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Research Paper

Studying The Economic, Technical and Financial Feasibility for The Dairy Cow Breeding Project in Nineveh Governorate

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Abstract
The economic feasibility studies of the proposed projects are considered one of the important studies that attract the attention of authorities, planners, researchers, and agricultural economic policymakers because the decision to implement the project depends on the results of the economic feasibility study, which expresses the optimal way to exploit the available economic resources, as well as its role in clarifying the means of maximizing production and minimizing costs. Our research aims to prepare an economic, technical, and financial feasibility study for the establishment and operation of a model farm specialized in raising dairy cows in the city of Mosul, to reduce the gap in milk production and consumption, based on the hypothesis that cow farms have high economic and financial feasibility in the production of raw milk. To prove the hypothesis of the research, a feasibility study was prepared for the project of raising dairy cows in the city of Mosul. Several conclusions were reached, the most important of which was the existence of economic and financial feasibility resulting from the implementation of such projects in the city of Mosul, and the lack of cow farms producing raw milk and the high costs of inputs, we recommend importing animals of selected origins and breeds that give high milk productivity, regulating feed prices and providing them at subsidized prices, and striving to protect the local product from foreign competition.

Key words:
Economic Feasibility, Dairy Cows, Mosul City.

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ورقة بحثية

دراسة الجدوى الاقتصادية والفنية والمالية لمشروع تربية ابقار الحليب في محافظة نينوى

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المستخلص

تعد دراسات الجدوى الاقتصادية للمشاريع المقترحة واحدة من الدراسات المهمة التي تحظى باهتمام الهيئات والمخططين والباحثين وصناع السياسة الاقتصادية الزراعية؛ لأن قرار تنفيذ المشروع يتوقف على نتائج دراسة الجدوى الاقتصادية التي تعبر عن الطريقة المثلى لاستغلال الموارد الاقتصادية المتاحة، فضلاً عن دورها في توضيح وسائل تعظيم الانتاج وتدنية التكاليف. يهدف بحثنا الى إعداد دراسة جدوى اقتصادية وفنية ومالية لانشاء وتشغيل مزرعة أنموذجية متخصصة في تربية أبقار الحليب في مدينة الموصل بقصد تقليص فجوة انتاج واستهلاك الألبان فيها بالاعتماد على فرضية مفادها أن مزارع تربية الأبقار تتمتع بجدوى اقتصادية ومالية عالية في انتاج الحليب الخام, ومن أجل إثبات فرضية البحث تم إعداد دراسة جدوى لمشروع تربية أبقار الحليب في مدينة الموصل. تم التوصل الى عدد من الاستنتاجات كان أهمها وجود جدوى اقتصادية ومالية تنجم عن تنفيذ مثل هذه المشاريع في مدينة الموصل، وقلة أعداد مزارع تربية ابقار انتاج الحليب الخام وارتفاع تكاليف المدخلات، ونوصي باستيراد حيوانات ذوات أصول وسلالات منتخبة تعطي انتاجية عالية من الحليب وتنظيم أسعار الأعلاف وتوفيرها بأسعار مدعومة والسعي لحماية المنتوج المحلي من المنافسة الأجنبية.

الكلمات الرئيسة

تقنيات مالية حديثة، جدوى اقتصادية, ابقار الحليب, مدينة الموصل.

مجلة

تنمية الرافدين

(TANRA): **مجلة علمية، فصلية، دولية، مفتوحة الوصول، محكمة.**

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Introduction

The recent years have witnessed an increasing interest in preparing feasibility studies for economic projects of different types, sizes, stages of growth, and economic and social systems. Those in charge of these studies began to search for more modern methods in selecting the economic criteria according to which the feasibility study of the project to be established is conducted, because the decision that is approved or rejected to choose the project depends largely on the results of the economic feasibility study, as a project may be adopted and a great loss for the community may be achieved, or the opposite may happen. Therefore, the feasibility study and the selection of the proposed project must be very accurate in which the benefits outweigh the costs and the selection of competing projects for the use of limited resources, taking into account other variables, especially social ones, that are related to the decision to implement the project or not. Regarding this matter, our study included a number of previous studies and prepared an economic, technical, environmental, and financial feasibility study proposed for this project.

The importance of research

The importance of the study lies in the significance of economic feasibility studies for proposed projects due to the scarcity of available economic resources, especially capital, as a result of the diversity of fields and activities in which it can be utilized. The dairy cow breeding sector plays an important role in the agricultural development at the level of the city of Mosul, not in terms of its production of raw milk, but in its role in generating added agricultural value and opportunities to employ large numbers of manpower in the aforementioned sector and its supporting sectors such as fodder production, marketing and food processing, such as fodder production, marketing and food processing. As for its waste, it is used as organic fertilizer to increase soil fertility. Some countries have developed means of using these wastes to generate methane gas, which is used in cooking and generating electric power. The importance of this activity has increased dramatically after the increase in population numbers, urbanization, and the increase in income rates and profits from selling the product until this activity became an important source of income for large numbers of rural and even urban families that are interested in this activity.

Research problem

The dairy cow breeding sector plays an important role in the agricultural output, as it is one of the main professions in many rural areas of the city of Mosul, because it provides daily and regular income throughout the year. This source is important, especially after the years of drought that the governorate witnessed, until this activity became a major source of rural income, despite the great opportunities to generate income in the aforementioned sector, the number of cows in the mentioned city is still low, as it reached 0.05% of the total number of cows in Iraq and its production does not meet the minimum limits for the city's individuals of milk according to the recommendations made by the World Food Organization, and this required preparing an economic, technical and financial feasibility study for the establishment and operation of such projects for the possibility of encouraging investors in the aforementioned sector to invest their money in it because it benefits the Iraqi producer

and consumer and the state budget because the values of imported milk are now reaching very high levels.

