The economic impact of investment on Moringa's fodder and seed projects in new land "case study in Aswan Governorate"

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Abstract: Moringa is characterized as a high economic yield crop that can add a return to the national economy by investing in farming projects for new lands which traditional crops usually do not suitable. In addition it can contribute essentially to solving part of the problem of animal feed shortages and its high costs suffered by the Arab Republic of Egypt, especially in the summer, by including moringa leaves in animal diets. Moringa cultivated in all new, old, desert and arid lands, even marginal lands with low productivity, as well as its therapeutic importance for many diseases and health problems.

The research aims to recognize the economic feasibility of Moringa's farming projects, so that farmers and investors especially smallholders are encouraged to investment in Moringa's farming projects by identifying the economic profits that farmers can earn and in an effort to help farmers adopt its cultivation under the concept of cost-volume-profit analysis, and to study the impact of changes affecting profitability of two moringa farms for feed and seed production through a number of scenarios.

❖ It is clear that the area variables at the level of the Republic lands are unstable around their average during the study period, the instability and fluctuation explains the non-spread of the crop and the lack of adoption of the crop by farmers as a result of their lack of knowledge of its benefits in feeding animal and therapeutic furthermore the marketing difficulties.

❖ The break-even point analysis of Moringa farming projects shows a high production safety margin of about 70.02%, 86.86%, which means that the projects have the potential to achieve gains and are safe from suffering losses in case of a decline up to those ratios. A sensitivity analysis of the break-even point of the fodder project shows that the maximum proportion the project can afford to raise operating costs and decrease revenue together by up to 22%.

❖ It is clear that the proposed scenarios sensitivity analysis indicators show the economic feasibility of the Moringa seed production project according to economic criteria, where the standards' values were(ROI), (PI), (NPV) and (B/C) for the third scenario has about 29. 86, 2. 31, 206.17 thousand pounds, 1.69. The results also showed that the estimated value (IRR) of the 3rd scenario analysis was about 15.17%, higher than the prevailing interest rate, and thus represented the best expense for the alternative opportunity of society.

❖ Results show that the proposed scenarios1,2 sensitivity analysis indicators economic feasibility of the feed production project in the light of the gradual reduction of the project's **(IRR)**, but it still exceeds the prevailing opportunity cost of society,high operating cost ratios and a decrease in revenue combined by 15%, 20% in the third scenario where the standard falls (IRR) is lower than the prevailing opportunity cost in society, reaching about 6.66%, 0%, and both criteria fall (PI) to 1.35, 0.68, and (NPV) to 11.273, (11.399) a thousand pounds, and (B/C) criterion is about 1 .05, 0.95 respectively. Which means no project feasibilityThe results of the economic assessment show that the net value- added criterion was approximately 13.895, 39.023 thousand pounds, indicating a marginal surplus of approximately 320.650, 112.291 thousand pounds.

❖ The investor capital productivity benchmarks and project capital density were estimated at 3.46, 3.80 pounds, 28.91%, and 26.3%.

❖ Social feasibility criterias were shown the social surplus, its proportion and the social return rate of feed project drops from seed production project to approximately about 7.417 thousand Pounds about 13.128%, 1.31. The level of labour units' contribution to the value-added and national income of the feed crop is amounted to about 781.77 LE, which is lower than the counterpart for the seeds production amounted to about 2118.23 LE.

Introduction :

The issue of development is one of the most crucial goals in recent times in light of the many challenges facing our national economy from the problems of population growth, climate changes,The Ethiopian Renaissance Dam crisisand the possible decline in Egypt's share of the Nile River waterand its entry into the phase of "water scarcity", which costs the state the burden of importing Agricultural crops with an estimated total water consumption of about 30 billion cubic meters.

These problems must be addressed, which necessarily requires restructuring the prevailing crop structures and replacing them with crops consistent with the expected and potential changes referred to by many studies.Therefore, moringa cultivation is one of the new, unconventional crops that can be used in animal nutrition in light of the steady rise in food feed prices due to the Corona crisis and the Ukrainian war. Moringa is characterized as having a high economic return, in addition to its physiological characteristics of tolerating temperatures up to 48°C, as well as the superior ability to withstand drought and water salinity up to 2500 ppm, low water needs during the year, its sufficiency for a quantity of rainwater ranging from 250-3000 mm per year[13] and the possibility of using water of the second degree. it is well cultivated in all new and old well-drained, desert, arid and hot lands, as well as marginal lands that are characterized by low productivity of acres, while they are not well cultivated in saline and watery lands.

Moringa is considered one of the crops that can add a return to the national economy by investing in reclamation and cultivation projects for new lands that are usually not suitable for traditional crops, but the expansion of its cultivation is still limited to what is not commensurate with the economic importance of the crop. Several studies have indicated the importance of the food crop in the field of animal production by feeding animals such as poultry, ruminants, cows, buffaloes, as well as fish. Moreover, beekeeping among Moringa trees increases the activity of honeybees, the quantity of honey production,its quality and medical benefits. Studies also indicate the nutritional significance of humans, particularly individuals who suffer from symptoms of nutritional deficiency, in addition to its therapeutic importance for many diseases and health problems.

Research problem

Moringa Oleifera is classified as a non-traditional crop that has the potential to be cultivated in in dry sandy lands, desert areas and marginal land with its high ability to withstand drought and climate changes, but the Moringa area is still very small compared to its importance in animal feed or their therapeutic use, multiple medical benefits and other uses.

The Arab Republic of Egypt suffers from the problem of animal feed shortages and its high costs, especially in the summer, which is one of the most important problems facing livestock. Green feeder is the actual basis for livestock feeding in the Arab Republic of Egypt; Green fodder is available during the winter, mainly based on a sustainable clover crop, Taherrich clover and the grass-rabbi clover with a production volume of about 51.294 million tons[1]. In addition to some other winter feeds such as elephant fodder, sorghum, sorghum corn and fodder beets .Where the total production of these feeds reached about 9.134 thousand tons during the average period 2016-2020[2]. While the production of summer and nile green fodder from Hijazi clover amounted to about 2.9 million tons, and other legume and evangelical green fodder produced about 324.5, 3.293 thousand tons for summer and nile fodder during the same average period[3].The production area of silage crops amounted to about 554.7, 0.576 thousand acres, showing that the total production of summer and nile green fodder covers about 30% of summer fodder production from a total area of about 59.7% compared to winter fodder[4]. Thus, Moringa can contribute to solving part of the problem of animal feed shortages

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[1],2,3,4, *Collected and calculated from data of Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Department of Agricultural Economics, General Department of Statistics,*

Agricultural Statistics Bulletin, Miscellaneous Publications.

and its high costs, especially in the summer, With the possibility of adding moringa leaves in animal diets, and replacing Moringa protein containing rates ranging from between about 25-29% as an alternative to soybean protein with a protein ratio of between (40-44%), which is imported from abroad and costs the state the burden of importing in hard currency.

Research importance :

The research derives its importance from the economic importance of the Moringa tree, which some call the miracle tree. Moringa trees belong to the Moringaceae family, and itsscientific name is Moringa oleifera. It is cultivated mainly in tropical and subtropical regions[10]such as the regions of the Middle East and Africa. In Egypt, Moringa peregrine is cultivated in the Sinai Peninsula below the mountains near the Red Sea's shores and used in Pharaonic ancient Egypt[4].The moringa is considered one of the fastest growing trees, and all parts of the tree are used from the soft and dry leaves, twigs, flowers, pods, seeds, bark and roots, which means the possibility of benefiting from all parts without the presence of residues. Moringa is characterized by its high The percentage of protein in the leaves, which reaches about 16% for green leaves, and about 25-29% for dry leaves[12]and the percentages of moisture, fats and carbohydrates reach about 5.9%, 17.15, 38.6%, and it can also be included in the poultry diet[26].Thus it can be To contribute directly to solving part of the problem of animal feed, especially in the summer, by mixing dry leaves in animal diets as a dietary supplement, as many studies have proven that There is an increase in animals weights and an improvement animal performanc [11].The increase in animals' weights is estimated by about 30% compared to the ones that were fed traditional fodder, and it was found that their health condition improved. The addition of dry leaves as a supplement to animal diets at a rate of 3 kg / day, while increasing milk production for cows by an estimated 58%.While milk ingredients including fat, raw protein, total solids, non-fatty solids and ash are not affected[16]as well as the properties of sensory dairy smell, taste and color. Dry feed from soft leaves is characterized by high nutrient and mineral ratios such as magnesium, calcium, potassium, iron, zinc and phosphorus, which play key roles in balancing the physiological, chemical and vital processes of livestock[21]Because livestock suffer from a low percentage of magnesium in the blood during lactation resulting in a decrease in milk production.

