Journal of Economics and Administrative Sciences Vol.27 (NO. 127) 2021, pp. 135-154

Journal of Economics
and Administrative Sciences (JEAS)

Available online at http://jeasiq.uobaghdad.edu.iq

Detailed feasibility study of the pre-cast reinforced concrete project and its importance in the construction of Iraq

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Received:29/2/2020 **Accepted: 20/5/2020** **Published: March/ 2021**

Purpose: Providing practical knowledge of the requirements of a detailed feasibility study for selecting the investment project.
Findings: Directing the private sector towards investing in productive projects - the pre-cast reinforced concrete project - as it achieves a financial return as well as providing Providing foreign currencies by reducing imports and exploiting available natural resources
Practical implications: The importance of a detailed feasibility study to determining whether the project can be implemented or not.
The precast concrete method is one of the best modern construction methods (high quality, low cost and fast to implement).
Social implications: Rapid treatment of destroyed infrastructure, consequently restoring stability to liberated areas, and community reconstruction.
Providing additional job opportunities that are sustainable, which contributes to reducing unemployment. And Reducing environmental pollutants.
Originality/value: The research has the value of originality, as it deals with the details of an industrial project in several aspects (technical, legal, environmental and economic impacts).

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Abstract

The feasibility study for the investor of the project is considered as the guide that illuminates a path towards safe investment, as it cares about the investment opportunity and reaching the final decision to accept the opportunity and convert it from just an idea to a project or reject it.

As a result of increasing need in Iraq to complete the construction work of the service sector (health, education and housing) in addition to reconstructing the provinces that were exposed to military operations, it was necessary to find alternatives that are characterized by low costs and fast delivery, also to finding solutions to the problem of government's inability to finance investment projects. Therefore, it was suggested that the private sector invest in a Pre-cast project to solve this problem.

The project site chosen in Anbar Governorate / Fallujah district because the site has several advantages, the most important one is the availability of raw materials, Also the roads connecting the province to the nearby governorates. The total area of the project is (23,200)m^2 and consists of line for production roofs with a capacity of 650 m^3/ day and line for production walls with a capacity of 1000 m^3/ day. The expected duration of completing the project is one year and the productive life of the project is ten years. On the basis of the expected demand the expenses and revenues were estimated and analyzed to reach an evaluation of the project's economic feasibility, where the expected internal rate of return for the project (IRR) (38%) and the recovery period is two years and 4 months.

Introduction:

After the Second World War and the mass destruction and displacement of millions of people Especially for European countries. Attention turned to rebuilding these cities, which were completely destroyed, but the demand for housing units was massive that could not meet the need of this huge number of people in a short period of time. For this main reason and for other reasons, there was a need to develop the traditional building method in infrastructure and housing units specifically and moved to the construction manufacturing stage.

Because of the difficult conditions that Iraq is going through, as most of the infrastructure is destroyed for a quick and effective response to the reconstruction of liberated area a short period of time at low cost. So, the intention was to choose the precast concrete method and indicate whether it can be used or not.

Research Question:

The majority of investment projects are held without a detailed economic feasibility study and if there is a feasibility study it has many Shortfalls, including not defining the need for the project products, the technology used, the extent to compatible with the available skills, suitability to the environment and the amount of profits achieved during the life of the economic project, which is reflected in the lack of optimal utilization of material and financial resources.

Research Hypothesis:

The study assumes effect of a detailed feasibility study (market, technical, legal, environmental, financial and economic study) in determining the market need for project products, the project alignment with legal legislation, the project's impact on the environment, therefore the impact on investment costs and the value added to the project and profits.

Keywords: detailed feasibility study, precast concrete project.

1.<u>Theoretical framework - Detailed feasibility study (concept and requirements)</u>

A detailed economic feasibility study is defined as a study that specializes in estimating demand, location and production capacity, income and spending flows for the purpose of making the final decision on the investment alternative. (Al-Jumaili and Jubran, 2013: 57) Accordingly, the detailed feasibility study consists of the following:

A. <u>Marketing study requirements</u>: Interested in studying the presence of demand for project products, which includes (a study of the state of the market, how to satisfy the demand at the present time, the extent of the possibility of increasing demand in the future and the project's share of the potential increase) (Musa and Salam, 2016: 59).

B. <u>Technical study requirements:</u> It is one of the basics of the detailed study, focusing on everything related to establishment of the project in terms of (choosing the project site, results that affect on production efficiency and the extent of continuity and progress in the work, preparing the interior design, providing equipment, machinery and production requirements, determining the technical specifications of the product and method of controlling production and quality).

