ISSN 2522-9400 **European Modern Studies Journal** Vol 7 No 1
available at www.journal-ems.com
DOI: 10.59573/emsj.7(1).2023.28

Cost-Benefit Analysis of Citrus Production in the Eastern Region of Ghana: The Case of Okumaning and Nkwantanang in the Kwaebibirem District

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Abstract. Citrus farming has not been as popular as cocoa and other traditional crops in Ghana. The University of Ghana Agricultural Research Station (UGARS) at Okumaning undertook a research into how citrus could be produced throughout the year and make the tree last longer. Why farmers cultivate citrus on small-scale basis and the impact of the results of the UGARS' research findings on the citrus industry in Ghana is the basis for this study.

Using a mixed method, the results revealed that the citrus industry has a very bright future since for every GH₵1.00 invested, a return of GH₵2.78 is obtained. Land acquisition in the study area is the challenge, coupled with the lack of credit. Farmers are unable to meet the collateral requirements of the banks and delay in loan approval also puts them off. As a result, the Adventist Development and Relief Agency (ADRA-Ghana) and the University of Ghana, Legon signed an agreement to intercrop citrus with food crops on the farm of low-income earning farmers. The adoption of the ADRA-University of Ghana's proposal by both part-time and full-time farmers in Ghana is a manifestation of the great impact the research findings of the UGARS, has on the country.

Based on the results of the study, it is recommended that citrus processing plant(s) be established to take care of the excess fruits that will arise as a result of the local supply outweighing local demand while alternative markets are sought outside the country. Also, the rigid procedure for loan application and approval, especially to farmers, should be reviewed to incorporate a little flexibility to help the farmers acquire credit to improve, expand and make their operations easier.

Key words: citrus, return on investment, small-scale, payback period, "abunu"

Introduction

Agriculture, as a career, could be very rewarding most especially when one enters into agricultural investments as a full-time business. However, it is exposed to several hazards, being dependent on the weather, which in most cases, cannot be predicted accurately, especially in places such as Ghana. An attempt to go round this myriad of uncertainty and risk involve a large amount of initial capital for investment.

Akyem Okumaning and Nkwantanang are two towns in the Kwaebibirem district of the Eastern region of Ghana, located near Kade, the district capital. They are about 134 kilometers and 127 kilometers respectively away from Accra, the national capital of Ghana. Several small-scale farmers are found in these towns and they cultivate a variety of crops among which are cassava, plantain, maize, cocoyam, citrus and cocoa. The rainfall pattern in the study is bi-modal, normally occurring between March and November with a mean of 1200 millimeters per annum. Temperatures range between 23˚C and 33˚C on the average.

Farming is the major economic activity of this area and it contributes a sizeable percentage of household income. Hitherto, most of the farmers in the study area cultivated food crops only. Moreover, apart from a few farmers who owned the land on which they cultivate

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their farms (either by outright purchase or as an inheritance), the rest are tenant farmers that had to share the proceeds with the landowners by dividing the proceeds into two equal parts usually referred to as "*abunu*". In this case, the tenant farmer and landowner share the proceeds from the farm equally. The income left for the farmer was therefore, very low. This did not make it possible for them to be able to save enough for expansion.

Citrus forms a part of the diet of many people in Ghana, supplying the much-needed natural vitamin C. Plestch (1973) classifies citrus as being made up of fruits as limes, sweet oranges, lemons and grapefruits. However, the most commonly grown citrus fruits in Ghana are limes and sweet oranges (Karikari, 1971). Karikari (1971) opines that, citrus has been grown since 1913 in Ghana but to an extent considerably below the production potentials of the country.

In May 1996, the Adventist Development and Relief Agency (ADRA-Ghana), a religious non-governmental organization signed an agreement with the University of Ghana Agricultural Research Station (UGARS) Kade, to intercrop citrus with food crops on the farms of low income, small holder farmers in the Eastern Region of Ghana. Many farmers in all parts of the Eastern region have joined this project which also provided employment for many Junior High School graduates who could not further their education by engaging them in the harvesting and loading of the fruits at maturity.

