An economic study of the current situation of olive production and export, and economic feasibility study for expansion in the olive trees cultivation in Egypt

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ABSTRACT
The olive fruit is one of the fruits that have great benefits and high nutritional value, it is rich in carbohydrates, vitamins, protein and mineral salts, which distinguish it from other oils. The total production in Egypt was about 496.1 thousand tons of fruitful tree cultivated area, averaging about 120.03 thousand feddans, the average productivity of feddan was about 4.8 tons during the period (2000-2017), Egypt's largest share of production went to the local consumption for pickling, and exported around 25.5 thousand tons of olive crops at a value of 275 thousand dollars. The study problem was despite the increase in the area cultivated with olive, the area increased from 108.3 thousand feddans in 2000 to 241.9 thousand feddans in 2017, the amount of production increased from 287.1 thousand tons in 2000 to about 1094.7 thousand tons in 2017, but it did not contribute to reducing the gap of vegetable oils in Egypt, where the self-sufficiency of vegetable oils reached about 5% in 2017, the Objective is the economic evaluation of the cultivation of olives in the areas of the project for the reclamation and cultivation of one and a half million feddans, to prove the feasibility of olives cultivation in these areas to increase the exported quantity, The main results were Egypt has a comparative advantage in olive production at low cost and good quality, The study proved the economic feasibility of expanding olive cultivation in the proposed areas, Produced amount of the proposed area is estimated at 3750.6 thousand tons of olives, and 815.6 thousand tons of oil, valued at 5.66 million dollars, contribute to reduce the deficit in the Egyptian trade balance by 0.167 %, so the study recommends the expansion of olive cultivation.

Keywords: The economic feasibility of olive cultivation, Olive exports, Sensitivity analysis, olive oil.

Introduction
The olive tree is one of the oldest trees on the earth and is one of the many trees spread all over the world. The olive fruit is one of the fruits that have great benefits and high nutritional value, because it contains olive oil known for its high nutritional value (Sayed and Mohamed, 2017), it is rich in carbohydrates, vitamins, protein and mineral salts, which distinguish it from other oils. The olive tree is a plant with a sustainable and perennial greenery, and resistant to difficult environmental conditions. Olive is considered a national wealth. Olive oil is called green gold (Ashraf, 2012).

The total production in Egypt was about 496.1 thousand tons of fruitful tree cultivated area, averaging about 120.03 thousand feddans, the average productivity of feddan was about 4.8 tons during the period (2000-2017), Egypt's largest share of production went to the local consumption for pickling, and exported around 25.5 thousand tons of olive crops at a value of 275 thousand dollars, local production of olive oil amounted to about 7.8 thousand tons, local consumption reaching 7.5 thousand tons, and Egypt is considered the most important exporter, Egypt accounting for about 50% world production, which reached 50.5 thousand tons at a value of about 35.7 million dollars during the period (2000-2017).

The problem:
Despite the increase in the area cultivated with olive, the area increased from 108.3 thousand feddans in 2000 to 241.9 thousand feddans in 2017, the amount of production increased from 287.1
thousand tons in 2000 to about 1094.7 thousand tons in 2017, but it did not contribute to reducing the gap of vegetable oils in Egypt, where the self-sufficiency of vegetable oils reached about 5% in 2017, and it did not achieve a big export ratio corresponding to these quantities of Egyptian olive producing. In addition to the problem of the lack of studies and researches in the new reclamation regions in determining the economic feasibility of these regions before directing agricultural investments to it.

Objective:
Assess the current situation of olive production and export during the period (2000-2017), and the economic evaluation of the cultivation of olives in the areas of the project for the reclamation and cultivation of one and a half million feddans, to prove the feasibility of olives cultivation in these areas to increase the exported quantity.

Research Method and Data Source:
The study relied on descriptive and quantitative statistical analysis methods, as well as estimating some economic indicators such as percentages and average. In addition to estimating the general time trend equations for the evolution of olive production and export during the period (2000-2017), and relied mainly on preliminary data through questionnaire with Sinai olive farmers to calculate the costs and revenue of feddan of olive to determine the feasibility of cultivate it in the new lands, and used published and unpublished secondary data issued by the Central Agency for Public Mobilization and Statistics, Ministry of Agriculture data, and Food and Agriculture Organization data (FAO)(FAOSTAT).