Studies have shown that Moringa oleifera is a nutritious forage It also removes toxins from the body and strengthens the immune system to prevent infections and diseases of the animal due to it was natural anti-microbial, anti-oxidant that have been reflected in improving milk production and

composition.It is therefore recommended to partially replace Moringa for clover feed in dairy cow feeding practices.[16]It is also anti-worm ingredients[26], and contains proteins from essential and non-essential amino acids and vitamins (A, B, C, D, H and K) in proportions above other competing crops.As illustrated by other studies the palatability of animals, especially rabbits, for Moringa leaves without a significant effect on the animal's milk productivity, as it was found that there were significant differences in the increase in animal weights and feed conversion ratios[20]compared to other feeds. Also, containing the food rations on Moringa oleifera stems in the feeding of ruminants shows a higher feeding efficiency without any negative impact on the performance of lambs[1]

Research Objective:

The research aims to identify the economic feasibility of Moringa's agriculture projects both for the purpose of producing feed and seed in the light of the concept of cost-volume-profit analysis and study the impact of changes affecting profitability in order to encourage farmers and investors in desert areas, new lands and smallholders, in particular smallholders, to familiarize themselves with the importance of the economic Moringa crop and the profits that farmers can earn and help them adopt its agriculture by achieving the following sub-objectives:

- Identifying the current situation of production and geographical distribution of the Moringa crop in Egypt.
- Identifying the cultivation of Moringa by intensive cultivation for the purpose of using it in animal nutrition and the actual economic returns to it.
- Learn about the cultivation of Moringa for the purpose of obtaining seeds and leaves and their actual economic returns.
- Identifying the economics of Moringa production for feeder and seed production farms inAswan Governorate.
- Conducting the financial assessment in accordance with the discounted and non-discounted criteria under the conditions of ascertainment for the projects to identify the extent of investment efficiency and the efficiency of economic performance.
- Studying the criteria for measuring profitability under conditions of uncertainty by analyzing both the break-even point and the sensitivity analysis of the projects.
- Conducting the economic and social assessmentof cultivation Moringa for the two projects of fodder and seed production, and conducting a comparison between the projects.

- Identifying the impact of potential changes in revenues and costs on the profits of the project and Some of the means of addressing these changes.

Research method and data sources:

In achieving its objectives, the research relied on the descriptive and quantitative methodologies to analyse and describe the economic variables under study, using simple statistical methods, some of measures related to determining the size of the project and the volume of its profitable production, and a number of discounted and non-discounted financial and economic assessment criteria under certain conditions, as well as criteria for measuring profitability Under uncertain conditions of uncertainty, using Break-even Point and analysis test to support decision-making.

The research relied on two data sources, the published and unpublished secondary data of the Economic Affairs Sector of the Ministry of Agriculture, the National Center for Agricultural Research, the Egyptian Scientific Association of Moringa, the Central Agency for Public Mobilization and Statistics, andthe Central Bank of Egypt's monetary policy reports,as well as field data to study the case of (Case Study) of two moringa farmer's production farms for the production of feed production and seeds inAswanProvince for the agricultural season (2021/2022).

Research Methodology:-

I.   Undiscounted criteria under conditions of certainty[18]: They are criteria that do not take into account the time value of money resulting from changes in prices in the future as a result of inflation, and they are as follows:

1. Capital Pay-back Period[22]:

It is an indicator of the degree of risk and liquidity of the project. It means the period during which the investor can obtain the value of the investment from the profits realized annually.

2. The rate of return on investment:

It means the ratio of the average annual return to the capital of the project, and this return is compared with the opportunity cost. If the rate of return achieves a rate greater than the opportunity cost, the project has economic feasibility and is accepted.

Return on investment = average annual cash flow/ investment costs x 100.

II. **The discounted criteria: They are the criteria for estimating the time value of money, including:**

1.   **The Net Present Value criterion.**

This criterion depends on the discounting of cash inflows and outflows at a discount rate that expresses the cost of the invested capital. It expresses the difference between the present value of cash inflows and the present value of cash outflows, and its positive value expresses the economic feasibility of the project, and the negative value expresses The project was rejected because it was not economically feasible.

$$NPV = \sum \frac{PVB}{(1+r)^n} - \sum \frac{PVC}{(1+r)^n}$$

Where: NPV: net present value, PVC: present value of annual cash outflows, PVB: present value of cash inflows, n: number of years of project life, r: discount rate.

2.   **Profitability Index:**

It expresses the productive efficiency of the invested capital, i.e. the profitability of the invested pound.Its shows the relationship between wave cash flows and initial investment costs, if the value of the output is one or more, then the project is economically feasible, but if the value of the output is less than The right one would be a pointless project and should be rejected.

Profitability Index = NPVR

$$= \sum_{t=1}^{n} \frac{NRn}{(1+r)^t} - \frac{TC_o}{(1+r)^t}$$

whereas: NR_n: total cash flow during the period, TC_0: total initial investment costs, r: discount rate, t: number of periods.

3.   **The cost rate of return criterion:**

It is the relationship between the present value of the returns expected to be achieved from the investment in the project and the present value of the costs expected from the investment throughout the project's life span. It is estimated from the following equation: $B/C = \frac{\Sigma R_i}{(1+r)^t} / \frac{\Sigma C_i}{(1+r)^t}$

Where: B/C: the rate of return to costs, ΣR_i: the present value of the project's expected return, ΣC_i: the present value of the project's expected costs.

4.   **Net rate of return / cost criterion** = (present value of return - present value of cost) / present value of cost. $NR = \frac{(\Sigma R_i/(1+r)^t - \Sigma C_i/(1+r)^t)}{\Sigma C_i/(1+r)^t}$

Where: NR: net return to costs ratio, ΣR_i: represents the project's expected returns, ΣC_i: represents the project's expected costs.

5.   **IRR (Internal Rate of Return)[28]:**

It expresses the marginal sufficiency of capital or investment and represents the profitability of the capital spent over the productive life of the project. It is defined as the discount rate at which the net present value is equal to zero. This criterion reflects the level of risk and the best criteria for measuring profitability.

$$IRR = r_1 + \frac{(r_2 - r_1) * (NPV_1)}{(NPV_1 + NPV_2)}$$

Where: IRR: the internal rate of return, r_1: the smallest discount rate, r_2: the largest discount rate, NPV_1: the

net present value at the smallest discount rate, NPV_2: the net present value at the largest discount rate.

III. Criteria for measuring profitability under circumstances of uncertainty:

Uncertainty circumstances mean that insufficient information is available for assessment, differentiation and change depending on prevailing and expected to prevail in the future, most importantly,break-even point analysis and sensitivity testing.

Break-even point analysis:

Helps institutions determine the quantity of production sold to achieve a certain volume of profits to cover operating expenses, calculate the net profit expected before interest and taxes at different levels of production, and analyze capital investments as a complement to investment valuation tools, to recognize the feasibility of the project.It is calculated from the following equations:

a) Break-even quantity = Fixed costs / Contribution margin or unit marginal profit.
b) Break-even quantity as a percentage of production capacity = break-even quantity / total production capacity of the project.
c) Cash break-even Value = fixed costs / contribution margin ratio.

1. **Margin of Safety:**

The volume of production achieved after achieving the necessary size i.e. the break-even point and indicates the extent betweenthe break-even point and the level of activity achieved by the project, It can reflect the extent to which production volumes can decrease before the project begins to produce losses. and the higher that range, the better for the project so that the safety margin in which the project operates is large and vice versa.

Productive safety margin=(target average production - break-even production).

d) Productive margin of safety ratio = (target average production - break-even production)/ average target production x 100.
e) Break-even price = (average total fixed costs/average total production) + variable cost per unit.
f) Price safety margin ratio=(average unit price produced - breakeven price)/average unit price produced x 100.

3. **Sensitivity Analysis:**

The variability of the project's economic efficiency criterionis measured[22] and used under uncertain circumstances to measure the effects of changes in any of the discount price variables, inputs or outputs and calculateof net cash flow over the life of the project on the net present value or internal rate of return of the project. The most significant changes affecting the project's performance in changes in the sales prices of products in domestic and global markets can be described either as an increase or decrease, changes in production costs and average unit costs, changes in investment costs, changes in interest rate and financing structure.

IV: Criteria for assessing national and social profitability: -

The feasibility study of the proposed project from a socio-economic point of view aims to assess its contribution to economic and social development and the various direct and indirect effects of the project, which are both monetary and non-measurable at shadow prices and represent economic prices, are taken into account in the assessment. Benefits and outflows are measured in real value without calculating support values or exemptions obtained by the project, and with the addition of subsidies that the project can receive.

1. An absolute efficiency test :-

calculates the social surplus for the projects from the following equation:

$NVA = TVO – (MC + D) – pv_W$

Where: NVA = net value added of the project, TVO = total present value of the outputs from the project, MC = total present value of the project's production inputs, D = value of annual depreciation, pv_w = total present value of wages.

2. Social return rate[18].

$Rosr = pv_{va} - pv_w / pv_i$

Rosr = Social return rate, pv_{va} =present value of net value added,pv_w= total present value of wages, pv_i= present value of the project's investment cost.

The results of the project's net value added assessment are interpreted as follows: if the current net national value added $\leq$ the total present values is local wages and salaries, in the sense that the social surplus is positive or at least equal to zero, then the project is feasible and achieves a social surplus, but if its value is lower than the wages, it means that the project is unacceptable from a social point of view.

2. Relative Proficiency Tests:

Additional criteria to be met by the project in the event of expectation of other objectives achieved by the project as well as the achievement of social surplus.

a) Capital intensity criterion.

