to meat and fish, this is taken from the ministry of trade.
- The vegetable crops fodder and milk are considered according to their rate at the local market price and these price are obtained from the local market in Chibayish.

RESULTS AND DISCUSSION

Accumulating cash flow: The cash flow represents the total cash flow during the operation of the agricultural project with 50 years' life production and with total amount of cash flow equal to 385463.97 Million ID as shown in Table 4.

Benefit of construction of the overflow structure: Due to construction, the overflow weir and the proposed regulator, the total output will be considered as the productivity of 1 m^3 of water as calculated from the cash flow as shown in Table 4 to be equal to 50 ID/m^3. Hence, this rate will be considered as the basis of the benefit of the water which can be used for developing the Chibayish region and the quantity of water used in cultivation for this development.

Table 3: Total project cost in million ID

Year	Total yearly cost	Capital cost	Total project cost	Year	Total yearly cost	Capital cost	Total project cost
1	0.0	18654.1	18654.1	26	4426.59	0.0	4426.59
2	0.0	26073.3	26073.3	27	4426.59	0.0	4426.59
3	0.0	18272.8	18272.8	28	4426.59	0.0	4426.59
4	2098.52	0.0	2098.52	29	9024.59	0.0	9024.59
5	3489.55	0.0	3489.55	30	4426.59	0.0	4426.59
6	4426.59	0.0	4426.59	31	4426.59	0.0	4426.59
7	4426.59	0.0	4426.59	32	4426.59	0.0	4426.59
8	4426.59	0.0	4426.59	33	4426.59	0.0	4426.59
9	9024.59	0.0	9024.59	34	10499.69	0.0	10499.69
10	4426.59	0.0	4426.59	35	4426.59	0.0	4426.59
11	4426.59	0.0	4426.59	36	4426.59	0.0	4426.59
12	4426.59	0.0	4426.59	37	4426.59	0.0	4426.59
13	4426.59	0.0	4426.59	38	4426.59	0.0	4426.59
14	10499.69	0.0	10499.69	39	9024.59	0.0	9024.59
15	4426.59	0.0	4426.59	40	4426.59	0.0	4426.59
16	4426.59	0.0	4426.59	41	4426.59	0.0	4426.59
17	4426.59	0.0	4426.59	42	4426.59	0.0	4426.59
18	4426.59	0.0	4426.59	43	4426.59	0.0	4426.59
19	9024.59	0.0	9024.59	44	10499.69	0.0	10499.69
20	4426.59	0.0	4426.59	45	4426.59	0.0	4426.59
21	4426.59	0.0	4426.59	46	4426.59	0.0	4426.59
22	4426.59	0.0	4426.59	47	4426.59	0.0	4426.59
23	4426.59	0.0	4426.59	48	4426.59	0.0	4426.59
24	10499.69	0.0	10499.69	49	9024.59	0.0	9024.59
25	4426.59	0.0	4426.59	50	4426.59	0.0	4426.59

Table 4: Accumulation cash flow

Years	Total future benefit	Total cost	Cash flow	Cumulative cash flow	Years	Total Future Benefit	Total cost	Cash flow	Cumulative cash flow
1	720	18654	-17934	-17934	26	15251	4426	10825	151603
2	720	26073	-25353	-43287	27	15251	4426	10825	162428
3	720	18272	-17552	-60840	28	15251	4426	10825	173253
4	3411	2098	1313	-59526	29	15251	9024	6227	179480
5	9573	4426	5146	-54380	30	15251	4426	10825	190305
6	15251	4426	10825	-43555	31	15251	4426	10825	201130
7	15251	4426	10825	-32730	32	15251	4426	10825	211955
8	15251	4426	10825	-21905	33	15251	4426	10825	222780
9	15251	9024	6227	-15678	34	15251	10499	4751	227532
10	15251	4426	10825	-4853	35	15251	4426	10825	238357
11	15251	4426	10825	5971	36	15251	4426	10825	249182
12	15251	4426	10825	16796	37	15251	4426	10825	260007
13	15251	4426	10825	27621	38	15251	4426	10825	270832
14	15251	10499	4751	32373	39	15251	9024	6227	277059
15	15251	4426	10825	43198	40	15251	4426	10825	287884
16	15251	4426	10825	54023	41	15251	4426	10825	298709
17	15251	4426	10825	64848	42	15251	4426	10825	309534
18	15251	4426	10825	75673	43	15251	4426	10825	320359
19	15251	9024	6227	81901	44	15251	10499	4751	325111
20	15251	4426	10825	92726	45	15251	4426	10825	335936
21	15251	4426	10825	103551	46	15251	4426	10825	346761
22	15251	4426	10825	114376	47	15251	4426	10825	357586
23	15251	4426	10825	125201	48	15251	4426	10825	368411
24	15251	10499	4751	129953	49	15251	9024	6227	374638
25	15251	4426	10825	140778	50	15251	4426	10825	385463