The importance of olive cultivation in the desert lands:
1- The price of olive seedlings was cheaper than other seedlings.
2- Easy care and handling for the harsh conditions and unsensitivity of disease.
3- Unexpansive in a program its fertilization or imitates it.
4- Bear thirst and salinity compared to other fruit species, it bears a salinity of up to 3800 ppm, and bear thirst until a week without affecting its economic growth and production.
5- Price stability made it a haven for investors to reduce the risk of fluctuating other fruit prices.
6- Low risk if the price does not match the investor, it can pickling or olive oil juice and thus obtain a return.
7- It does not need trained labor or professional engineers to get a good return from the investor.

Most important olive varieties:
1-Cortina, 2- Kronaki, 3- Al marquee, 4- Arbequin, 5- Tofahi, 6-Al hamed, 7- Klamata, 8- Shallali, 9- Frantoyo, 10- Bequilal, 11- Dolce 12- Wattaken, 13- Manzanelo.

Factors affecting of the olive productivity:
1- Cold control in the process of flowering of olives affect the feddan productivity.
2- Some people believe that the olive bears very harsh conditions, and therefore irrigation once a month or fertilization once a year, and this is a big mistake reflected on the feddan productivity.
3- Severe climatic changes have a significant impact on the feddan productivity of olive in Egypt. Because Plants have not been able to break dormancy phase, due to lack of coldness in winter in some years. This was evident in the 2017-2018 productivity.
4 - Lack of full awareness of the seriousness of some diseases and insect injuries that reduce the feddan productivity.
5- Leaving some oil varieties to mature more than necessary, or collected from the trees before reaching the appropriate maturity, thus affect the amount of oil produced and it quality, also reduces the feddan productivity.
6 - Not cultivate pollinators of the main varieties in the farm, and the belief that the standardization of the variety is the best, leads to obtain weak production and recipes not good (Ahmad, 2005).

Alternate bearing problem:
One of the problems facing olive farms, where the crop is abundant in a year and light or non-existent in the following year, and the main reason for the occurrence of this phenomenon is that the
olive tree in the year of heavy production directed all its energies towards the formation of fruits, and therefore do not form new branches to carry crop next year.

**Causes of Alternate bearing problem:**
1- Variety: some varieties, especially varieties that have a high oil content increase the alternate bearing problem.
2- Age: Increasing the lifespan of trees leads to an increase in the rate of alternate bearing problem.
3 - The date of maturity and picking: the phenomenon decreases in the early varieties, but increase the phenomenon by the late date of the picking.
4 - Increasing phenomenon in rainfed agriculture
5- Lack of nitrogen and potassium fertilizers and boron.

To reduce this phenomenon, new vegetative growth should be carried out by pruning vegetation annually, taking into account raising the rate of irrigation and fertilizing of the trees with nitrogen and potassium fertilizer, and spraying with urea solution at a rate of 2% after 20 days of the completion of flower growth during the flowering period.

The current situation of the evolution of olive production and consumption in Egypt during the period (2000-2017):

By studying the evolution of the area, productivity, production and consumption of olives in Egypt during the period (2000-2017), Table (1) shows that the increase in the cultivated area of olives from 108 in 2000 to 241.9 thousand feddans in 2017, an increase of 123.35% with an average of about 164.8 thousand feddans during the study period. Also, the fruitful area increased from 77.3 in 2000 to 241.9 thousand feddans in 2017, an increase of 197.34% with an average of about 119.8 thousand feddans. The productivity is fluctuated from 2.6 to 5 tons per feddan during the study period.

