FEASIBILITY STUDY AND ECONOMIC ANALYSIS OF SPOTTED DEER (*Axis axis*) FARMING IN NEPAL

SUBMITTED TO

TRIBHUVAN UNIVERSITY
INSTITUTE OF FORESTRY
HETAUDA

ADVISOR

Mr. SHANKAR PD LAKHEY
ASSOCIATE PROFESSOR
INSTITUTE OF FORESTRY
HETAUDA

SUBMITTED BY

RAJESH K RAI
BSc FORESTRY (FOURTH YEAR)
INSTITUTE OF FORESTRY
HETAUDA
rjerung@yahoo.com

Required for the partial fulfillment of the BSc Forestry Degree in Tribhuvan University, Institute of Forestry

TRIBHUVAN UNIVERSITY
INSTITUTE OF FORESTRY
HETAUDA, NEPAL
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CERTIFICATE OF ACCEPTANCE

This is to certify that Mr. Rajesh Kumar Rai has undertaken project paper entitled "Feasibility study and Economic Analysis of Spotted Deer (Axis axis) Farming in Nepal " my supervision and has accepted this paper as a part of requirement for B.Sc. Forestry Degree in Tribhuvan University, Institute of Forestry, Hetauda, Nepal.

(S.P. Lakhey)
Associate Professor
Institute of Forestry
Hetauda,Nepal

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EXECUTIVE SUMMARY

In the present economic condition, farmers have to diversity their current programs for cattle, sheep and cereal production. One form of diversification, which is rapidly growing in popularity, is to farm deer. Domestication of deer as a business is not in practiced and legally permitted in Nepal. Rearing of deer for personal pleasure is an age-old practice. Illegal hunting of deer is in practice in Terai excessively for meat. This study deals with feasibility study and financial return of deer farming with emphasizing Chital in Nepal.

The study was carried out in two phases. First by observation of deer husbandry farm and second by market survey done through questionnaire for feasibility and propose price of deer products. In feasibility study, 250 questionnaires were sent to respondents in 5 major cities of the country, 50 in each city.

In the model of 2 ha Chital farm, expenditure was more than revenue in the first four years. Then increase rate of revenue will be greater than expenditure in the following year. Financial analysis of deer farm in Nepal shows that the internal rate of return (IRR) of 2 ha farm is 20.14%. Collecting the information based on the study of deer rearing center and proposed price of deer products by respondents and current market price of different materials did analysis.

The response shown in five major cities of country showed that most Nepalese people are interested to use deer products. Out of total respondents 68% have keen interest to use meat of Chital and 83% are interested to use antler and skin for different purposes. In all five cities, majority of people proposed to pay higher price than that of mutton.

Commercial farming of chital will be beneficial to community forest and leasehold forest. It also helps in conservation work if it is practiced in buffer zone.

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ACRONYMS

ADB	Asian Development Bank
BPP	Bio-diversity Profile Project
BS	Bikram Sambat
CP	Crude Protein
DM	Dry Matter
DNPWC	Department of National Parks and Wildlife Conservation
EFN	Education for Nature
GDP	Gross Domestic Product
HMGN	His Majesty's' Government Nepal
IRR	Internal Rate of Return
KWTR	Koshi Tappu Wildlife Reserve
NRs	Nepali Rupees
PAs	Protected Areas
PWR	Parsa Wildlife Reserve
RBNP	Royal Bardia National Park
RCNP	Royal Chitwan National Park
RSWR	Royal Shuklaphanta Wildlife Reserve

CHAPTER-I

INTRODUCTION

Nepal is an agro-based country having more than 90% people depending on agriculture. It occupies area of 147,181 sq.km (approx 14.75 mill. ha of land) with diverse geographic feature from 75 m to top of the worlds i.e. 8848m above the mean sea level. There is a wide variation in climate due to the altitudinal differences and the physiography. The physical isolation of areas, especially, in the difficult mountain regions of Nepal, has generated tremendous bio-diversity in plant and animal genetic resources in those areas.

