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An Economic Study of a Honeybee Breeding Project

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Abstract

Honey bee projects are characterized by a low capital required to start the project when compared to that needed for other projects. The capital cycle is relatively fast, as it reaches honey every 4 months, and produces and multiplies the by-products of **honey bee breeding project**, such as wax, royal jelly, trade in parcels, bee venom, bee glue (propolis), queens, medicines from bee products, pollination of fruit trees, increasing agricultural production, and other by-products. Accordingly, during the current study, the focus was on the feasibility study for the honey beekeeping project, where the focus was on a case study for the financial evaluation of syphilis cell apiary projects in Qalyubia Governorate as one of the projects that facilitate the joining of young graduates, and also as one of the small and micro agricultural investment projects that absorbed not a small amount of young graduates and absorbed a significant amount of unemployment currently existing in Qalyubia Governorate in Egypt, during the agricultural season 2021.-2-22. The problem of the study is that despite the multiplicity of benefits of honey breeding projects, these projects did not receive sufficient attention and awareness of guidance and economic from investors and decision makers. The research aims to seek to raise the economic efficiency of some existing agricultural investment projects in Qalyubia Governorate in Egypt, through financial and economic evaluation, as well as analysis of the sensitivity of honey production projects in light of some assumptions that aim to achieve the maximum possible economic efficiency, in order to give a clear picture to investors about the actual status of the project under study, a honey production project, in order to decide on judging the success of investment in the project so that the investor can invest his money as efficiently as possible. The published and unpublished data were obtained from the official authorities from several sources, the most important of which is the Small Projects Development Authority in Qalyubia Governorate. Many different sources have also been relied on to cover the elements of the research through studies, reports, bulletins and other sources related to the subject of the research. As well as the preliminary data through the number of 25 questionnaire forms as a sample, where a deliberate sample was selected to study the feasibility of **honey bee breeding project**, a case study of Qalyubia Governorate, as an example of small agricultural projects, and the choice was made for the spread of honey breeding apiaries in it as a place for study, which is that intentional sample that was relied upon with the owners of projects to raise honey bees, in addition to the Internet and specialized references to the subject of the study. The most important results were that this project achieves at the discount rate of 15% a positive net present value estimated at 140541.0868 pounds / year, as well as the ratio of discounted cash flows to discounted costs > 1 and the discounted profitability index for this project was estimated at about 1.44%, which is a value greater than the correct one. It means that each invested pound has generated a net return of 44 piasters, which exceeds the opportunity cost of this project, which is the interest rate on borrowing estimated at about 16%, which indicates that the project has the capabilities and ability to recover fixed capital, production costs (variable) and operating costs (depreciation, maintenance) that were spent on it. Therefore, the study recommends that these types of projects continue to be funded according to this criterion.

Keywords: Honey bee; Economic; Breeding; Project; Egypt.

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1. Introduction

Honey bee projects are characterized by the low capital required to start compared with that required for other similar projects. Also its capital cycle is relatively fast, as honey production is obtained every 4 months. There are many secondary-products of **honey bee breeding project** ,such as wax, royal jelly, trade in parcels, Bee venom, bee glue (propolis), malic acids, medicines from bee products, pollination of fruit trees, increasing agricultural production, and others. So, the research focused on the feasibility study of the **honey bee breeding project**. Where it focus on the financial evaluation of apiary projects with Frankincense hives in Qalyubia Governorate in Egypt, as one of the projects in which it is easy for young graduates to join. Also as one of the small and micro agricultural

investment projects that absorbed a significant amount of both the young graduates and the unemployment which existing currently in Qalyubia Governorate during (2021/2022).

1.1. Research Problem

Despite the many benefits of **honey bee breeding project**, these projects have not received sufficient attention, guidance, and economic awareness from investors and decision makers. So, the study asks the following question: Are honey bee projects economically feasible or not from the point of view of the owner (the investor)?

The problem of the study is that the seek to increase the economic efficiency of some existing agricultural investment projects in Qalyubia Governorate, through the financial and economic evaluation of these projects under some assumptions which aimed to achieving the maximum possible economic efficiency to give investors a clear picture of the actual situation of the project under study, which enable the investor to invest his money as efficiently as possible.

1.2. Research Objectives

This study aims to evaluate the financial performance of **honey bee breeding project**,this study focus on discounted standards only, which take the time element into account, calculate the inflation rate, or take the time value of the money unit, by studying the following objectives:

- Evaluating the investment costs, production costs, maintenance and operation costs of the project.
- Evaluating revenues and the value of capital assets at the end of the project's lifespan.
- Calculating the financial evaluation indicators of the project in order to make a decision regarding the extent of the success of investment in the project, as well as analyzing the sensitivity of the project.

3. Methodolgy

To achieving the objectives and obtain the results, The research relied on the descriptive and quantitative economic analysis, which used in evaluating the commercial and financial profitability of **honey bee breeding project**.

The standards used in financial evaluation can be classified according to the inclusion of the time element into discounted and non-discounted standards.

Non-discounted criteria: which do not take the time element or the inflation rate in the caculation, the most important of them are:

• Pay back period criteria (PBP).
• Accounting Rate of Return on Investment (ARR).

Discounted criteria: which take the time element, the inflation rate in the caculation, or take the time value of the money unit. The most important of these criteria are:

• Benefit/Cost Ratio criteria (B/C).
• Profitability Index criteria (P.I)
• Net Present Value criteria (N.P.V)
• Internal Rate of Return criteria (IRR).