$CC = PVC/PVAV$

Where: CC = capital intensity criterion, PVC = present value of total invested capital, PVNV = present value added.

b) Invested Capital Productivity Standard: This ratio reflects the social return rate of capital invested in the project.

$CPS = PVAV/ PVC$

Where: CPS = Invested Capital Productivity Standard, PVC = Current Value of Total Invested Capital, PVNV = Present Value Added.

c) Agricultural worker productivity standard

PW = PVAV/ NW

Where: PW = Agricultural worker productivity standard, NW = Number of workers, PVNV = present value added.

About Moringa Crop

Moringa is currently a profitable and non-pervasive crop, and is a medical and aromatic perennial plant with a lifespan of about 15 years. It is a pharmaceutical industrial plant that can suit the nature of climate changes that Egypt suffers from fluctuating temperatures, rising summers and falling at night. Where the crop is characterized by tolerance of temperatures up to 48 ° C, It has low water needs and is suitable for cultivation in all Egyptian lands, especially desert and marginal, except in wet and salty lands. It is also characterized by its ability to withstand drought, thirst and tolerance of salinity to 2,500 ppm without being affected by production. In addition to its reduced composting requirements, ploughing, has not recorded insect injuries or diseases except in the wetlands[6], compared to the crop Hijazi as a perennial feed crop on which the animal relies for food, whose production in the new lands is lower than in the old lands.It is a non-traditional crop developed on Egyptian agriculture despite its ancient use in Pharaonic Egypt in the mummification process[10].Thanastudy showed that in 2015 the area of Moringa reached about 1000 acres at the level of the Republic s seed production, witha higher economic efficiency of the production and higher returns to cost.The research also focused on the importance of the environmental dimension and the positive environmental impacts of the crop and the absence of any negative practices for moringa farmers on the environment,by taking advantage of all parts of the tree, and highlighted the main obstacles facing farmers in the study area[23].

Moringa cultivation with intensive cultivation for use in animal feeding:

Moringa is used as a green or dry feed crop by changing the properties of the perennial tree and transforming it from a tree or shrub into a summer herbal crop grown in the summer beginning from March - April conducted a number of operations to increase the vegetation density by intensifying the crop with farming distances of about 30 cm x 30 cm, to obtain a number ofmowing up to about (5 for the agricultural season starting from July for intensive cultivation)", which is harvested each 40 per day is harvested at about 45 tons of green material during the single agricultural season/acre, and is equivalent to the harvest of about(5 acres) of the Clover Tahreesh crop innew and reclaimed land.The moringa crop in the first mowing gives a production volume of 8-10 tons/acre,

while the next mows reach 15- 20 tons/acre until the last mowing in December[6].

Cultivation of moringa for the production of seeds, leaves.

The production of seeds and dry leaves requires an acre of about 700 trees/acre and is either planted with seedlingsor by cuttingsin the month of June - August, the best cuttings are taken after the tree has finished producing its fruit. Planting with seeds, acre need about (1/4 kilo of seeds) and are planted in plastic bags in an area of about 3 × 3 m2 and then transported for planting on the ground after about 2-3 weeks of planting on sandy lands, trees begin to flower in May, harvesting after 6-8 months of planting. The production volume of an acre of seeds is about 40.5-250 kg from the first year to the third year,and the seed yield increases with an increase of up to 30% annually. Until the production volume reaches about 1.5 tons / acre for the eighth year to the tenth year, the volume of oil production of seeds reaches about 105-125 litres/acres for the first year[6].

Results and discussion

I. The current status of moringa crop area, productivity and production in Egypt:

Table (1) data and statistical analysis shows that the average area and productionof the Moringa crop cultivation at the level of the Republic during the period (2013-2021) amounted about 121 acres, 130 tons, The areaand productionranged from a minimum of 11 acresand 11 tons in 2013 an estimated decrease of 90.9%, 90.7% over the average, the beginning of commercial crop cultivation. The area and production increased during the period up to 2021 and reached the maximum value of about 293 acres. And about 406 tons in 2021, growth rates are estimated at 142%, 212% over the average of the total area and production. Estimating the **coefficient of variation (C.V)** of the area at the level of the Republic, the old and new lands turned out to be about 84.3%,115% and 86.4% respectively. The **coefficient of variation (C.V)** for production is about 120.95%, 177% and 121% respectively.

- The area variables and productionare found to be unstable around their average during the study period. Instability and volatility of the areas are explained by the non-proliferation of the crop and farmers' non-adoption of the crop as a result of their lack of knowledge of its benefits in feeding the animal and its therapeutic benefits, as well as the marketing difficulties faced by farmers.
- The general time trendequations (1,2) show that the area of the moringa crop at the level of the Republic and the new lands during the period (2013-2021) increased to about 32.6, 28.3 acres,

with a growth rate of about 26.9%, 27.5% of the annual average. Statistical significance has been confirmed by the growing area.The **(R²)coefficient value** was about 75.9%, 76%. The **(R²\)determination coefficient** value of approximately 0.725, 0.727, which means that about 72 .5%, 72.7% of the changes in the Moringa area are due to the change reflected in the time variable. While the Statistical significanceof the growing area of old land has not been confirmed.

- $\hat{Y}i = -41.3889 + 32.5667\chi i$
  (-1.0615)⁻(4.700)**R² = 0.759,   R²\= 0.725,F = 22.092**(**)significant 0.10, (⁻)unsignificant.

- $\hat{Y}i = -38.722 + 28.3\chi i$
  (-1.1479)⁻ (4.721)**R² = 0.761,   R²\= 0.727, F = 22.29**(**)significant 0.10, (⁻)unsignificant.

- The general time trendequations (3.4) show that the prodution of the moringa crop at the level of the Republic and the new lands during the same period increased to about 30.59, 39.15Tons, with a growth rate of about 23.57%,36.9% of the annual average. Statistical significance has been confirmed by the growing prodution. The**(R²)coefficient value** was about 76.5%, 70%.The**(R²\)determination coefficient** value of approximately 0.639,0.652 which means that about 63.9%, 65.2% of the changes in the Moringa prodution are due to the change reflected in the time variable. While the Statistical significanceof the growing prodution of old land has not been confirmed.

- $\hat{Y}i = 30.5929\chi i$
  (5.9929)**   R²= 0.765 , R²\=0.639, F= 26.04**(**)significant 0.10.

- $\hat{Y}i = -89.528 + 39.15 \chi i$
  (-.1626)⁻   (4.002)**   R= 0.70 , R2=0.652, F= 16.012**(**)signifiant 0.10, (⁻)unsignificant.

- Data from the same table also show that the average feddan productivity at the level of the Republic during theperiod under consideration was characterized by a rise and decrease fluctuation between a minimum of about 0.258 tons/acres in 2017, an estimated decrease of about 37.1% from the average of about 0.797 tons/acres, while the upper limit reached about 1,290 tons/acres in 2020, an estimated increase of about 214.6% from the average.

- Estimating the **coefficient of variation**of productivity at the level of the Republic, the old and new lands turned out to be about 51.8%, 66.09% and 52.75% respectively, showing that the productivity variables are unstable around their average. This shows the equation of the time trend of productivity at the same level as the Republic for the same period that it increased and reached about 0.07 tons, a rate of change representing about 19.12% of the annual average productivity. While statistical significance has not been confirmed for the increase in the productivity of acres, the fluctuation between rise, decline and instability is explained by the fact that seed productivity increases annually by 30% over the years of the crop's life, and that the entry of new farms into production results in a decrease in productivity of acres, while the source of the statement did not provide an estimate of the leaf crop from moringa.

Table (1): Development of the area, productivity and production of the moringa crop at the level of the Republic in the old and new lands in Egypt during the period (2013-2021)

Years	Old Lands			New Lands			Total Republic		
	Area (acres)	Productivity (ton/acre)	Production (ton)	Area (acres)	Productivity (ton/acre)	Production (ton)	Area (acres)	Productivity (ton/acre)	Production (ton)
2013	8	1.000	8	3	1.000	3	11	1.000	11
2014	13	0.771	10	60	0.652	39	73	0.674	49
2015	15	0.500	8	38	0.355	13	53	0.389	21
2016	12	0.583	7	65	0.492	32	77	0.506	39
2017	12	0.250	3	50	0.260	13	62	0.258	16
2018	3	0.333	1	53	0.518	27	56	0.518	28
2019	23	1.696	39	209	1.213	254	232	1.261	293
2020	8	0.625	5	228	1.313	299	236	1.290	304
2021	74	1.757	130	219	1.263	276	293	1.275	406
Average	19	0.835	23	103	0.785	106	121	0.797	130
Standard Deviation	21.47	0.55	41.51	88.84	0.41	128.53	102.35	0.41	156.96
Difference FactorC.V	115.0	66.09	177.1	86.4	52.75	121.0	84.27	51.8	120.95

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Department of Agricultural Economics, General Department of Statistics, Agricultural Statistics Bulletin, Miscellaneous Publications.

Geographical distribution of moringa cultivation in the Arab Republic of Egypt:

- A study of the geographical distribution of moringa cultivation in Egypt during the period

(2013-2021) found that it is one of the newly dispersed non-traditional crops in Egyptian territory with a number of farms not confined to the productive areas, especially in Upper Egypt and Sinai region. The total area under cultivation in new and old lands represents about 84.7%, 15.3% of the total area of the Republic.

