Original Research Article

INVESTMENT ANALYSIS OF MEDIUM SCALE PRIVATE FOREST PLANTATION DEVELOPMENT IN OGUN STATE

ABSTRACT

Forest plantation development has the capacity of increasing wood supply and stemming the pressure on natural forest in Nigeria. However, forest managed by public institution has not been sustainably managed due to the rate of exploitation and inadequate funding of projects. Hence, this paper examines private investment in forest plantation development with a view to encourage and alert potential private investors on feasibility and benefits of forest plantation development. Measures such Net Present Value (NPV), Benefit Cost Ratio (BCR), Internal Rate of Return (IRR), Annual Equivalent Value (AEV), Land Expected Value (LEV), Return on Investment (ROI) and Discounted Payback Period (DPBP) were used to analyse the cash flow statement of the investment.

The study revealed that small scale *Tectona grandis* plantation of 0.4ha with 12 year rotation had NPV of ₦1,096,118.00, BCR of 2.62, IRR of 35.30%, AEV of ₦208,262.42ha^{-1}, LEV of ₦1,608,350.84ha^{-1}, ROI of 162% and DPBP of 5.6 years. The results showed that investment in small scale forest plantation development is profitable going by the economic returns indices. It is recommended that private forest plantation development should incorporate multiple land use systems in order to increase economic returns and reduce the payback period.

Keywords: Private investment, Investment analysis, Financial returns, Cashflow, Sustainable forest development

1. INTRODUCTION

Forest plantation can serve as a viable alternative of wood production especially as an important raw material source for forest industries in Nigeria. According to [1], the global industrial plantations have significant growth potentials especially in terms of areas in the coming decades and the total volume of timber supplied from such plantations is also likely to grow. The report of [2] confirmed that forest plantations satisfy about one-third of the world's industrial roundwood demand and large areas of exotic and indigenous tree species were planted. However, in Nigeria there has been crude overexploitation and depletion of the natural forests over the past years and many efforts at sustainable forest development as failed.

In Nigeria, large scale reforestation and afforestation was established by government with assisted loans from foreign banks (World Bank and African Development Bank) and was expected to be a successful solution for issues with the timber supply and trade; nonetheless, history reveals that after the end of the foreign financial assistance in 1996, the forestry sector in Nigeria became largely dependent on public funding. Unfortunately, public funding of forest projects and programmes in Nigeria has been inadequate and untimely at both Federal and State government levels [3]. Furthermore, the established forest plantations had been scandalously exploited with little or no tree replacement. Hence, there is need to promote private investment in forest plantation development so that timber production will increase and meet the demand of the nation.

Private investment in forest plantation has ~~a lot of~~ great potential to rescue the forestry sector and in turn contribute to sustainable forestry development in Nigeria. Like all investments, forestry involves costs and revenues. Many private forest plantation owners consider their forest to be an investment [4] and the main objective of investment is to make profit. However, many private forest plantation owners do not fully understand the basic ingredients that make up a forestry investment. According to [5] investments in forestry include the costs of creating, managing, and conserving forest resources, and establishing facilities for the production and marketing of forest products and services. Therefore, it is important that private forest plantation owners to understand the relevance of cash flow and understand the concept of investment analysis in order to determine the profitability and acceptability of their investment.

Researchers have assessed, analysed financial criteria of forest plantation development and have documented that investment in forest plantation is profitable [6, 7, 8]. However, in Nigeria, there is no or little systematic research on investment analysis and information on incurred cash flows are limited due to poor record keeping system. This study therefore assesses the investment analysis of small forest plantation in Ogun State, Nigeria using financial indicators to reveal the feasibility of the investment.

2. METHODOLOGY

2.1 Study Area

The total land area of Ogun State is 16,980.55km^2. In the State, forest reserves occupy about 15.9% of the land area (273,162ha). The projected population density was 4,412,299 in 2011 [9]. It has a total annual rainfall of over 1500mm and average temperature ranges between 21.8^{0}C to 33.2^{0}C throughout the year. The climate is tropical in nature and characterized by wet and dry seasons. About 10% of the forest reserve (27,740ha) has been converted to forest plantations and this comprises 18% of total forest plantations in Nigeria [10].

2.2 Location of the Plantation

The forest plantation covers a land area of one acre, located in Ijari, Ijebu North East Local Government Area, Ogun State.

2.3 Analytical Procedure

Analysis was carried out by critically assessing the cost and benefits associated with private forest plantation development in the study area. Major elements examined include the Net Present Value (NPV), Benefit Cost Ratio (BCR), Internal Rate of Return (IRR), Annual Equivalent Value (AEV), Land Expectation Value (LEV), Return on Investment (ROI), and Pay Back Period (PBP) of the investment. Hence, profitability of forest plantation investment was known using investment formulas to determine if the investment is profitable, economically efficient and socially acceptable.