4. Sources of Data

The study relied on published and unpublished data from official authorities from several sources, the most important of which is the Small Enterprise Development Agency in Qalyubia Governorate. Many different sources were also relied upon to cover the research elements through studies related to the research topic, As well as primary data through 25 questionnaires with owners of honey bee breeding project, in addition to the Internet and references specialized in the subject of the study.

5. The Study Sample

A deliberate sample was chosen as an example of small agricultural projects to study the feasibility of honey bee farming projects in Qalyubia Governorate, which was chosen because of the spread of honey bee breeding project

6. Definition of Small Projects in Egypt

Small projects in Egypt were suffered from the lack of a clear and specific definition for them, due to the different perceptions of them among the planning, implementation, statistics and financing agencies. With the issuance of Law No. 141 of 2004, called the Small Enterprise Development Law, every company or individual establishment that practices a productive, service, or commercial economic activity whose paid-up capital is not less than fifty thousand pounds and does not exceed one million pounds, and the number of workers in it does not exceed fifty workers. As for micro-enterprises, the law defines them as every company or individual establishment that practices a productive, service, or commercial economic activity and whose paid-up capital is less than fifty thousand pounds. It is noted from the previous definition that the Egyptian legislator used the standard of labor and capital in defining small projects, and this definition applies to the honey production project [1].

Technical and technological feasibility study for the honey bee breeding project.

The technical and technological methods that the project may need or use are identified in this part, and the extent to which these means and methods are consistent with the technical and technological needs of the project and are compatible with the project's circumstances. It also includes studying the availability of technical knowledge of these methods, its cost, the possibility of developing them, and their relationship to the nature of the product (honey). So, we must not overlook the necessity of choosing methods that are compatible with local conditions, most feasible for application and development, and least use of complex technology.

7. Feasibility

7.1. Commercial and Financial Profitability Criteria for Honey Bee Breeding Project

The financial feasibility criteria of projects, can be use in judging on the extent of acceptance or rejection "success or failure" of a particular project through a set of financial criteria, which are called investment criteria, that can be classified according to whether or not the time element is taken in the calculating it into two types:

- Simple non-discounted criteria and measures : that do not take the time factor in calculation [2].
- Simple discounted criteria , that take the time factor in the calculation and therefore they use the time value of money, and this value varies whenever the interest rate or time period differs.

First: Simple non-discounted criteria **and measures**

- **Rate of return investment** criteria
- **The simple** criteria **for calculating the payback period**

Second: Simple discounted criteriaand measures [2]

- Net Present Value criteria (N.P.V).
- Benefit cost ratiocriteria (B/C).
- Capital recovery period criteria as a discounted criteria.

7.2. Commercial Profitability Evaluation Criteria under Conditions of Risk and Uncertainty for a Honey Bee Breeding Project

Sometimes the investment decision maker does not have sufficient information about the proposed alternatives, which makes the process of investing in these alternatives characterized by uncertainty and risky investment in them. **Risk** means unexpected fluctuations in investment returns, and the degree of risk increases as the degree of volatility increases, and it is considered a relative measure of the extent of the volatility of the expected net investment return. As for **uncertainty** means that the natural situations which may occur in the future and it is impossible to predict the potential returns of them about investment, and it also mean the lack of any sufficient historical information or data for the decision maker to make the investment decision [3]

7.3. Economic Evaluation of a Honey Bee Breeding Project

The first thing that man knew of the benefits of bees was honey, but also There are many other bee products that are no less important than honey production as a source of income for beekeepers, such as the production of bee parcels, queens, royal jelly and bee venom.The importance of the last two products in addition to honey for its medicinal and medicinal uses. Despite the above, there is another part that has importance and impact on agricultural field, which is the important role played by the honey bee in pollinating the flowers of agricultural crops, and the impact of this on the qualitative and quantitative increase in the yield of feddan, which has a positive impact on farmers and national income. As the honey bee is considered one of the most important pollinating insects, where about 80% of field and horticultural crops depend on it for pollination, and about fifty crops either depend entirely on bees for pollination or that increases their production. Generally, it can be said that **honey bee breeding project** can significantly contribute in increasing agricultural production and thus national income. It also helps in creating good job opportunities, starting from manufacturing wooden hives and ending with marketing the project's various products [4].

7.4. Annual Production Capacity of the Project

The project's production capacity is primarily based on establishing an apiary of one hundred hives, which can produce:

- Annual honey production with good specifications about (1750 kg - 2000 kg)
- Annual production of bee parcels is about (150-250 bee parcels)
- Annual beeswax production ranges between (300-320 kg)
- Annual royal jelly production ranges between (750-950 grams).

7.5. The Production Capacity of the Project (Annually)

The production capacity of the project is based primarily on establishing an apiary with a capacity of one hundred hives and can be limited to:

- The annual production of honey with good specifications ranges between (1750 kg - 2000 kg)
- The production of bee packages ranges annually between (150-250 bee packages)
- The annual production of beeswax ranges between (300-320 kg)

- The annual production of royal jelly ranges between (750-950-grams).