▪ Table 2 shows that the moringa crop is widespread in a number of governorates despite its climate diversity. Moringa agriculture is concentrated in 8 governorates at the level of the Republic.Aswanprovince occupies the first place with an average area representing about 55.35% at the level of the Republic.Its area in new and old lands represents about 46.49%, 8.86% of the total area of the Republic.Ismailia province occupies is ranked second with an average area

of about 37.86% at the level of the Republic, representing in new and old lands about 33.34%, 4.57% of the total area of the Republic.

▪ The area of Suez, Sharkia, Dakahlia, Qena, Red Sea and Hurghada occupies positions from 3rd to 8th, representing about 4.02%, 1.92%, 0.27%, 0.27%, 0.21% and 0.10% of the total area of the Republic, respectively.

▪ The area of Suez, Sharkia, Red Sea and Hurghada in the new territories occupies positions from the third to the sixth, representing about 4.02%, 0.55%, 0.21% and 0.10% of the total area of the Republic. While the area of Sharkia governorates, Dakahlia and Qana in old lands occupy the positions from the third to the fifth, representing about 1.37%, 0.27%, 0.27% of the total area of the Republic.

Table (2):Geographical distribution of moringa plant cultivation in the Arab Republic of Egypt during the period (2013-2021)

Governorate	Old Land				New Land *				Total Republic			
	Area		Production		Area		Production		Area		Production	
	(acres)	%	(ton)	%	(acres)	%	(ton)	%	(acres)	%	(ton)	%
Sharkia	1.67	1.37	1.33	1.028	0.67	0.55	0.667	0.51	2.333	1.92	2.000	1.54
Ismailia	5.56	4.57	2.78	2.143	40.56	33.34	19.400	14.96	46.056	37.86	22.178	17.11
Aswan	10.78	8.86	18.78	14.48	56.56	46.49	83.722	64.58	67.333	55.35	102.50	79.06
Suez	0.00	0.00	0.00	0.000	4.89	4.02	1.889	1.46	4.889	4.02	1.889	1.46
Al dakahlia	0.33	0.27	0.33	0.257	0.00	0.00	0.000	0.00	0.333	0.27	0.333	0.26
Qena	0.33	0.27	0.11	0.086	0.00	0.00	0.000	0.00	0.333	0.27	0.111	0.09
Red Sea	0.00	0.00	0.00	0.000	0.25	0.21	0.424	0.33	0.250	0.21	0.424	0.33
Hurghada	0.00	0.00	0.00	0.000	0.13	0.10	0.212	0.16	0.125	0.10	0.212	0.16
Total	18.7	15.3	23.3	18.0	103.0	84.7	106.3	82.0	121.7	100.0	129.6	100.0

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Department of Agricultural Economics, General Department of Statistics, Agricultural Statistics Bulletin, Miscellaneous Publications.

II. Economics of Moringa crop production.

Studying the structure of investment costs with its fixed capital (fixed assets), working capital and economic return is important to know the economic feasibility of investing in moringa crop cultivation. Two farms were studied as a case study according to the purpose of production in the new lands ofAswanProvince for the 2021/2022 agricultural season.

(1) The first farm has an area of about 5 acres for the purpose of producing feed in dense cultivation to obtain soft leaves.

(2) The second farm has an area of about 60 acres for the purpose of producing seeds and dry leaves for medical purposes.

A.Economics of production of moringa crop forage

▪ **The investment costs of the feed farm** are shown in Table (3) data that the investment costs per acre amounted to approximately 66.050 thousand

Pound, and the fixed costs averaged around 40.550 thousand pounds, representing about 61.39% of total investment costs.

1. The purchase price of the land was about 33 thousand pounds, which represents about 81.38% of the average fixed costs, and about 53.75% of the average investment costs.

2. The total cost of the project's premises is about Pound2,000 and represents about 4.93% of the average fixed costs.

3. The cost of irrigation machinery and equipment and accessories amounted to about Pound2.5000 representing about 6.17% of total fixed costs, about 3.79% of average investment costs.

4. Maintenance and repair costs amounted to about Pound550 representing about 1.36% of average fixed costs, while project buildings and maintenance and repair costs are about 3.86% of average investment costs, as shown in figure (1).

Table 3: Average cost and revenue structureper acre of moringa crop for fodder production inAswanProvince for the agricultural season (2021/2022)

investment costs	average costs		% of total investment costs
	value (pounds)	% of total fixed costs	
fixed costs			
First: the price of the land	33000	81.38%	
Pre-cultivation	2500	6.17%	53.75%
Second: machinery and equipment			
Watering machine and accessories	2500	6.17%	3.79%
Fixed costs for buildings and others			
the leaf blower leaves	2000	4.93%	
Rental value	0.00	0.00%	
Maintenance and repair	550	1.36%	3.86%
Total fixed costs	40550	100.0%	61.39%
working capital (variable costs)	value (pounds)	% total operating costs	% of total investment costs
Cost of seeds for foraging	7500	29.41%	
Cultivation cost	2200	8.63%	
Permanent and temporary labor wages	4800	18.82%	
Management and supervision	1600	6.27%	
The cost of irrigation, labor and energy	2000	7.84%	
Fertilization and prevention cost.	3400	13.33%	
Mowing cost (5 times / acre)	4000	15.69%	
Total variable costs	25500	100.0%	38.61%
Total cash outflows (initial investment)	66050	-	100.0%
inflows (revenue).	Value (pound)	% of total revenue	
Acre production of fresh fodder (tons)	40	-	
Price (pounds / ton)	1100	-	
revenue (pound)	44000	100.0%	
scrap value 10%	0.00	0.00%	
Total inflows (revenue)	44000	100.0%	
net cash flow	(22050)	-	

Source: Collected and calculated from the Field Research Questionnaire Form of the Moringa Farm in the New Lands ofAswan Province for the Agricultural Season (2021/2022).

- **Operational costs are shown from the data of the same table:**
1. The average variable costs are about 25.500 thousand pounds and represent about 38.61% of the average total investment costs.
2. The cost of seedlings , irrigation, (The wages of labour and energy), The cost of of composting and protecting and The cost of harvesting and the crop (mowing) were represent about 29.4%, 7.84%, 18.82%, 6.27%, 13.33%,15.69% of the totalaverage variable costs.
- **Project revenues**: Dense cultivation for feed production up to the number of bedding for the crop (4-5 bedding for the agricultural season) starting from July and lasting until the fourth bedding in October, and the last bedding in December at the rate of (each month and a half) bedding. The average production is about 40.5 tons of green/per acre papers, the average price of a ton of papers is about 1100 pounds, and the project's average revenue is about 44 thousand pounds.

B. Economics of production of moringa crop seeds.
- The investment costs of the seed production farm are shown in table (4) data that the investment costs per acre amounted to approximately Pound 162.540 thousand pounds and fixed costs averaged around 128,390 thousand pounds, representing about 79% of total investment costs.
- **The fixed costs:**
1. The price of the land and the cost of reclamation and infrastructure represent about 29.13%, 33.96% of the total investment costs and the average fixed costs.

2. The cost of establishment, project buildings, the cost of machinery and equipment, and Maintenance and repair costs represents about

8.40%, 25.82%, 15.34%, 0.31% respectively, of the total investment costs, As shown in Figure (2).

Figure No. (1) The total fixed and variable costs of the initial investment of the Moringa project for producing fodder in 2021/2022

Figure No. (2) The total fixed and variable costs of the initial investment cost of the Moringa seed production project 2021/2022
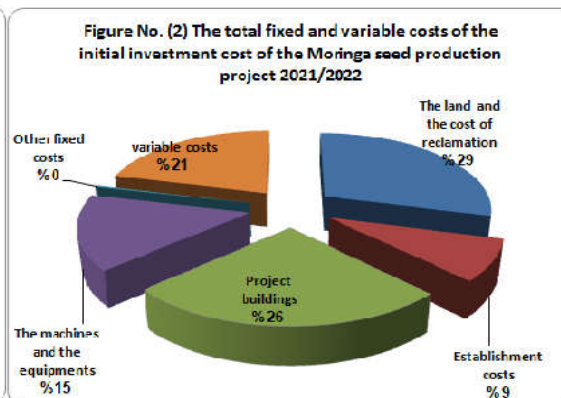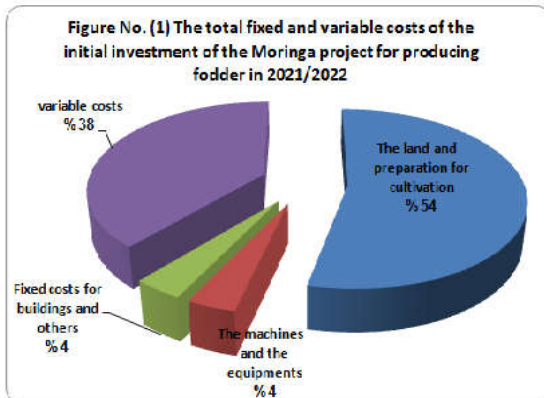
Source: Tables (3), (4).