2.4 Specification of Financial Analysis

The Net Present Value (NPV)

NPV converts a series of periodic income flows to a single number that can be used to compare mutually exclusive investment alternatives over the same investment horizon at a given discount rate (cost of capital) [11]. NPV is essentially the difference between the sum of discounted benefit and the sum of the discounted cost. For single investment decisions, positive NPVs indicate that the project is feasible [5]. The project with the highest positive NPV is usually considered most feasible and recommended. In the economic sense, it is the NPV that gives an indication of the investment activity to satisfy the given rate of discount (interest on capital) and still yields surplus income [12].

NPV can be written in equation form as:

$$NPV = \sum_{t=0}^{t=n} \frac{R_t}{(1+r)^t} - \sum_{t=0}^{t=n} \frac{C_t}{(1+r)^t} \ldots\ldots\ldots\ldots\ldots Eqn.1$$

Where

NPV = Net Present Value

R_t = revenues in each year n,

C_t = costs in each year n,

r = discount rate,

n = an index for years and

t = number of years of discounting.

Benefit Cost Ratio

The benefit cost ratio is useful in allocating a fixed sum of money between different investment alternatives. The benefit cost ratio is used to compare total discounted benefits with total discounted costs [5]. If the benefit cost ratio for an investment project is one or greater, the project is feasible and acceptable. The criterion can be written in an equation form as

$$B/C = \frac{\sum_{t=0}^{t=n} \frac{Bt}{(1+r)^t}}{\sum_{t=0}^{t=n} \frac{Ct}{(1+r)^t}} \ldots\ldots\ldots\ldots\ldots\ldots Eqn\ ..2$$

Bt = Benefits (revenue) in each project year

Ct = Costs in each project year

n = Duration of the project in years

r = Discount rate

t = Number of years of discounting

Internal Rate of Return (IRR)

This is the discount rate at which net present value of the project equals zero (NPV = 0). The Internal Rate of Return (IRR) is also defined as the discount rate that makes the present value of project revenues equal the present value of project costs [11]. For individual investments, the IRR is usually compared to any alternative rate of return [5]. It is often times referred to in forestry as financial yield or economic rate of returns. The IRR is widely used and widely preferred because it is a better reflection of the productivity of capital in an investment [8]

It can be expressed as follows:

$$IRR = \sum_{t=0}^{t=n} \frac{R_t}{(1+r)^t} - \sum_{t=0}^{t=n} \frac{C_t}{(1+r)^t} = 0 ...... Eqn.3$$

IRR can be obtained either by calculation or by iterations which involve the use of different discount rates by trial and error. Two interest rates, one at which the NPV is positive, and the other one at which NPV is negative, need to be selected to calculate IRR. The discount rate between the two NPV which is equal to zero is the IRR.

IRR can be approximated by using the following formula:

IRR = Discount rate resulting in the last positive NPV

$$+\left[Difference\ between\ the\ two\ discount\ rates\ X\ \frac{positive\ NPV}{increamental\ NPV}\right] .... \text{Eqn 4}$$

Annual Equivalent Value

AEV is useful for comparison to other investments that have an annual return, such as agricultural crops. Annual equivalent value is an indicator that expresses NPV in annual equivalents distributed equally over the years of the lifespan of the investment. Since AEV is calculated based on NPV, it is positive when NPV is positive and negative when NPV is negative. Annual equivalent value is useful in an agroforestry context because it allows for comparing alternatives on an annual basis, which is particularly helpful when comparing long-term tree investment with annual agricultural crop production [4]. The formula for calculating AEV is as follows:

$$\text{AEV} = \text{NPV}\left[\frac{r(1+r)^t}{(1+r)^t - 1}\right] .... \text{Eqn 5}$$

Land Expectation Value

Land Expectation Value (LEV) is a financial tool used as an estimate of the value of a tract of land for growing timber and when calculating LEV the land cost is not included [13]. Thus, the LEV can also be used to establish the value of a specific land parcel based on costs and revenues associated with both tree and agricultural production. In this case, the LEV is interpreted as the maximum amount of money a land user can pay for the land and still earn the minimum acceptable rate of the return on the investment. LEV for timber production is calculated assuming the land will be used to produce a perpetual series of even-aged or uneven aged stands; each stand in the perpetual series is assumed to have the same revenues and costs that are projected for the first rotation or the first cutting cycle. LEV is applied just like NPV in making investment decisions, with positive LEVs inferring investment acceptability and negative LEVs suggesting project rejection [11].

$$\text{LEV} = \frac{NPV\ (1+r)^t}{(1+r)^t - 1} \quad \text{..............................Eqn 6}$$

Return on Investment or Rate of Return on Investment

The return on investment formula is mechanically similar to other rate of change formulas. It measures percentage return on a particular investment.