**Table 1: Current Status of evolution of area, production, consumption and per capita of olive in Egypt during the period (2000-2017)**

| Year | Total Area thousand feddan | Fruitful Area thousand feddan | Productive ton | Production thousand ton | Olive Consumption thousand ton | Oil Consumption thousand ton | Population Million People | Per Capita of Olive Kg |
|------|---------------------------|-------------------------------|----------------|------------------------|-------------------------------|-------------------------------|---------------------------|------------------------|
| 2000 | 108.32                    | 73.5                          | 3.84           | 287.08                 | 293.9                        | 11.7                         | 68.1                      | 4.22                   |
| 2001 | 113.08                    | 77.34                         | 3.8             | 281.75                 | 293.9                        | 11.7                         | 68.9                      | 4.09                   |
| 2002 | 117.19                    | 80.36                         | 4.19           | 393.9                  | 356.4                        | 12.4                         | 70.2                      | 5.61                   |
| 2003 | 118.77                    | 78.56                         | 2.61           | 336.44                 | 204.5                        | 10.3                         | 71.5                      | 4.71                   |
| 2004 | 116.83                    | 81.13                         | 3.89           | 304.72                 | 314.7                        | 7.4                          | 72.8                      | 4.19                   |
| 2005 | 118.38                    | 96.81                         | 3.24           | 315.19                 | 309.5                        | 5.1                          | 74.2                      | 4.25                   |
| 2006 | 125.37                    | 108.3                        | 5.03           | 514.45                 | 499.8                        | 5.6                          | 75.6                      | 6.80                   |
| 2007 | 135.69                    | 110.76                        | 4.58           | 544.64                 | 506.5                        | 9.1                          | 76.9                      | 7.08                   |
| 2008 | 150.32                    | 109.95                        | 4.37           | 507.05                 | 479.9                        | 5.9                          | 78.3                      | 6.48                   |
| 2009 | 158.1                     | 110.18                        | 4.08           | 480.07                 | 468.8                        | 0.9                          | 79.7                      | 6.02                   |
| 2010 | 163.27                    | 119.43                        | 3.27           | 549                    | 611.8                        | 5.1                          | 81.4                      | 6.74                   |
| 2011 | 155.82                    | 125.4                         | 3.67           | 390.93                 | 457                          | 6.5                          | 82.5                      | 4.74                   |
| 2012 | 202.74                    | 137.02                        | 4.11           | 459.65                 | 560                          | 7.2                          | 84.6                      | 5.43                   |
| 2013 | 240.46                    | 146.93                        | 3.69           | 563.07                 | 535                          | 5.6                          | 88.1                      | 6.39                   |
| 2014 | 237.4                     | 144.8                         | 3.93           | 541.79                 | 530                          | 9.2                          | 90.2                      | 6.01                   |
| 2015 | 227.7                     | 165.9                         | 4.2            | 665.5                  | 540                          | 8.1                          | 93.5                      | 7.12                   |
| 2016 | 235                       | 172                           | 4.6            | 698.9                  | 500                          | 7.5                          | 95.69                     | 7.30                   |
| 2017 | 241.933                   | 218.546                       | 4.83           | 1094.7                 | 543                          | 8.8                          | 97.55                     | 11.22                  |
| Average | 164.80                  | 119.83                        | 3.99           | 496.05                 | 441.49                       | 7.58                         | 80.541                    | 6.02                   |

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Economy Bulletin, Different Issues.

In terms of production, the quantity increased from 287 thousand tons in 2000 to 1.09 million tons in 2017, an increase of 281.33%, an average of about 496.1 thousand tons during the study period. And consumption increased from about 256 thousand tons in 2000 to 543 thousand tons in 2017, an increase of 112.11%, an average of about 441.49 thousand tons during the study period.

The study of the general time trend of the evolution of the total area of olives and fruitful area, production, productivity and consumption, where Table (2) shows the general trend equations, the
first equation shows the increase of the total area by about 10 thousand feddans annually, and this increase was statistically confirmed at a significant level of 1%. Adjusted determining coefficient indicates that 80% of the changes in total area are due to time. The second equation shows the increase of the fruitful area by about 6.8 thousand feddans annually, and this increase was statistically confirmed at the level of significance of 1%, and the adjusted determining coefficient indicates that 89% of the changes in the fruitful area due to time.