Nepal's level of income (US$ 210 per capita) is one of the lowest in the world; more than half of the population survives on less than one dollar a day. The rate of income growth is lower than that of the Asian and South Asian countries (ADB 1997). Growth was most rapid during the last decade when the economy grew by about 5 percent compared with the average growth rates of 8 and 6 percent for the Asian and South Asian economies respectively. Moreover, Nepal's economic growth is narrow-based and has low employment intensity, with the result that income distribution is uneven. Overall, low rate of income growth, skewed income distribution, and particularly, deteriorating terms of trade of agricultural sector vis-à-vis other sectors have intensified poverty (Nepal Human Development Report 1998).

In the decade of '70s Gross Domestic Product (GDP) growth averaged 2.1 percent per annum. With the population growing by 2.6 percent per annum during the same time, real per capita income declined by 0.5 percentage points. As the agricultural sector grew by just as 0.5 percent, per capita agricultural income declined by 2 percentage points. During the '80s, growth rates in both the agricultural and non- agricultural sector grew by 2.3 and 2.9 percent respectively. During the '90s so far, although the growth in per capita income has remained 2.9 percent on average, per capita agricultural income has recorded a decline (table I) (Nepal HDR, 1988).

Table-I

Per capita GDP growth rate

INDICATOR/PERIOD	1971-80	1981-90	1991-96
Real GDP growth rate	2.1	4.9	5.2
Agricultural GDP	0.5	4.6	2.2
Non-agricultural GDP	7.0	5.2	7.8
Population	2.6	2.3	2.3
Per capita income growth	(-0.5)	2.6	2.9
Agriculture	(-2.1)	2.3	(-0.1)

(Source: Ministry of Finance 1997)

The Nepal Living Standard Survey (Central Bureau of Statistics 1997) shows Nepal's average per capita income as $142 (with a regional variation as follows: $298 for urban areas, $131 for rural areas, $446 in Kathmandu, $146 in Eastern Terai, $110 in Mountains and $107 in Western Terai. (The per capita income shown is lower than in national account figures because it takes into consideration only the household sector and does not incorporate business, government and external sectors of the economy) Farm income is the major source of household income in 1996. Income from non-farm enterprises accounted for 22 percent and income from other sources (mainly financial assets) accounted for 16 percent of the total household income. Urban income is more than double the rural income levels, reflecting the wide intra-country disparities in per capita income. The same applies for household level incomes as well (Nepal HDR 1998).

High rate of population growth, traditional farming system, illiteracy is the causes of poverty. More than 80% people live in the rural area whose main income source is agriculture. There is a close relationship among forest, agriculture and animal husbandry. According to Asian Development Bank 1993, about half of the country's forested area is estimate to be grazed by livestock and 50% of livestock fodder comes from forest sources. Farming system of Nepal mostly depends upon forest and animal husbandry. Animal provides manure and drought power to farm and forest provides green manure to farm and feed to cattle.

The total population of cattle, buffalo, goat, sheep for 1995/96 are 7.60million, 3.23million, 5.82million and 0.63 million respectively. The population growth rate for different species of animals are assumed to be cattle 0.8%, buffaloes 1.5%, goat 1.4%, and sheep 0.9%. The demand for fodder for the growing livestock population will rise from 20.9 million metric ton (2053/54 BS) to 25.6 million metric ton (2073/74 BS) and crude protein from 2.29 million metric ton for the rise from the present level of 24.5% to 29.7%. In other words, the major thrust had to be put on the production of feed to match the growing population of improved animals as well as local ones. (Raut, 1997/98).

The present situation in Nepal is that encroachment by villagers into forest continues unabatedly. Now, we have only 4.27 million ha (29%) forest and 1.56 million ha (10.6%) shrub area. Both forest and shrub together covers 39.6% of total land area of the country. From 1978/79 to 1994, forest area has decreased at an annual rate of 1.7% whereas the forestland shrub together has decreased at an annual rate of 0.5% (HMG/N, 1999 Nov.). The land denuded from forest is often lost to coarse almost useless grasses (such as *Imperata cylindrica* or to a wilderness of shrubs and shrubby plants of little value to commerce or villagers. These widespread, virtually unproductive areas are increasing. Forest loss and the resulting erosion of the topsoil, will send the living standards of agricultural people continuously to a lower level. It will therefore be imperative to find alternate solutions for these people.