C. <u>Environmental study:</u> The relationship between the environment and the project is not from one side, rather it is a reciprocal relationship through the effects of the environment with all its components in the project. The impact of the project on the environment - whether this effect is negative or positive. By showing the extent of the project's impact on the environment, according to two possibilities, <u>The first</u> is a positive impact that makes the project feasible from an environmental perspective, <u>The second</u> is a negative impact caused by the project to the environment, whether through air or water pollution and the assessment of negativity according to the following: (Previous source, 47-48):

- ✓ **The possibility of treatment at high costs: Through the harmful effects that are treated by installing special equipment with high cost on the project, which affects the cash flows.**
- ✓ **The possibility of treatment at low costs: The harmful effects on the environment that can be treated at lower costs.**
- ✓ **Inability to treat: In this case, preferable to reject the project and not build it due to environmental feasibility.**

D. Legal study requirements: It aims to discuss basic and complementary investment laws and legislation that is represented in financial and tax legislation, As well as labor legislation, wages, social insurance and other laws that affect the performance of the project and have positive effects then the expected cash flows that the government gives to investment projects within the framework of encouraging investment in certain areas (Ibid., 53).

E. Financial study requirements: It is considered complementary to the above, focuses on the financial aspects in the establishment of the project, as possible through it to present a critical concept in the language of numbers about the inputs and outputs of the investment project. The investment costs are divided into the following: (for more, see Al-Jumaili and Jibran, previous source: 118-119)

- ✓ **Fixed investment costs: Assets in long-term periods (lands, machines and equipment).**
- ✓ **Operating investment costs: Assets in the short-term period (salaries, wages, inventory (final products, raw materials, spare parts and fuel)).**

F. Economic study requirements :For the purpose of estimating commercial profitability, the following criteria were adopted: (for more, see Al-Najjar, 2013: 131,212, 264 and 266 respectively)

-Non-discounted criteria in confirmation conditions.

-The discounted criteria in the circumstances of uncertainty.

2.Practical study (Detailed feasibility study for the Pre-Cast project)

Some provinces of Iraq faced the control of the terrorist organization (ISIS) in 2014, including Al-Anbar Governorate and the resulting destruction the infrastructure in all sectors (education, health, housing and government buildings, etc.). For the purpose of reconstruction and stability of these areas, it was necessary to give investment priority to construction projects, including a pre-cast project.

Construction at the present time depends on the on-site casting of concrete, which is characterized by its high costs and long time required for implementation as well as waste of materials used which will be shown in the environmental study. The choice of the project:

a) came on the basis of what this technology provides in terms of reducing time, speed of implementation and completion of a number of reconstruction projects in the province. In addition to being a production project that works to provide job opportunities and exploit the locally available raw materials in abundant quantities and qualitative specifications in accordance with international and local specifications.

b) Utilizing the available resources in the country to create forward links, which are:

- ✓ **Availability of raw materials (iron, bauxite, sand, gravel, etc.) in large quantities and high quality specifications in conformity with international specifications and low costs of extracting because it is present in the upper layers with an appropriate thickness and the availability of its tests locally.**
- ✓ **It requires medium-skilled and unskilled labor.**

First: Marketing feasibility study for the project (Al-Anbar Governorate).

- Expected demand: determined according to the need of government buildings, service, educational, health and housing sector (housing complexes).

Table 1: The size of the current and future demand of buildings for several sectors in Anbar.

The main sector	Secondary sector	Estimate the size of the damage	Quantity
Education	Schools	Partial Destroyer	782
		Destructive	142
		Shortage	285
		Future need[3]	1137
Higher Education	Universities	Anbar and Fallujah universities	30 Buildings
	Institutes	Technical Institute	5 Buildings
Health	Health centers	Shortage	70
		Reconstruction	26
		Future need[4]	44
	Hospitals	Reconstruction	4
Services sector[5]	Water and wastewater treatment plants	No data	-
	Power distribution stations	No data	-
	Other government buildings	No data	-
Housing	Residential complexes	Deficit due to destruction[6]	10500
		Estimated housing deficit for the year 2012[7]	7944

Reference: The table was prepared by researchers based on data from the Planning and Follow-up Division / Al-Anbar Governorate and the Ministry of Planning, housing deficit in Iraq, Table (2), p9.

-The expected demand at the present and future:

The expected demand from walls and roofs has been determined based on the typical designs of government buildings, the housing sector and the criteria adopted in determining the future need.

Table 2: shows the expected demand from concrete (walls and roofs) according to the designs.