As for productivity, the third equation in the table shows the increase of productivity by about 0.1 tons annually, while the significance of this increase was not statistically confirmed, and proved that this increase is not significant, also, the adjusted determining coefficient decreased to about 3%.

The fourth equation in the table shows the increase in production by about 22.8 thousand tons annually, the increase was statistically significant at the level of 1%. The adjusted determining coefficient was about 70%. Also, for consumption, where the fifth equation shows an increase in consumption by about 20.93 thousand tons annually, and the statistically significant increase at the level of 1%, The adjusted determining coefficient was about 62 %,this means that 62 % of the changes in consumption due to time as shows in Table (2).

Table 2: General time trend equations for the evolution of total area, fruitful Area, productivity production, and consumption of olives during the period (2000-2017).

| Equation | Statement | Function | $R^2$ | F |
|----------|-----------|----------|-------|---|
| 1        | Total Area thousand feddan | $\hat{Y} = 75.2 + 10.1x$ | 0.80 | 81** |
| 2        | Fruitful Area thousand feddan | $\hat{Y} = 50.6 + 6.82x$ | 0.89 | 152** |
| 3        | Productive ton | $\hat{Y} = 2.9 + 0.102x$ | 0.03 | 0.04 |
| 4        | Production thousand ton | $\hat{Y} = 198.23 + 22.82x$ | 0.70 | 45** |
| 5        | Olive Consumption thousand ton | $\hat{Y} = 250.72 + 5.93x$ | 0.62 | 28** |

(Y) Indicate the Estimated value of dependent variable, (i) year, (x) time element, $i = 1,2,3,17$.

*, ** Indicates the significance at 5% and 1% respectively

Source : Collected and Calculated from Table (1) data.

The current situation of the evolution of the export and import of olives in Egypt during the period (2000-2017):

The study of olive export during the study period (2000-2017), where the table (3) shows the increase in the quantity of exports from 33 tons in 2000 to 456 tons in 2017, with an increase of about 1281%, and an average of about 251.5 tons during the study period, also increased the value of exports from about 19.8 thousand dollars to 1412 thousand dollars , With an increase of about 1980% , and an average of about 412 thousand dollars, while the export price fluctuated from 600 dollars in 2000 to 903 dollars in 2017 , and it had been fluctuations in price in some years and decreased to about 369.7 dollars in 2002, then rose to 5027 dollars in 2015, the average export price was about 1193 dollars during the study period.

As for olive imports, Table (3) shows the decrease of imported quantities during the study period, this quantities are few in irregular year.

By studying the general trend of the evolution of the quantity, value of exports and the export price of olives during the period (2000-2017).

Table (4) shows the general trend equations, the first equation shows the increase in the quantity of exports by about 12.6 tons annually. This increase was statistically confirmed at a significant level of 5%. The adjusted determining coefficient indicates that 22% of the changes in the quantity of exports are due to time, the second equation shows an increase in the value of olive exports by about 32.3 thousand dollars annually. This increase was statistically confirmed at a significant level of 1%. The adjusted determining factor indicates that 62% of the changes in the value of exports are due to time. While the third equation shows the increase in the export price by about 76.8 dollars annually, and the significance of this increase was not statistically significant, the
adjusted determining coefficient was about 3 %, means 3 % of the changes in the export price were due to time.

Table 3: Evolution of the quantity, value and price of olive export and import in Egypt during the period 2000-2017.

