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YAM MINISETT PROCESSING MACHINERY, VIABILITY ANALYSIS

Igbo J. Chidiebere[*1], Kadurumba H. Chukwuma[2] , Abam I. Fidelis[2]

[1]*Engineering Research Unit, National Root Crops Research Institute, Umudike, Nigeria*
[2]*Department of Mechanical Engineering, Michael Okpara University of Agriculture, Umudike, Nigeria*

Abstract: Developed Yam minisett processing machine was evaluated in this study and the economic viability was determined using benefit – cost methodology so as obtain the investment cost and to encourage its wide acceptance and adoption to control food security. Benefit –cost ratio, payback period, net present value nd account rate of return which constitute the economic parameters of the machine evaluated subject to prevailing economic indicators of materials in Abia State of Nigeria in 2021. The annual return rate of 64.90% outweighed banks maximum fixed deposits return of 16% and prime lending rate of 29% in Nigeria, its payback period of 1.85years is less than its 10 years useful life, the machine cost- benefit ratio of 1.75 and, net present value of ₦105,749,969.20 are more than one which was worthy for investment. These economic indicators setting showed positive credit recovering prospects of this innovation.

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Key words*: Yam minisett processing, Viability analysis, Food security, Benefit – cost methodology.*

INTRODUCTION

Economic viability points such as net present value, payback period, benefit cost ratio and accounting rates of returns are individually used to ascertain the economic efficiency of systems, the integrated methodology of these decision pointers are called benefit – cost analysis and are often used in new machinery assessment because of its high prediction accuracy, [1].

[*]Corresponding Author. E-mail: igbojoejoe@gmail.com
ORCID: 0000-0003-2906-4924; 0009-0009-0640-4659

All the potential cost and revenues that may be generated prior to actual implementation of investment decision in order to avoid the risk of going into an unprofitable investment and wasting valuable time and money using Cost- benefit analysis tool [2]. Using the cost–benefit analysis as a tool, it involves identification, categorization, projection, monetization, computing and comparison of present values of cost and benefits over the lifespan of an investment [3]. Using benefit-cost analysis, it indicates that an investment is worthy when its projected potential benefits outweigh its costs; when the rate of return exceeds the required minimum rate, its payback will be less than its salvage period and its net present value exceeds zero [1].

The costs and benefits of expenditure on engineering education from the viewpoints of students, the government and industry was researched by [4]. In a modern society the intellectual property generated by engineers is the drive of the economy. The intellectual property leads to production of the products required for a high standard of living. The trade of these products enables other occupations to flourish. Engineers may be obtained by training a nation's youth or by importing those trained elsewhere. The findings are that all parties benefit significantly from expenditure on engineering education, and that engineering education provides benefits to the government and the nation exceeding those derived from expenditure on education in other disciplines. The factors considered in the analysis were students, government, and industry, with society in general being linked to the gains to the government.

The objective of the research work done by [5], was to evaluate, on the basis of theoretical aspects of the project cost-benefit analysis (CBA) method, the efficiency of methods applied in the construction and infrastructure development projects currently taking place in Latvia. At the end of the research, it was found that application of project management principles to improve efficiency of the administration of allocated financing and to perform compliant project initialization, securing efficient realization of construction and infrastructure development projects that is compliant with the project management principles and fosters sustainable business.

A resilient and dynamic cost benefit analysis (CBA) framework for road construction projects was developed by [6]. The research systematically reviewed academic quality ensured, selected Norwegian construction projects and rigorous peer-reviewed articles. The research identified some key attributes (e.g. resiliency, dynamics, system thinking) that the traditional CBA lacks and the framework developed integrates these attributes to fill the gap. The research has theoretical implication from the methodological improvement perspective. The practical implication was to avoid inefficiencies and obtain better regulation in government policies.

It was stated by [7], on his research that a cost-benefit analysis (CBA) methodology is presented to enable contractors to assess the true cost of accidents prevention and the associated benefits of accident prevention as part of pre- and post-contract project evaluation. The research investigated the cost and benefit of accident prevention, with a view to drawing attention to the economic consequences of effective/ineffective management of health and safety by contractors. A quantitative research methodology was employed in investigating these costs and benefits within the UK construction industry. The results of ratio analyses indicate that the benefits of accident prevention far outweigh the costs of accident prevention by a ratio of approximately 3:1. Further, the results demonstrated that for every £1 spent on accident prevention, contractors gained £3 as benefits.