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[3]The governorate need was determined for the next ten years according to the criteria for establishing a school for every 5,000 citizens.

[4] The governorate need was determined for the next ten years according to the standard of a health center for every 10,000 citizens .

[5] Due to the lack of a data about this buildings, it was not calculated within the expected quantities as a need during the life of the project.

[6]According to the governorate's letter to the Ministry of Planning / Sectors Planning Department.

[7] Ministry of Planning, Estimates of Projections for the Population of Iraq 2015-2018, Table 170: p. 261.

No.	The main sector	Secondary sector	Walls m^3	Roofs m^3
1	Education	12-class school	1675044	1291082
		18- class school	2207586	2005830
2	Higher Education	Universities	133000	77000
3	Internal security	Police Stations (30)[8]	89500	50000
4	Health	Hospitals	151960	75980
5	Housing	Residential complexes[9]	2500000	1475000
Total			6757090	4974892

Reference: The researchers prepared the table based on data from the Planning Department in Anbar Province.

Second: Technical feasibility Study of the project.

Reccurment major	Secondary elements
The project Location: Anbar Governorate / Fallujah District	**The cost of transportation:** -There is a network of roads available in the governorate that guarantees marketing the product by connecting the province to the nearby governorates (Baghdad, Salah al-Din, Nineveh, Karbala and Najaf). -Population:The population of the district is (580,162)constitutes35.4% of the governorate's population, As it is considered the most populated districts after the Governorate Center (Ramadi) near to the project site. -Infrastructure:availability of water and electricity services.
Estimate the cost of land and buildings	Ownership of the property: a private property of the project. Project area: The area allocated to the project is 23,200 m^2 Consisting of: − Main shed with dimensions (48-190) and a total area of (9120) m^2. − Dimensions of the production line for roofs (18-190) meters, the production line of walls (18-190) meters and the working area with dimensions (12-190) meter. −Storage area (2600) m^2 to store the product. −Administration building with an area of (200) m^2, a restaurant with an area of (44) m^2, reception with dimensions (16) m^2,a warehouse for spare parts with an area of (40) m^2 and fence with dimensions (290 - 80)meter.
Determine the production capacity	Determine the daily production Roofs: (650) m3 / day. Walls (1000) m 3 / day. Annual production capacity / Walls production / Roofs production First Year / 70% / 135,000 / 87,750

[8]Determine the governorate need of the security centers, which amount to (30) centers,this has been determined by the local government to reconstruct this sector .

[9] Fixed designs with an area of 120 m^2 and 140 m^2 approved horizontal construction in the form of complexes or a four-story vertical building to determine the amount of concrete blocks expected in this sector.

	Second Year	90%	150,000	97,500
	Third Year	100%	225,000	146,500
	Fourth Year	100%	225,000	146,250
Production processes	***Roofs production line:(see figure(1))** **1.Cleaning the molds and pulling the wires: The pre-tensioned hollow roofs are produced in molds. Before casting the molds are cleaned and oiled, then the wires are pulled and spread by a specialized device.** **2.Pulling the wires: The wires of the one mold shall be tightened at the same time. It is possible to tighten each wire separately, as a special equipment has been developed for this purpose, this equipment will be transversely moved from one mold to another, thus all the wires will be tightened within the production line.** **3.Concrete transfer: The concrete is transported from the Batch Plant by means of an overhead conveying system where the shuttle cart brings the concrete mix automatically to the desired location and discharged into a container within the upper bridge that discharges the mixture inside the extruder.** **4.Extrusion: use of the high-efficiency Extruders is the main component of the production process as it extrudes and produces roofs as a continuous process.** **5.Draw the holes with the drawing machine: All openings to be identified and drawn are determined by the drawing machine, as well as the point of cutting or separating the roofs and gaps, in addition to the identification information required for the roofs, where it is identified and drawn by the drawing machine.** **6.Cut the hollow roofs into molds: After the process of ripening the roofs, the tensioned wires are released and cutting the roofs according to the marking marks.** **7.Transfer roofs for storage: The roofs are placed on the transport vehicles. The end of the roofs is marked with the project numbers, then the vehicles move to the storage.** ***Wall Production Line:(see figure(2))** **1.Cleaning and lubricating the molds: The walls are produced on floor molds, before casting the molds are cleaned and oiled to be ready for the next step.** **2.Draw the holes with the drawing machine: The dimensions and identification information required for the wall are determined and drawn, which are pre-loaded by the drawing machine, and after the wall profile is installed.** **3.Transfer and pour concrete: The concrete is transported from the Batch Plant by means of an overhead conveying system where the shuttle cart brings the concrete mix automatically to the desired location and discharged into a container within the upper bridge that discharges the mixture inside the extruder.** **4.Maturation of concrete, opening and tilting of formwork: After completing the casting process, the molds are transferred to a steam heating system for the purpose of ripening the concrete, followed by opening and tilting the**			