Community forestry development program is one of the best, where participating people in conservation work while fulfilling their subsistence need of forest products since last two decades. In recent years, it is realized that income-generating activities in community forest helps to increase the living standard of forest user group members and for community development. It may be possible and profitable to rear deer in community forest and forest managed in buffer zone by user groups. Many community forest user groups are interested for this program and government should provide incentive for them.

Over population of domestic animals increases the pressure on forest. Deficit in supply of dry matter will increase the poor health of animals. It causes deforestation and low agricultural yields, which is major cause to poverty. It is essential to promote people towards income generating sources. Deer farming may be a good income source for the people of Nepal.

Deer farming as a business is almost new in Nepal. Many people are domesticating deer (especially spotted deer and barking deer) in small number in private land for their pleasure since time immemorial. Hunting of deer is excessive for meat, skin and sport. Most Nepalese people have curiosity for new taste. It also creates an opportunity of employment and income generation.

For subsistence communities, the establishment of neighboring parks or wildlife reserves generally removes substantial subsistence possibilities and has, therefore, adverse effects on their economy and sometimes their culture. If the needs of the local people are ignores, they will feel exploited and, in their search for means of survival, they will be tempted to appropriate protected resources or to encroach on boundaries of protected areas. This will result in a destructive relationship between the local people and government authorities and encroachment will generally continue, despite efforts to enforce the law.

Improvements are necessary in educational standards and extension programs in order to make the local people appreciate the objectives of parks and reserves management, and the benefits they themselves may derive from it. Such programs should also make them realize that their future is tied in with the ecological health of the environment and that their livelihood will depend on it. Wildlife utilization should be viewed as an integral part of the socio-economic and cultural life of the people. Buffer zones should be established around parks and reserves, which would serve as intermediate land-use zones, managed both for the benefit of the local community and for the protection of these protected areas. Buffer zones are suitable locations for game farming/ ranching. In practical terms it seems that the only chance conservation really has is to demonstrate that wildlife farming areas are of real benefit to the local people, and to convince land use planners and government authorities in general that these areas are a useful tool in the rational utilization of natural resources.

To achieve this it is essential to focus the attention on increasing the potential of these areas to enhance human welfare and to develop management procedures, which will optimize their economic and social outputs.

Every possible effort should be made to achieve the desired conservation objectives with a minimum disruption of traditional ways of life and a maximum benefit to local people.

The planning and development of wildlife utilization areas should be undertaken within the framework of similar activities in surrounding areas to provide for a viable and sustainable economic future for the communities to be concerned.

No rural development program can be successful without the active involvement and full participation of the intended beneficiaries. Therefore, the rural people concerned with the planning, development and operation of programs including the equitable sharing of benefits (such as a share of meat, hides or other animal products).

As the people can produce wildlife as a regular harvest for utilization, the rural population should be encouraged to become involved in wildlife ranching/farming as a valuable means of earning extra income, while at the same time conserving species of wildlife.

For the prospects of game utilization to be realized, some important changes in traditional attitudes toward wildlife will need to be implemented. Paramount among these changes is the need to regard wildlife as an economic resource and to recognize that only to a very limited extent do wildlife diseases hinder the development of the domestic livestock industry.

Such a change in attitude is an essential prerequisite for initiating appropriate legislation to encourage the development of better wildlife utilization through the introduction of appropriate management systems such as game ranching.

There is a great deal of emotional pressure from those who do not appear to comprehend that range-land conservation and wildlife conservation go hand in hand and that a rational land conservation strategy includes the management of wildlife populations. There is a need for those with an understanding of the animal-human-land relationships to stand up to these pressures if a rational conservation strategy is to evolve.

Nepal has diverse ethnic groups. Government has already announced that 61 castes are nationalities. Every ethnic group has their own culture. Traditionally, Brahmin and Chhetri (called higher castes) use only meat of mutton, Newar usually use Buff and other nationalities don’t use mutton. Deer meat is the one, which is not restricted by culture. So, it is suitable in Nepal.

Commercial farming of deer or any wild animals is illegal in Nepal. It is not sure to amend the government act and rule for wildlife farming. But, past activities of Department of National Parks and Wildlife Conservation (DNPWC)-HMG/N shows that government is positive for this. DNPWC had proposed a project entitled "Ungulates Farming Project" (Activity no. 15). The main objectives were to encourage the farming of ungulate species such as spotted deer, Barking deer, Blue bull, Wild boar in adjoining villages of Protected Areas (PAs),

- To increase income in rural areas adjoining PAs,
- To supply additional sources of protein, pelts and other wildlife products which has commercial

Deer are widely hunted for its meat, skin and sports. Meat, skin and antler have high demand in market. It creates severe problem not only by the decreasing the deer population but also affect the population of predator species like tiger, leopard etc.