| Year | Exports Quantity Ton | Export Price dollars/ton | Export Value thousand dollars | Quantity of Imports/ton | Import Price Dollars/ton | The value of imports thousand dollars |
|------|---------------------|-------------------------|-------------------------------|------------------------|-------------------------|---------------------------------------|
| 2000 | 33                  | 600                     | 19.8                          | 0                      | 0                       | 0                                     |
| 2001 | 34                  | 617.6                   | 21                            | 0                      | 0                       | 0                                     |
| 2002 | 46                  | 369.6                   | 17                            | 5                      | 200                     | 1                                     |
| 2003 | 25                  | 577.8                   | 130                           | 0                      | 0                       | 0                                     |
| 2004 | 519                 | 593.4                   | 308                           | 0                      | 0                       | 0                                     |
| 2005 | 459                 | 653.6                   | 300                           | 0                      | 0                       | 0                                     |
| 2006 | 194                 | 742.3                   | 144                           | 0                      | 0                       | 0                                     |
| 2007 | 504                 | 343.3                   | 173                           | 0                      | 0                       | 0                                     |
| 2008 | 166                 | 831.3                   | 138                           | 0                      | 0                       | 0                                     |
| 2009 | 402                 | 579.2                   | 233                           | 20                     | 550                     | 11                                    |
| 2010 | 116                 | 1206.9                  | 140                           | 0                      | 0                       | 0                                     |
| 2011 | 314.2               | 1057                    | 332.3                         | 24                     | 1458.33                 | 35                                    |
| 2012 | 179.1               | 1414                    | 253.4                         | 9                      | 2222.22                 | 20                                    |
| 2013 | 192.8               | 1613.5                  | 311.1                         | 80                     | 562.5                   | 45                                    |
| 2014 | 573                 | 1562                    | 895.1                         | 0                      | 0                       | 0                                     |
| 2015 | 113                 | 5027                    | 568.1                         | 0                      | 0                       | 0                                     |
| 2016 | 201                 | 2782.6                  | 559.3                         | 9                      | 2888.89                 | 26                                    |
| 2017 | 456                 | 903.51                  | 412                           | 0                      | 0                       | 0                                     |
| Average | 251.51             | 1193.03                  | 275.28                        | 8.17                   | 437.89                  | 7.67                                  |

Source: Food and Agriculture Organization (FAO)( FAOSTAT)

Table 4: General time trend equations of the evolution of the quantity, value and the price of export and import of olives in Egypt during the period (2000-2017)

| Equation | Statement | Function | \( R^2 \) | \( F \) |
|----------|-----------|----------|-------------|--------|
| 1        | Exports Quantity Ton | \( \hat{Y} = 65.27 + 12.64 \times (0.77) \) | 0.22  | 3.7*  |
| 2        | Export Value thousand dollars | \( \hat{Y} = 92.02 + 32.3 \times (1.02) \) | 0.62  | 28**  |
| 3        | Export Price dollars/ton | \( \hat{Y} = 17.20 + 76.8 \times (0.72) \) | 0.03  | 0.69  |

\( Y \) Indicate the Estimated value of dependent variable, (i) year, (x) time element, \( i = 1,2,3,17 \), * , ** indicates the significance at 5% and 1% respectively

Source : Collected and Calculated from Table (3) data.

Economic evaluation of olive cultivation in the areas under the project of reclamation and cultivation of one and a half acres, and the feasibility of planting it in these areas.

- Average production of feddan olive (120-116 trees per feddan)
- In pickling or oil varieties, the average yield varies according to the density of cultivation and cultivated variety

    Generally, the average production per tree in the third year of planting is about 3 kg, Increase in the fourth year to 10 kg, and then increase in the fifth to 20 kg. In the sixth year of cultivation about 40 kg. Then, after the eighth year, stabilize at 70 to 100 kg, if there is a good interest in fertilization and irrigation, and for oil varieties are very close to pickling varieties, and this is not a measure of the average production per feddan.

- The variety, oil ratio and picking time are control the final oil production.
- Profit of feddan of Olive

The profit per feddan depends on several factors such as:
1- Number of trees per feddan 2- cultivated variety 3- age of trees 4 Average price in the selling season.
In the 2018 season, the average price of Agouzi was about 9 LE, and the price of Tefahy 9.75 LE, while the proposed varieties range from 15-20 pounds per kilo, and the average price per liter of oil about 80 pounds.

