***Original Research Article***

# INVESTMENT ANALYSIS OF MEDIUM SCALE PRIVATE FOREST PLANTATION DEVELOPMENT IN OYO STATE


## ABSTRACT

Forest and non-forests products are becoming scarce in Nigeria due to insatiable wants of the resources by the people. The performance of public sector forest plantation development in Nigeria has fallen short of expectations of various stakeholders, hence, the need for investment in Private Forest Plantation Development (PFPD), fostered towards increasing wood supply and reducing the pressure on natural forest. Consequently, investment analysis of medium scale PFPD was investigated to show feasibility of the investment. 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 showed that medium scale of *Tectona grandis*, *Gmelina arborea,* with few *Terminalia spp*. plantation of 20ha with 18 year rotation had NPV of ₦1,504,841.70, BCR of 1.35, IRR of 24.03%, AEV of ₦316,016.76ha$^{-1}$, LEV of ₦2,186,997.89ha$^{-1}$, ROI of 35% and DPBP of 17.7years. The results showed that the investment is feasible based on economic returns indices. It is recommended that PFPD should incorporate multiple land use systems and apply appropriate silvicultural techniques in order to maximize the net return.



**Keywords:** Private investment, Cashflow, Investors, Forest stakeholders, Sustainable forest development

## 1. INTRODUCTION

The rapidly growing demand for forest products and non-forest products for industries, companies etc. are major factors contributing to decline in forest cover in African's natural forests [1]. According to the report of [2] the demand for wood raw material by industries in recent times in Nigeria has outstripped the production capacity of the forest. Nigeria's natural forest has been overexploited without adequate conversation and the depletion is as a result of urbanisation, industrialisation and, above all, human population growth. Thus, there has been a large gap in the supply-demand trend of the wood-based industries for wood raw material because of the inability of the forests to sustain the industries.

Afforestation and reforestation started in 1914 in Nigeria, and it was directed against desertification [3]. However, the oldest plantation recorded was that of Olokemeji Forest Reserve, near Ibadan, which was established in 1929; other plantations were later raised in 1936 in llorín Native Authority Forest Reserve. In addition, large scale planting of species was undertaken at Iwopin, Ogun State with the primary aim of providing raw materials to service the Nigeria pulp and paper mills in Niger and Ogun States. Federal government secured a loan from the World Bank in 1979, under Forestry 1 project to establish 25,000 hectares of forest plantation for the pulp and paper industry. Forestry 1 project was a success, which made the World Bank to advance another loan of US $72 million for Forestry II project [4]. Furthermore, African Development Bank (ADB) was contacted for a continuation loan to proceed with the project towards the end of the World Bank loan in 1987. The loan was granted and became effective from 1989. [5] reported that by the end of the ADB assisted portion of the project around 1995/96, the project had established 23,130 hectares of plantation and only *Pinus spp*, *Tectona grandis* and *Gmelina arborea* were widely cultivated [6].

Nonetheless, [7] observed that after the end of the foreign financial assistance which include World Bank and ADB, the forestry sector in Nigeria became largely dependent on public funding. Incidentally, public funding of forest projects and programmes in Nigeria has been inadequate and untimely at both Federal and State government levels. Besides, studies have shown that the funded forest plantation projects has been invaded by crude exploitation and exported out of the country at a scandalous rate without any thought of reforestation

programme. Consequently, there is need for private investment in forest plantation development in the country.

Forest plantation development has the capacity of increasing wood supply and stemming the pressure in the natural forests in Nigeria [8]. It also contributes substantially to the economic, social and environmental development of country. Studies have documented that forest plantations are relatively simple production systems, typically even aged monocultures, with the capacity to produce wood yields many times greater than natural forest. Hence, private investment in forest plantations is an important means to sustainably mobilize forest resources for meeting the needs of the people. Similarly, assessing investment analysis is very important in forest plantation development because it helps forest stakeholders, policy makers and potential private investors understand and determine whether the investment make sense in terms of profitability and also help in determining where improvements could be made to increase the returns on investment.

