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ECONOMIC APPRAISAL OF CHANGA MANGA IRRIGATED FOREST PLANTATION

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The proposed study was designed to analyze the economics of Changa Manga Irrigated Forest Plantation, Pakistan Kasur by using different economic tools i.e., Benefit Cost Ratio (BCR), Net Present Worth (NPW) and Internal Rate of Return (IRR). Overall results showed that the plantation is continuously running in loss (BC ratio= 0.74097, NPW= -81.27 million). It was suggested that a suitable working plan and adopting proper managerial approaches can improve the economics of the Changa Manga Irrigated Plantation.

Keywords: Forest economics, irrigated plantation, Net present worth, benefit cost ratio, internal rate of return

INTRODUCTION

Forests are one of the most precious resources envisaging a number of tangible and intangible benefits contributing substantially towards improvement of the environment. These include absorption of pollutants, reduction of traffic noise, windbreaks and shelterbelts, as well as reduction of radiation and solar heat gain through shading and evapotranspiration (Hiemstra *et al.*, 2008; Forest Research, 2010). The immense impact of trees on the stability and development of a country like Pakistan cannot be denied (Sheikh, 1993). Irrigated plantations cover an area of 103,000 ha, largely in Punjab and Sindh province. Regular supply of irrigation water to these irrigated plantations is indispensable for the continuous supply of timber and fuel wood (FAO, 2009).

Pakistan is one of the most populous countries of the world having an estimated population of 184.35 million in 2012-2013. Pakistan has moved from 13th largest country in 1950 to 6th largest country in 2013 and under current circumstances, it is expected that Pakistan can attain fifth position in 2050. This rapid increase in population leads to greater demand for wood, food, infrastructure and other basic needs. The energy requirements of the population are mostly met by the forests, which are being brutally felled throughout the world. There is a dire need to manage the forest resources on scientific and economic basis.

At present forest cover of Pakistan is only 2.2% which is not enough to meet the nation's demand of wood and wood based products (FAO, 2010). In 1998, the wood consumption in Pakistan was 33,018 thousand cubic meters, whereas total wood produced was only 350 thousand cubic meters. This resource scarcity puts a burden on the foreign exchequer. In 1998-99, Pakistan imported wood and wood products of worth Rs. 8499.3 million. Its total exports of wood and wood products stood mere at Rs 381.4 million (Hassan, 2000). Wood is being used as a source of energy and it has been observed that fuel wood demand of Pakistan would increase from 31.523 million m³ in 2003 to 42.051 million m³ by 2018 on the basis of existing per capita consumption of 0.205 m³.

The existing management strategies of forests and irrigated plantations have been examined and economic aspects extrapolated. Existing economic decline in forest productivity is a challenge for foresters, researchers and land planners. There is also need to look into the potential of plantations to fulfill the energy requirements of the nation. Some researchers have analyzed and evaluated the economics of forests, especially the irrigated plantations (Siddiqui, 1991; Siddiqui and Khan, 1991; Sharma, 1995; Harminder *et al*., 1996). Azhar *et al*. (2011) carried out the economic evaluation of Daphar Irrigated Plantation in Punjab, Pakistan. On the basis Net Present Worth, Benefit Cost Ratio and Internal Rate of Return they declared that Daphar Plantation was running in profit but the land rent was not included in studies.

Benefit Cost Ratios (BCR) of the plantation under the existing conditions depends upon the tree species, demand and marketability of the forest produce and the intensity of management practices (Siddiqui, 1991). Hence management practices in these plantations should be intensified with large financial and technical inputs to make them financially sound undertaking. Calculated the economic evaluation of Kamalia Irrigated Plantation for the period of ten years from 1999 to 2009 with land rent and concluded that plantation was running in loss. Similarly Anwar et al. (1994) studied the economic feasibility of Kamalia Irrigated plantation and found that plantation was hardly making any profit in true economics sense.

First man made irrigated plantation was established at Changa Manga in 1866 for the fuel wood supply to railway engine, which lies between latitudes 31° 1 to 31° 7 North and longitude73°-56/ to 74°-4/ East, along the Karachi Lahore Railway line. Its soil is formed by river alluvium laid down by Ravi and Sutlej under the combined action of scrub vegetation and semi arid; sub-tropical continental climate (Working Plan, 2012).