- **Operating costs** from the same table data show that the average variable costs are about 34,150 thousand pounds, representing about 21.01% of the average total investment costs.

The cost of seedlings Wages for permanent employment, administration and supervision, irrigation from labor and energy cost, composting and protecting, collecting and packing represent about 35.14%, 18.45%, 4.10%, 10.07%, and 10.98%, 5.74% of the average variable costs.

- **Project revenues:**

State of crop cultivation for seed production seedlings are preferable to seed cultivation [6]. It was found that the production of the crop of seeds is increasing annually, as an acre produces about 40.5 kg for the first year of seeds, and about 350 kg of leaves, then continuing to increase annually in seed production by about 30% until the production volume reaches about 1.5 tons per acre for the eighth to the fifth year ten. The annual average revenue is about 15,088 thousand pounds, which represents about 53.02% of the leaf crop, and about 46.98% of the seed.

Third: Financial assessment of Moringa crop cultivation projects

Financial evaluation is the practical tool for measuring the feasibility of projects, decision-making and final resolution, whether before establishment to select the best investment alternatives available to the project and identify the most appropriate means to distribute available material, financial and human resources according to the strategies determined by the state's political and economic system, or evaluate the project after completion. The project's financial and sensitivity analysis relied on several assumptions, including:

1- The project's life expectancy is 10 years, while the economic productivity age [9] is 15 years.
2- The tables of Cash Inflows, Cash Outflows and Net Cash Flows have been prepared for the duration of the project for 10 years.
3- The discount rate expresses the interest rate of long-term loans or the lower rate of return or average interest rate on deposits in banks and is about 12.5% as the average period (2020- 2022), meaning that it reflects the best opportunity expense available for capital investment. A discount rate has been fixed by the Central Bank of Egypt during the years (2020 – 2022) for consecutive time [27]. But with the expectation that inflation will rise simultaneously with the beginning of the Ukraine War and the raising of the U.S. interest rate, the average discount and credit rate will rise in the community
4- The value of the land was valued at about 43.6 thousand pounds in new lands.
5- Tables No. (3,4) show that the average cash inflows, average cash outflows, and average net cash flows of the feed production farm were approximately about 44, 66 and 0.050 (22.050) thousand pounds. The seed and paper production farm has reached about 15.1, 162.5, (147.452) thousand pounds for the project.
6- Sensitivity analysis shows 3 scenarios, the first increased operational costs by 5% - 20%, But the second scenario a 5% - 20% decrease in income, the third scenario an increase in both operating costs and a decrease in revenues together with rates of 5% - 20% .

Table 4: Average cost and revenue structure per acre of Moringa crop for seed production inAswan Province for the agricultural season (2021/2022)

Investment costs	Average costs		% of total investment costs
	value (pounds)	% of total fixed costs	
fixed costs			
The price of the land	**43600**	**33.96%**	
The cost of reclamation and infrastructure	**3750**	**2.92%**	29.13%
Establishment costs			
Registration and tenure	10500	8.18%	
Area Maps	1450	1.13%	
Soil Analysis	350	0.27%	
Irrigation Water Analysis	350	0.27%	
General expenses and transfers	1000	0.78%	8.40%
: Project buildings			
Lining Water Tank	19560	15.23%	
Small break and inclusions (2 rooms + kitchen + bathroom)	20400	15.89%	
Paper Drying	2000	1.56%	25.82%
IV: MACHINERY AND EQUIPMENT			
Extension of irrigation system for main and sub-lines, drip hoses, traps, valves etc. (drip irrigation)	11750	9.15%	
Irrigation machine and accessories	9760	7.60%	
Electric Back Machine	870	0.68%	
Thickness and barrel for spraying	550	0.43%	
Farming Tools	2000	1.56%	15.34%
V. Other fixed costs			
Rental value	0.00	0.00%	
Maintenance and repair	500	0.39%	0.31%
Total fixed costs	128390	100.0%	79.00%
working capital (variable costs)	value (pounds)	% total operating costs	% of total investment costs
seedling cost	12000	35.14%	
Cost of farming drilling and equipping	2150	6.30%	
Cost of pre-cultivation soil processing(compost in the field)	3150	9.22%	
permanent labor wages for the project	6300	18.45%	
Management and supervision	1400	4.10%	
Irrigation cost	3440	10.07%	
Fertilization cost and prevention.	3750	10.98%	
cost of collecting and packing	1960	5.74%	
Total variable costs	34150	100.0%	21.01%
Total cash outflows (initial investment)	162540	-	100.0%
Inflows (income).	Value (pounds)	% of total revenue	
Acre production of seeds in kg (acre production changes)	40.5	-	
Price in pounds / kg at wholesale price	175	-	
Revenue (pound)	7087.5	46.98%	
(by-product crop) yields acres of dry leaf powder	8000	53.02%	
scrap value 10%	**0.00**	**0.00%**	
Total inflows (revenue)	15087.5	100.0%	
net cash flow	(147452.5)	-	

Source: Collected and calculated from the Field Research Questionnaire Form of the Moringa Farm in the New Lands ofAswan Province for the Agricultural Season (2021/2022).

Financial assessment results:

Discounted and non-discounted metrics show that moringa green feed production and seed production projects can be a good opportunity to invest according to the results of the following criteria for the current situation inAswan Province.

1. **ThePayback period criterion** reached nearly two years for the feed production project, to cover the value of the initial investment in full, While the standard exceeded 3 years for the seed production project. The increase in the value of the second project benchmark is explained by the

different in cash flow during the life years of the project, where the return in the first years of the project decreases by a decrease in seed production, and the production of seed crop during the following years increases by 30% annually.

2. **The rate of return on investment for the project (ROI)** was about 72.98%, 78.94% which is excellent if compared to the interest rate, where the rate exceeds the prevailing opportunity cost in the community.

3. **The Commercial Profitability Index (PI)** represents the profitability of the investor pound of moringa crop cultivation, which is more than (1) to register about 4.6 for the feed production

project, while it is about 3.45 for the seed production project.

4. **The net present value** benchmark was about 79.288, 361.11 thousand pounds, and **the rate of return on cost** was about 1.37, 2.33 at the 12.5% discount rate, which shows the feasibility of the two projects for farmers financially and economically.

5. **The project's internal rate of return (IRR)** was recorded at about 79 .22%, 41.34%, meaning that the profitability of the project is about 79 .2, 41.34 a penny per pound invested, and it exceeds the interest rate prevailing in banks during the period (2020-2022), which means the feasibility of investing in the cultivation of moringa feed and seeds in new lands.

Table (5): Results of the Financial Assessment of the Moringa Feed and Seed Production Farm for the Agricultural Season (2021/2022)

Statement	PBP	ROI	PI	NPV	B/C	IRR
feed production	1.37	72.98%	4.60	79.288	1.37	79.22%
seed production	3.8	78.94%	3.45	361.11	2.33	41.34%

Source: Collected and calculated from the analysis of field research data of the Moringa Feed and seed Production Farm in the New Territories ofAswan Province.

IV: Criteria for measuring profitability in circumstances of uncertainty:

A. **Break-even Point analysis of the moringa feed production farm inAswanProvince.**

1. **Break-even Point analysis and the production and price safety margin ratio.**

1) Table 6 data show that the project's quantitative break-even point was about 13.132 tons/acre, representing about 29.98% of the project's total production capacity. The Break-even point is lower than the average quantity of moringa crop production by about 70.02%, which represent the ratio of the project's productive safety margin, which means that the project achieves gains and is safe from making losses.

2) The the break-even price was found to be about 329.8 Pound/ tonne, representing about 29.99%from Sale Price. The average annual revenue of the project of about 14.446 thousand Pound exceeds the project's break-even revenue, Which means the profitability of the project and its achievement of gains, with the production and price security margin of the project being about30.67 tonnes/acre, 770.19 Pounds.

3) With regard to the ratio of the price safety margin of the project reflecting the sensitivity of the project to the change in the economic variables affecting the productive capacity of the project has reached about 70.02%, which means that the project is profitable and its chances of gains are

increasing. The decline in the price of sale or production capacity to rates of up to 70.02% means that the project is safe from achieving losses, Lower productive safety or price safety ratios than that rate expose the project to losses.

2. **Project sensitivity under the break-even point analysis for feed production:**

The break-even point was analyzed under a number of economic variables through a number of scenarios .I and IIscenario isan increase in operational costs and a decrease in revenues of up to 20%each separately.The third scenario is an increase in both operational costs and a decrease in revenues together of up to 15%, 20%.As shown in table 6.

1. Data from the same table show that the impact of the rise in operating costs and the decrease in revenues of up to 20% each separately, as well as the rise in both operating costs and the decrease in revenues of up to 15% resulted in higher estimated break-even point by an increasing rates ofchange of about 29.01%, 73.88% and 95.05% of the current quantitative break-even point. It is still below (average rank-and-file productivity) the project's average productivity, which means that the project remains profitable.