SELECTION OF CHITAL FOR FARMING

The choosing of species suitable for deer farming requires detailed knowledge of such aspects as rate of reproduction, meat yield, resistant to diseases, behavior under controlled conditions, case of rearing, quality of product, market for the product and economics of the enterprises.

In Nepal the following deer species occur:

1. Spotted deer or Chital (*Axis axis*)
2. Hog deer or Laguna (*Axis porcinus*)
3. Musk deer or Kasturi (*Moschus chrysogaster*)
4. Swamp deer or Barahsingha (*Cervus devaucelli*)
5. Sambar or Jarayo (*Cervus unicolor*)
6. Barking deer or Ratuwa *(Muntiacus muntijak*)

Among these Six species of deer, last two i.e. Musk deer and Swamp deer are protect by government (enlisted as endangered species). It is impossible to get stocks for farming of these species and costly to domesticate them.

The habitat of Swamp deer consist of open localities consisting of either of marshes and grasslands or wood lands with an under story of grasses. Moderately flat hill terrainian and place, where water and water plants and wallow are prevalent (Schaller,1967). It is not possible to domesticate Swamp deer in wide range. Flat hill terrainian found only in southern part of the country, which is productive for agriculture. And, it is not practice to rear Swamp deer in enclosure elsewhere.

Rate of reproduction in Swamp deer is rather slow. Hind conceive when it is two years old. First rut takes place in 2 years age so that first fawn is produced at about three years

of its age. One fawn per year is born as a rule. The gestation period is of 240-250 days. Rutting activities occurs between mid-December to mid-march (Shrestha, 1981).

In Nepal, musk deer are found around the Lake Rara (Bolton, 1976) and Langtang (Borradiale et al., 1977) regions. The species is found in Bajhang, Doti, Namlang Valley, Tibrikot and Markhov Lake in west Nepal, Dhorpatan and Manang in central Nepal, and Jatapokhari, Chipua, Taplejung and Arun valley in eastern Nepal (Jamwal, 1972).

Musk deer feed on lichen and mosses of the alpine region. They may take leaves of *Rhododendron companulatum* (Guras), *Juniperus* (Juniper), *Abies* (fir), and Deodar. If nothing is available musk deer uproots grasses, lichens (*Usnea cadonia),* mosses (*Hypnum sps.)* and bear berries. Natural and artificial salt licks may be utilized by musk deer (Shrestha, 1981). They are given special food in Musk deer research project, Godawari (Appendix-I). The elevation of musk deer farm should be around 3,000 m and space requirement for each animal is 50 sq.m. (Tiwari et al.). It required specific knowledge to extract musk. So, it is expensive and not suitable in Nepalese situation to farm musk deer commercially.

Hog deer is not so widespread in Nepal. It is found in Royal Chitwan National Park (RCNP), Royal Bardia National Park (RBN, Royal Shuklaphanta Wildlife Reserve (RSWR), Parsa Wildlife Reserve (PWR), Koshi Tappu Wildlife Reserve (KTWR) and Bara district. It is found in altitude less than 300 m (BPP, 1995). The hog deer are the species of grasslands. They are mostly solitary i.e. 49.6% hog deer were seen solitary, 24.7% in pairs and a few larger groups were seen in patches of cut grasslands (Mishra, 1982). Due to its specific habitat requirement, distribution in lower altitude and lack of stock for farming are the limitations to farm hog deer.

Sambar is largest deer found in Nepal. It is introduced in Australia and New Zealand (BPP1995). It is solitary and specialist forest species (Mishra, 1982). They found in RBNP, RCNP, RSWR, PWR, Bardia, Kailali, Kanchanpur and doti, only in southern part of the country (BPP, 1995). Due to its specific habitat in dense forest, require large spaces and availability of stock is not in large scale.