Keeping in view the importance of Changa Manga Irrigated Plantation, its economic appraisal was done in the present study. Changa Manga is one of the oldest irrigated plantations of Pakistan, as it was established in 1866, covering an area of 12510 acres. The objective of the study was to estimate the profitability/loss of Changa Manga Irrigated Plantation by determining the Net Present Worth (NPW), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR).

MATERIALS AND METHODS

The economic evaluation of the focused plantation was based on the data for the last 22 years (full economic rotation) regarding the expenditures and revenues from the office of Divisional Forest Officer, Kasur and Sub-divisional Forest Officer, Changa Manga through a structured questionnaire in person.

The economic tools and techniques employed for data calculation, its analysis and interpretation were as under:

***Net present worth (NPW)*:** It is the difference between the present worth of discounted benefits and the present worth of discounted costs. This is the most straight forward discounted cash flow measure. The formal criterion for the present worth measure of project is to accept a project with a positive net present worth. Hence,

$$NPW = PWB - PWC$$

Where,

NPW = Net Present Worth

PWB = Present Worth of Benefit stream

PWC = Present Worth of Cost stream

The discount factor $1/(1+i)^n$ determine the size of NPW.

Where,

i = Discount rate , n = Number of years

***Benefit cost ratio (BCR)*:** It is the benefit and cost discount ratio. The benefit cost ratio is used almost exclusively as a measure of social benefit at the prevalent opportunity cost of capital in country It is used to evaluate projects and the formal decision criterion is to accept a project if B/C ratio is one or more, when discounted at opportunity cost of capital. Hence,

$$BCR = PWB / PWC$$

Where,

BCR = Benefit Cost Ratio

PWB = Present worth of Benefit stream

PWC = Present worth of Cost stream

***Internal rate of return (IRR)*:** It determines the average earning capacity of the project. It is the measure which the World Bank uses practically for all its economic and financial analysis of projects, as do most other international financial agencies. Hence,

IRR = LDR + Diff. between two discount rate

(NPW at LDR) Absolute difference between NPW of two discount rates

Where,

IRR = Internal Rate of Return

LDR = Lower Discount Rate

NPW = Net Present Worth

Diff = Difference

RESULTS AND DISCUSSION

***Benefit cost ratio (BCR)*:** Discounting plays an important role in forestry economics because harvesting cycles are often much longer than project cycles for other investments (Hepburn and Phoebe, 2007. Discount rate used was 11.5%, and accordingly the discount factor was calculated year wise. If the value of benefit cost ratio is greater than 1, it means that we are earning profit and vice versa.

Table 1. Year Wise Benefit Cost Ratio (BCR) from 1985-86 to 2007-08

Year	Benefit cost ratio	Year	Benefit cost ratio
1985-86	0.438083	1997-98	0.470126
1986-87	1.923325	1919-99	0.544382
1987-88	1.832129	1999-00	0.161995
1988-89	1.427393	2000-01	0.338313
1989-90	0.633150	2001-02	0.532397
1990-91	0.875180	2002-03	0.318897
1991-92	0.899440	2003-04	0.238761
1992-93	0.943747	2004-05	0.535748
1993-94	0.726484	2005-06	0.479406
1994-95	0.923394	2006-07	0.365935
1995-96	0.791252	2007-08	0.382353
1996-97	0.706399		

The values in Table-1 showed the year wise values of BCR from 1985-86 to 2007-08 (with land rent). During the years 1986-87, 1987-88, 1988-89, the Benefit Cost Ratio indicated that there was less expenditure than the revenue collected and during this period the plantation was running in profit (Table1). During this whole period of 23 years, 1.923 was the highest value of BCR during 1986-87, which showed the highest profit level of the concerned plantation which are in conformity the findings of Siddiqui (1991), financial analysis for poplar plantation.

$$\text{Benefit Cost Ratio} = \frac{\text{PW benefits (@ 11.5\%)}}{\text{PW cost}} = \frac{232.4947}{313.7684} = 0.74097$$

The Benefit Cost Ratio (with land rent) of Changa Manga Irrigated Plantation for 23 years is 0.74097, which means that the plantation is running in loss. Other research studies on the irrigated plantations of Pakistan especially Changa Manga Irrigated Plantation also stated that this plantation is running in loss (Siddiqui, 1991; Siddiqui and Khan, 1991).