2. Changes in costs and revenues in the same previous ratios have also increased the quantitative break-even points ratio of total production capacity to approximately 38.68%, 58.48%,58.48% which also resulted in the project's production safety margin falling to

approximately 26.86, 20.09,18.19 tons/acre, and the reduction of the productive safety margin to61.32%, 47.87% and 41.52% respectively, but the project continues to gain earns. in the sense that although the quantities produced decreased to those projected ratios, the project is still safe from losses,The lower safety margin than those ratios exposes the project to loss.

3. The impact of the rise in operating costs and the decrease in revenue by 20% each separately,and the rise in both operating costs and the decrease in revenue by about 15% resulted in a decrease in the contribution return from approximately 517.8 to 401.4, 297.8 and 265.5 pounds/unit, It also increased the break-even price of the project to about 425.5, 458.8, 546.78 pounds and the price safety margin decreased to about 674.52, 421.25, 388.22 pounds.

4. **Project sensitivity under Break-even point analysis for feed production: -**

1. The rise in operating costs and the decrease in revenue together are about 20%(lower revenue, whether due to lower product sales price or lower quantities of production). The estimated break-even amount of the project increased to about 29.99,37.49 tons/acre, the contribution yield decreased to about 226.7, 181.4 pounds, the quantitative break-even points ratiosfrom total production capacity increased to about 85.59%. The break-even priceincreased to about 941.6, 753.3 pounds, and the price safety margin decreased to about 158.4, 126.73pounds. It is also clear that the decrease in the safety margin ratio whether the sale price of products or the decrease in the volume of production to about 14.40% means that the project is still able to make a profit.

2. The maximum percentage that the project can afford to raise operating costs and decrease revenues together is up to 22% (decrease in revenue whether it results from a drop in the sale price of products to about 24%, or a decrease in the volume of production to about 22%), resulting in losses to the Green Feed Project to increase the production quantity to about 46.03, 47.68 tons/acre, where the actual production exceeds and reduced the project's contribution return to 147.7, 142.6 Pound, and also led to an increase in the break-even price to about 924.8, 1497 pounds, which is also more than the sale

price[5].While the project continues to make a profit in the case of the sale of the project's products of dry fodder leaves for use in animal feeding or medical purposes due to the high sale price of the products of the papers dry from the green leaves.

B. **Break-even Point analysis of the moringa seed production farm inAswan Province.**

1. **Break-even Point analysis and the production and price safetymargin ratio.**

   1) According to Table 7 data, the project's quantitative Break-even point is about 126.11 kg. It is down from the average production quantity of the moringa crop by about 86.86%, which means that the project is gaining earns. The Break-even amount represents about 13.14% of the total production capacity. The Break-even price was also found to be about 33.51 Pound for production as a whole. The average annual income of the project was found to exceed the income of the project's Break-even point of about 17,700 thousand pounds, meaning the profitability of the project and its gains, as the production safety margin of the project was about 883.58 kg, As for the ratio of the Productive and price safety margin was about 86.86%, which means that the project is profitable and has increased opportunities for gains·

   2) Lower safety margin ratios for quantities produced or sale priceto 86.86% means that the project is still safe from achieving losses.A lower rate of productive or price safety margin than that would expose the project to losses.

   3) Break-even point analysis Project sensitivity to the current situation under scenarios shows that higher operating costs, The decrease in revenues by 20%each separately and the rise in operating costs and the decrease in combined revenues by 15%, 20% increased the estimated Break-even points at an increasing rate of 4.1%, 31.47%, 26.44% and 38.65% of the current quantitativeBreak-even point, which means that the project continues to make a profit.

   4) Changes in costs and revenues in the same proportions as prior scenarios resulted in a rise in quantitative Break-even points ratios from total production capacity of 0.64%, 4.14%, 3.47% and 5.08%, as well as a decrease in the rate of return on the balanced contribution from approximately

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[5] *Collected and calculated from data analysis and scenarios.The value of the production has been calculated at the lowest possible selling price.*

117.2 to 112.65, 89.2, 92.75 and 84.58. The project's production safety margin also decreased from about 883.58 kg/acre to about 828.41, 793.89, 800.24 and 784.84 kg/acre. Thus, the productive safety margin ratios decreased to86.32%, 82.72%, 83.39%, 81.78%, respectively, and the project continues to gain. In

the sense that although the quantities produced fall to those expected ratios, the project is still safe from achieving losses, and the lower safety margin than those ratios exposes the project to loss.As well as the Break-even point price for the project also shows an increase of about 34.88, 35.01, 37.17 pounds.

Table (6): Break-even analysis and productive and price safety margin for the production of moringa feed acres inAswan province for the agricultural season (2021/2022).

Statement	Unit	Quantity, value or%					
		Status quo	First scenario	Scenario II	Scenario III		
			Higher operating costs 20%	* lower revenue 20%	Higher * operating costs, lower revenue 15%	* * Higher operating costs, lower revenue 20%	* Higher operating costs, lower revenue 20%
Contribution Return	Pound/ Unit	517.8	401.4	297.8	265.5	226.7	181.4
Average variable unit costs	Pound	582.19	698.63	582.19	669.52	698.63	698.63
Project quantitative break-even point	Tons	13.132	16.94	22.83	25.61	29.99	37.49
Amount of increase in the break-even quantity	Tons	-	3.81	9.70	12.48	16.86	24.36
Rate of change in break-even quantity	%	-	29.01	73.88	95.05	128.40	185.50
Break-even quantity as a proportion of production capacity	%	29.98	38.68	52.13	58.48	85.59	85.60
Project Value break-even point	thousand pounds	14.446	18.636	20.09	23.949	32.993	32.993
Productive Safety Margin	Tons	30.67	26.86	20.97	18.19	5.05	6.31
Productive safety margin ratio	%	70.02	61.32	47.87	41.52	14.40	14.40
break-even price	Pound	329.8	425.5	458.8	546.78	941.6	753.3
Amount of change at break-even price	Pound	-	95.68	128.95	216.98	611.79	423.47
Rate of increase at break-even price	%	-	29.02	39.00	65.79	185.50	128.40
Price Safety Margin	Pound	770.19	674.52	421.25	388.22	158.41	126.73
Price Safety Margin Ratio	%	70.02	61.32	47.87	41.52	14.40	14.40

(*) Lower revenues rates of 15%, 20% resulting from lower sales price in the same proportions.
(**) Higher operating costs and 20% decrease in revenue (resulting from 20% decrease in the quantity of feed produced).
Source: Collected and calculated from the analysis of field research data of the Moringa Feed Production Farm in the New Lands ofAswan Province for the Agricultural Season (2021/2022), Compiled and calculated from table 3 data.

5) The Break-even analysis of moringa seed production also shows from the same table data that the quantitativeBreak-evenpoint for seeds and leaves is about 80 .12 kg, 45.99 kg, which is about 86.86% lower than the average quantity of production of moringa of about 609 .69, 350

kg/acre, which means that the project makes gains. It was also found that the Break-even price was about 23, 10.51 pounds representing about 13.14% per kilo average price of seeds and leaves, and that the average annual revenue exceeds the project's Break-even point income of

about 14 0.021, 3.680 thousand pounds, by about 86.86%, which means the project's profitability from agriculture and increased chances of gains.

6) It was also found that the productive safety margin was about 529.57, 304.01 kg, and that the ratio of the productive safety margin of the project was about 86.86%, which means that the project makes a profit, and that the decrease from that proportion in seed production and leaves exposes the project to loss.

3. Project sensitivity under break-even point analysis for seed production.

1) Scenarios show that the impact of an increase in operational costs and a decrease in revenues of up to 20% each separately, higher operating costs and lower revenues together in proportions by 15% and 20% increased the estimated break-even points for seed production by an increasing change of about 1.89, 14.48, 12.16, 17.78 kg from the quantitative break-even point.The break-even points of the leaves crop also increased by an increasing change of about 1.89, 14.48, 12.16 and 17.78 kg from the quantitative break-even point of the leaves for the time being. It is still below average rank-and-file

productivity, which means that the project remains profitable.

2) The scenarios also showed that there was a decrease in the production safety margin of the seed crop and leaves to about 526.29, 504.36, 508.24, 498.61 kg/acre for the seed crop, and about 302.12, 389.53, 291.85, 286.32 kg/acre for the leaf crop. All expected break-even points are found to be lower than the current state of production, which means that the project continues to gain gains and is safe from losses for seed and leaves crop outputs.

3) The effect of the third scenario of rising operating costs and a decrease in revenue at rates estimated at 15%, 20% led to an increase in the break-even price of the seed crop and the leaves to about 24.71, 25.51 pounds/k for seeds, about 11.30, 11.66 pounds/kL. Previous changes have also reduced the price safety margin of seeds to around 124 0.04, 114.49 pounds per kilo. As for leaves production, the price safety margin decreased to about 56.70, 52.34 pounds per kilo, and the price safety margin ratio for seeds and leaves was estimated to be 83.39%, 81.78%.