7.6. The Results

The project's main and secondary products and their specifications:

First: Honey production:

It is considered one of the main objectives of the project

Second: Producing bee parcels [5]

It is considered one of the important objectives as it results in either an increase in the number of colonies in the apiary or an increase in the project's income by selling them and producing bee parcels. Important requirements, including good experience, especially in the field of queen rearing and dividing good colonies. It was possible to start producing parcels during January and February, especially in the first period, as sources of nectar and pollen are available that help in this. It is also possible to produce parcels during the flowering period of citrus gardens, as this period is characterized by the abundance of parcels that can be hunted, housed, and cared for. Parcels can also be produced during the last period of cotton abundance. Through the project, it is possible to produce 150-250 packages annually.

Third: Production of queen jelly and royal jelly:

This type of production can serve the field of parcel production and requires high experience and skill.

Fourth: Production of beeswax

Producing beeswax and marketing its commercial importance in treatment, industry and other fields with an average annual quantity of about 300 -320 kg of bee wax annually.

Fifth: Creating new job opportunities:

Annual revenue (sales):

The project consists of one hundred bee colonies and applies the stable beekeeping system to them in a fixed and permanent location.

Table-1. Investment costs of honey bee breeding project) Value per pound

Value	Statement
39334	Capital costs
19300	Operating costs for one session (duration of the course is four months)
58634	Total investment costs of the project

Source: Collected and calculated from the data of the study sample.

- Calculating investment costs on the basis of:
- Capital invested in the project = initial investment + operational costs for one cycle (the duration of the cycle is four months) =
- Total investment costs for the project = fixed costs + variable costs
- Total investment costs for the project = 39334 + 19300 = 58634 pounds

Table-2. Shows capital costs, operating costs and total annual investment costs. Value per pound

Total Investment	Operating Costs	Capital Costs	Statement
58634	**19300**	**39334**	Total investment costs for the course
57900	**19300**	**3**	Number of courses per year
97234	**57900**	**39334**	Total annual costs

Source: Collected and calculated from the data of the study sample

Table-3. Shows the fixed capital of the honey bee breeding (Value per pound)

Serial	item	number	price	value per pound
1	Wood cells two boxes	100	150	15000
2	Bee parcels	100	100	10000
3	filtering device honey	1	2545	2545
4	Surface cooker	1	350	350
5	Gas tube	1	445	445
6	Buildings (room)	1	1333	1333
7	Scraping table	1	325	325
8	Travel Boxes	50	40	2000
9	Vaccination needles	5	35	175
10	Pen work cups	1	25	25
11	Queens Barriers	5	50	250
12	Mounting plate	5	50	250
13	Chimney	2	75	150
14	Protective mask	5	125	625
15	Leather shoes	2	75	150

16	glove	2	25	50
17	Ovarol	2	120	240
18	balance	1	220	220
19	knife skimming	2	60	120
20	Bee brush	2	15	30
21	Nutrition	100	6	600
22	Big Suit	3	100	300
23	Plastic Mobile	3	17	51
24	Refrigerator	1	2500	2500
25	Osmosis honey	5	300	1500
26	Carpentry kit	1	100	100
Total			9186	39334

Source: Collected and calculated from the data of the study sample

Table-4. Shows the operating costs and variable capital for one cycle of four months and three cycles per year. (Value per pound)

Serial	Item	Number	Price	one course Four Months	Number of three courses	Annual total
1	Feed sugar/kg	1000	7	7000	3	21000
2	Half ball cages	100	2.5	250	3	750
3	cages	100	2.5	250	3	750
4	Land rent/ct	2	350	700	3	2100
5	Royal jelly packages	500	1.25	625	3	1875
6	1 kg jars	1500	2	3000	3	9000
7	Base wax	50	25	1250	3	3750
8	Varroa resistance	20	20	400	3	1200
9	Bags	100	2.5	250	3	750
10	Paradex / kg	5	30	150	3	450
11	Wax / kg	5	30	150	3	450
12	Land preparation costs	1	475	475	3	1425
13	Labor wages	4	1200	4800	3	14400
14	Total		2147.75	19300	3	57900

Source: Collected and calculated from the data of the study sample

Table-5. Annual operating costs Production input costs for the year Labor costs for the year(Value per pound)

1	Production input costs for the year	**43500**
2	Labor costs for the year	**14400**
3	Annual operating costs for three cycles	**57900**

Source: Collected and calculated from the data of the study sample

Table-6. Cost of operating one cell per cycle Operating one cell per year Costs per cycle 100 cells Operating costs per year(Value per pound)

Serial	The cost of operating one cell per cycle	The cost of operating one cell per year	Costs per cycle 100 cells	Average operating costs for the year
1	193	579	19300	57900
2	193	579	19300	57900
3	193	579	19300	57900
4	193	579	19300	57900
5	193	579	19300	57900

Source: Collected and calculated from the data of the study sample

Table-7. Shows the principal of the loan, the interest, the total debt, and the annual installment for the honey bee breeding project (Value per pound)

Years	The loan	Interest 10%	Total debt	Annual installment
1	58634	5863.4	64497.4	11726.8
2	46907.2	4690.72	51597.92	11726.8
3	35180.4	3518.04	38698.44	11726.8
4	23453.6	2345.36	25798.96	11726.8
5	11726.8	1172.68	12899.48	11726.8
Total	———	———	————	58634

Source: Collected and calculated from the data of the study sample

Table-8. Shows the value of the asset. Depreciation rate, depreciation value, annual depreciation premium, residual value. (Value per pound)

Statement	Asset value	Depreciation rate	Consumption value	Annual depreciation installment	Residual value
Capital costs	**39334**	**10%**	**35400.6**	**7080.12**	**3933.4**
Total				**7080.12**	**3933.4**