Research hypothesis

Dairy cow farms are an important source of income generation for many rural families. Therefore, our research relies on the hypothesis that such farms have high economic and financial feasibility in producing raw milk, as they show means of maximizing production and minimizing costs, and the best ways to enhance management skills in this activity.

The aim of research

The activity of producing raw milk is one of the types of activities that contribute to the achievement of agricultural development. Therefore, the research aims to prepare an economic, technical and financial feasibility study for the establishment and operation of a model farm specialized in raising dairy cows in the city of Mosul, with the aim of identifying ways to reduce the gap in milk production and consumption in it.

Research Methodology

In its methodology, our study relied on the descriptive method, which is based on previous theoretical studies that examined this subject, as well as preparing an economic, technical and financial feasibility study for the establishment and operation of a model farm specialized in raising dairy cows in the city of Mosul.

Reference Presentation and Contemporary Studies for The Preparation of Economic Feasibility Studies for Dairy Cow Breeding Projects

Economic feasibility studies are of great importance for various types of projects because they determine the type of decision according to which the project will be accepted or rejected. These studies are of exceptional importance for livestock projects, as they are characterized by a high percentage of fixed capital and the multiplicity and diversity of production requirements in them, as well as the existence of a time difference between raising animals and the beginning of its production, so we have dealt with the most important studies that touched on the issue of the economic feasibility of milk cow breeding projects, according to their historical sequence, so that they can be relied upon in analyzing and discussing the research problem.

Yilmaz *et al*. conducted a study in 2016 on the economic analysis of dairy cow farms in the Turkish state of Hatay. The study showed that the dairy cow breeding sector contributes to agricultural development by generating positive added value and job opportunities. The number of cows in the sector reached 9.2 million heads out of a total of 14.3 million heads in 2014. The study found that the costs of feed represent the largest percentage of total variable costs in these farms. The Turkish government allocated funds to establish farms specialized in cow feed production to reduce variable costs. The study examined 148 farms and found that the farms achieved an annual profit rate of about 90%. The net value added criterion was positive, indicating that these farms covered fixed and variable costs while achieving positive added value. The benefit-to-cost ratio was 1.482 dollars, meaning that each dollar spent on these farms resulted in a return of 0.482 dollars. The rate of return on invested capital was

28%, and the capital recovery period was 3.5 years. The researchers recommended improving means of marketing and exporting raw milk, providing low-interest loans, and implementing protective measures for local products.

In 2017, Akshak *et al*. examined the economic feasibility of establishing and operating dairy cow farms in the Karnataka region of India. Despite challenges such as the lack of modern farming methods and infrastructure, as well as limited market access, these farms were able to produce a significant amount of raw milk. In fact, they were able to meet 50% of India's milk demand. The net present value criterion showed positive results, indicating economic viability for these projects. The benefit-to-cost ratio was $1,201, demonstrating a good return on investment. Karnataka ranked eleventh in the world in milk production, providing income for many rural families. The researchers recommended improving irrigation networks, providing better inputs, facilitating marketing methods, adopting advanced technology, and offering favorable loan terms.

In 2019 Ralte explained in his study entitled, "The Economics of Dairy Farming", states that this sector plays a major role in the Indian economy Ralte highlights the important role of the dairy sector in the Indian economy, particularly in rural areas. Dairy farming provides employment and income opportunities for a large number of agricultural populations. Unlike other agricultural activities, dairy farming is less exposed to risks and uncertainties caused by drought or natural disasters, making it a preferred profession for many farmers.

The state of Mizoram has implemented measures to facilitate milk marketing both within and outside India. This includes removing restrictions that hindered milk exports and providing incentives to exporters. As a result, foreign demand for Indian milk has increased, leading to an upward trend in milk prices.

In addition to milk sales, cow breeders in Mizoram generate additional income from the sale of cow waste, which serves as organic fertilizer for various crops in the state. The economic feasibility of cow-breeding farms in Mizoram was evaluated using several criteria. The annual profit rate was identified as a significant incentive that encouraged farmers to increase their production and exports.

The study also considered the internal rate of return, which amounted to approximately 13.227%. This indicates that these dairy farming projects have an earning capacity of 10.227% annually, surpassing the 3% annual interest rate offered by Indian banks. Ralte recommended the reduction of input costs and the adoption of modern scientific methods in cow breeding to further increase profit rates in milk sales.

In 2021, Hadad explained in his study the cost of dairy production in Erbil Governorate, confirming the significant role of agriculture in the region's economy, selling prices, farm economic feasibility, raw milk quantities, and cow productivity. Thus, Hadad focused on these aspects by conducting a field survey on twenty farms specialized in cow breeding and milk production.

The study collected data on the size of each farm, the number of cows during the productive year of 2021, and the findings revealed that each farm had a daily production of 9500 kg of milk. Using the multiple regression function and the Cobb-

Douglas production function, the ordinary least squares method (OLS) was applied to estimate these results. The average fixed costs per animal were approximately 49,500 dinars, and the average variable costs were around 162,500 dinars.