Table (7): Break-even analysis and productive and price safety margin for the production of moringa seed acres inAswan province for the agricultural season (2021/2022)

Statement	Unit	Status quo	First scenario Higher operating costs 20%	Scenario II * lower revenue 20%	Scenario III Higher * operating costs, lower revenue 15%	* Higher operating costs, lower revenue 20%
Balanced rate of contribution return[**]	Pound/Unit	117.3	112.65	89.2	92.75	84.58
Project quantitative break-even point[***]	Kg	126.11	131.28	165.80	159.45	174.85
Rate of change in break-even quantity	%	-	4.10	31.47	26.44	38.65
break-even quantity as a proportion of production capacity	%	13.14	13.78	17.28	16.61	18.22
Project Value break-even Point	A thousand pounds	17.700	18.426	18.617	19.022	19.633
Productive Safety Margin	Kg	883.58	828.41	793.89	800.24	784.84
Productive safety margin ratio	%	86.86	86.32	82.72	83.39	81.78
break-even Price	Pound	33.51	34.88	35.24	36.01	37.17
First: Seed Production						
Amount of change in break-even Point quantity	Kg	80.12	83.40	105.33	101.30	111.09
Amount of change in break-evenquantity	Kg	-	3.28	25.21	21.18	30.96

Value break-even Point	A thousand pounds	14.021	14.595	14.747	15.068	15.552
Productive Safety Margin	Kg	529.57	526.29	504.36	508.24	498.61
Break-even Price	Pound	23.00	23.94	24.19	24.71	25.51
Price Safety Margin	Pound	152.00	151.06	115.81	124.04	114.49
Second: leaves production						
Amount of change in break-evenquantity	Kg	45.99	47.88	60.47	58.15	63.77
Amount of change in break-evenquantity	Kg	-	1.89	14.48	12.16	17.78
Value break-even Point	thousand pounds	3.680	3.830	3.870	3.954	4.081
Productive Safety Margin	Kg	304.01	302.12	289.53	291.85	286.32
Break-even Price	Pound	10.51	10.94	11.06	11.30	11.66
Price Safety Margin	Pound	69.49	69.06	52.94	56.70	52.34
Price Safety Margin Ratio	%	86.86	86.32	82.72	83.39	81.78

❖ (*) Lower revenues rates of 15%, 20% resulting from lower sales price in the same proportions.
❖ (* *) Balanced rate of contribution = total contribution return ÷ total unit sales volumes.
❖ (***)The break-even point calculated the quantity produced on the basis of the ratio of sales volume composition and bass on the basis of sales revenue.

Source: Collected and calculated from the analysis of field research data of the Moringa seed Production Farm in the New Lands ofAswan Province for the Agricultural Season (2021/2022),Compiled and calculated from table 4 data.

C. **Sensitivity Test:**Variables affecting the project's financial valuation criteria were studied under scenarios (1.2 an increase in operational costs and a decrease in revenues by about 5% - 20%, as well as third is an increase in both operational costs and a decrease in revenues togetherby rates ranging from about 5% - 20%.

1. **Moringa Feed Cultivation Project as shown in Table No. (8): -**
1) The Payback period criterion(PBP) is the maximum value of approximately 3 years by increasing operating cost ratios and decreasing total revenuestogether by approximately 20%. While the criterion for a refund period alone increases costs by 20%, and the decrease in revenue by 20% is about 2 .41, 2.90 year using average cash flows.
2) Calculating the **Payback period criterion** using annual cash flows for higher operating cost ratios, lower revenue, or higher operating costs and lower revenue rate together by about 5%, 10%, 15% and 20%, the criterion does not exceed 3 years.
3) It is clear that despite increased operating costs, lower revenue and (increased operating costs and lower revenue combined) rates of about 5%, 10%, 15% and 20% result in lower **rate of return on investment (ROI),** but it is still the best expense for alternative opportunity in the community, illustrating the project's feasibility.

4) 5) **The business profitability index (PI)** shows a decrease of about 4.06 to 2.75 for higher operating cost ratios up to 20%. It also ranges from about 3.66 - 1.66 for lower revenue ratios from 5% - 20%.**The profit index** varies by about 0.87 - 2.45 for the impact of the increase in operating costs and reduce income together by 5 - 15%,To record a low value of about 0.68 for higher operating costs and a 20% decrease in revenue together, the project is not feasible in case of higher operating costs and a 20% decrease in revenue.

5) A decrease in revenue of about 5% - 20% was also shown to result in a lower **net present value standard(NPV)** for the project than an increase in operating cost by the same ratios on net present value. However, it is still **positive**, indicating the project's financial viability. **The net present value** benchmark was also recorded with the impact of increased operating cost and decreased revenue together at rates of about 5% - 10%, while the net present value benchmark recorded a **negative** value of about (11.399) thousand pounds due to the impact of higher operating

costs and a decrease of revenue together by about 20%, which means the project achieves the loss and indicates the project's unfeasible compared to other projects.

6) **The rate of return on cost(B/C)** has decreased as operating costs have risen from 5% - 20% and between 1.19 - 1.32. **The rate of revenue** on cost in light of the decline in income ratios up to 20% is about 1.30, 1.23, 1.16 and 1.09 respectively, while the ratio of both operating costs and revenue has risen to 15% by 1.25, 1.15 and 1.05. While the increase in both operating costs and the decrease in revenue by 20% lead to a decrease in **the rate of return on cost** to 0.95, which is less than (1) indicating the unfeasible of the project.

7) The project's **internal rate of return (IRR)** gradually decreased in the first scenario, with operating costs rising to 20% to around 30.11%. The rate of internal return in the secondscenario to 12.40% is also shown by the decrease in revenue ratios up to 20%. The **rate of internal return** of the project also decreased to 30.01%, 20.95% in the third scenarioto the impact of higher cost ratios and lower income ratios together by 5%, 10%. Those estimated values of analysis are higher than the prevailing interest rate and therefore represent the best expense for society's alternative opportunity, which means the feasibility of investing in the project. While the project's sensitivity to a 20% decline in

revenues is shown, the **internal rate of return** is down from the interest rate by about 0.10%, as well as to increase operating costs and decrease revenue together by 15%, 20%, where t**he internal rate of return** falls below the prevailing interest level in the community, illustrating the unfeasible of the feed project in the light of higher operating costs and lower revenue.

It is clear that the project can in this case convert the production of freshgreen leavesinto dry leaves and store them for possible use in animal feeding to raise the prices of dry leaves fromfreshgreenleaves or using dry leaves in other alternatives. As a medical aspect due to the multiple benefits of the crop, dry leaves are used in the treatment of anaemia, heart and brain diseases, nerves, cancer and diabetes, as well as in the prevention of blindness loss resulting from vitamin (A)[24,]Contained and rich in vitamin (C)[25,][7], deficiency and in the treatment of diseases of cystitis, prostate, gonorrhoea,, flora, yellow fever, rheumatism and arthritis[7],[5].

As the project has developed its future plan to establish a the leaf blower to dry the leaves, it can be used as a pharmaceutical product in view of the increasing demand for plant medicines and sanitary products as the possibility of its used in the future development of nutritional supplements that may be useful in cases of disease and thus enhance the quality of life.

Table 8: Moringa feed Farm Sensitivity Analysis Evaluation Results for the Growing Season (2021/2022)

Statement	(PBP)	ROI	PI	(NPV)	(B/C)	IRR
First scenario						
5% increase in operational costs	2.29	43.76%	4.06	71.347	1.32	50.87%
10% increase in operational costs	2.33	42.95%	3.58	63.406	1.27	43.29%
15% increase in operational costs	2.37	42.16%	3.14	55.464	1.23	36.40%
20% increase in operational costs	2.41	41.41%	2.75	47.523	1.19	30.11%
Scenario II						
5% revenue reduction	2.36	42.37%	3.66	64.558	1.30	45.03%
10% revenue reduction	2.49	40.14%	2.88	49.827	1.23	32.65%
15% revenue reduction	2.64	37.91%	2.23	35.097	1.16	22.00%
20% revenue reduction	2.90	35.68%	1.66	20.366	1.09	12.40%
Scenario III						
Increased operating costs and reduced revenues by 5%	2.41	41.57%	3.22	56.617	1.25	38.01%
Increased operating costs and reduced revenues by 10%	2.57	38.92%	2.17	33.945	1.15	20.95%
Increased operating costs and reduced revenues by 15%	2.79	35.84%	1.35	11.273	1.05	6.66%
Increased operating costs and reduced revenues by 20%	3.02	33.13%	0.68	(11.399)	0.95	0.00%

Source: Data collected and calculated from the analysis of fieldwork data from the Moringa Feed Production Farm in the New Territories ofAswanGovernorate.

2. **Sensitivity Analysis of the Moringa Seed Plantation Project, as illustrated in Table No.(9).**

1) **The Payback period criterion(PBP)** is the maximum value of approximately 3 years by increasing operating cost ratios and decreasing total revenuestogether by approximately 20%. While the criterion for a refund period alone increases costs by 20%, and the decrease in revenue by 20% is about 2 .41, 2.90 year using average cash flows.

2) **(PBP)** is the maximum value of approximately 3years under the third scenario by increasing operating cost ratios and decreasing revenue together by about 20%.While the benchmark under scenario I and II is a 20% increase in costs alone, and a 20% decrease in revenue is about 2.68, 3.21 years, using average cash flows.

3) By calculating **(PBP)**using the annual cash flows for theI, II and III scenarios, the criterion is greater than four years.