**Economic feasibility for the cultivation of feddan of olives:**

Summary of feasibility study of olive feddan cultivation / ten years planting distances:
The optimum planting distances are:
6 * 6 = 36 m, area of feddan is 4200 m / 36 m = 116 trees per feddan.
Table (5) shows the fertilization costs, irrigation, service, the price of seedlings, the cost of labor, management and control costs from the stage of agriculture until the age of 10 years, where the total cost per feddan reached about 13372 pounds.

**Table 5: Structural and operational costs to cultivate feddan of olives.**

| Serial | Costs per pound | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
|--------|-----------------|----|----|----|----|----|----|----|----|----|----|
| 1      | Irrigation network costs (drilling and installation) | 4000 | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| 2      | Fertilizer costs (organic and chemical) | 770 | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| 3      | Costs of digging and filling injustice | 464 | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| 4      | Value of seedlings | 522 | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| 5      | The cost of planting seedlings | 116 | -  | -  | -  | -  | -  | -  | -  | -  | -  |
| 6      | Costs of administration and supervision | 100 | 2000 | 2000 | 2000 | 2500 | 2000 | 2000 | 2000 | 2400 | 2000 | 2650 |
| 7      | Fertilization, irrigation, control | 0 | 300 | 250 | 200 | 400 | 350 | 500 | 450 | 500 | 550 | 800 |
| 8      | Winter Service | 0 | 300 | - | 300 | - | 550 | - | 400 | - | 200 | - |
| 9      | Network maintenance and hoses | 0 | - | - | 1000 | 600 | 600 | 2000 | 650 | 600 | 1350 | 650 |
| 10     | Wages | 500 | 1400 | 2750 | 2500 | 3500 | 4500 | 4500 | 4500 | 4500 | 2900 | 3000 |
| 11     | Total Structural and seedlings costs | 6472 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 8000 | 8000 | 7000 | 7000 |
| 12     | Total costs per pounds | 13372 |

Source: preliminary data through the questionnaire with Sinai olive farmers in 2017.

**Results of financial analysis:**

Table (6) shows that the average quantity of feddan produced was about 3.5 tons, and the net profit for olive feddans reached about 34.6 thousand pounds as the average profit for the trees age (10 years).
- The benefit /cost ratio of about 2.59 is greater than the correct one indicating the feasibility of investing in olive growing.
- The redemption period was about 2.38 years indicating the possibility of recovering the invested capital within 3 years from the beginning of production (the fourth year).
The internal rate of return is about 35%, which is higher than the borrowing interest rate represented by the interest rate in banks, which is 12%. This represents the opportunity cost of invested capital, which proves the feasibility of investing in olive cultivation.

**Table 6: Structural and production Costs and Investment Efficiency Criteria per feddan of olives.**

| Year     | Cost (feddan) per Thousand pounds | The quantity produced of feddan Of olive | The average price ( per kg) | Revenue of the feddan per Thousand pounds | Net profit per Thousand pounds | Return / costs per Thousand pounds | Capital Redemption Period |
|----------|----------------------------------|----------------------------------------|-----------------------------|-------------------------------------------|-------------------------------|-----------------------------------|--------------------------|
| Structural costs | 6.472                               | -                                      | -                          | -                                         | -                             | -                                 |                          |
| First    | 4                                 | -                                      | -                          | -                                         | -                             | -                                 |                          |
| Second   | 5                                 | 360 kg                                 | 14                         | 5040                                      | 0.4                           | 0.8                               | 2.5                       |
| Third    | 6                                 | 750 kg                                 | 14                         | 10.5                                      | 4.5                           | 0.85                              | 1.33                      |
| Fourth   | 7                                 | 1 tons                                 | 15                         | 15                                        | 8                             | 1.14                              | 0.88                      |
| Fifth    | 8                                 | 2 tons                                 | 15                         | 30                                        | 22                            | 2.75                              | 0.36                      |
| Sixth    | 9                                 | 4 tons                                 | 15                         | 60                                        | 51                            | 5.66                              | 0.18                      |
| Seventh  | 8                                 | 4.50 tons                              | 15                         | 67.5                                      | 59.5                          | 7.43                              | 0.13                      |
| Eighth   | 8                                 | 4.50 tons                              | 15                         | 67.5                                      | 59.5                          | 7.43                              | 0.13                      |
| Ninth    | 7                                 | 4.50 tons                              | 15                         | 67.5                                      | 60.5                          | 8.64                              | 0.12                      |
| Tenth    | 7                                 | 4 tons                                 | 15                         | 60                                        | 53                            | 7.57                              | 0.13                      |
| Average  | 13.37                             | 3.2                                    | 15                         | 48                                        | 34.63                         | 2.59                              | 0.39                      |