According to [9] investment returns of forest plantations are indeed an important concern around the world. Appraising investment returns ensure that projects are using scarce capital well and meet the minimum economic standards expected by forestry communities and landowners, foreign aid donors, and technical assistance groups. It can also help identify which benefits are more valuable to society and local communities, which is useful for forest policy decisions, such as developing forestry programs for local communities, helping produce goods and services efficiently, making payments for environmental services, and helping conserve valuable ecosystems and community welfare. NPV, BCR, IRR and other measures were often used as indicators for assessing investment returns of forest plantations [10].

However, in Nigeria, investment analysis is one task that forestry professionals and private forest plantation owners in the country fail to undertake. There is little or no information on investment analysis done to show the feasibility in forest plantation development. In the absence of such facts, forest plantation investments have so far been undertaken without a critical look at efficiency and profitability issues. Therefore, this study assesses the investment analysis of medium scale private forest plantation in order to help forest industry, stakeholders and academics learn more about the opportunities in forest plantation investment and inform relevant policy makers and investors about economically sound forest plantation development.

## 2. METHODOLOGY

### 2.1 Study Area

Oyo state covers approximately an area of 28,454km$^2$. The state is located in latitude between 6º55' and 8º45'N and between longitude 2º50' and 3º56'E in southwestern Nigeria. The projected population of the state in 2011 was 6,596,392 in 2011 [11]. Average daily temperature ranges between 25$^0$C and 35$^0$C, almost throughout the year while the annual rainfall ranges from 1000 mm to 1500 mm with well drained and rich ferruginous tropical soils which favours production of crops. Oyo state had about 41.2% forestland area in 1978, but this diminished to 27.7% (783,221 ha) in 1995 as reported by [12].

### 2.2 Grouping of Forest Plantations

This study for the purpose of easy grouping of forest plantation sizes, adopted and modified [13] classification of private forest plantations into, between 0.5 ha and 3.99 ha as small; between 4 ha and19.99 ha as medium and 20 ha and above as large. Thus, forest plantations of less than 5 ha (0.1 - 4.99), between 5 ha and 29.99; and 30 ha and above were classified as small, medium and large forest plantations for this study.

### 2.3 Location of Forest Plantation

The forest plantation covers a land area of 20 hectares, located in Erin Omu, Kajola, Oyo State.

### 2.4 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.

### 2.5 Specification of Financial Analysis

**The Net Present Value (NPV)**

NPV is essentially the difference between the sum of discounted benefit and the sum of the discounted cost. The Net Present Value (NPV) converts a series of recurring revenue streams

into a single number that can be used to compare mutually exclusive investments at a given discount rate (cost of capital). For single investment decisions, positive NPVs indicate that the project is feasible [14]. 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 [15].

NPV can be written in equation form as:

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

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 [14]. 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

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

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. For individual investments, the IRR is usually compared to any alternative rate of return [14]. 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 [16].
It can be expressed as follows:

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

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

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

**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 [17]. The formula for calculating AEV is as follows:

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

**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 it the land cost is not included [18]. 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.

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

**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.

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

TC = Total Revenue

TR = Total Cost

**Payback Period**

Payback period refers to the period of time required to recoup the funds expended in an investment, or to reach the break-even point [19]. Payback period intuitively measures how long something takes to "pay for itself." Payback period is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows

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:

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

**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

In Oyo State, relevant information on timber prices by product sizes /species were gathered through personal contacts with private forest plantation owner and the price of a tree at the time (girth from 0.8m and above) was ₦8000.

It is important to note that in a hectare of land, 1600 seedlings are used.

1 Hectare = 100 m x 100 m

Escapement = 2.5m x 2.5m (Standard spacing)

Total number of seedlings per hectare is derived as follows:

$$\frac{1\ hectare}{spacing\ for\ planting\ teak\ seedlings}$$

$$\frac{100m\ x\ 100m}{2.5m\ x\ 2.5m}$$

=1600 seedlings

Total number of seedlings per hectare = 1600 seedlings. 1600 seedlings represent the full stock per hectare of land

However, the forest plantation owner planted 1200 seedlings per hectare. Thus, 1200 trees per hectare are expected to be harvested from the forest plantation at the end of 18 year rotation.