Problem Statement and Justification for the Study

Comparing the lifestyle of the people in the study area prior to the signing of the agreement between ADRA-Ghana and the UGARS and after the agreement, one could see a significant improvement. After having diversified their farms from the "unprofitable" food/cash crop production to citrus, there has been a great change as most farmers are able to sponsor their wards for higher education. This change in their standard of living calls for a closer investigation into citrus cultivation in the study area and to find out why farmers still decide to cultivate it on small-scale basis.

As the Institute of Statistical, Social and Economic Research (ISSER, 1994) asserted, the performance of the crop sector depends heavily on rainfall. However, agricultural production in Ghana is mainly rainfed. Should one be able to find an antidote to these uncertainties and risks such as unstable prices and the vagaries of the weather, one stands the chance of gaining high returns on his/her investment. If this is so, then the question is: why are farmers in the study area cultivating citrus on small-scale basis? (the size of farms are not big enough to support industrial demand – just a little above subsistence production). In addition, how much equity capital does one have to invest, in relation to total capital amidst the numerous uncertainties and risks, in order to reap positive returns on investment? And finally, what constraints to production of citrus exist in the study area.

Primarily, this study aimed at assessing the viability of the citrus industry at Okumaning and Nkwantanang in the Eastern region of Ghana by analyzing the costs involved in its cultivation as compared to the returns that accrue to it. Moreover, the socio-economic characteristics of the farmers was also analysed. Constraints that hamper the production of citrus in industrial quantities by the farmers was also analysed.

Undoubtedly, the aim of every rational investor is to maximize profits or at worst, minimize losses in the long run (Amanfo, 1989). It therefore follows theoretically, as Gittinger (1982) asserts that, unless the investor (in this case, the farmer) receives a rate of return that is equal to or higher than the opportunity cost of his/her capital, he/she would re-allocate his/her investment to other sectors where the returns to capital invested will be highest, in order to maximize profits. It may seem that decreases in prices do not discourage investors. Hence, it is worth investigating into the profitability of the citrus industry in the study area.

Methodology

A number of indicators and ratios used in project analysis were employed in the study. These included the net present value, benefit-cost ratio and internal rate of return which are recommended by international development agencies such as the World Bank, and have been used in several countries and the success of their stories tell the usefulness of these ratios and indicators. Examples of such projects are the Philippine Ilocos Irrigation System Improvement and the Upper Region Agricultural Development Project in Ghana (Squire & Van der Tak, 1995).

Analytical Framework

In the estimation of cost and returns of citrus production, as well as its profitability in this study, the discounted measures of project worth were employed. These are the net present value (NPV), internal rate of return (IRR) and the benefit-cost ratio (BCR).

NPV is the present worth of the net cash flow stream of a project at a specified discount rate (Gittinger, 1982). Alternatively, one may calculate the NPV by finding the difference between the present value of the benefit stream and the net present value of the cost stream. Symbolically, the NPV is given as:

$$NPV = \sum_{t=0}^{t=n} \frac{B_t - Ct}{(1+i)^t}$$

Where, B_t = benefit in year t

C_t = cost in year t

i = interest (discount) rate

n = number of years

If the result of the summation is positive, then this investment is worth undertaking because it has positive estimated NPV. If the NPV is negative however, the effect would be unfavourable. The NPV is therefore, used as a criterion to accept (if the NPV is positive) or reject (if the NPV is negative) a project. In the unlikely event that the NPV turns out to be exactly zero, one would be indifferent to taking the investment or not.

The internal rate of return (IRR) is the discount rate that makes the increment net benefit stream equal to zero. Thus, it is the maximum interest rate a project could pay for the use of resources if the project is to recover its investment and operating cost and still break even (Gittinger, 1982). Symbolically, the IRR is derived from the expression:

$$IRR = \sum_{t=0}^{t=n} \frac{B_t - Ct}{(1+R)^t} = 0$$

where:

R is the IRR,

B_t is the benefit in year t

C_t is the cost in year t

n is the number of years.

The IRR is a very useful tool, which the World Bank and other financial agencies internationally, use for practically all their economic and financial analysis of projects (Squire & Van der Tak, 1995). At this rate of return, it is realized that the NPV is positive when the discount rate is below the IRR but tends to be negative when the discount rate is above the IRR. Hence, it could be used to either accept or reject when the NPV becomes negative above the IRR.

The benefit-cost ratio (BCR) on the other hand, is obtained when the present value of the benefit stream of a project is divided by the present value of the cost stream at a specified discount rate.