Source: compiled and calculated from Table(5)

**Results of Sensitivity Analysis:**

One of the advantages of financial and economic analysis of the project can be used to test the feasibility of the project if the reality in implementation differed from the expectations made when planning the project, and most projects are sensitive to change in costs or revenues or both, therefore use sensitivity analysis to measure changes in the project feasibility metrics. As a result of the expectation of a change in costs or in the price of the product, the increase in the costs can transform the project is economically feasible to not economically feasible. Consequently, it is possible to measure the extent of the project to bear the risks of increasing costs, as well as to the decline in revenues (Ahlam, 2018); hence when the cost increase by 10% or decrease of revenue by 10% or the application of increase and decrease together for the project of planting feddan of olives for the average life of the project (ten years), In all cases, it is profitable and proven to be feasible as evidenced by the financial analysis measures in table (7).

**Table 7: Sensitivity Analysis for Olive Farming Project (Cost Increases 10% - Revenue Reduction 10% - Application of Increase and Reduction at the same time)**

| Costs after Increases 10% per pounds | 14709.2 | Revenue after reduction 10% per pounds | 43200 | Sensitivity Analysis in case of increased costs and reduced revenue together (10%) at the same time |
|-------------------------------------|--------|----------------------------------------|-------|-----------------------------------------------------------------------------------------------|
| Net profit after Costs Increases 10% per pounds | 33290.8 | Net profit after revenue reduction 10% | 29828 | Net profit per pounds 28490.8                                                                |
| % Return on capital Redemption period after costs increases | 44.18% | % Return on capital Redemption period after revenue reduction | 44.83% | Return on capital % 49.31 %                                                               |
| Redemption period after costs increases | 1.442 | Redemption period after revenue reduction | 1.648 | Payback period 2.516                                                                         |
| Return / cost ratio after cost increases | 2.26 | Return / cost ratio | 2.23 | Return / cost ratio 1.94                                                                       |
| IRR% | 30% | IRR% | 28% | IRR% | 27% |

Source: compiled and calculated from Table 5.6.
Proposed olive cultivation areas:

The State's plan for the development of Egypt included the reclamation of one and a half feddans in the areas (west of Minya, al-Magharah, old Farafra, New Farafra, Toshka behind the High Dam Lake, extension of East Owainat, Toshka wells, East Siwa, East of Toshka low) with an area of (420, 150, 96, 120, 142, 100, 10, 30, 50) thousand feddans respectively, as shown in table (8).

The proposed areas in which olives cultivation are:

(old Farafra, New Farafra in New Valley Governorate, and East Siwa, al-Magharah in Matruh Governorate).

Table 8: Proposed areas, area, water source and cost of irrigation source (2017 prices)

| No. | Region       | Governorate | Area (per thousands of feddan) | Irrigation source | Number of wells | Average depth of wells (meters) | Cost of wells per million pounds |
|-----|--------------|-------------|--------------------------------|-------------------|----------------|---------------------------------|----------------------------------|
| 1   | Old Farafra  | New Valley  | 96                             | Underground wells  | 700            | 600                             | 2100                             |
| 2   | New Farafra  | New Valley  | 120                            | Underground wells  | 1000           | 1000                            | 2500                             |
| 3   | East of Siwa | Matruh      | 30                             | Underground wells  | 150            | 600-1000                        | 300                              |
| 4   | Almaghr    | Matruh      | 150                            | Underground wells  | 1500           | 700-1000                        | 577.5                            |
| 5   | Total       |             | 396                            | Underground wells  | 3350           | -                               | 5477.5                           |

Source: compiled and calculated from Ministry of Agriculture data (The State's plan for the development of Egypt2030).