$$ROI = \frac{\text{TR}-\text{TC}}{TC} \times 100\% \quad \text{...................... Eqn 7}$$

TC = Total Revenue

TR = Total Cost

Payback Period

Payback period refers to the period of time it takes for an investment to “pay back” its initial costs i.e. period of time required to recoup the funds expended in an investment, or to reach the break-even point [13]. It is also a very commonly used criterion in project analysis. Payback Period is simply the length of time it takes to recover the cost of a project, without accounting for the time value of money. This means Payback Period doesn’t consider the time value of money, it ignores the timing of cash flows, and it ignores cash flows that occur beyond the Payback Period. The formula to calculate payback period of a project depends on whether the cash flow per period from the project is even or uneven. In case they are even, the formula to calculate payback period is:

$$Payback\ Period = \frac{Initial\ Investment}{Cash\ Inflow\ per\ period}$$

When cash inflows are uneven, we need to calculate the cumulative net cash flow for each period and then use the following formula for payback period:

$$Discounted\ Payback\ Period = A + \frac{B}{C}$$

A is the last period with a negative cumulative cash flow;
B is the absolute value of cumulative cash flow at the end of the period A;
C is the total cash flow during the period after A

3 RESULTS

Table 1 Small Scale Forest Plantation's Cashflow for a 12 year Rotation Plantation

Year	Items	Cost (₦)	Revenue (₦)	NPV	r (15.48%)	D.C	D.R	DNPV (15.48%)	DNPV (36%)
1	Land	240,000		331000	1	331000	-	331000	331000
	Land clearings	35,000							
	Seedlings	35,000							
	Planting	14,000							
	Transportation	7,000							
2	Tending &maintenance	70,000	-	70000	0.74	51800	-	51800	37800
3	Tending &maintenance	70,000	-	70000	0.64	44800	-	44800	28000
4	Tending &maintenance	70,000		65000	0.55	38500	2750	35750	18850
	Fuelwood		5,000						
5	Tending &maintenance	70,000		63000	0.48	33600	3360	30240	13860
	Fuelwood		7,000						
6	Tending, maintenance and harvesting cost	90,100		703800	0.41	36941	325499	288558	112608
	Fuelwood&pole		793,900						
7	Tending, maintenance and harvesting cost	85,000		525000	0.35	29750	213500	183750	63000
	Fuelwood&pole		610,000						
8	Tending, maintenance and harvesting cost	94,000		870000	0.30	28200	289200	261000	78300
	Fuelwood&pole		964,000						
9	Tending, maintenance and harvesting cost	88,000		644000	0.26	22880	190320	167440	38640
	Fuelwood&pole		732,000						
10	Tending, maintenance and harvesting cost	97,000		988000	0.23	22310	249550	227240	49400
	Fuelwood&pole		1,085,000						
11	Tending, maintenance and harvesting cost	100,000		1105000	0.20	20000	241000	221000	33150
	Fuelwood&pole		1,205,000						
12	Tending, maintenance and harvesting cost	108,000		1416000	0.17	18360	259080	240720	28320
	Fuelwood&pole		1,524,000						
Total						678141	1774259	1096118	-26092

*NPV (Net Present Value), D.R (Discounted revenue), D.C (Discounted cost), DNPV (Discounted Net Present Value) and r (Discounted rate)

Net Present Value (NPV)

$$NPV = \sum_{t=0}^{t=n} \frac{R_t}{(1+r)^t} - \sum_{t=0}^{t=n} \frac{C_t}{(1+r)^t}$$

Where

R_t = revenues in each year n,

C_t = costs in each year n,

r = discount rate,

n = an index for years and

t = number of years of discounting.

NPV = 1774259- 678141

= ₦ 1,096,118.00

Benefit Cost Ratio (B/C)

$$B/C = \frac{\sum_{t=0}^{t=n} \frac{Bt}{(1+r)^t}}{\sum_{t=0}^{t=n} \frac{Ct}{(1+r)^t}}$$

$= \frac{1774259}{678141} = 2.62$

Internal Rate of Return (IRR)

IRR = Discount rate resulting in the last positive NPV

$+\left[Difference\ between\ discount\ rates\ X\ \frac{positive\ NPV}{increamental\ NPV}\right]$