The results also show that small contractors spend relatively higher proportions of their turnover on accident prevention than medium- and large-sized contractors and that small- and medium-sized contractors gain relatively higher proportions of their turnover, in total, as benefits of accident prevention than large contractors. It is concluded that the CBA method can provide a guide to contractor's decision making in regard to accident prevention. When acted upon, the method has the potential to contribute to a reduction in costs.

Safety issues in the construction site with the base of Cost Benefit Analysis was researched by [8] . Their work reviewed the rate of accidents in the construction industry and presents a model predicting CBA of accident prevention on construction projects. A quantitative method approach was used to collect data from health and safety managers in the construction industry for the survey. A total of 29 companies were selected for questionnaire survey. A Ratio Analysis was adopted to calculate the relationship between the turnover and cost/benefit of the companies and Correlation Analysis was used to find the correlation coefficient for developing CBA model. A simple linear regression model was adopted to identify the effect of total costs of accident prevention on benefits of accident prevention. The result revealed that costs of accident prevention are significantly associated with benefits of accident prevention.

Profitability of a gari processing machine in Ondo state was revealed by [9], while [10], confirmed viability of small – scale palm oil processing in River State with this procedure. [11], showed that the novel palm nut-pulp machine is profitable when compared to the existing manual method of processing by the use of cost benefit analysis. [12] showed a cost benefit ratio of more than one garri produced when cost and returns of cassava production in Ekiti state were analyzed. Since is advisable for investors to be convinced of the profitability and wide acceptance of novel yam minisett processing machine before investing. From the review, the established minisett technology was not adopted by famers because of drudgery and risk of inflicting injuries thus mechanized yam minisett technology by the design and fabrication of yam minisett production machine, cost-benefit to determine its potential profitability in investing

MATERIAL AND METHODS

The yam minisett processing machine was assessed for economic viability in this study with multi – criteria cost – benefit analysis measure. This involved computation and comparison of its payback period, accounting rate of return, net present value and benefit cost ratio using the prevailing economic indicators which is the market prices of materials in Abia state of Nigeria between January and December, 2021. The decision criteria applied include that the payback period of this machine must be less than its assumed useful life of five years, thus five years business plan was used. Its net present value and benefit cost ratio must be greater than zero and one respectively. In addition, the investment’s rate of return must be greater than the upper limits of Nigerian banks lending and fixed deposit interest rates in order to justify its possible funding from personal savings and bank credits [11].

Records showed the benchmark business registration cost, interest rate, corporate income tax rate for Nigeria companies (with more than one million Naira turnover) as N25,000, 14% and 30% respectively within this study period. ([13], [14]).

The fixed deposit interest rate of Nigeria bank as at December 31, 2021 fall between 7.09 to 16% while their prime lending rates for agriculture or manufacturing range from 7 to 29% [13]. The maximum annual rent of required space for this business is N150,000 while N30,000 constitute Nigeria minimum wage per month during this investigation. Five (5) working days per week of 8 hours per day with one hour break per day was also applied. The average unit cost of seed yam and electric energy bulb used during this period were N254.3/kg and 36.150 per kwh respectively while the mini sett andyam peels sale for N367/kg and N 65/kg respectively. The payback period (Pb), accounting rate of return (ARR), net present value (NPV) and benefit - cost ratio (BCR) of the yam minisett processing machine were computed from its financial data collected. The optimal performance parameters are also determined in this study using the following relations in equation (1), (2), (5) and (6) given by [3];

$$P_b = \frac{C_i}{Bn} \quad (1)$$

$$\frac{33{,}739{,}426.24}{18{,}280{,}661.89} = 1.85$$

The cash inflow at year t is given by the total revenue at year t less the total expenses for that year.

$$ARR = \frac{Bn}{C_i} \quad (2)$$

ie $\frac{18{,}280{,}661.89}{33{,}739{,}426.24} = 0.54181$

$$NPV = \sum_{t=1}^{n} \frac{B_{nt}}{(1+r_i)^t} - C_i \quad (3)$$

Also,

$$BCR = \frac{PVB}{PVC} \quad (4)$$

ie $\frac{399{,}383{,}204.19}{228{,}480{,}098.93} = 1.75$

similarly,

$$PVC = \sum_{0}^{t} \frac{C_i}{(1+r_i)^t} \quad (5)3.41)$$

and

$$PVB = \sum_{0}^{t} \frac{B_n}{(1+r_i)^t} \quad (6)3.42)$$

Where:

Ci = initial investment cost
Bn = average annual net benefit (cash inflow)
Bnt = net cash inflow at time, t
PVC = present values of costs
PVB = present value benefits
Pb = Payback period
ARR = Account rate of return
NPV = Net present value
BCR = Benefit cost ratio
ri = Rate of Return

RESULTS AND DISCUSSION

The unit cost of fabrication and installation of the yam minisett cutting machine was determined as two hundred and forty-three thousand, five hundred naira (₦243,500) only, while thirty-three million, seven hundred and thirty-nine thousand, four hundred and twenty-six naira, twenty-four kobo (N33,739,426.24) only constitutes its associated the initial investment cost (Table 1). This table also showed that this investment goes with a net annual profit (cash inflow) of eighteen million, six hundred and ten thousand, ninety-two naira, fourteen kobo (N18,610,092.14) only and a payback period of 1 years Eight months (1.85 years). Thus, cutting yam mini sett with this machine is worthy since its payback period is less than its salvage period of ten years. In addition, its benefit-cost ratio shown in Table 2 is 1.75 which implies a benefit of ₦1.75 for every ₦1 spent is also encouraging. Positive investment potential of this yam minisett cutting machine is also very obvious from Table 3 which showed that its annual rate of return as 64.90% and its net present value as one hundred and five million, seven hundred and forty-nine thousand, nine hundred and sixty-nine naira, twenty kobo (₦105,749,969.20) only. Positive net present value (> 0) is desirable of any worthy investment while 64.90% annual return of this machine is encouraging because it outweighed banks maximum fixed deposits return of 16% and prime lending rate of 29% in Nigeria. These indicated positive prospect of recovering credit used for funding this investment. Hence, advancing the yam minisett processing sector with this machine is encouraged.

Table 1. Analysis of Initial Investment cost and payback period of yam minisett processing machine

Description	Expenditure (₦)	Revenues (₦)
FIXED COSTS		
Machine Fabrication/Installation Cost	218,500.00	
Business Registration Cost	25,000.00	
SALVAGE VALUE OF MACHINE		
SUB-T0TAL	*243,500.00*	
ANNUAL RECURRENT EXPENDITURE		
Yam cost	28,860,000.00	
Electric energy cost	539,776.24	
Water cost	1,620,000.00	
Maintenance cost	584,150.00	
transportation cost	1,040,000.00	
Wage	632,000.00	
Rent	2200,000.00	
SUB-TOTAL	*33,495,926.24*	
INITIAL INVESTMENT COST	33,739,426.24	

Contin. Table 1.		
ANNUAL RECURRENT REVENUE		
Sales from Yam minisett		56,523,210.96
Yam Peels		3,244,105.55
SUB-T0TAL		59,767,316.*51*
GROSS ANNUAL INCOME		26,271,390.27
LESS FIXED COST RECOVERY	156,160.00	
NET INCOME		26,115,230.27
LESS 30% TAX	7,834,569.081	
PROFIT		18,280,661.89
PAYBACK PERIOD	1.85	

Table 2: Analysis of benefit-cost ratio of yam minisett cutting machine

Period (Years)	PVC (₦)	PVB (₦)
0	33,739,426.24	58,976,517.07
1	30,264,265.34	52,901,935.81
2	27,147,046.01	47,453,036.43
3	24,350,900.27	42,565,373.67
4	21,842,757.54	38,181,140.18
5	19,592,953.49	34,248,482.70
6	17,574,879.28	30,720,888.98
7	15,764,666.71	27,556,637.41
8	14,140,906.04	24,718,303.76
9	12,684,392.72	22,172,318.47
10	11,377,900.29	19,888,569.71
Total	228,480,093.93	399,383,204.19
	BENEFIT-COST RATIO	1.75

Table 3. Analysis of annual rate of return and net present value of yam minisetting cutting machine