	molds by means of hydraulic levers. **5.Transfer walls for the purpose of storage : The walls are lifted from the formwork by an upper bridge and placed on the transport vehicles and transferred to the places designated for storage.**
Choose the production method	**- Availability of production elements: availability of raw materials (sand, gravel, cement) near the project.** **-The orientations of the country's economic policy:** **Increasing private sector investment in economic sectors, raising the proportion of its contribution to fixed capital formation to 38.3 in 2022.** **Restoration programs for the liberated areas, including the rehabilitation of schools, health centers and government buildings. (Development Plan, 2018: 87 and 112, respectively)**
Internal planning of the project	**The nature of the industry: structural transformational.** **Approved standards and specifications for the product:** **- Compressive strength of test samples ISO 4012: 78.** **- Flexion resistance of test samples ISO 4013: 78.** **- Typical horizontal separators between walls ISO 7728: 85.** **- Typical vertical separators between walls ISO 7729: 85.** **- Carbon steel anchor bolts with a large head ASTM A 307: 97.** **- Carbon steel sheets ASTM A361 M: 97a.**
Periodic maintenance	**Potential production stoppages: bi-annual maintenance**
Description of work within the project	**Project implementation period: One year, as in Table (3).** **Daily working times: Once an average eight hours.**
Estimating the life of the economic[10] and productive[11] project	**-Economic Age: 3 years.** **- productive life: ten years**

[10]**The period of time during which the project works and achieves a high return in specific circumstances, so that its operation is economically viable.**

Table 3: The schedule of the project implementation phases.

Months / The stages of project implementation	1	2	3	4	5	6	7	8	9	10	11	12
Signing the contract with the investor	-											
Agreement on the supply of machinery and equipment		-										
Installation of the Equipment				-	-	-	-	-	-	-	-	
Installing the water treatment system											-	
(RO) System installation											-	
Site preparation		-										
Civil works				-	-	-	-	-				
Administration building				-	-	-	-	-	-	-		
Purchase of trucks									-	-	-	

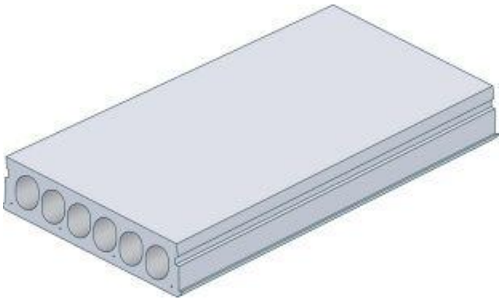

Figure 1:Roof

Figure 2: Wall

Third: Environmental study of the project.

Choice a factory for the production of precast concrete both types of roofs and walls considered one of the most advanced precast concrete production plants in relation to high quality and optimum consumption of raw materials used in production with very little environmental impact. According to the following:

Reccurment major	Secondary elements
Control of raw materials	1.The reinforcing process in the precast linear and thus leads to optimal use of the steel sections, So there is not much waste. 2.The water used in the ripening process is steam from the boiler. Accordingly, the use of water shall be restricted to cleaning activities, which can be recycled through treatment unit. 3.Gravel, sand and cement produce little waste due to the constant control of the amount of materials prepared for production.
Noise Pollution	Noise is limited to the production region, so its negative impact on the environment is very minimal
Air emissions	The volatility of the materials used in the precast (cement and sand) with a negative impact on the environment is controlled by storing the cement in special silos. As for sand, resorted to the work of continuous hydration with water.
Mixture additives	Concrete additions to the concrete mix to improve the quality of the mixture are controlled through a central system.
Casting molds111	Casting molds are made of iron and used more than once.
Mold lubricating oils	A small percentage of oils are used that can be replaced with vegetable or marine fats with a safe environmental impact.

It appears from the above, that the impact of the project on the environment is very little with the possibility of treatment at low costs compared to the work of site casting concrete.

Fourth: The legal study of the project.