Hence the total cash flow per year = 385463.97/ 50 = 7709.279 million *ID*; Total cash flow per Dons = 7709.279 /45000 = 0.171 million *ID*; Total water used for the project equal to 155 million m^3; One cubic meter per Dons = 155/45000 = 3444.4 m^3/ *Don*; ID / cubic meter = 0.171 ×1000000/3444.4 = 49.65 ID say 50 *ID*

- Total water requirement from Table 1 which is equal to 155 million *ID*
- Already water used for existing Summer and Winter crops (Wheat and Barley and Rice) for area equal to 8000 *Dons*, the existing water duty 1.47 *L*/*s*/*hec*, hence the total water used equal to 92.72 million cubic meter
- Hence the net water required for the project 155-92.72 = 62.3 million m^3
- The total income of the water rate equal to 62.3 million m^3×50 *ID* = 3115 million *ID*/*year*

Economic analysis: The purpose of the economic analysis is to know the preponderance of the benefit of the project over total cost or vice versa and the result can be considered economically feasible or not. The economic analysis used number of factors to examine the project.

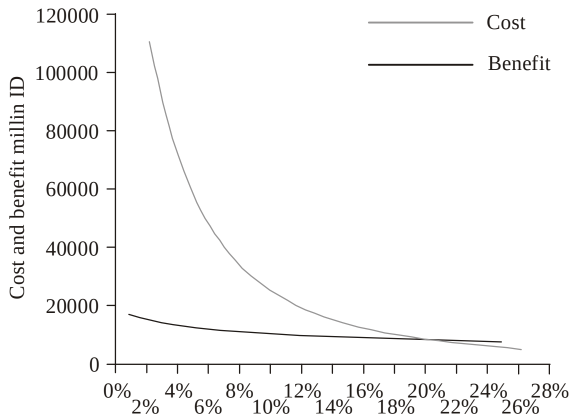


Fig. 3: Relation of the cost and benefit

Net present value: The net present value of the project can be calculated using the following relation (Blank and Tarquin, 2005):

$$\text{N.P.V} = \sum_{i=1}^{n} \frac{Bi - Ci}{(1+r)^i} \tag{1}$$

where,

N.P.V. = Net present value
B_i = The yearly benefit obtained
C_i = The yearly cost expected
r = Discount rate %
n = The economic life of the project:

$$\text{Discount rate factor} = \frac{1}{(1+r)^i} \tag{2}$$

Net present value for all life production of the project (50 years) are listed for different discount rates (1-25) %. It is found that the net present value is 4.734 million ID for a discount rate equal to 22% and B/C equal to 1.0. The relation between the cost, benefit and discount rate shown in Fig. 3.

Payback period: By the payback period, the time period for returning the capital cost of the overflow weir which invested in the project can be known (Ye and Tiong, 2000). The net yearly cash flow is presented in Table 5 in order to find the payback period time. Also, Table 5 represents the accumulative yearly cash flow for all period of the project. The time period for returning the capital cost can be calculated as follows:

- Net yearly cash flow for the year sixth (6) = 2053.575 + 890.205 = 2943.78 *Million ID*.
- Then payback = 6 +2053.575/2943.78 = 6.7 *years*

The payback period can be achieved after 6.7 years or after 7 years from the operation time of the project (the construction period is 3 years).

Benefit cost ratio: According to these variables, we can justify the efficiency of the investment of the capital cost. This variable can be calculated by finding the ratio B/C which can represent the present value of the benefit to the present value of the cost:

$$\text{Benefit cost ratio } B/C = \frac{\sum_{i=1}^{N} \frac{Bi}{(1+r)^i}}{\sum_{i+1}^{N} \frac{Ci}{(1+r)^i}} \tag{3}$$