Source: Collected and calculated from the data of the study sample

Depreciation = Purchase price of the assets - annual depreciation rate (10% of the asset value) / the number of years in which the asset is expected to be used (5) years [6]
Depreciation =(39334-3933.4)/5=7080.12 pounds

Table-9. Shows the depreciation items for one cycle and the annual depreciation for the honey bee breeding project(Value per pound).

items	Depreciation One cycle	Annual depreciation
1	2360.04	7080.12
2	2360.04	7080.12
3	2360.04	7080.12
4	2360.04	7080.12
5	2360.04	7080.12

Source: Collected and calculated from the data of the study sample

Table-10. Shows the operating costs for both production input costs and labor costs per cell, per cycle, and per year

items	Value per pound	Costs of production supplies and labor costs for one cell Value pounds	Value per pound	Costs of production supplies and labor costs for one cycle	Value per pound	Costs of production supplies and labor costs for the year
1	14500	Costs of production supplies for one cell	145	Costs of production supplies for one cycle	43500	Costs of production supplies for the year
2	4800	Costs of labor costs for one cell	48	Costs of labor costs for one cycle	14400	Costs of labor costs for the year
3	19300	Total operational costs for the one cell per cycle	193	Total operational costs for the apiary per cycle	57900	Total operational costs for the apiary in three cycles per year

Source: Collected and calculated from the data of the study sample.

Table-11. Shows the cell productivity per cycle, the number of cells in the apiary, the average apiary production, the number of production cycles per year, and the average annual production (Value per pound)

Production for year 5	Production for year 4	Production for year 3	Production for year 2	Production for year 1	Product selling price in pounds	Product
2000	1900	1850	1800	1750	40	**Bee honey/kg**
250	225	200	175	150	100	Bee packages/package
950	900	850	800	750	20	Royal jelly/kg
320	315	310	305	300	30	Beeswax/kg
133600	125950	120300	114650	109000	_____	Total revenue

Source: Collected and calculated from the data of the study sample

Table-12. Shows the cell productivity per cycle, Number of cells in the apiary, Average production of the apiary, Number of production cycles per year. Average production
(Value per pound)

Average apiary productivity per year	Average apiary production in one cycle	Number of cells in the apiary	Cell productivity in three cycles	Number of production cycles per year	Cycle productivity per cell	Selling price in pounds	Product
1860.00	620	100	18.60	3	6.20	40	Honey/Kg
200.00	67	100	2.00	3	0.67	100	Bee Parcels/Package
850.00	283	100	8.50	3	2.83	20	Royal Jelly/Gm
310.00	103	100	3.10	3	1.03	30	Beeswax/Kg

Source: Collected and calculated from the data of the study sample

Table-13. Shows the selling price in pounds, the unit hive revenue for the cycle, the hive revenue per year, the apiary's revenue per cycle, and the average apiary revenue per year(Value per pound)

Average apiary revenue per year	Average apiary's revenue per cycle	Cell revenue per year	Revenue per cell in cycle	.Product
74400	24800.0	744.00	248.00	Honey/kg
20000	6666.7	200.00	66.67	Bee parcels/parcels
17000	5666.7	170.00	56.67	Royal Jelly/g
9300	3100.0	93.00	31.00	beeswax/kg
120700	40233.3	1207	402.33	Total Revenues

Source: Collected and calculated from the data of the study sample

Table-14. shows the income statement, revenues, operating costs, depreciation, gross profit, interest, and net profit per year for the honey bee breeding project (Value per pound)

Net profit	Interest	gross profit	Total	depreciation	operating costs	Revenues	years
38156.48	5863.4	44019.88	64980.12	7080.12	57900	109000	1
44979.16	4690.72	49669.88	64980.12	7080.12	57900	114650	2
51801.84	3518.04	55319.88	64980.12	7080.12	57900	120300	3
58624.52	2345.36	60969.88	64980.12	7080.12	57900	125950	4
67447.2	1172.68	68619.88	64980.12	7080.12	57900	133600	5
261009.2	29317	278599.4	324900.6	35400.6	289500	603500	Total

Source: Collected and calculated from the previous tables (from Table 2 to Table 13)

Table-15. Shows the annual cash inflows and outflows of the honey bee breeding project (Value per pound).

Net inflows		Total outflows	Outflows				Total inflows	Inflows				
Net	Outflows	Depreciation	Interest 10%	Debt service	Operating costs	Investment costs	Total inflows	Residual value (scrap)	capital recovery	Loan	revenues	Years
26429.68	141204.32	7080.12	5863.4	11726.8	57900	58634	167634	-	-	58634	109000	1
33252.36	81397.64	7080.12	4690.72	11726.8	57900	-	114650	-	-	-	114650	2
40075.04	80224.96	7080.12	3518.04	11726.8	57900	-	120300	-	-	-	120300	3
46897.72	79052.28	7080.12	2345.36	11726.8	57900	-	125950	-	-	-	125950	4
78953.8	77879.6	7080.12	1172.68	11726.8	57900	-	156833.4	3933.4	19300		133600	5
225608.6	459758.8	35400.6	29317	58634	289500	58634	685367.4	3933.4	19300	58634	603500	**Total**

Source: Collected and calculated from the previous tables (from Table 2 to Table 13)

Table 14: shows the items of total inflows, which include (revenues, loan, capital recovery, residual value (scrap), and the items of total outflows, which include (investment costs, operating costs, debt service, interest, depreciation) and annual net flows.