The legal framework	The legal paragraph compatible with the investment decision
Investment Law No. (13) of 2006 amended	Chapter III 2- The Iraqi investor may own lands allocated for industrial projects belonging to the state, the public sector, etc. Chapter V Article (15) First: A- The project that obtained an investment license from the authority shall enjoy exemption from taxes and fees for a period of 10 years from the date of commercial operation. Article (17) The project obtaining an investment license shall enjoy the following:

	First: Exemption of imported assets etc. **Fifth: A- Exempting the raw materials imported for the commercial operation of the project from fees, taxes, etc.** **Article 2** **First: Encouraging investments and technology transfer to contribute to development and expand the production and service base.**
Environmental Protection and Improvement Law No. (27) of 2009	**Chapter Four / First Section** **Article (9): The entities whose activities result in environmental pollution shall comply with the following:** **First: Providing pollution treatment systems.** **Second: Providing equipment for measuring and monitoring pollutants. etc.**
Mineral Resources Investment Law No. (91) of 1988	**Chapter Three / Land investment for quarries and mines.** **Article 4, Paragraph 1 The mining materials are considered to belong to the state and the investment fees shall be paid, etc.**
Industrial Investment Law No. (20) of 1998	**Chapter Four / Exemptions and Privileges** **Third: The industrial project that obtained the founding license shall enjoy the following exemptions:** **1- The project profits are exempt from income tax for a period of (5) years.** **Article 9 - First: The relevant state departments allocate what the industrial project needs from the state-owned lands.**

We find from the above that the legal frameworks encourage private investment and provide the necessary exemptions for that, which is reflected in reducing costs.

Fifth: The financial study of the project.

-Investment costs (Investment expenditure):

A. Construction costs:

Table 4: shows the Construction costs. Value: million dinars

No.	Description	Cost of m^2	Total Cost
1	Main building	600.000	5472
2	Storage area	200.000	520
3	Administration buildings, restaurant, and warehouse for spare parts	400.000	120
4	The fence	100.000	222
Total		1300	6334

B. Machines and equipment cost: The total estimated cost of production lines for roofs and walls is (8,204,000,000) $ and the installation cost for production lines is (500) million $.

Table 5: shows the cost of the production line for the hollow roofs with a capacity of 650 m^{3}day.

No	Description	Qty	Price USD	Sum USD
1	Extrusion system	1	364754.854	364754.854
2	Fully automated concrete distributor complete with all accessories	1	91766.724	91766.724
3	Motor driven foil-de-coiler battery driven complete with all accessories	1	38833.85	38833.85
4	Mobile concrete saw universal joint type complete with all accessories	1	242282.412	242282.412
5	Overhead crane complete with all accessories	1	202865.157	202865.157
6	Product transfer system	1	81756.885	81756.885
7	Stressing equipment	1	171811.321	171811.321
8	Steel casting beds complete with all accessories	1	542121.012	542121.012
9	Complete heating plant with all accessories	1	240341.061	240341.061
10	Vacuum bed cleaner complete with all accessories	1	247204.166	247204.166

Table 6: shows the cost of the solid walls production line with a capacity of 1000 m^3/ day.

No	Description	Qty	Price USD	Sum USD
1	Tilting tables with hydraulic devices complete with all accessories	1	1013592.68 8	1013592.68 8
2	Hydraulic aggregate complete with all accessories	1	734498.765	734498.765
3	Electric fixed vibrators complete with all accessories	1	956583.733	956583.733
4	Magnets with basic angles	1000	115	115000
5	Magnets with support system for sides	1000	115	115000
6	Concrete distributor complete with all accessories	1	223621.998	223621.998
7	Bridge crane complete with all accessories	1	137392.796	137392.796
8	Overhead crane complete with all accessories			
8.1	Wall panel production area	1	158662.093	158662.093
8.2	Radio control	1	15416.555	15416.555
8.3	Power rail for fully automated	1	52881.647	52881.647
8.4	Travelling rail	1	51457.976	51457.976
9	Flexible stair mould and landing mould attachment for wide range of different size (lift and right) complete with all accessories	1	205831.904	205831.904

Table 7: shows the costs of the concrete mixing line with a production capacity of (50) m^3 / hour.

No	Description	Qty	Price USD	Sum USD
1	Aggregate dosing device	1	136269	136269
2	Pneumatic system	1	19296.75	19296.75
3	Accessories of silo cement	2	7880	15760
4	Cement screw conveyer	2	1300	2600
5	Cement dosing devices	1	2700	2700
6	Admixture dosing devices	1	6200	6200
7	Mixing devices	1	12500	12500
8	Structure for mixer and bucket line	1	42924.78	42924.78
9	Control panel	1	4500	4500
10	Distribution system for hollow core plant	1	98555.2	98555.2
11	Distribution system for wall panel plant	1	98555.2	98555.2
12	Automation distribution system for flying bucket	2	36449.4	72898.799
13	Control cabin	2	23584.5	47169.811

Table 8: shows the cost of the equipment.