Total trees from the plantation =1200 trees x 20hectares = 24000 trees.

Projected revenue for the forest plantation is therefore, 24000 x 8000 = ₦ 192,000,000.

Also, ₦ 500 is assumed to be used to harvest and transport a tree. Therefore, the total projected cost of harvesting and transporting 24000 trees is equal to ₦500 x 24000 = ₦12,000,000.

**Table 1a: Medium Scale Forest Plantation's Cashflow for a 18 year Rotation Plantation**

| Year | Items | Cost (₦) | Revenue (₦) | NPV | r (23.44 %) | D.C | D.R | DNPV (23.44%) | DNPV (25%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Land Survey, demarcation, land clearing and preparation, seedlings, pegs and pegging, planting. | 2830000 | | -2830000 | 1 | 2830000 | | 2830000 | 2830000 |
| 2 | Cleaning, application of fertilizer, beating up Planting activities Planting exercise Tending& maintenance Monitoring supervision | 559070 | | -559070 | 0.69 | 385758.3 | | 385758.3 | 357804.8 |
| 3 | Cleaning, beating up Tending& maintenance Monitoring supervision | 320000 | | -320000 | 0.58 | 185600 | | 185600 | 163200 |
| 4 | Tending& maintenance Monitoring supervision | 280000 | | -280000 | 0.48 | 134400 | | 134400 | 114800 |
| 5 | Monitoring&supervision | 280000 | | -280000 | 0.40 | 112000 | | 112000 | 92400 |
| 6 | Monitoring&supervision | 280000 | | -280000 | 0.33 | 92400 | | 92400 | 72800 |
| 7 | Monitoring&supervision | 120000 | | -120000 | 0.28 | 33600 | | 33600 | 25200 |

**Table 1b: Medium Scale Forest plantation's Statement of Cashflow for a 18 year Rotation Plantation**

| Year | Items | Cost (₦) | Revenue (₦) | NPV | r (23.44 %) | D.C | D.R | DNPV (23.44%) | DNPV (25%) |
|---|---|---|---|---|---|---|---|---|---|
| 8 | Monitoring&supervision | 120000 | | -120000 | 0.23 | 27600 | | 27600 | 20400 |
| 9 | Monitoring&supervision | 120000 | | -120000 | 0.19 | 22800 | | 22800 | 15600 |
| 10 | Monitoring&supervision | 100000 | | -100000 | 0.16 | 16000 | | 16000 | 11000 |
| 11 | Monitoring&supervision | 100000 | | -100000 | 0.13 | 13000 | | 13000 | 8600 |
| 12 | Monitoring&supervision | 100000 | | -100000 | 0.11 | 11000 | | 11000 | 6900 |
| 13 | Monitoring&supervision | 100000 | | -100000 | 0.09 | 9000 | | 9000 | 5500 |
| 14 | Monitoring&supervision | 100000 | | -100000 | 0.07 | 7000 | | 7000 | 4400 |
| 15 | Monitoring&supervision | 100000 | | -100000 | 0.06 | 6000 | | 6000 | 3500 |
| 16 | Monitoring&supervision | 100000 | | -100000 | 0.05 | 5000 | | 5000 | 2800 |
| 17 | Monitoring&supervision | 100000 | | -100000 | 0.04 | 4000 | | 4000 | 2300 |
| 18 | Harvesting and transportation cost Timber | 12000000 | | +18000000 | 0.03 | 360000 | 5760000 | 5400000 | 3240000 |
| Total | | 192000000 | | | | 4255158.3 | 5760000 | 1504841.7 | -497204.8 |