Among the variable costs, feed costs ranked first, followed by machinery consumption costs. In terms of economic feasibility, the farms under study demonstrated positive results for the standard of annual profits, profit rates, and return on capital. Through sensitivity analysis using the time preference criteria, the benefit/cost ratio (B\C ratio) at a discount rate of 12% was calculated at 1.225 dinars. This implies that every dinar spent on these projects generates an additional income of 0.225 dinars.

The net present value (NPV) for farmers was positive, indicating the economic feasibility and potential for annual profitability throughout the project's lifespan. The internal rate of return (IRR) at discount rates of 12% and 15% reached 13.826%. This signifies that the project has an earning capacity of 10.826%, representing the opportunity cost when the bank interest rate is 3%. The study concludes by recommending support for input prices, particularly fodder and veterinary medicines, as well as the facilitation of milk marketing procedures to neighboring governorates in the region.

In 2021, Haddad explained in his study on the cost of dairy production in Erbil that raising cows contributes a major role to the region's economy. The goal of the research was to collect data on twenty farms specialized in milk production using a field survey method and concluded that the daily production from each farm reaches To 9500 kg, based on the Duclas cup production function.

The aforementioned studies show that they dealt with the issue of the economic feasibility of raising dairy cows within the concepts of theories of the economics of agricultural production. However, what distinguishes our study is that it dealt with this subject according to the concepts of the aforementioned theories, and then its data were applied in one of the huge projects for raising milk cows in the city of Mosul, with the aim of identifying the factors that maximize production and reduce the impact of factors that have negative effects, and this matter is one of the recent studies that followed this approach.

The practical aspect and interpretation of the results

Introduction:

The projects of raising dairy cows at the present time are considered one of the important economic activities in the city of Mosul because they contribute to the production of a certain amount of milk, which is characterized by a great demand by the community. With regard to the project for raising dairy cows to be established, its economic and financial feasibility can be studied through the following paragraphs:

The aim of project:

1- Provision of milk locally at fair prices that match the prices of the same imported product in terms of quality and price, and contribute to filling a large amount of the local market's need for this product.

2- Employing certain numbers of manpower, and this is one of the means of reducing unemployment rates in the city.

The economic justification for setting up the project

1- The project's contribution to increasing the domestic product from a necessary product that is required in all seasons of the year and for most segments of society (fresh milk) because most types of liquid and powdered milk available in the local market are imported from foreign countries or from neighboring countries, therefore, the production of milk locally will contribute to reducing the imported quantities of it, in addition to that increasing the local supply will contribute to reducing the local prices compared to the prices of the same imported product and reducing the burden on the state's budget, which pays exorbitant sums for the quantities imported from the aforementioned product to the exporting countries.
2- The project's contribution to providing job opportunities for large numbers of local labor force with different levels of skill (technicians, management, servicemen), and this has a very important role in reducing unemployment rates in the city.
3- The contribution of the project to the employment of national capital in the field of local production and productive investments instead of the fields of circulation, hoarding and speculation, and this has a very important role in reducing inflation rates because the establishment of such projects works to withdraw cash liquidity from circulation.
4- The presence of such projects with different sizes and production capacities and high technologies contribute to achieving a large amount of economic savings for other sectors through the state of interdependence between the economic sectors that form the structure of the national economy.
5- Establishing such projects with the support of national financial institutions does not cost the national economy large financial burdens because most of the requirements for establishing the project and its services are available locally (such as fodder, manpower, and veterinary services).

Environmental feasibility study for the project:

The main objective of this study is to assess the environmental impact of the proposed investment project, which includes determining the potential impacts (positive or negative) of the project on the environment, the primary purpose of assessing the negative environmental impact of the project is to ensure human safety and health, and at the same time ensure the optimal use of natural resources by identifying the basic negative effects harmful to nature and seeking to overcome and reduce them as much as possible by creating the necessary data sources in order to make the appropriate and sound decision in order to modify the design of the project in a way that is appropriate for the environment and sustainable development of the province. This process gives the decision-maker a means of acknowledging and accepting the approval of the project from the authorities that have the right to grant the appropriate licenses for the establishment of the investment project or not. Despite the negative effects that these projects generate on environmental pollution, their establishment will be outside the municipal boundaries of the governorate, the city

center, and the population center, with the aim of avoiding environmental pollution with liquid, solid, and gaseous wastes.

Market study

By extrapolating the reality of the local market for the city of Mosul and its surrounding areas and the neighboring governorates, it is clear that milk is imported from different origins with varying qualities and is sold at very high prices, in these markets, the local product constitutes only a small percentage, which means that there is a promising market for the products of the project to be established, not at the level of the city of Mosul, which has a population of about 3.5 million people, but it is at the level of the northern governorates. Therefore, encouraging the establishment of such projects is a necessary issue for the benefit of the Iraqi consumer and producer, as well as its support for the national economy, because its market feasibility is very high.

The technical, material and human requirements necessary for the establishment of the project

The data on the requirements for establishing this project indicate that most of the requirements for its establishment are available locally, such as fodder, manpower, and veterinary services that can be obtained from the local market or from state or private sector facilities at good prices and quality, this requires providing a loan from a specialized government bank with a value of up to (**50,366,800,000**) dinars for the purpose of establishing and operating the complete project.