The proposed planting varieties:

According to its quality, productivity and consumer desire locally and globally for export, it is recommended to plant several varieties in one farm due to the need for some varieties of pollinators.

The total quantity produced of olives from the proposed areas was about 3750.6 thousand tons, and the quantity of oil produced was about 815.6 thousand tons. As shown in Table (9).

Table 9: Proposed varieties, areas and total quantity produced of olives and oil of proposed areas in Egypt

| No. | Varieties | The proposed area | Purpose of cultivation | Oil ratio | Maturity date | Feddan productivity per ton | Area per thousands of feddans | The expected quantity of olive production per thousand tons | The amount of expected produced oil per thousand tons |
|-----|-----------|-------------------|------------------------|-----------|---------------|----------------------------|-------------------------------|------------------------------------------------------|-----------------------------------------------------|
| 1   | Alwatkin  | Siwa              | Pickling and oil extraction | 18-20%    | September - November | 3.5                         | 30                              | 105                                      | 21                                                  |
| 2   | Almaraki  | Matruh            | Pickling and oil extraction | 25%       | November - December | 2.8                         | 150                             | 420                                      | 105                                                  |
| 3   | Coratina  | the new Valley    | Oil extraction         | 18-22%    | November - January | 3.8                         | 216                             | 820.8                                    | 180.6                                                |
| 4   | Kronaki   | Matrouh, Siwa    | Oil extraction         | 16-24%    | November - December | 3.9                         | 180                             | 702                                      | 168.5                                                |
| 5   | Kalamata  | Siwa, New Valley | Black pickling         | 15-20%    | September - October | 4.3                         | 396                             | 1702.8                                   | 340.6                                                |

Total area and quantity produced of olives and oil

|                                           |                            |
|-------------------------------------------|-----------------------------|
|                                           | 396                         |
|                                           | 3750.6                      |
|                                           | 815.6                       |

Source: compiled and calculated from Table(6,8) data .

Sources of Financing the Olive Project:

The state is trending to implement the new land reclamation policy to increase land units, the state plan for the development of Egypt included the reclamation of 1.5 million feddans, The average value of reclamation of feddan ranges from 20-25 thousand pounds according to the means of irrigation, whether by immersion through canals or wells or any means of traditional irrigation.
methods, Up to 50 thousand pounds per feddan for irrigation by spraying or dotting, because of the high cost of these machines and equipment.

Due to water scarcity, the trend will be towards the use of modern irrigation methods such as spraying and dotting to rationalize water use in agriculture in the new lands, thus, the cost of reclaiming the feddan is 50 thousand pounds, in addition to the value of the production requirements of the feddan.

**Marketing Policy for produced olives:**

Directing 40% for local marketing (for domestic consumption), 60% for export, especially olives do not require more pesticides or chemical fertilizers. It can be closer to organic olives.

**Conclusion**

**Olive cultivation in the new lands in the proposed areas is proved economically feasible.**

-When directed 60% of the quantity produced from the proposed areas (3750.6 thousand tons) amounted to about 2250.36 thousand tons

The export price of olives in 2017 = 903 dollars per ton

Accordingly, the export value of this amount is about 2.03 million dollars.

-Also the amount of oil produced amounted to about 815.6 thousand tons, directed to export, and the export price of oil in 2017 amounted to about 4383.42 dollars per ton, thus, the value of exporting this amount of oil amounted to about 3.58 million dollars. The deficit in the Egyptian trade balance in 2018 amounted to about 3.43 billion dollars, exporting this amount of olives and oil reduces the deficit by 0.164%.

**Recommendations:**

1. Expansion of olive cultivation in the new lands in the proposed areas because it is proved economically feasible.
2. Cultivation of high-yield varieties of olives and oil, such as kronaki.
3. Olive must be cultivated for export and international export conditions apply.
4. Providing market and export information, and olive world markets to facilitate the export.

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