Period (Years)	1	2	3	4	5	6	7	8	9	10	Average
Annual Income (₦)	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.91	26,742,005.9	26,742,005.91	26,742,005.91
Discount Factor at 14%	0.877192982	0.769467528	0.674971516	0.592080277	0.519368664	0.455586548	0.399637323	0.350559055	0.307507943	0.26974381	
Present Value of Income (₦)	23,457,899.92	20,577,105.19	18,050,092.28	15,833,414.28	13,888,959.89	12,183,298.15	10,687,103.64	9,374,652.32	8,223,379.23	7,213,490.55	13,948,939.54
Depreciation (₦)	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00	156,160.00
Net Income After Depreciation (₦)	23,301,739.92	20,420,945.19	17,893,932.28	15,677,254.28	13,732,799.89	12,027,138.15	10,530,943.64	9,218,492.32	8,067,219.23	7,057,330.55	13,792,779.54
Taxes at 30%	6,990,521.98	6,126,283.56	5,368,179.68	4,703,176.28	4,119,839.97	3,608,141.45	3,159,283.09	2,765,547.70	2,420,165.77	2,117,199.17	4,137,833.86
Net Income After Taxes (₦)	16,311,217.94	14,294,661.64	12,525,752.59	10,974,077.99	9,612,959.92	8,418,996.71	7,371,660.55	6,452,944.62	5,647,053.46	4,940,131.38	9,654,945.68
Initial Value of Investment (₦)	33,739,426.24	33,583,266.24	33,427,106.24	33,270,946.24	33,114,786.24	32,958,626.24	32,802,466.24	32,646,306.24	32,490,146.2	32,333,986.24	
Final Value of Investment (₦)	33,114,786.24	32,958,626.24	32,802,466.24	32,646,306.24	32,490,146.24	32,333,986.24	32,177,826.24	32,021,666.24	31,865,506.2	31,709,346.24	
Average (₦)	18,201,528.78	17,206,561.64	16,329,521.77	15,555,926.87	14,873,073.18	14,269,817.03	13,736,383.30	13,264,197.30	12,845,737.3	12,474,405.59	14,875,715.28
ARR (%)			64.90								
NPV (₦)			105,749,969.20								

CONCLUSIONS

The developed yam minisett processing machine is economically viable because its annual return rate of 64.90% outweighed banks maximum fixed deposits return of 16% and prime lending rate of 29% in Nigeria. Also its payback of 1.85years is far less than its 10 years useful life while its respective benefit-cost ratio and net present value of 1.75 and ₦105,749,969.20 are more than one expected of worthy investment. These economic indicators setting imply positive credit recovering prospect of this innovation. Hence, general adoption of this novel yam minisett processing machine is recommended because it reduced drudgery and food losses and improves food security

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MINISET MAŠINE ZA PRERADU ZRNA YAM, ANALIZA ODRŽIVOSTI

Igbo J. Chidiebere[1], Kadurumba H. Chukwuma[2], Abam I. Fidelis[2]

[1]*Engineering Research Unit, National Root Crops Research Institute, Umudike, Nigeria*
[2]*Department of Mechanical Engineering, Michael Okpara University of Agriculture, Umudike, Nigeria*

Apstrakt: Razvijena miniset procesna mašina za preradu zrna kulture Yam procenjena je u ovoj studiji. Ekonomska isplativost je određena korišćenjem metodologije koristi – troškovi, kako bi se dobio trošak investicije i podstaklo široko prihvatanje i usvajanje mašine u kontroli bezbednosti proizvodnje hrane.

Odnos koristi i troškova, period vraćanja, netto sadašnja vrednost i stopa prinosa koji čine ekonomske parametre mašine procenjene su u zavisnosti od preovlađujućih ekonomskih pokazatelja materijala u državi Abija u Nigeriji u 2021. Godišnja stopa povrata sredstava od 64,90% nadmašila je određeni maksimum banaka.
Povraćaj fiksnih depozita od 16% i primarna kreditna stopa od 29% u Nigeriji, njen period otplate od 1,85 godina je kraći od korisnog veka mašine, od 10 godina.
Odnos troškova i koristi mašine od 1,75 i netto sadašnja vrednost od 105.749.969,20 ₦ su više od onog koji je bio vrednost ulaganja.
Ovo predstavljanje ekonomskih pokazatelja pokazalo je pozitivne izglede za kreditni oporavak ove inovacije.

Ključne reči: *Yam miniset prerada, analiza održivosti, bezbednost hrane, metodologija koristi – trošak.*

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