Mathematically, it is given as:

$$BCR = \frac{\sum_{t=0}^{t=n} \frac{B_t}{(1+i)_t}}{\sum_{t=0}^{t=n} \frac{Ct}{(1+i)^t}}$$

Where the variables are as explained in the NPV and IRR above.

In addition, the BCR measures the performance of the project, that is, the value created per cedi invested. The higher the ratio, the greater the benefit created by investing in the project. In all these, the cost includes all incurred expenditure in the project while all revenue or returns that accrue to it is termed as benefit.

These indicators help to assess the viability of the citrus industry in Ghana, as the discount rate will be compared with the IRR to ascertain whether or not it is worthwhile investing in the industry. They also give an overview of the cost structure of the industry, as the total cost is the sum of all costs incurred before, during and after the investment.

In identifying the sources of funds for financing the operations of the farmers and also the constraints to production of citrus in the study area, a structured questionnaire and personal interview of the farmers is used. Then, the frequency distribution tables will be used to analyse and rank the sources of funds and constraints.

Sources of Data

A field study was undertaken to identify the citrus farmers at three (3) locations namely Okumaning township, Nkwantanang and the UGARS, Kade, in the Eastern Region of the republic of Ghana. In all, 30 out of 80 farmers were randomly sampled and were interviewed. Then, a structured questionnaire and personal interview of the farmers were used to elicit data on their socio-economic characteristics such as their ages, sex etc. Then, the frequency distribution tables were applied to analyse them in relation to their operations. In order to ascertain the credit needs of the farmers, a structured questionnaire was used randomly to get the needed information from them.

Under a trading system in which policy intervention were reduced so that producers had incentives to respond directly to the world price, producers are likely to base their production plan on anticipated growth in consumption and on changing market conditions. How farmers are able to source for funds for their operations was obtained from the questionnaire. Furthermore, the reason for the low cultivation of citrus (i.e. constraints) in the study area are addressed through the questionnaire. In addition, the effect on the individual farmer and the economy as a whole should there be the need for expansion in the industry is also dealt with from the responses to the questionnaire.

Personal interviews with the farmers and credit institutions were used to back up the structured questionnaire administered. This was done because the study area is beset with too many illiterate farmers who do not have any record on their farms hence this affected some responses to the questionnaire.

Results and Discussion

The study revealed that, several socio-economic factors affect farmers' productivity. These include their ages, family size, level of education as well as the level of interaction with the Agricultural Extension Officers (AEOs). The study revealed that 90% of the farmers were male while 10% were females. This is indicative of the fact that, empowerment of women to be entrepreneurs is somehow centered in the cities and towns but not in the real villages as the study area. The study also revealed that 70% of the farmers interviewed were illiterates, 23% had up to elementary education {i.e. up to the Middle School Leaving Certificate (MSLC)} while the remainder had secondary education. It was realized that the farms of those who had formal education are better cared for than those who had no or little education. This means that, those with formal education are able to read and apply recommendations given by the AEOs on their farms. The study further revealed that, about 66.7% of the respondents were below 40 years signifying a majority of the farmers are youth.

The family size of the farmer also influences the farmer's performance since he/she has to satisfy the consumption needs of the family before any excess capital could be invested. As a result, though farmers with large family size have large farms, they were unable to care for the farms as expected, and this had made weeds take over portions of the farm and this reduces productivity. The average family size, according to the study was 8. The average farm size was between 2 and 4 acres per family. The study showed that only 17% farmers cultivated more than 4 acres. However, most of the farms (about 67%) were in their peak period – more than 8 years old. Even though the Ministry for Food and Agriculture had extension officers in the district, it was realized that, majority of the farmers had no interaction with them (AEOs). While 13.33% of the respondents went to see the AEOs voluntarily for advice, as much as 60% never had any encounter with them and 26.67% saw the AEOs occasionally.

Cash Flow Projections

Majority of the famers in the study area are tenant farmers. Therefore, in establishing the farms, the lands on which they cultivated the citrus were leased for a minimum of 20 years, assumed to be the project life of the citrus, after which the land will revert to owner(s). Land in the study area was measured with a rope, which, in most cases, is a little longer the hectare. Hence, for the purpose of this study, that was adopted as the standard. It was also revealed that, there were no hard and fast rules as to the number of hours that is used in doing any activity such as weeding. Hence, after charging for the farmer, the labourers used a maximum of six hours to do the job. To make it realistic, it was standardized to 8 hours. A virgin forest was used for the estimation of the cost of establishment per hectare per year.