The project's current manpower needs can be clarified in the following table:

Table (1) The current requirements for the dairy cow breeding project to be established in terms of manpower

No.	The type of work required	Number	Monthly wage / dinars	Total annual wages / dinars
1	project manager	1	750,000	9,000,000
2	veterinarian	1	600,000	7,200,000
3	accountant	1	600,000	7,200,000
4	Agronomist	1	650,000	7,800,000
5	driver	4	500,000	24,000,000
6	service workers	20	500,000	120,000,000
7	technical workers	4	550,000	26,400,000
8	guards	2	450,000	10,800,000
Total: two hundred and twelve million four hundred thousand dinars				212,400,000

Source: Prepared by researchers based on the results of personal interviews with the owners of dairy cow breeding projects in Nineveh Governorate for the year 2023.

Buildings and structures needed by the project:

The project to be established needs buildings and constructions, according to the engineering specifications applied in the construction of dairy cows breeding projects.

Table (2): Buildings and constructions needed for the project of raising dairy cows

No.	The type of work required	Number	Dimensions and area m^2	Total value / dinars
	Land leveling and modification	62,500m^2	-	62,500,000
	Building breeding halls with its accessories using thermostone and cement, with a sandwich panel ceiling, dimensions 6×6 m^2, height 3 m, one hall for every 5 cows, with all its accessories, materials, and labor wages.	400	6×6 = 36 m^2	24,000,000,000
	Building a maternity barn with thermostone and cement, with a sandwich panel ceiling, dimensions 10×8 m^2, height 3 m, with all its accessories, materials, and labor wages.	1	10×8 = 80 m^2	6,000,000
	Building a store for fodder and straw with blocks and cement, with molding of the ceiling with reinforced concrete and the floor with cement, dimensions 15×15m^2, height 3 m, materials with labor wages	4	15×15 = 225 m^2	28,000,000
	Building a suite for the administration and the accountant with blocks and cement, with pouring the ceiling with reinforced concrete and paving the floor with mosaic tiles, dimensions 10×15 m^2, height 3 m, with a sanitary facilities (bathroom, facilities and sinks) material with labor wages	1	15×10 = 150 m^2	30,000,000
	Building cooled rooms for milk with thermostone, pouring the ceiling with reinforced concrete, covering the walls and ceiling from the inside with insulating materials, and paving the floor with mosaic tiles, dimensions 7×6 m^2, height 3m, materials with labor wages	4	7 × 6 = 42 m^2	42,000,000
	Excavating and building a water drainage gutter with dimensions of 2.5×4×6 m^3 using blocks and cement materials with labor costs.	2	2.5 × 4 × 6 m^2	6,000,000
	Building a cement and block incinerator with dimensions of 2×4×1 m^3	1	2 × 4 × 1 m^2	3,000,000

No.	The type of work required	Number	Dimensions and area m^2	Total value / dinars
	Drilling an artesian water well with a depth of 200-250 meters, with the pumping crew and all accessories	1	-	15,000,000
	Building a wing for workers and guards using blocks and cement, pouring the ceiling with reinforced concrete and paving the floor with mosaic tiles, dimensions 20×10 m^2, height 3 m, with a sanitary facilities (bathroom, facilities and sinks) materials with labor wages	1	20×10 = 200 m^2	50,000,000
	Building an arena for cows with an area of 800 m^2, with blocks and cement, at a rate of 4 m^2 for each cow, with an open-sided shinko roof. Materials with labor wages	1	800 m^2	60,000,000
	Building a shed for generators with blocks and cement, with a shinko roof, open sides, and its accessories, dimensions 8×5 m^2, height 5 m, materials, and labor wages.	1	8×5m^2 = 40m^2	4,000,000
	Building an information suite with a room for the guard and a sanitary group using blocks and cement, and pouring the ceiling with reinforced concrete, with dimensions of 5×6 m^2, a height of 3m, materials and labor wages.	1	5×6 = 30 m^2	8,000,000
	Building a fence for the project using BRC material with concrete columns for an area of 25 dunums, a height of 3 m. Materials with labor wages	-	-	250,000,000
	Construction of electric lighting poles, one pole for every 50 m around the project. Materials and labor wages	-	200 columns	25,000,000
	Casting the roads inside the project with cement, 1500m long and 6m wide, with cement, materials and labor costs	-	-	75,000,000
	Building a warehouse for waste collection with blocks and cement, dimensions 20×10 m^2, height 3 m, pouring the ceiling with reinforced concrete, and pouring the floor with	200 m^2	150,000	30,000,000

No.	The type of work required	Number	Dimensions and area m^2	Total value / dinars
	cement, with all accessories, materials, and labor wages.			
	Water installations for the project	-	-	5,000,000
	Electrical installations for the project	-	-	7,500,000
	Building a veterinary room with veterinary medical equipment, dimensions 10×5 m^2, height 3 m, with blocks and cement, pouring the ceiling with reinforced concrete, paving the floor with mosaic tiles, and covering the walls with ceramic materials with labor wages	50 m^2	200,000	10,000,000
	Constructing five homes for housing workers and their families, with dimensions of 20×10 m^2, a height of 3 m for each house, materials with labor wages.	5	200,000,000	100,000,000
Total: Twenty-seven billion, nine hundred and sixty-seven million dinars				27,967,000,000

Source: Prepared by researchers based on the results of personal interviews with owners of dairy cows breeding projects and with engineers specialized in establishing dairy cows breeding projects in Nineveh Governorate for the year 2023.