How to choose the appropriate discount rate for honey bee **breeding project**

The goal of the discount rate is to remove the effect of time on the cash flows of the project, from the beginning of its implementation to its completion, in case of increased reliance on the interest rate determined by the Central Bank on loans. However, if the project costs are covered by the Project Development Agency For small businesses or project owners, the discount rate is estimated as follows [7]:

Owned capital: variable costs for three seasons on average = 57,900 x 3 = 173,700 pounds .

Discount Price = (Owned capital ×minimum required rate of return for the entrepreneur+ borrowed capital× interest on loan) / Total Capital

Discount rate = (61833×14%) + (40000× 16%) × 100 / 101833= 0.148 = Approx. 15%

The appropriate discount rate for this project is =15% compared to the opportunity cost available to invest in the community (investing in banks).

The discount rate is determined in light of the cost of available funds or the weighted average cost, i.e. the discount rate is equal to the minimum weighted cost of financing rate. This rate represents the minimum demand of the owners for a return on their funds invested in the project [8].

Table-16. Shows the present value of the outflows, inflows and net of the honey beekeeping project at a discount rate of 10%

Present value of net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at 10% discount rate	Net Benefits or Net Cash Flow (EGP)	Total Outflows (EGP)	Total inflows (EGP)	Years
24024.57912	128354.727	152379.31	0.909	26429.68	141204.32	167634	1
27466.44936	67234.4506	94700.9	0.826	33252.36	81397.64	114650	2
30096.35504	60248.945	90345.3	0.751	40075.04	80224.96	120300	3
32031.14276	53992.7072	86023.85	0.683	46897.72	79052.28	125950	4
49030.3098	48363.2316	97393.541	0.621	78953.8	77879.6	156833.4	5
162648.8361	358194.0613	520842.8974		225608.6	459758.8	685367.4	**Total**

Source: Collected and calculated from data in tables 14 and 15.

Discounted commercial profitability criteria for a honey bee breeding project.

By studying the results of Table 17: It is clear that according to the following discounted commercial profitability criteria:

The criterion of the ratio of discounted revenues to discounted costs “the ratio of benefits to costs at a discount rate of 15%

Benefit /Cost Ratio (B/C).

Benefit / Cost Ratio (B/C) =461496.3458/320955.259=1.438≅1.44%Pound

It represents the ratio between the present value of revenues or benefits and the present value of total costs according to the following equation:

Ratio of revenues to costs = present value of revenues / present value of costs

By calculating this ratio, we find the answer is one of three answers, and the acceptance or rejection of the project is judged by it.

The first: The ratio of revenues to costs is greater than one.

∴The project is accepted and we recommend its implementation.

The second: The ratio of revenues to costs is less than one.

∴ The project is rejected and we do not recommend its implementation.

Third: The ratio of revenues to costs = 1

∴ The extent of acceptance or rejection of the project depends on the project owner. Whether he accepts it or rejects it, this is his decision because it will not achieve any economic returns, but sometimes it is accepted to implement such cases in cases when they have social returns.

And according to the criterion The ratio of current benefits to current costs at a discount rate of 15%, as it equals 1.44, which is a value greater than one. It means that every pound invested has generated a net return of 44 piasters. Therefore, we recommend continuing to finance these types of projects in accordance with this standard.

Net Present Value: Net Present Value (NPV)

Net Present Value = Present Value of Net Cash Inflows - PresentValue of Net Cash Outflows [9]

Net Present Value = 461,496.3458 – 320,955.259 = 140,541.0868 pounds.

This is according to the net present value criterion, as it was found to be equivalent to 140,541.0868 pounds, which is a positive value (at a discount rate of 15%). The project is also economically feasible.

Internal Rate of Return (IRR) standard:

The internal rate of return for a honey bee breeding project:

It is the rate at which the present value of cash inflows equals the present value of the initial investment. It is estimated according to the following relationship:

Internal rate of return = minimum discount rate + (largest discount factor - smallest discount factor) x net present value of the smallest discount rate x 100 /

sum of the net present value of the largest and smallest discount coefficient.

That is: calculating the method of the rate of income return

Trial and Error)Internal Rate of Return) –IRR

IRR=R1+(R2-R1)NPV1/(NPV1-NPV2)

R1=Smaller discount rate that makes NPV positive

R2 = the largest discount rate that makes NPV negative

NPV1=Net present value at the minimum discount rate

NPV2 = Net present value at the greatest discount rate

IRR = Income Rate of Return [10]

Internal rate of return = minimum discount rate (15) + difference between the two discount rates (5)

=15 +(20 -15) × 140541.0868/ 140541.0868 +122521.6092= 702705.4 / 263062.68 = 17.67%

Loan interest rate at the bank is 16%

Required rate of return for the entrepreneur = 14% , Selected discount rate = 15%

Therefore, the rate of income return is calculated with a value greater than the previous values, which is the value of 20%, and the difference between the larger discount rate and the smaller discount rate must not be less than 5%. This means that the project remains feasible as long as the opportunity cost of investment upfront is less than 17.7%.