The establishment cost per hectare of citrus farm in the study area is given thus: all amounts are in Ghana Cedis (GH₵).

Table 1: Establishment cost

ITEM	AMOUNT (GH₵)
Rent for one hectare	350.00
Land clearing (70 man days @ GH₵50/man day)	3,500.00
Preparing land for planting	860.00
Lining and pegging	150.00
Holing	260.00
Seedlings (625 seedlings @ GH₵5.00/seedling)	3,125.00
Planting	125.00
Contingency (5%)	418.50
Total	8,788.50

Annual Cost Estimates

Weeding under the farm is done thrice in a year. However, in the first year, it will be done twice since the preparation of the land for planting takes place in the same year. This will be done until the 8th year, by which time the farm would have formed canopies that will prevent too much weeds from growing under the plantation. After the 8th year, the weeding will be done twice in a year. The cost of weeding a hectare is GH₵800, which is assumed to be at constant prices. The application of insecticides costs GH₵536 per annum. It was realized that, farmers in the study area used pest control only in the first two years. Since this study is about what prevails there, it is assumed that the use of insecticides is done in the first two years.

Cost of harvesting is assumed to vary with the level of output since more labour will be required for harvesting and collection of the fruits. The study showed that, harvesting is done in boxes with each box comprising 10,000 fruits which is approximately 2.5tonnes which costs GH₵4,000. Estimated cost of weeding, pest control and harvesting are presented in Table 2 below.

Table 2: Estimated Annual Cost of Weeding, Pest Control and Harvesting at Constant Prices

Year	Weeding	Insecticides & Application	Harvesting*	Total Cost
0	600	536	-	1,136.00
1	800	536	-	1,336.00
2	800	-	-	800.00
3	800	-	218.75	1,018.75
4	800	-	525.00	1,325.00
5	800	-	918.75	1,718.75
6	800	-	1,268.75	2,068.75
7	800	-	1,531.25	2,331.25
8	800	-	1,881.25	2,481.25
9	800	-	2,187.50	2,787.50
10-18	800	-	2,406.25	3,006.25
19	600	-	2,275.00	2,875.00
20	600	-	2,165,63	2,765.63

Source: Field data

Revenue Estimates

The average yield per tree (number of fruits) was estimated as against the age of the tree. Prices at which the fruits were sold varies. As stated early on, the fruits are sold in boxes comprising 10,000 fruits weighing about 2.5 tons on the average. An analysis of the selling price for the various respondents indicated that, on the average, about 70% of the output were sold at GH₵3,500 while 30% were sold for GH₵4,000, depending on the size (weight) and scarcity (availability) of the fruits. On the basis of the relevant data as mentioned above, the revenue estimates were made as presented in Table 3 below.

Table 3: Estimation of Annual Production and Gross Revenue Per Hectare of Citrus Farm

Year	Yield/tree/season (fruits)	Yield/tree/year (fruits)	Total Annual production (fruits)	Total Revenue at GH₵2800/100 fruits
0	-	-	-	-
1	-	-	-	-
2	-	-	-	-
3	50	100	62,500.00	1,750.00
4	120	240	150,000.00	4,200.00
5	210	420	262,500.00	7,350.00
6	290	580	362,500.00	10,250.00
7	350	700	437,500.00	12,250.00
8	430	860	537,500.00	15,050.00
9	500	1,000	635,000.00	17,500.00
10-18	550	1,100	687,500.00	19,250.00
19	520	1,040	650,000.00	18,200.00
20	495	990	618,750.00	17,325.00

Source: Field data

Discount Rate

It was realized from the study that most of the citrus farmers took loans from local credit unions of which they were members. An example is the UGARS Workers Credit Union, Kade. The results indicated that none of the farmers took any loan/credit facility from any bank for their operations. This is partly due to the delay in loan approval and also the farmers' inability to meet collateral requirements of the banks. In order to reflect current rate of interest, a discounted rate of 14%, which is the average of current market rate is used for the calculation of the discounted measures of project analysis for the purpose of this study. This is because, the study showed that 60% of the resources used for the farmers' cultivation were loans from the Credit Unions while equity was 40%. Lastly, unless otherwise stated, all costs and revenue items are assumed to be at constant prices.