To calculate IRR, NPV must be negative. Since the NPV for this investment is positive, there is need to increase the discount factor to get negative NPV. Therefore, at 36% discount factor, NPV= -26092 and the last positive NPV = 11246 at 35% discount factor. The difference between the two discount rates is 36 – 35 = 1

$$IRR = 35 + \left[1\ X\ \frac{11246}{26092 + 11246}\right]$$

IRR = 35 + [1 x 0.301]
= 35 + [0.301]
= 35.30%

Annual Equivalent Value

$$AEV = NPV\left[\frac{r(1+r)^t}{(1+r)^t-1}\right]$$

$$= 1096118\left[\frac{0.16(1+0.16)^{12}}{(1+0.16)^{12}-1}\right]$$

$= 1096118 \times 0.19$

$= ₦208262.42ha^{-1}$

Land Expectation Values

$$LEV = \frac{NPV\ (1+r)^t}{(1+r)^t - 1}$$

Rent is ₦240000

NPV without the rent = 1773890 - 438141 = 1335749

$$LEV = \frac{1335749 \times 5.9}{4.9}$$

$= ₦\ 1,608,350.84ha^{-1}$

Return on Investment or Rate of Return on Investment

$$\text{Discounted ROI} = \frac{Net\ Present\ value}{Present\ value\ of\ cost} \times 100$$

$$\frac{1095749}{678141} \times 100$$

$= 162\%$

Payback Period

Discounted Payback Period

$$Discounted\ Payback\ Period = A + \frac{B}{C}$$

Where,

A = Last period with a negative discounted cumulative cash flow;
B = Absolute value of discounted cumulative cash flow at the end of the period A;
C = Discounted cash flow during the period after A.

$$5+ \left[\frac{168410}{288189}\right]$$

$= 5 + 0.58$

$= 5.58$

$\approx$ 5 years 7months

4. DISCUSSION OF RESULTS

The forest plantation was established in the year of 2008 and the only species planted is teak (*Tectona grandis*). The plantation was established for the purpose of timber/pole production, aesthetic view, fuel wood and seeds. The harvesting cost, transportation cost and revenue generated were projected for a 12 year rotation period. . The base year for the plantation was 2008 and [14] recorded the lending rate of 2008 in Nigeria as 15.48%.

This study revealed that because of the long production (and rotation) period, timber prices can be affected by inflation and other factors in the country. As years goes by, the cost of silvicultural practices (tending and maintenance) reduces, but the prices of timber and labour are not equal throughout the production period and it is difficult to calculate them precisely. Due to various limitations of long term production, there was assumption and projection of prices for timber, silvicultural and administrative cost used. Corroborating this assumption is the report of [5] which stated that prices in financial analyses are based on current market prices, historical data, or future projections and changes. The study further revealed that when using ~~this~~ these financial prices for forestry project, the changes should be small enough (marginal) ~~that they do~~ not to distort current market costs and prices.

In addition, the study revealed that the owner of the forest plantation understood the relevance of keeping records and engaging in optimal silvicultural management. The result shows that when the costs and revenues were discounted from year 1 to year 12, the NPV is ₦ 1,095,749.00 with a corresponding B/C 2.62. IRR 23%, AEV ₦208192.31ha^{-1}, LEV ₦1,608,350.84ha^{-1}, ROI 1.62%, DPBP 5.58. Based on the criterion of the economic measures, the NPV is positive while the corresponding B/C is greater than 1. This shows that the investment on small scale private forest plantation is profitable, economically efficient and socially acceptable.

5. CONCLUSION

The study provides information on the feasibility and acceptability of small scale forest plantation investment to potential investors. This paper has shown that the investment in small scale teak plantation makes a valuable economic, social and environmental contribution to the private owner and the society. The forest plantation produces benefits in the form of goods (timber, poles and fuelwood) and services (amelioration of microclimate, watershed, reduction of soil erosion, provision for shelter and shade, etc.).

The study also revealed that the private owner had adequate knowledge of forest management such as site selection, silvicultural and managerial practices, etc. which contributed to high productivity of forest plantation. Therefore, involving many stakeholders in small scale plantation investment whereby fast growing exotic tree species like teak and gmelina are planted will be a major way of achieving sustainable forest development, improve the standard of living of people through income generation and abundant supply of timber and non-timber forest products when demanded from time to time by industries and people.

6. RECOMMENDATION

Intensively managed productive forest plantation must be guaranteed regardless of the scale of production. The private owners must be concerned with how to get high yield and price. For high yield teak plantation, it needed suitable site or good quality site and adequate silvicultural practises (tending and maintenance). It's also recommended that private forest plantation owners should incorporate multiple land use system to increase the productivity, that is, practise agroforestry at the early years of forest plantation establishment.

Well-coordinated and systematic record on investment cash flows of forest plantations is required for investment analysis. Therefore, it is recommended that private investors keep financial records and understand how to use economic tools (investment analysis) in order to assess factors affecting their investment and proffer solution so that the profit from their investment will increase.

Finally, ~~good governance,~~ government should formulate law that will protect the small scale private forest plantation owners to market their timber without too much tax. Government at local, state and federal levels should encourage and persuade forestry stakeholders to join the train of private investors involved in forest plantation development and also offer technical and financial incentives to all private forest plantation owners.

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