Results of the economic evaluation of the honey bee breeding project:

This project achieves at the discount rate of 15% Table 17: Net positive present value estimated at 140541.0868 pounds / year, as well as the ratio of discounted cash flows to discounted costs > 1 The discounted profitability index for this project was estimated at about 1.44%, which is a value greater than the correct one, which means that each pound invested has generated a net return of 44 piasters, which exceeds the opportunity cost of this project, which is the interest rate on borrowing estimated at about 16%, which indicates In addition to achieving a return of 28% on the use of funds invested by the investor (self-financing), and it is required to achieve an economic return of 14%, as a minimum, or borrowed by the Social Fund for Development or (currently the Small Projects Development Authority) at an interest rate of 10%, or in the case of borrowing from the bank, where the interest rate was estimated at 16% for that. This project was able to cover the loan and its cost (interest), it is left with an additional profit for the investor of 28%, which is the difference between the best alternative opportunity of 16%, which is (the bank) and the investment in the project, 44%. Therefore, in light of the current results, the financing of this project can be considered a successful effort by the Social Fund for Development or (currently the Small Enterprise Development Agency). Therefore, we recommend continuing to fund these types of projects in accordance with this Criteria.

Table-17. Shows the present value of the outflow, inflow and net flows of the honey bee breeding project at a discount rate of 15%

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 15% discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
22967.39192	122706.554	145673.95	0.869	26429.68	141204.32	167634	1
25138.78416	61536.6158	86675.4	0.756	33252.36	81397.64	114650	2
26369.37632	52788.0237	79157.4	0.658	40075.04	80224.96	120300	3
26825.49584	45217.9042	72043.4	0.572	46897.72	79052.28	125950	4
39240.0386	38706.1612	77946.2	0.497	78953.8	77879.6	156833.4	5
140541.0868	320955.259	461496.3458		225608.6	459758.8	685367.4	Total

Source: Collected and calculated from data in tables 14 and 15.

Table-18. Shows the present value of the outflows, inflows and net of the honey bee breeding project at a discount rate of 20%

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 20% discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
22015.92344	117623.199	139639.12	0.833	26429.68	141204.32	167634	1
23077.13784	56489.9622	79567.1	0.694	33252.36	81397.64	114650	2
23163.37312	46370.0269	69533.4	0.578	40075.04	80224.96	120300	3
22604.70104	38103.199	60707.9	0.482	46897.72	79052.28	125950	4
31660.4738	31229.7196	62890.193	0.401	78953.8	77879.6	156833.4	5
122521.6092	289816.1062	412337.7154		225608.6	459758.8	685367.4	Total

Source: Collected and calculated from data in tables 14 and 15.

8. Sensitivity Analysis of the Honey Bee Breeding Project by Increasing Outflows at a Rate of 5% Annually

In this part of the study, we address the financial evaluation of the honey bee breeding project under conditions of risk and uncertainty:

It is known that the honey bee breeding project, like other agricultural projects, is exposed to a lot of risk and uncertainty. This is done by conducting a sensitivity analysis for the project at the discount rates of 10% and 15% in the event that outflows increase at a rate of 5% annually while inflows remain constant, and also in the case of a decrease in inflows at a rate of 2% while outflows remain constant at the discount rates of 10% and 15**%** [11]. Table 19, 20 shows the project's profitability under the conditions of conducting a sensitivity analysis by increasing outflows at a rate of 5% annually while keeping inflows constant at discount rates of 10% and 15%.

Table-19. Shows the present value of the outflow, inflow and net flows of the honey bee breeding project at a discount price of 10% after increasing costs by 5%

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 10% discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
17606.84	134772.5	152379.3	0.909	19369.46	148264.54	167634	1
24104.73	70596.17	94700.9	0.826	29182.48	85467.522	114650	2
27083.91	63261.39	90345.3	0.751	36063.79	84236.208	120300	3
29331.51	56692.34	86023.85	0.683	42945.11	83004.894	125950	4
46612.15	50781.39	97393.54	0.621	75059.82	81773.58	156833.4	5
144739.13	376103.76	520842.9	-	202620.66	482746.74	685367.4	Total

Source: Collected and calculated from data in tables 14 and 15.

Table-20. Shows the present value of the outflow, inflow and net flows of the honey bee breeding project at a discount price of 15% after increasing costs by 5%

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 15% discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
16832.06	128841.9	145673.9	0.869	19369.46	148264.54	167634	1
22061.95	64613.45	86675.4	0.756	29182.48	85467.522	114650	2
23729.98	55427.42	79157.4	0.658	36063.79	84236.208	120300	3
24564.6	47478.8	72043.4	0.572	42945.11	83004.894	125950	4
37304.73	40641.47	77946.2	0.497	75059.82	81773.58	156833.4	5
124493.32	337003.02	461496.35		202620.66	482746.74	685367.4	Total

Source: Collected and calculated from data in tables 14 and 15.

The profitability of the project under the conditions of conducting sensitivity analysis by increasing outflows by 5% with constant inflows at a discount rate of 10% - 15%

The increase in the first year was calculated on the basis of = 141204.320 ×5/100 = 7060.22 pounds.

= 141204.320+7060.22=118264.54 EGP

The increase in the second year was calculated on the basis of = 81397.64 ×5 / 100 = 4069.88 pounds

= 81397.64 + 4069.88 = 85467.522 pounds.