Financial Cash Flow and Viability Position

The summary of the various calculations above is given in the financial cash flow projections in Table 4.

Table 4: Summary of Cash Flow Projections at 2019 Constant Prices

Year	Fixed Cost (GH₵)	Annual Cost (GH₵)	Total Cost (GH₵)	Total Revenue (GH₵)	Net Revenue (GH₵)	Discount Rate at 14%	Present Value at 14%
0	8,788.59	700.00	9,488.59	-	(9,488.59)	1	(9488.59)
1	-	900.00	900.00	-	(900.00)	0.8772	(789.47)
2	-	600.00	600.00	-	(600.00)	0.7695	(461.68)
3	-	1,018.75	1,018.75	1,750.00	731.25	0.6750	493.57
4	-	1,125.00	1,125.00	4,200.00	3,075.00	0.5921	1,820.65
5	-	1,518.75	1,518.75	7,350.00	5,831.25	0.5192	3,028.57
6	-	1,868.75	1,868.75	10,250.00	8,381.25	0.4556	3,818.38
7	-	2,131.25	2,131.25	12,250.00	10,118.75	0.3996	4,043.83
8	-	2,468.25	2,468.25	15,050.00	12,581.75	0.3506	4,410.65
9	-	2,787.50	2,787.50	17,500.00	14,712.50	0.3075	4,524.21

10-18	-	3,006.25	3,006.25	19,250.00	16,243.75	1.5210	4,381.65
19	-	2,875.00	2,875.00	18,200.00	15,325.00	0.0828	1,271.18
20	-	2,765.63	2,765.63	17,325.00	14,559.37	0.0728	1,059.36

Source: Summary of Tables 1 to 3

From Table 4, the NPV is GH₵18,112.32 at 14% discount rate. This is the difference between the investment's market value and its cost. Since this value is positive, it implies that the project is financially viable. Thus, there would not be any losses if one invests in the citrus project. Ross and Westerfield (1995) assert that the effect on invested capital is always positive when the NPV is positive.

It is also realized from the table that the IRR, which makes the NPV of an incremental net benefit stream equal to zero is 32%. Ross and Westerfield (1995) state that, an investment should be accepted, and is worthwhile when the IRR exceeds the required rate of interest. It would be realized that when the discount rate is 32%, which is the IRR, the NPV is positive, a confirmation of the acceptability and financial viability of the citrus project. The implication is that, the maximum interest rate at which this project could pay for the use of resources in order to recover its initial investment and operating costs and, still break-even is 32% as seen in Table 4 above. It should however, be noted that above or beyond this rate, one is likely to make losses if he/she borrows to invest in the project.

The BCR which is also known as profitability index measures the value created per Ghana Cedi invested. This is given by dividing the present value of an investment's benefit/inflow by the present value of its cost. From Table 4,

$$BCR = \frac{\text{Present value of benefit stream}}{\text{Present value of cost stream}}$$

Thus,

$$BCR = \frac{90{,}571.03}{32{,}553.09} = 2.78$$

This means that, for every one Ghana cedi that is invested (cost), a benefit of GH₵2.78 is received. This implies that the return from citrus farming in the Eastern region is lucrative and the industry could be used to generate more foreign exchange for the nation.

Conclusion

The study revealed that most of the farmers used their personal savings for the operations of their farms. However, about 60% took soft loans from Credit Unions to which they belong. Most of the farmers are tenant farmers who share their proceeds with their landowners. Land is not easy to come by because most of the people are getting involved due to the support from ADRA-Ghana. Thus, land is not available for expansion if one wishes to do so.

The viability of the citrus cannot be overemphasized considering the fact that it has reduced poverty levels in households in the study area. This can be seen from the farmers leaving their hitherto mud houses to building cement block houses for themselves and then being able to sponsor their wards in higher education.

Since the return on investment is positive as the study revealed, there is a greater potential for citrus industry if the government and other stakeholders will take keen interest in promoting it and encourage the youth to get involved since there is wealth in the soil.

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