4) It is clear that despite increased operating costs, lower revenue and (increased operating costs and lower revenue combined) rates of about 5%, 10%, 15% and 20% lead to lower **(ROI),** under the three scenarios it is still the best alternative opportunity expense in the community, illustrating the project's economic feasibility.

5) (PI) showed a decrease of approximately 3.16-3.37 to increase the operating cost ratios to 20%, and between 2.56-3.22 to decrease the income ratios from 5% to 20%.The (PI) ranges from 2.31-3.15 to the impact of higher operating costs and lower revenue combined by 5% - 20%. As evidenced by the project's economic feasibility.

6) It was also shown that the revenue decline in IIscenario of around 5% - 20% results in a lower **(NPV)** for the project than the impact of increased operating cost in the same proportions as the first scenario. All values are **positive,** indicating the project's economic viability. **(NPV)**criterion was also recorded by the impact of the increased operating cost and the decrease in revenue combined for the III scenario, which amounted to approximately Pound206.17 thousandPound, meaning that the project realized the gains.

7) **(B/C)**criterion benchmark was good under the three scenarios and was lower at about 1.69 for higher operating costs and lower revenues combined by 20%, and all estimated values of larger scenarios (1) indicating project feasibility.

8) The project's (IRR) declines in the first scenario to 22.84% for higher operating costs of up to 20%.The rate for the second scenario also decreases to 17.81% for lower revenue ratios up to 20%, and the third scenario also drops to 15.17% with the effect of higher cost and lower revenue ratios together by 20%. All estimated values from the analysis are higher than the prevailing interest rate of about 12.5% and therefore represent the best expense for the alternative opportunity in the community, which means the feasibility of investing in the project in new lands.

All indicators and criteria prior to the current situation and sensitivity analysis show the feasibility of the moringa seed production project financially according to all standards.

Table 9: Moringa Seed Farm Sensitivity Analysis Evaluation Results for the Growing Season (2021/2022)

Statement	(PBP)	ROI	PI	(NPV)	(B/C)	IRR
First scenario						
5% increase in operational costs	2.60	38.49%	3.37	354.01	2.27	24.92%
10% increase in operational costs	2.63	38.09%	3.30	346.87	2.22	24.21%
15% increase in operational costs	2.65	37.71%	3.23	339.74	2.16	23.52%
20% increase in operational costs	2.68	37.33%	3.16	332.61	2.11	22.84%
Scenario II						
5% revenue reduction	2.71	36.95%	3.22	329.53	2.22	24.01%
10% revenue reduction	2.86	35.00%	3.00	297.92	2.10	21.83%
15% revenue reduction	3.02	33.06%	2.78	266.31	1.98	19.84%
20% revenue reduction	3.21	31.12%	2.56	234.70	1.87	17.81%
Scenario III						
Increased operating costs and reduced revenues by 5%	2.73	36.57%	3.15	322.40	2.16	23.30%
Increased operating costs and reduced revenues by 10%	2.96	33.75%	2.86	283.65	1.99	20.43%
Increased operating costs and reduced revenues by 15%	3.12	32.05%	2.58	244.91	1.84	17.81%
Increased operating costs and reduced revenues by 20%	3.35	29.86%	2.31	206.17	1.69	15.17%

❖ Average seed production during the lifetime of the project 609. Kg/per acre.

❖ This is not deducted from the current value of the first year (N=0) = 1 at the discount price (at the time value of cash $(1/(1 + R)^N)$.

Source: Data collected and calculated from the analysis of fieldwork data from the Moringa Seed Production Farm in the New Territories ofAswanGovernorate.

V. Criteria for economic and social evaluation:

An analysis of society and the national economy[9], so the financial cost is converted into an economic cost according to the World Bank's estimated conversion transactions where the labor force is estimated (0.67), automatic service (1.5), seed (1.05), chemical fertilizer (1.1), pesticides (1.2), while the rest of the units had an unchanged conversion factor (1).

The results in table (10) indicate that the cash return of the moringa crop for the purpose of seed production and for the purpose of feed production averaged about 128.321, 48.205 thousand pounds, while the total costs averaged about 38.895, 33.340 thousand pounds, with an average net return of about 89.426, 14.865 thousand pounds.

The results of the Economic and Social Assessment analyses showed with the same table data for moringa crop cultivation for feed and seed production that the average present value of total revenue was approximately 29.461,63.219 thousand pounds, while the present value of total costs amounted to about 22.04, 29,293 thousand pounds. The results also showed that the two projects achieved added values to society, starting from the second year of agriculture, estimated at about 25,422, 18,142 thousand pounds.

While the average value added during the project period was about 19.544, 52.956 thousand pounds. The net value added criterion was also found to have added value in society from the second year, estimated at about 22 .711, 17.698 thousand pounds, and the average net value added during the project period was about 13. 895, 39.023 thousand pounds, indicating a social surplus of about 7.417, 33.629 thousand pounds, and a marginal surplus of about 320.650, 112.291 thousand pounds.

Thesame table also shows that the invested capital productivity standard for the two projects estimated at 3.46, 3.80 LE, reflects the number of invested capital units required to add a unit of value added. Projects with lower ratios usually prefer to mean that each unit of value-added requires fewer investments. The capital intensity criterion for each unit comes from value added of about 28 .91%, 26.31% means that each 28.9, 26.3 unit of capital add one unit of valu-added, and usually favors projects with lower ratios in the sense that each unit of value-added requires fewer investments.

It is also clear that the capital intensity standard of the seed production project was found to be relatively higher than the value of the capital intensity standard of a feed production project.

Finally, the results showed that the agricultural worker's productivity criterion of the feed production project was about 781.77 LE, which is lower than the value of the standard for seed production, reaching about 2118.23 LE, which explains the extent to which labour units contribute to value- added and national income.

Table (10): Measures of economic and social assessment of the cultivation of an acre of moringa crop inAswan Province

Item	Unit	Feed Production	Seed Production
Average gross revenue	A thousand pounds	48.205	128.321
Average current value of total revenue *	A thousand pounds	29.461	63.219
Average total costs	A thousand pounds	33.340	38.895
Average present value of total costs *	A thousand pounds	22.044	29.293
Average net revenue	A thousand pounds	14.865	89.426
Value added *	A thousand pounds	19.544	52.956
Net added value *	A thousand pounds	13.895	39.023
Marginal surplus * *	A thousand pounds	320.650	112.291
Investor Capital Productivity Standard *	Pounds	3.46	3.80
Capital intensity standard for each unit of value added *	%	28.91	26.31
Agricultural Worker Productivity Standard *	Pounds	781.77	2118.23
Social Return Rate		1.31	2.43
Social surplus *	A thousand pounds	7.417	33.926
% social surplus	%	13.128	24.34

* Current values are discounted at the discount price.* * Marginal surplus = income - variable costs.
Source: Collected and calculated from the analysis of field research data of the Moringa Feed and seed Production Farm in the New Territories ofAswan Province.

Since social assessment is concerned with the project's social impact on society as a whole, it does not match the philosophy of analysis of economic assessment, which relies on measuring economic efficiency and growth without attention to social aspects. Measuring the project's social return rate, it was estimated at 1.31, 2.43, which indicates that the two projects are valid from a social point of view.

The social surplus is also estimated to be about 13.128%, 24.34%, and is defined as part of the value added that is spent in different distribution channels within the national economy such as profit that goes to shareholders, interest on borrowed capital that goes to financial institutions and taxes goes to the public treasury. A portion of the social surplus is usually used to finance public and private consumption, while the bulk of the social surplus is saved and directed to investment. Projects with a high social surplus are usually preferred because they are a source of individual consumption at present and are also an essential source of future savings for economic and social development.

Recommendations:

1. Focus on Moranga's cultivation in new lands where it can be included in the crop composition of 1.5 million acres because of its reduced water needs and salinity tolerance.
2. The possibility of changing the consumption patterns of rabbits, cows, buffalo and ruminants due to the palatability of moringa-taste animals so that they can be relied uponto contribute to reduce the gap from Egypt's summer feed crops.
3. The necessity of co-operation between Economics Research Institute and Extension Research Institute to clarify the economic feasibility and financial return from its cultivation, in addition to defining its marketing methods.
4. The State should provide the environment for investment in the Moringa crop and encourage the private sector to provide reliable seedlings of a green mind.
5. Preparing further studies at the Animal Health Research Institute to study the effects and damages that may result from feeding animals to moringa.
6. Improve marketing strategies by leveraging social networks in both marketing and extension processes to grow the crop.

Execution Mechanism:

1. Necessity for further research and studies at the Animal Health Research Institute and the Animal Production Research Institute to determine the appropriate and homeopathic ratios for replacing moringa leaves with other feed crops, the number of concentrates, as well as setting appropriate dates for giving appropriate nutrition to the animal.
2. The necessity of co-operation between the horticultural research institute, extension research institute and the National Research Center to disseminate useful and healthy new cropsthat have the potential to withstand climate changes between farmers and investors by conducting training and guidance courses on the economic importance of the crop and its farming methods and technical recommendations for achieving its highest productivity.
3. Encouraging the private sector to set up factories drying and leaf-packing plants to extract Moranga oil, thereby increasing income, providing new jobs opportunities and establishing other industries on the output of the pressing process, such as feed and fertilizer.

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