By studying Table 19, 20, it becomes clear that:

Internal rate of return on investment = smaller discount rate (10) + difference between the two discount rates (5)

Present value of net cash flow at the smaller discount rate /Absolute net cash flow difference at discount rates

= 144739.13 / 144739.13+ 124493.32 = 723695.65 / 269232.45 = 12.69%

Benefit /Cost Ratio (B/C) $=\frac{461496.35}{337003.02} = 1.369 \cong 1.37\% Pound$

$$PI = \frac{461496.35}{337003.02} = 1.369 \cong 1.37\% Pound$$

Net Present Value (N.P.V)

$= 461496.35 - 337003.02 = 124493.32$ Pound/Year

It is clear from the results of the sensitivity analysis of the honey beekeeping project the sensitivity of the project to an increase in production costs by 5% Table 19, 20, 17, where the increase in the costs of raw materials used by 5% led to a decrease in the net present value from 140541.0868 pounds / year Table 17 to 124493.32 pounds / year Table 20. As well as the decrease in the profitability index from 1.44% to 1.37%, which means a decrease in the profit invested on each pound from 44 piasters to 37 piasters, with a decrease of 7 piasters for each 5% increase in costs. An additional profit for the investor is estimated at 21%, which is the difference between the best alternative opportunity (16%) which is (the bank) and the investment in the project 37%. Thus, in light of the current results, the financing of this project can be considered a successful work by the Small Projects Development Authority for this project, provided that the installments and interest of the loan are paid annually.

Table-21. Shows the present value of the outflow, inflow, and net flows of the honey bee farming project at a 20% discount price after a 5% increase in costs

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 20 % discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
16134.76	123504.4	139639.1	0.833	19369.46	148264.54	167634	1
20252.64	59314.46	79567.1	0.694	29182.48	85467.522	114650	2
20844.87	48688.53	69533.4	0.578	36063.79	84236.208	120300	3
20699.54	40008.36	60707.9	0.482	42945.11	83004.894	125950	4
30098.99	32791.21	62890.19	0.401	75059.82	81773.58	156833.4	5
108030.8	304306.91	412337.72	-	202620.66	482746.74	685367.4	Total

Source: Collected and calculated from data in tables 14 and 15.

Table-22. Shows the present value of the outflow, inflow and net flows of the honey bee breeding project at a 10% discount rate after a 2% decrease in revenue

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 10 % discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
20976.99	128354.7	149331.7	0.909	23077	141204.32	164281.32	1
25572.43	67234.45	92806.88	0.826	30959.36	81397.64	112357	2
28289.45	60248.94	88538.39	0.751	37669.04	80224.96	117894	3
30310.67	53992.71	84303.37	0.683	44378.72	79052.28	123431	4
47082.44	48363.23	95445.67	0.621	75817.13	77879.6	153696.73	5
152231.98	358194.06	510426.04	-	211901.25	459758.8	671660.05	Total

Source: Collected and calculated from data in tables 14 and 15.

Sensitivity analysis of a honey bee breeding project when inflows decrease at a rate of 2% annually:

In this part of the study, we address the financial evaluation of the project under conditions of risk and uncertainty and conduct a sensitivity analysis with a decrease in inflows at a rate of 2% annually with outflows constant at two discount rates of 10%. and 15%.

It is known that the honey bee breeding project, like other agricultural projects, is exposed to a lot of risk and uncertainty, by conducting a sensitivity analysis for the project at the discount rates of 10% and 15% in the event that outflows increase by 5% annually while inflows remain constant. Likewise, in the case of a decrease in inflows at a rate of 2% while outflows remain constant at the discount rates of 10% and 15%, Table 22, 23 shows the profitability of the project under the conditions of conducting a sensitivity analysis with a decrease in inflows at a rate of 2% annually with outflows constant at My prices are 10% and 15% discount.

Table-23. Shows the present value of the outflow, inflow and net flows of the honey bee breeding project at a discount rate of 15% after a 2% decrease in revenue

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 15% discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
20053.91	122706.6	142760.5	0.869	23077	141204.32	164281.32	1
23405.28	61536.62	84941.89	0.756	30959.36	81397.64	112357	2
24786.23	52788.02	77574.25	0.658	37669.04	80224.96	117894	3
25384.63	45217.9	70602.53	0.572	44378.72	79052.28	123431	4
37681.11	38706.16	76387.28	0.497	75817.13	77879.6	153696.73	5
131311.16	320955.26	452266.42	-	211901.25	459758.8	671660.05	Total

Source: Collected and calculated from data in tables 14.

The decrease in the first year of inflows was calculated on the basis of: 167634 x 2 / 100 = 3352.68 pounds.

The decrease in the first year of inflows was calculated on the basis of =167634 -3352.68=164281.32 pounds.

The decrease in the second year of inflows was calculated on the basis of: 114650 x 2 / 100 = 2293 pounds

The decrease in the second year of inflows was calculated on the basis of: 114650 - 2293 = 112357 pounds

The decrease in the third year of inflows was calculated on the basis of: 120300 x 2 /100 = 2406 pounds

The decrease in the third year of inflows was calculated on the basis = 120300 - 2406 = 117894 pounds.

The decrease in the fourth year of inflows was calculated on the basis of: 125950 x 2 / 100 = 2519 pounds.

The decrease in the fourth year of inflows was calculated on the basis of =125950 – 2519 =123431 pounds.

The decrease in the fifth year of inflows was calculated on the basis of: 156833.4 x2 /100= 3136.668 pounds

The decrease in the fifth year of inflows was calculated on the basis of=156833.4–3136.668=153696.73 pounds.

By studying Table 22, 23, it becomes clear to us that:

The internal rate of return on investment = the smaller discount rate (10) + the difference between the two discount rates (5).