Current costs of the project's operating equipment:

The current costs of project operation equipment can be illustrated in the following table:

Table (3) the current costs of the project's operating equipment

No.	Details	Number	Single price / dinars	Total value / dinars
1.	A 75 KVA generator with bases, cables and all accessories, with transportation and connection costs	2	15,000,000	30,000,000
2.	250L milk cooling tank with transportation costs	200	1,000,000	200,000,000
3.	Mobile milking machines with transportation costs	200	1,000,000	200,000,000
4.	1000 liter metal tanks with transport and connection costs	25	125,000	3,125,000
5.	An electrical transformer with a capacity of 250 KVA, with transportation, connection and installation costs	1	3,000,000	3,000,000

No.	Details	Number	Single price / dinars	Total value / dinars
6.	Electrical poles for a distance of 950 meters, one pole for every 50 meters, with two poles for the transformer, with transportation, connection and installation costs	21	125,000	2,625,000
7.	Electrical wires for a distance of 950 meters with its accessories, transportation, connection and installation costs, materials and labor costs 950m×3 = 2850 m	2850 m	4000	11,400,000
8.	A locally manufactured, mechanical and electrical dual-purpose forage crusher with transport, connection and installation costs	1	4,500,000	4,500,000
9.	Straw crushing machine with transportation, connection and installation costs	1	1,500,000	1,500,000
10.	Electric submersible with transportation, connection and installation costs	1	250,000	250,000
11.	Carrying car (Pickup) 1-ton double cabin	2	25,000,000	50,000,000
12.	Tractor with cart	2	15,000,000	30,000,000
13.	A 4-ton Kia car for transporting cows	2	30,000,000	60,000,000
14.	Ground sprinkler for watering the cultivated land with fodder	2	50,000,000	100,000,000
15.	Pump for distributing and withdrawing drinking water for cows, with all its accessories	2	25,000,000	50,000,000
16.	Tank cars for transporting raw milk with all its accessories	2	35,000,000	70,000,000
17.	Agricultural harvester with all its accessories	1	150,000,000	150,000,000
18.	Agricultural seeder with all its accessories	1	15,000,000	15,000,000
19.	Pesticide spraying machine with all its accessories	1	10,000,000	10,000,000
Total: nine hundred and ninety-one million four hundred thousand dinars				**991,400,000**

Source: Prepared by researchers based on the results of personal interviews with the owners of dairy cow breeding projects in Nineveh Governorate for the year 2023.

Annual operating costs

The annual operating costs can be explained in the following table:

Table (4) annual operating costs for the dairy cow breeding project

No.	Details	The total quantity required is one ton/year/2000 cows	Price per ton / dinar	Total value / dinars
1.	Concentrated feed	3000	250,000	750,000,000
2.	Green feed	7200	180,000	1296000000
3.	Straw	2160	150,000	324,000,000
4.	Medicines, veterinary supplies, treatments, vaccines and serums	2000 cows	400,000	800,000,000
5.	Fuel (gas oil) for the generator and wheels	-	-	25,000,000
6.	Oils, greases and filters	-	-	1,000,000
7.	Imported Friesian (Dutch) cows with transportation costs 2000 cows×9,000,000 dinars	-	-	18000000000
Total: Twenty-one billion, one hundred and ninety-six million dinars				**21196000000**

Source: Prepared by researchers based on the results of personal interviews with the owners of dairy cow breeding projects in Nineveh Governorate for the year 2023.

Fixed costs incurred by the dairy cow breeding project

The total fixed costs can be shown in the following table:

Table (5) Fixed costs for the dairy cow breeding project

No.	Cost type	Total value/dinars
1.	The annual depreciation cost of the project's buildings and structures at 5% of the total cost	1,398,350,000
2.	The annual depreciation cost of project operating equipment at a rate of 10% of the total cost	99,140,000
3.	The cost of bank interest at 3% of the total capital costs	868,752,000
4.	The annual rent of the land	1,875,000
5.	Project establishment costs	10,000,000
Total: two billion, three hundred and seventy-eight million, one hundred and seventeen thousand dinars		**2,378,117,000**

Source: Prepared by researchers based on the instructions of the Ministry of Agriculture, Department of livestock, Department of Animal Production and instructions of the Ministry of Finance, Agricultural Cooperative Bank, Credit Department, Division of Economic Feasibility Studies for the year 2023.

Total annual operating costs

The total annual operating costs can be shown in the following table:

Table (6) annual operating costs for the dairy cow breeding project

No.	Cost type	Total value/dinars
1	Labor costs (Table 1)	212,400,000
2	Annual operating costs (Table 4)	21,196,000,000
Total: Twenty-one billion four hundred and eight million four hundred thousand dinars		**21,408,400,000**

Source: Prepared by the researchers based on the data in Tables (1, 4).

The total funding required

The total required funding can be shown in the following table:

Table (7): Total funding required

No.	Funding type	Total value /dinars
1	Building and construction costs (Table 2)	27,967,000,000
2	Project operating equipment costs (Table 3)	991,400,000
3	Annual operating costs (Table 6)	21,408,400,000
Total: Fifty billion, three hundred and sixty-six million, eight hundred thousand dinars		**50366800000**

Source: Prepared by researchers based on the data in tables (2, 3, 6).

Expected annual revenue

The main objective of establishing the project is the production and sale of milk. Production, sales and revenue can be calculated as follows:

The project includes 2000 dairy cows, in which the mortality rate reaches 2%, so the number of remaining cows becomes as follows:

2000 - 40 = 1960 cows

Revenue from selling milk:

a. The average period of time a cow gives milk is 290 days a year.

b. The rate of milk production per cow per day is 20 kg/milk/day.