**Net Present Value**

**NPV** = 5760000 – 4255158.3

= ₦1,504,841.7

**Benefit Cost Ratio**

**BCR:** $= \frac{5760000}{4255158.3}$ = 1.35

**Internal Rate of Return**

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 25% discount factor, NPV= -497204.8 and the last positive NPV = 17204.5 at 24% discount factor. The difference between the two discount rates is 25 – 24 = 1

**IRR** = $24 + \left[1\ X\ \frac{17204.5}{497204.8+17204.5}\right]$

IRR = 24+ [1 x 0.03]

= 24+0.03

= 24.03%

**Annual Equivalent Value**

$= 1504841.7[\frac{0.2(1+0.2)^{18}}{(1+0.2)^{18}-1}]$

= 1504841.7 x 0.21

= ₦316,016.76ha$^{-1}$

**Land Expectation Values**

Land rent is 600000

NPV without rent = 5760000 – 3655158.3

= 2,104,841.7

LEV = $\frac{2104841.7 \text{ x } 26.62}{25.62}$

= ₦2,186,997.89ha$^{-1}$

**Return on Investment or Rate of Return on Investment**

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

$$= \frac{1504841.7}{4255158.3} \times 100$$

$$= 0.35 \times 100$$

$$= 35\%$$

**Payback Period**

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

$$17 + \frac{3635158.3}{5400000}$$

$$17 + 0.67$$

$$\approx 17 \text{ years } 8\text{months}$$

N.B. A huge capital was expended at the initial stage of investment and no revenue was generated until the end of year of rotation. Hence, initial outlay will never be fully paid until the end of rotation when the investment will yield returns.

## 4 DISCUSSION

The forest plantation was established in 1999. The species planted were *Tectona grandis* and *Gmelina arborea* and the purpose of establishment was for timber production. The forest plantation has not been harvested at the time of this study, so the revenue from the investment, harvesting and transportation cost for 18 year rotation period were projected. Also, the lending rate of 1999 in Nigeria (20.29%) was used in this study [20].

The 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 projection of prices for timber, silvicultural and administrative cost used. Corroborating this is the report of [14] which

stated, prices in financial analyses are based on current market prices, historical data, or future projections and changes. The study further stressed that when using this financial prices for forestry project, the changes should be small enough (marginal) that they do not distort current market costs and prices.

Nigeria lending interest rate (20.29%) for year 2001 was used to calculate the discounted rate from the 1st year to the 18th year. The result shows that when the costs and revenues were discounted from year 1 to year 18, the NPV was ₦1,504,841.70 with a corresponding B/C 1.35, IRR 24.03%, AEV ₦316,016.76ha$^{-1}$, LEV without land rent ₦2,186,997.89ha$^{-1}$, ROI 35%, DPBP 17.7 years. 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 of large scale private forest plantation is profitable, economically efficient and socially acceptable.

## 5 CONCLUSION

Forest plantations are established because of the need to increase wood supply and reduce the pressure on natural forest in Nigeria. Hence, private investment in forest plantation development will be a major way of achieving sustainable forest development, income generation, increase wood supply and also reduce the pressure on natural forest in Nigeria. The study showed that investment in forest plantation development is profitable going by the economic returns indices. However, the payback period is relatively long compared to the rotation but the investment is socio-economically justified because the financial returns from the timber production is positive. It is expected that the findings of the study will have a positive contribution to professionals and researchers around the world dealing with forest plantation development.

## 6 RECOMMENDATION

There is no doubt that Nigeria has a high potential for forestry development that has not been adequately exploited. Private investors' interest can be stimulated through provision of incentives in order to fulfil Nigeria potentials in forest plantation development. Adequate government programs of incentives (financial support, free seedlings), good governance, secured land, established markets, coupled with good technical advice to private forest plantation owners, are needed to stimulate forest plantation establishment, especially among small and medium-sized private forest owners with limited financial resources.

Private forest plantation owners should endeavour to keep cash flow statements of their investments in order to find out the extent to which they stand to gain or lose from resources committed to the project. Also, to increase economic returns and reduce the payback period, it is recommended that private forest plantation development should incorporate multiple land use systems.

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