Benefit Cost Ratio calculated without including land rent is 2.32 (by using PW Benefit Rs. 232.4947 million. and PW Cost Rs. 100.0673 million.) which show that the plantation is yielding profit. Similar results have been described by Azhar (2011).

***Net present worth (NPW)*:** Net present worth (NPW) was calculated by simply subtracting the present worth of cost (PW Cost) from present worth of benefits (PW Benefits). Discount rate used for calculation was 11.5% and the discount factor was calculated year wise accordingly.

Net Present Worth = PW Benefits – PW Cost (@11.5%)
= 232.4947-313.7684
= -81.2737 million

Table 2 manifested the NPW including land rent of the Changa Manga Irrigated Plantation, which is -81.2737 million, which revealed that the plantation is going continuously in loss. Some earlier studies (Siddiqui, 1991) had narrated similar results for all the plantations excluding the poplar (*Populus deltoides*) plantations.

Regarding, net present worth (NPW) excluding land rent, the value becomes Rs 132.4274 million (by using PW Benefits i.e. Rs. 232.4947 million and PW Cost i.e. Rs. 100.0673 million) which revealed that the plantation is earning profit which matches the findings of Azhar (2011).

***Internal rate of return*:** For Internal Rate of Return (IRR) the incremental net benefits must have some negative values meaning that the project is starting from zero and there were no benefits at start. But as we know that, this plantation was established in 1866. So, Internal Rate of Return could not be calculated for the said period of 23 years.

Internal rate of return (IRR) gives the value of profit/loss in % age for a given period of time. So, in place of % age, the profit/ loss on average annual basis were calculated by using the previous tables, as follows:

Avg. annual benefit (AAB) = CRF (PW Benefits-PW Cost)

Where, CRF = Capital recovery factor

PW Benefit = Present Worth of Benefits

PW Cost = Present Worth of Cost

Now, $$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where, i = Rate of interest (11.5%) , n = No. of years (23)

Now, $$CRF = \frac{0.115\,(1+0.115)^{23}}{(1+0.115)^{23} - 1} = 0.125$$

Now,

Average annual benefit/loss (AAB/AAL)
= 0.125 (232.4947-313.7684)
= Rs. -10.159 Million.

The value of average annual benefit/loss with land rent explained that we had lost Rs. 10.159 Million every year during the said period of 23 year. But if we calculate average annual benefit/loss without land rent then it will be Rs 16.55 Million (by using PW Benefits Rs 232.4947 Million and PW Cost Rs. 100.0673 Million, which shows that we have earned this amount, every year during the said period of 23 years which matches the findings of Azhar (2011).

***Conclusion*:** From the present research study, we concluded that the Changa Manga Irrigated Plantation is constantly running in loss, which is of a great concern for the forest department, policy makers and land planners. The authorities

Table 2. Net present worth (NPW) of Changa Manga irrigated plantation (1985-86 to 2007-08)

Year	P W Cost (Million)	P W Benefits/Revenue (Million)	Year	P W Cost (Million)	P W Benefits/Revenue (Million)
1985-86	12.04175	5.27528	1997-98	14.53167	6.831719
1986-87	13.90486	26.74356	1998-99	14.64782	7.974011
1987-88	13.32023	24.40438	1999-00	12.57922	2.037766
1988-89	13.73908	19.61107	2000-01	11.26725	3.811852
1989-90	14.60050	9.24430	2001-02	13.44642	7.158833
1990-91	14.39567	12.59880	2002-03	12.66748	4.039626
1991-92	15.86153	14.26650	2003-04	12.29547	2.935683
1992-93	16.40227	15.47959	2004-05	11.94295	6.398411
1993-94	15.88832	11.54262	2005-06	11.31756	5.425711
1994-95	16.64489	15.36979	2006-07	11.59830	4.244229
1995-96	16.10980	12.74691	2007-08	9.25452	3.538491
1996-97	15.31080	10.81553			

should focus on the tangible and non-tangible benefits on more scientific and economic basis. They should manage the plantation intensively to get more benefits and to meet the energy requirements by keeping pace with the growing population

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