Therefore, the amount of milk given by a herd of cows during one year is:

1960 cows × 20 kg/milk/day × 290 days = 11,368,000 kg/milk/year

The average price per kilogram of milk in the local market is 1000 dinars, so the revenue from selling milk is:

11368000 kg/milk/year × 1000 dinars/kg = 11,368,000,000 eleven billion three hundred and sixty eight million dinars annual revenue from selling milk.

Incidental revenue

Organic waste is one of the types of incidental revenues that are produced in such projects, which are used as organic fertilizers. The annual revenue is expected to be as follows:

The average daily excretion of manure per cow is about 8 kg, so the total daily excretion of the herd (1960 cows) is estimated at:

1960 cows × 8 kg/manure = 15680 kg / day

The total amount of manure for one year is:

15680 kg × 360 days = 5644800 kg/manure per year.

The price of a ton of manure is about 45,000 dinars,
Therefore, the annual revenue from the sale of manure is:
5644.8 tons × 45,000 dinars = 254,016,000 two hundred and fifty-four million and sixteen thousand dinars

Project financial analysis

1- The annual operating costs are 3,408,400,000 dinars.
2- Sales revenue:
A- Revenue from the sale of milk 11,368,000,000 dinars.
B- Revenue from the sale of organic waste 254,016,000 dinars.
Total annual revenues 11,368,000,000 + 254,016,000 = 11,622,016,000 eleven billion six hundred and twenty-two million and sixteen thousand dinars

Project evaluation criteria

1- Annual Profit = Total Annual Revenues - Total Annual Costs (Fixed + Variable)
= 11622016000 – 5786517000 = 5,835,499,000
Five billion eight hundred and thirty-five million four hundred and ninety-nine thousand dinars
2- Profit rate = annual profit ÷ sales revenue
= 5835499000 ÷ 11622016000
= 50%
3- Rate of return on capital = annual profit ÷ initial investment value
= 5835499000 ÷ 28958400000
= 20%
4- Project capital recovery period = initial investment value ÷ annual profit
= 28958400000÷ 5835499000
= 4.9 four years and nine months

Table (8) Project Evaluation Criteria

No.	Criterion type	The result
1.	annual profit	5,835,499,000Dinar
2.	profit rate	50%
3.	The rate of return on capital	20%
4.	capital recovery period	4.9 Four years and nine months

Source: Prepared by the researchers based on the results of the project evaluation criteria

Criteria for measuring business profitability under uncertainty

There are several methods that can be used to evaluate projects and compare between them under conditions of uncertainty, which range from accuracy and complexity to theory and application. Among these methods are:

1- Break-even point

The break-even point represents the point beyond which the project begins to achieve returns and profits. It represents the zero point at which the turnover achieves neither profit nor loss, that is, the level of activity at which the total revenues cover the total costs, and then the result is neutral.

In order to calculate the break-even point with cash totals, this requires calculating the fixed costs for one year. My agencies:

The break-even point was calculated for the project, which amounted to (2047977369) dinars, which is the minimum production that the project must produce within a time period of 360 days in order to cover all costs. The break-even point is calculated as follows:

28958400000 ÷ 20 years = 1447920000 billion four hundred and forty-seven million nine hundred and twenty thousand dinars, considering that the expected productive life of the project is 20 years.

The break-even point was calculated using cash totals as follows:

The break-even point with monetary totals is $=\frac{\text{Fixed costs}}{1-\frac{\text{variable costs}}{\text{total revenues}}}$ $=\frac{1447920000}{1-\frac{3408400000}{11622016000}}$

= 2047977369 two billion forty-seven million nine hundred and seventy-seven thousand three hundred and sixty-nine dinars

The break-even point above indicates that the project must achieve the aforementioned amount within one year in order to be able to cover the total costs. Anything more than that is considered a profit for the project, and anything less than that is considered a loss. The numbers above make it clear that the project achieves neither profit nor loss.

When comparing the output at the break-even point with the expected output of the project within 360 days, it turns out that the project achieves a production higher than the break-even point, meaning that this project is one of the profitable projects that encourages the expansion of cow's milk production.

2- Sensitivity analysis

In order to arrive at non-misleading indicators of the feasibility of the project, the study required conducting a financial analysis using time preference criteria and then conducting a sensitivity analysis considering that the project has an economic life of 20 years, which are:

1. Benefit/cost ratio B/C ratio

In order to calculate the benefit-to-cost ratio, this requires the use of Table (9).

1- Total benefit/cost ratio

Table (9) Ratio of present benefits to present costs of the project (dinar)