Table 5: Net yearly cash flow

Years	Total Future Benefit	Total cost	Cash flow	Cumulative cash flow	Years	Total future benefit	Total cost	Cash flow	Cumulative cash flow
1	0	3302	-3302.	-3302	26	3115	171.22	2943	56822
2	0	3849	-3849	-7151	27	3115	171.22	2943	59765
3	0	3849	-3849	-11000	28	3115	171.22	2943	62709
4	3115	94	3020	-7979	29	3115	171.22	2943	65653
5	3115	132	2982	-4997	30	3115	171.22	2943	68597
6	3115	171	2943	-2053	31	3115	171.22	2943	71540
7	3115	171	2943	890	32	3115	171.22	2943	74484
8	3115	171	2943	3833	33	3115	171.22	2943	77428
9	3115	171	2943	6777	34	3115	171.22	2943	80372
10	3115	171	2943	9721	35	3115	171.22	2943	83316
11	3115	171	2943	12665	36	3115	171.22	2943	86259
12	3115	171	2943	15609	37	3115	171.22	2943	89203
13	3115	171	2943	18552	38	3115	171.22	2943	92147
14	3115	171	2943	21496	39	3115	171.22	2943	95091
15	3115	171	2943	24440	40	3115	171.22	2943	98034
16	3115	171	2943	27384	41	3115	171.22	2943	100978.
17	3115	171	2943	30328	42	3115	171.22	2943	103922
18	3115	171	2943	33271	43	3115	171.22	2943	106866
19	3115	171.22	2943	36215	44	3115	171.22	2943	109810
20	3115	171.22	2943	39159	45	3115	171.22	2943	112753
21	3115	171.22	2943	42103	46	3115	171.22	2943	115697
22	3115	171.22	2943	45046	47	3115	171.22	2943	118641.
23	3115	171.22	2943	47990	48	3115	171.22	2943	121585
24	3115	171.22	2943	50934	49	3115	171	2943	124528
25	3115	171.22	2943	53878	50	3115	171	2943	127472

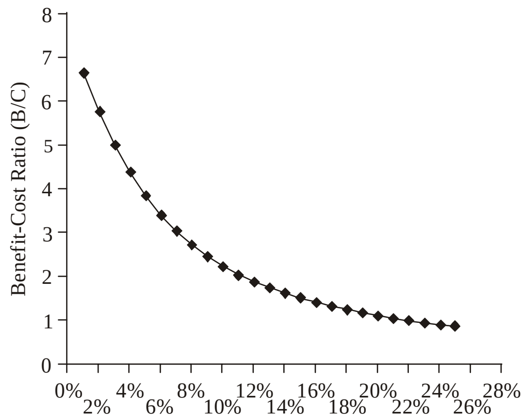


Fig. 4: Relation between benefit cost ratio B/C and the discount rate%

Table 6: Details of the sensitivity analysis

No.	Condition	Internal rate of return (IRR) for
1	Actual values of the cost and benefits	22%
2	Increase the cost 10% and keeping the benefit constant	20%
3	Increase the cost 20% and keeping the benefit constant	18%
4	Decreases the benefit 10% and keeping the cost constant	20%
5	Decreases the benefit 20% and keeping the cost constant	17%
6	Increases the cost 10% and Decreases the benefits 10%	18%
7	Increases the cost 20% and Decreases the benefits 20%	15%

where,

B/C = The ratio of the benefit to the cost
Bi = The yearly benefit obtained
Ci = The yearly cost expected
r = The discount rate %
N = The economic life of the project

The ratio B/C is equal to 1 when the discount rate is 22% as shown in Fig. 4.

The sensitivity analysis: The sensitivity analysis is worked in order to examine the economic analysis and find the effect of the Internal Rate of Return (IRR) as shown in Table 6.

CONCLUSION

The current agricultural location to the south of the country is clearly remarked as the agricultural is highly unproductive and the water is wasted. Some gapes in the knowledge still exist to be able to clearly identify to cause of these problems but it is clear that an increase of the water efficiency must be achieved. The major benefit of the agricultural water efficiency are:

Increasing agricultural productivity: Usually irrigation system improvement first focuses on the conveyance network followed by on-farm improvement. Combination of both is necessary to achieve higher yields.

Improving the water quality: The current use of water resources could limit the salinization of soil, the percolation of the salt and the contamination of the ground water. It can eliminate run off that could pick up salt and contaminate water resources allocated for irrigation in different parts of water shade basin.

Construction of the regulator weir:

- Due to construction of the regulator, this it will allow the water exchange between central marches, Euphrates River and Hammar marshes. This process will decrease the salt in the water.
- Enable to control water level of the marshes in the region which can help the population to re-settle.
- Increasing the quantity of fish capturing operation. Also, it will be increasing the number of the animals specially buffalos and cattle.

o According to the above information, an economic analysis was worked taking all the cost of the activities of the agricultural requirement and livestock. The benefits and the economical parameters such as: Internal Rate of Return (IRR), Benefit Cost ratio (B/C), payback period, net present values for different discount rate and accumulated cash flow.

o Construction of the regulator in the Chibayish region on the Euphrates River will improve the district by developing the agricultural situation and will increase the product of the livestock and fish capturing. Additionally, the economic analysis showed that the time of the payback period is equal to 7 years after 3 years for construction time and can be considered economic feasible. The results of the construction of the overflow weir will give rate of water of 50 ID to cover the total cost of the project during the life of production.

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