No.	Description	Qty	Price
1	(onan) of internal type 1500 KVI 11 / 0.4 KV with high pressure plate	1	30
2	Prime sound proof diesel generator 1500 kva with automatic 3000 amp adapter	1	350
3	Fuel storage tanks with pumps	1	10
4	5m3 / h industrial water treatment unit with tank	1	50
5	20 m3 / hour RO water filter unit with tank	1	25
6	Laboratory examination equipment	-	50
7	Iron cutting machine	2	2
8	Welding machine 400 amp	2	1
9	Electric cutter avcan type size 1.5 inch	2	2
10	400 liters compressor	1	0.5
11	Welding machine (plasma cutter) 22 mm	1	3.5
12	Crane 10 ton space 18 m	2	250
	Total		774

C. Transportation Means:

Table 9: cost of transportation Means. Value: million dinars

No	Description	Qty	Price	Total cost
1.	Tipper 35 m3	4	150	600
2.	Shfal	1	150	150
3.	Crane	1	150	150
4.	Loader	2	100	200
5.	Fork-lift	2	25	50
Total				1150

Table 10: The capital costs of the project.

No	Description	Cost / million $
1	Machinery	8.204.000.000
2	Equipment	774.000.000
3	Installation	500.000.000
4	Construction work (civil + electricity + services)	6.334.000.000
5	Transportation Means	1.150.000.000
6	Earth	250.000.000
7	Furniture	100.000.000
	Total	17.312.000.000

– Operational costs:

A. Manpower: The number of workers in the project is (66) from various specializations as shown in the table below.

Table 11: The terms of reference and numbers of workers. Value: million dinars

No	Jurisdiction	Qty	Monthly Salary	Annual salary
1	Manager	1	1.5	24
2	Engineers (civil, mechanical, electrical)	3	1.25	45
3	Laboratory	2	1	24
4	Technical supervisor	4	1	48
5	Technical	8	0.8	76.8
6	Workers	30	0.6	216
7	Store employee	1	0.8	9.6
8	Administrative and accountant	6	0.8	57.6
9	Guards	4	0.5	24
10	Driver	7	0.6	50.4
	Total	66	8.85	575.4

B. Primary and auxiliary materials: Operation of the project requires quantities of raw materials (gravel, sand, cement, iron, additives) available locally and in the quantities shown in the table below.

Table 12: Quantities of raw materials. Value: million dinars

Description	Unit	The amount of roofs / year	Price	Cost	The amount of walls / year	Price	Cost	Total cost
Gravel	m^3	38.000	0.010	380	70.000	0.010	600	342
Sand	m^3	30.500	0.010	305	65.000	0.010	600	274.5
Cement	Tons	15.000	0.100	1500	25.000	0.100	2500	1200
Reinforcement steel	Tons	1.200	0.800	960	4.200	0.75	3150	960
Additives	-	-	-	6	-	-	8	6
Total				3151			6858	2782.5

C. Industrial uses: The project needs services (water, electricity, fuel, oils and greases).

Table 13: The annual industrial uses required for production. Value: million dinars

No	Description	Qty	Cost
1	Electricity	1200 kWh	400
2	Fuel	1500 liters / day	202
3	Oils and greases	1500 liters / month	48
4	Water	400 liters / day	12
Total			662

D. Obsolescence:

Table 14: Costs of Obsolescence

No	Description	Annual percentage	Cost / year
1	Machinery	10%	820.400.000
2	Equipment	10%	77.400.000
3	Construction (civil + electricity + services)	3%	1.578.000
4	Transportation Means	10%	115.000.000
5	Furniture	10%	10.000.000
	Total		1024.378

E. Insurance: The amount of insurance for the project is (100) million dinars annually.

Table 15: Shows fixed and variable operating costs at 100% operating capacity.

No.	Description	Cost / million
1	Raw materials	10009
2	Services (water, electricity, fuel)	462
3	Backup tools	250
4	Salaries	575.4
5	Maintenance	250
6	Insurance	100
7	Administrative services	50
8	Marketing	120
9	Costs without Obsolescence	11816.4
10	Obsolescence	1.038.580
Total		23634.418

-Revenue:

Sales revenue has been calculated, Square meters of walls (40) dollars and roofs (30) dollars, As it is considered competitive prices with the traditional construction as shown below.

Table 16: Cash flows.