The present value of the benefits at the discount rate of 12%	The discount factor at the discount rate is 12%.	Total benefits	The present value of costs at the discount rate of 12%	The discount factor at the discount rate is 12%.	Total costs	Operational costs	Invested capital	the year
-	0.892	-	25830892800	0.892	28958400000	-	28958400000	1
9262746752	0.797	11622016000	2716494800	0.797	3408400000	3408400000		2
8263253376	0.711	11622016000	2423372400	0.711	3408400000	3408400000		3
7379980160	0.635	11622016000	2164334000	0.635	3408400000	3408400000		4
6589683072	0.567	11622016000	1932562800	0.567	3408400000	3408400000		5
567740096	0.506	11622016000	1724650400	0.506	3408400000	3408400000		6
5253151232	0.452	11622016000	1540596800	0.452	3408400000	3408400000		7
4683672448	0.403	11622016000	1373585200	0.403	3408400000	3408400000		8
4183925760	0.360	11622016000	1227024000	0.360	3408400000	3408400000		9
3742289152	0.322	11622016000	1097504800	0.322	3408400000	3408400000		10
3335518592	0.287	11622016000	978210800	0.287	3408400000	3408400000		11
2975236096	0.256	11622016000	872550400	0.256	3408400000	3408400000		12
2661441664	0.229	11622016000	780523600	0.229	3408400000	3408400000		13
2370891264	0.204	11622016000	695313600	0.204	3408400000	3408400000		14
2115206912	0.182	11622016000	620328800	0.182	3408400000	3408400000		15
1894388608	0.163	11622016000	555569200	0.163	3408400000	3408400000		16
1685192320	0.145	11622016000	494218000	0.145	3408400000	3408400000		17
1510862080	0.130	11622016000	443092000	0.130	3408400000	3408400000		18

The present value of the benefits at the discount rate of 12%	The discount factor at the discount rate is 12%.	Total benefits	The present value of costs at the discount rate of 12%	The discount factor at the discount rate is 12%.	Total costs	Operational costs	Invested capital	the year
1348153856	0.116	11622016000	395374400	0.116	3408400000	3408400000		19
1197067648	0.103	11622016000	351065200	0.103	3408400000	3408400000		20
71020401088			48217264000					

Source: Prepared by the researcher Based on local market data for the city of Mosul for the year 2022.

The benefit-to-cost ratio at the discount rate is 12% $=\frac{71020401088}{48217264000}$= 1.472Dinar

Shows through the result of analyzing the benefit-to-cost ratio when the discount rate is 12% is that it has reached1.472This means that the dinar that will be spent on the project will achieve an additional income of 0.472Thus, the project achieves financial profitability throughout its economic life

2. Net present value NPV

The net present value of the project at the discount rate of 12% amounted to 22803137088 dinars. As a result of the financial analysis, it was found that the net present value is positive. This means that the project is profitable at the discount rate of 12%. The net present value was obtained mathematically as follows:

NPV = BC

Net present value =71020401088– 48217264000=22803137088Twenty-two billion eight hundred and three million one hundred and thirty-seven thousand and eighty-eight dinars

The above result shows that the net present value of the project is positive, which indicates the feasibility of the project from an economic standpoint and that it achieves an annual profit throughout its productive life.

3. Internal rate of return IRR

In order to calculate the internal rate of return for the project, this requires the use of Table (10) and my agencies:

Table (10) Project internal rate of return (dinar)

Cash flow at 15% discount rate	Cash flow at 12% discount rate	cash flow	Discount factor at 15% discount rate	The discount factor at the discount rate is 12%.	Total benefits	Total costs	Invested capital	the year
-25164849600	-25830892800	-28958400000	0.869	0.892	-	28958400000	28958400000	1
6209493696	6546251952	8213616000	0.756	0.797	11622016000	3408400000		2
5396345712	5839880976	8213616000	0.657	0.711	11622016000	3408400000		3
4689974736	5215646160	8213616000	0.571	0.635	11622016000	3408400000		4
4082167152	4657120272	8213616000	0.497	0.567	11622016000	3408400000		5
3548282112	4156089696	8213616000	0.432	0.506	11622016000	3408400000		6
3080106000	3712554432	8213616000	0.375	0.452	11622016000	3408400000		7
2677638816	3310087248	8213616000	0.326	0.403	11622016000	3408400000		8
2332666944	2956901760	8213616000	0.284	0.360	11622016000	3408400000		9
2028763152	2644784352	8213616000	0.247	0.322	11622016000	3408400000		10
1757713824	2357307792	8213616000	0.214	0.287	11622016000	3408400000		11
1527732576	2102685696	8213616000	0.186	0.256	11622016000	3408400000		12
1330605792	1880918064	8213616000	0.162	0.229	11622016000	3408400000		13
1158119856	1675577664	8213616000	0.141	0.204	11622016000	3408400000		14
1002061152	1494878112	8213616000	0.122	0.182	11622016000	3408400000		15
870643296	1338819408	8213616000	0.106	0.163	11622016000	3408400000		16
755652672	1190974320	8213616000	0.092	0.145	11622016000	3408400000		17
657089280	1067770080	8213616000	0.080	0.130	11622016000	3408400000		18
574953120	952779456	8213616000	0.070	0.116	11622016000	3408400000		19
501030576	846002448	8213616000	0.061	0.103	11622016000	3408400000		20
19016190864	28116137088							

Source: Prepared by the researchers based on local market data for the city of Mosul for the year 2023.

The financial analysis showed that the internal rate of return for the project reached 13.788% at the discount rates of 12% and 15%. This means that the project has an earning capacity of 10.788% according to the bank interest rate (interest cost) of 3%, which represents the opportunity cost of investing capital. In society, the internal rate of return is calculated IRRAs follows:

Internal rate of return at discount rates of 12% and 15%IRR= The lower discount price + [the difference between the two discount prices x $\frac{\text{The present value of the cash flow at the lower discount rate}}{\text{Sum of the absolute values of cash flow at the discount rates of 12\% and 15\%}}$]×100

$12 + [(15\text{-}12)\left(\frac{28116137088}{47132327952}\right)] \times 100 = 13.788\%$

The result of the automatic analysis of the project showed that the project's internal rate of return at the discount rates of 12% and 15% reached 13.788%. This means that the project has an earning capacity of 10.788% when the interest rate (bank interest cost) is 3%, which represents the opportunity cost of investing capital in community, and the project's earning capacity is calculated according to the following equation:

13.788% - 3% = 10.788%, which is the earning capacity of the project at the interest rate of 3% throughout its productive life.