The present value of the net cash flow at the smaller discount rate/ the absolute difference of the net cash flow at the two discount rates

= 152231.98/ 152231.98+ 131311.16 = 761159.9 / 283543.14 = 12.68%

Benefit /Cost Ratio (B/C) = $\frac{452266.42}{320955.26} = 1.409 \cong 1.41\% Pound$

PI = $\frac{452266.42}{320955.26} = 1.409 \cong 1.41\% Pound$

Net Present Value (N.P.V)

$= 452266.42 - 320955.26 = 131311.16$ Pound/Year

It is clear from the results of the sensitivity analysis of the honey bee breeding project how sensitive the project is to a 2% decrease in revenue (inflows) with outflows remaining constant, as Table 17, 21 shows, where a 2% decrease in revenue (inflows) with outflows remaining constant led to a net decrease. The current value is from 140,541.09 pounds/year to 131,311.16 pounds/year, as well as a decrease in the profitability index from 1.44% to 1.41%, which means a decrease in the profit invested on each pound from 44 piasters to 41 piasters, with a decrease of 3 piasters, which represents 2% in revenues. From the previous results, it is clear that the project has little sensitivity to any decrease in revenues, which means that the project is economically feasible at the present time, but the sensitivity to any future changes will increase. Therefore, this project was able to cover the loan and its cost (interests), and still have an additional profit for the investor of an amount Bingo is 25%, which is the difference between the best alternative opportunity of 16% (the bank) and investing in the project 41%. Therefore, in light of the current results, financing this project can be considered a successful effort by the Small Enterprise Development Agency. Therefore, we recommend continuing to finance these types of projects according to this criterion.

Table-24. The present value of the outflows, inflows and net of the honey bee breeding project at a discount rate of 20% after a 2% decrease in revenue

Present value For net benefits (EGP)	Present value of outflows (EGP)	Present value of inflows (EGP)	Discount coefficient at a 20 % discount rate (EGP)	Net benefits or net cash flow (EGP)	Total outflows (EGP)	Total inflows (EGP)	Years
19223.14	117623.2	136846.3	0.833	23077	141204.32	164281.32	1
21485.8	56489.96	77975.76	0.694	30959.36	81397.64	112357	2
21772.71	46370.03	68142.73	0.578	37669.04	80224.96	117894	3
21390.54	38103.2	59493.74	0.482	44378.72	79052.28	123431	4
30402.67	31229.72	61632.39	0.401	75817.13	77879.6	153696.73	5
114274.85	289816.11	404090.96		211901.25	459758.8	671660.05	Total

Source: Collected and calculated from data in tables 14

-The most important results were that this project achieves at the discount rate of 15% a positive net present value estimated at 140541.0868 pounds / year, as well as the ratio of discounted cash flows to discounted costs > 1 and the discounted profitability index for this project was estimated at about 1.44%, which is a value greater than the correct one.

It means that each invested pound has generated a net return of 44 piasters, which exceeds the opportunity cost of this project, which is the interest rate on borrowing estimated at about 16%, which indicates that the project has the capabilities and ability to recover fixed capital, production costs (variable) and operating costs (depreciation, maintenance) that were spent on it.

- In addition to achieving a return of 28% on the use of the money invested by the investor (self-financing), and it is required to achieve an economic return of 14%, as a minimum, or borrowed by the Social Fund for Development or (currently the Small Projects Development Authority) at an interest rate of 10%, or in the case of borrowing from the bank, where the interest rate was estimated at 16%, so this project was able to cover the loan and its cost (interest), and it remains for him to have an additional profit for the investor as much as 28%, which is the difference between the best An alternative opportunity 16%, which is (the bank) and investment in the project 44%.

-Thus, in light of the current results, the financing of this project can be considered a successful work by the Small Projects Development Authority.

-Also, the results of the sensitivity analysis of the honey beekeeping project showed the extent of the project's sensitivity to the decrease in revenue (inflows) by 2% with the stability of outflows, as it led to a decrease in revenue (inflows) by 2%. With the stability of outflows to a decrease in the net present value from 140541.09 pounds / year to 131311.16 pounds / year as well as a decrease in the profitability index from 1.44% to 1.41%.

Which means a decrease in the profit invested on each pound from 44 piasters to 41 piasters With a decrease of 3 piasters representing 2% in revenues.

- From the previous results, it is clear that the project is of little sensitivity to any decrease in revenues, which means that the project is economically feasible at the present time, but it will increase sensitivity to any future changes.

-Therefore, this project was able to cover the loan and its cost (interest), and leave him with an additional profit for the investor estimated at 25%, which is the difference between the best alternative opportunity (16%), which is (the bank) and the investment in the project 41%.

-Thus, in light of the current results, the financing of this project can be considered a successful work by the Social Fund for Development or (currently the Small Projects Development Authority).

9. Conclusion

The most important results were that this project achieves at the discount rate of 15% a positive net present value estimated at 140541.0868 pounds / year, as well as the ratio of discounted cash flows to discounted costs > 1 and the discounted profitability index for this project was estimated at about 1.44%, which is a value greater than the correct one.

It means that each invested pound has generated a net return of 44 piasters, which exceeds the opportunity cost of this project, which is the interest rate on borrowing estimated at about 16%, which indicates that the project has the capabilities and ability to recover fixed capital, production costs (variable) and operating costs (depreciation, maintenance) that were spent on it.

Therefore, the study recommends that these types of projects continue to be funded according to this criterion.

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