Year	Wall production m^3	Roof production m^3	Damage Percentage	Revenue/ walls	Revenue/ roofs	Annual Revenue
One 70%	224.000	145.600	5%	10640000000	5187000000	15827000000
Tow 90%	288.000	187.000	5%	13680000000	6669000000	20349000000
Three 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Four 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Five 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Six 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Seven 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Eight 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Nine 100%	320.000	208.000	5%	15200000000	7410000000	22610000000
Ten 100%	320.000	208.000	5%	15200000000	7410000000	22610000000

(3000) million dinars are added to the income in the last year of the project's life as a liquidation of fixed assets.

Sixth: Economic Study. -Operating costs over the life of the project.

Table 17: Outgoing cash flows **Value: billion dinars**

Items	Implementation period	1	2	3	4	5	6	7	8	9	10
	First	70%	90%	100%	100%	100%	100%	100%	100%	100%	100%
Investment cost	17312	-	-	-	-	-	-	-	-	-	-
Production cost (raw materials)	-	7006.3	9008.1	10009	10009	1000	1000	1000	1000	1000	1000
Maintenance and backup costs	-	-	-	500	500	500	500	-	-	500	500
Replacement cost	-	-	-	-	-	-	-	5000	-	-	-
Salaries and wages	-	575.4	575.4	575.4	575.4	575.4	575.4	575.4	575.4	575.4	575.4
Services (electricity + fuel)	-	462	462	462	462	462	462	462	462	462	462
Insurance + marketing + administrative services	-	270	270	270	270	270	270	270	270	270	270
Total outflows	17312	83183.7	0315.5	1816.4	1816.4	1816.4	1816.4	1816.4	1816.4	1816.4	11816.4
Discounted outflows	15738	6870.8	7750.8	8070.8	7337	6670	6063.7	10177	4799	555.7	4141.5

Internal rate of return: (38%), recovery period: two years and four months.

Table 18: Cash inflows & outflows and net profit
Value: billion dinars

Items	Implementation period	Operation period									
	First	1 70%	2 90%	3 100%	4 100%	5 100%	6 100%	7 100%	8 100%	9 100%	10 100%
Investment cost	17312	-	-	-	-	-	-	-	-	-	-
Discounted Cash outflows	15738	6870.8	7750.8	8070.8	7337	6670	6063.7	10177	4799	555.7	4141.5
Discounted Cash inflows	0	13080	15288	15442	14039	12762	11602	10547	9588	8717	8976
Discounted net cash flows	15738	5796	7538	7372	6701	6092	5538	2702	4789	4161	4834

- **Sensitivity Analysis**

✓ **Decreas the sales percentage of by (30%). The results: Internal rate of return (13%), payback period (4) years and (3) months.**

Table 19: Cash inflows & outflows and net profit . Value: billion dinars

Items	Implementation period	Operation period									
	First	1 70%	2 90%	3 100%	4 100%	5 100%	6 100%	7 100%	8 100%	9 100%	10 100%
Investment cost	17312	-	-	-	-	-	-	-	-	-	-
Discounted Cash outflows	17312	6870.8	7750.8	8070.8	7337	6670	6063.7	10177	4799	555.7	4141.5
Discounted Cash inflows	0	13080	118914	10810	9827	8933	8121	73837	6712	6102	659.8
Discounted net cash flows	17312	5796	4140	2739	2490	2263	2058	462	1912	1546	2452

✓ **Lower selling prices due to competition to \$ 35 per m^2 for walls, \$ 25 per m^2 for roofs. The results: Internal rate of return (24%), payback period (3) years and (3) months.**

Table 20: Cash inflows & outflows and net profit. Value: billion dinars

Items	Implementation period	Operation period									
	First	1 70%	2 90%	3 100%	4 100%	5 100%	6 100%	7 100%	8 100%	9 100%	10 100%
Investment cost	17312	-	-	-	-	-	-	-	-	-	-
Discounted Cash outflows	17312	6870.8	7750.8	8070.8	7337	6670	6063.7	10177	4799	555.7	4141.5
Discounted Cash inflows	0	11266	131683	13301	12092	10998	9993	90850	8259	7508	7877
Discounted net cash flows	17312	3982	5418	5230	4755	4323	3930	1240	3460	29526	3737

✓ **High production costs (20%). The results: Internal rate of return (28%), payback period (2) years and (11)months**

Table 21: Cash inflows & outflows and net profit. Value: billion dinars

Items	Implementation period	Operation period									
	First	1 70%	2 90%	3 100%	4 100%	5 100%	6 100%	7 100%	8 100%	9 100%	10 100%
Investment cost	17312	-	-	-	-	-	-	-	-	-	-
Discounted Cash outflows	17312	6870.8	7750.8	8070.8	7337	6670	6063.7	10177	4799	555.7	4141.5
Discounted Cash inflows	0	13080	15288	15442	14039	12762	11602	10547	9588	8717	8976
Discounted net cash flows	17312	4339	5988	5758	5234	47582	4326	1600	3829	3250	4006

Seventh: The effect of a feasibility study on the investment decision:

1.The project energy chosen in the study covers about half of the province's need and it is possible to expand if the demand for the product increases.