4. Sensitivity analysis:

After conducting the financial or commercial evaluation of the project according to the estimated costs and revenues, a sensitivity analysis of the project was conducted regarding the assumption of some negative changes likely to appear during the project implementation period and their impact was studied to hedge in the future any changes that affect its progress and success, and the financial or commercial evaluation was conducted again for the project and during its life. The economist uses time preference criteria as follows:

1. Assuming that the actual costs exceed the expected or estimated costs by 10%, while the estimated revenues remain constant

The benefit/cost ratio at the discount rate decreased by 12% from 1,472 dinars to 1,339 dinars, i.e. 0.133 dinars, and the net present value decreased from 22803137088 dinars to 17981410688 dinars, i.e. 4821726400 dinars. As for the internal rate of return at the discount rates of 12% and 15%, it decreased from 13.788%. To 13.513%, or 0.275%.

It is clear from the above that the project still enjoys profitable financial viability and that during its economic life it achieves a net capital return of 10.513% according to the interest rate (bank interest cost) of 3%, which represents the opportunity cost.

2. Assuming that actual revenues are 10% lower than the estimated revenues while the estimated costs remain constant

It was found that the benefit/cost ratio decreased at the discount rate of 12% from 1.472 dinars to 1.325 dinars, i.e. by 0.147 dinars, and the net present value decreased at the same discount rate from 22803137088 dinars to 15701096980 dinars, i.e. by 7102040108 dinars. The internal rate of return also decreased at the two discount rates of 12%. And 15% from 13.788% to 13.361%, or 0.427%.

It is clear from the above that the project still enjoys profitable financial viability and during its economic life achieves a net capital return of 10.361% at the bank interest rate of 3%.

Table (11) Total inflows and total outflows for the dairy cow breeding project (dinars)

Statement / Year	Total inflows	Total outflows
2024	-	28958400000
2025	11622016000	3408400000

Statement / Year	Total inflows	Total outflows
2026	11622016000	3408400000
2027	11622016000	3408400000
2028	11622016000	3408400000
2029	11622016000	3408400000
2030	11622016000	3408400000
2031	11622016000	3408400000
2032	11622016000	3408400000
2033	11622016000	3408400000
2034	11622016000	3408400000
2035	11622016000	3408400000
2036	11622016000	3408400000
2037	11622016000	3408400000
2038	11622016000	3408400000
2039	11622016000	3408400000
2040	11622016000	3408400000
2041	11622016000	3408400000
2042	11622016000	3408400000
2043	11622016000	3408400000

Source: Prepared by the researchers based on local market data for the city of Mosul for the year 2023

From the previous results it is clear that there is an economic and financial feasibility in establishing the aforementioned project, in addition to the possibility of recovering the money invested in it and in an acceptable period of time, and achieving an annual profit that exceeds the interest rates granted by local banks, which gives the opportunity to achieve remunerative profits for the producer, and the role of the project in producing an important vital product, which is cow's milk. This reflects its positive impact on the Iraqi economy and reducing the burden on the state's general budget.

Conclusions

1. The lack of numbers of farms specialized in the production of raw milk in the city of Mosul due to the high costs of their establishment. This is accompanied by the

lack of numbers of this type of government farms due to the state's dependence on foreign imports of the product under study.
2. The high costs of inputs in dairy cow farms, as feed costs rank first among the total operating costs, followed by the costs of manpower, transportation and the costs of veterinary services.
3. The multiplicity and diversity of constraints facing milk cow breeders, which are represented by the difficulty of providing feed, the lack of advanced veterinary care means and the manpower specialized in managing this activity, in addition to the restrictions on transportation, distribution and marketing of the product, accompanied by the failure of the state to take the necessary measures to protect the local product to the extent that its price does not cover production costs due to the competition of the corresponding foreign product.
4. The results of the practical study showed that there is an economic and financial feasibility resulting from the implementation of such projects in the city of Mosul, because of its great role in providing a necessary product in the lives of members of society in all seasons of the year and at reasonable prices and reduces the burden on the state budget that imports raw milk from foreign countries and neighboring countries.

Recommendations

1. Taking comprehensive and effective measures in organizing farmers' awareness programs on the method of managing dairy cow breeding projects and preserving their health, as well as providing them with vaccines, veterinary medicines, serums and sterilizers necessary to control diseases that spread in the herds of these livestock.
2. Take the necessary measures to regulate feed prices or provide them at subsidized prices and avoid cases of irregular supply because it constitutes a major challenge for this type of farmers because feed costs contribute to the largest proportion of the total operating costs.
3. Increasing the values of government spending in the agricultural sector by granting loans and facilities on soft terms to farmers of dairy cows with the aim of expanding the scope of investment in such projects as well as providing the rest of the types of inputs, developing rural and marketing infrastructure, and protecting the local product from foreign competition.
4. Conducting large-scale studies and surveys with the towns that are distinguished in raising dairy cows with the intention of importing animals of selected origins and breeds that give high productivity of raw milk as well as their ability to coexist in Iraqi environment.

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