2. The legal study showed the compatibility of legal and legislative frameworks that encourage private investment in this sector and provide the necessary exemptions that are reflected in reducing costs.

3. The capital cost of the project is (17,312,000,000) dinars, the productive life of the project is (10) years and the implementation period is one year.

4.The expected internal rate of return for the project (IRR) (38%) higher than the interest rate (4%), which means that the project is entitled to profitability.

5.The payback period is (2) years and 4 months, it is a short-term period for the recovery of capital.

6. Project sensitivity analysis:

- Decreas the sales percentage of by (30%). The results were as follows: the internal rate of return (13%) and the payback period 4 years and 3 months.

- Lower selling prices due to competition to $ 35 per m^2 for walls, $ 25 per m^2 for roofs. The results were as follows: The internal rate of return is 24%, the payback period is 3 years and 3 months.

- High production costs (20%). The results were as follows: Internal rate of return (28%), payback period 2 year and 11 months.

This means that the project can face risks and achieve profitability.

Conclusions:

1.The detailed feasibility study is considered a guide for making the investment decision to accept or reject the project. In addition to the possibility of adopting it as an action plan to implement the project, if accepted.

2.Choicing precast project as the best solution because of the possibility of establishing the project and production in a short period to rebuild the governorate and remedy the damage caused by Military operations.

3. The aim of the study to show the possibility of implementing the project according to (technical, legal, environmental, financial and economic frameworks) by adopting the available information and data to statement of rejecting or accepting the investment project.

Recommendations:

The establishment of a pre-cast project should be promoted through private investment because it fulfills the national policy aimed at raising fixed capital for the private sector, In addition, it is one of the productive projects with a short-term implementation period and there is a need to establish the project to rebuild the infrastructure of the governorate .

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دراسة الجدوى التفصيلية لمشروع الخرسانة المسلحة مسبقة الصب واهميتها في اعادة الاعمار والبناء في العراق

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Received:29/2/2020 Accepted: 20/5/2020 Published: March/ 2021

مستخلص البحث

تعد دراسة الجدوى بالنسبة للمستثمر او صاحب المشروع بمثابة الدليل الذي يضئ طريق نحو الاستثمار الآمن، كونها تهتم بالفرصة الاستثمارية والوصول للقرار النهائي بقبول الفرصة وتحويلها من مجرد فكرة إلى مشروع أو رفضها.

ونتيجة تزايد حاجة العراق لاستكمال الاعمال الانشائية للقطاع الخدمي (الصحة، التعليم والسكن) الى جانب اعادة اعمار المناطق المحررة من الارهاب، استوجب ايجاد بدائل تتسم بانخفاض التكلفة وسرعة الانجاز فضلاً عن ذلك ايجاد الحلول لمشكلة عدم قدرة الحكومة على تمويل المشاريع الاستثمارية ،من خلال اعتماد عدد من الاساليب لتمويل المشروع. لذا تم اقتراح استثمار القطاع الخاص في مشروع الخرسانة المسلحة مسبقة الصب ، لحل هذه المشكلة.

تم اختيار موقع المشروع في محافظة الانبار/ قضاء الفلوجة، لما يمتلكه الموقع من عدة مميزات اهمها توافر المواد الاولية، وجود شبكة من الطرق تربط المحافظة بالمحافظات القريبة. وتبلغ مساحة المشروع الكلية (23,200) م^2، ويتكون من خط لانتاج السقوف بطاقة 650 م^3/ يوم وخط لانتاج الجدران بطاقة 1000 م^3 / يوم. والمدة المتوقعة لانجاز المشروع سنة والعمر الانتاجي للمشروع عشر سنوات. و على اساس الطلب المتوقع تم تقدير النفقات والايرادات وتحليها للوصول الى تقييم جدوى المشروع اقتصادية، حيث معدل العائد الداخلي المتوقع للمشروع (IRR) (38%) وفترة الاسترداد (2) سنة و4 اشهر.

المصطلحات الرئيسة للبحث: دراسة الجدوى التفصلية، مشروع الخرسانة المسلحة مسبقة الصب.