Barking deer is widespread in Nepal. It is distributed from 100-2450m in Nepal (BPP 1995). It is solitary in nature and specific forest species (Mishra 1982). It is not suitable being too small and fragile (FAO, 1986).

Spotted deer is considered to be the most suitable for farming. It has wide distribution in Nepal. They are known to occur in hills and plains in altitude from 200 to 3500 ft. (Shrestha, 1981). The species commonly associated with a mixture of forest and more open grass-shrub associations (Graf and Nichols 1966, Ables et al. 1977, Dinerstein 1979b, Mishra 1982). However it occupier a wide range of habitats from mainly grass-shrub vegetation in Wilpattu National Park, Sri Lanka (Esinberg and Lockhart 1972) to denser areas in the Gir forest of India (Berwick 1974). In Hawaii, axis deer is also found in areas ranging from semi deserts to rain forest (Graf and Nichols 1966). The relatively

wide range in habitats of the sub-populations is also reflected in diet selection. Axis deer is mainly a grazer in Texas (Abies et. al. 1977, Henke et. al.1988), a browser in Gir forest (Berwick 1974) and feed on herbs in Tamilnadu, India (Johnsingh and Sankar, 1991). Although the deer is mainly a grazer in lowland Nepal, fruits, leaves and seedlings from a wide variety of tree, shrubs and forbs species are also utilized (Dinerstein 1982).

Although axis deer do congregate in large herds, the social structure of the species is loose with individuals readily joining and splitting from groups (Mishra, 1982). The only stable relationship is between mother and calf (Mishra, 1982). Males are non-territorial and in Nepal male groups are common except for the peak-mating season in April-May (Dinerstein, 1980).

In recent decades, forest devastation, unconventional slaughter, disease and habitat destruction have already wiped out the deer population from some parts of the country. Through, they are still found commonly in contrast with other members of cervidae family due to their rugged adaptability and prolific breeding mechanism. Therefore, it is suitable for farm. On the one hand, it increase the economic condition of people, on the other hand, it reduce the illegal hunting of deer and pressure on forest. It also reduce the decreasing rate of large carnivores like tiger, leopard, which feed on it.

It seems success in rearing Chital in many parts of the country. In Private farm of Laharepauwa, Rasuwa district it was very successful. Although they have no formal record they had increased about three times in number of Chital within five years i.e. from 15 to 44. It is also in good condition in Musk deer research center, Godawari, Kathmandu. Breeding in captivity at the center seems to be satisfactory (Gairhe, 1988). So, Chital is suitable species for farming in Nepal.

LITERATURE REVIEW

By deer farming is meant the husbandring of deer population for the production of deer meat and by-products – including hides, velvet, antlers and musk, -on a commercial basis. (FAO,1982).

Deer farming has been well established for a century or more in the Far East. However, it is a new enterprise elsewhere which during recent years has been increasingly accepted as an economically promising industry. New species have been successfully tried and farming techniques are become more sophisticated. Many deer farms are, however, improperly run because either the owners or managers are not up-to-date with deer husbandry methods, or they lack relevant knowledge of the biology of the species concerned (FAO, 1982).

The deer is the family of one of the noblest mammals to be found on the face of the earth. Generally speaking the males are distinguished by antlers, which are shed periodically. Usually the antlers are renewed once a year. The different varieties of deer are distributed over a large portion of the world surface, from the Arctic North to Patagonia and all trans-Himalayan regions. However, in Madagascar, Australia and New Zealand no native deer species are present, if they occur they are introduced species such as chital which can be raised on a commercial scale. The habitat management of chital and sambar in Gokarna will provide immense benefits in the future. The other species of deer such as swamp deer; musk deer are strictly protected animals. Their management in the wild will redress the lost population and will be a contribution to the wildlife heritage of the world. In economic terms the Alpine deer farming of musk deer has been successful in China and Russia, and it will be practicable in Nepal also if meticulous management is practiced (Shrestha, 1981).

A large number of chital population found in the forest of hills and plains of Nepal offer a unique opportunity for the management to attract the deer population throughout the year so that they may not wander away from the given habitat. In the National Parks and Reserves of Nepal, deer are seen playing hide and seek in pleasant manner. ‘A long-term planning and management can help to conserve the deer fauna which also provides a great economic return (Shrestha, 1981).

The axis deer (Axis axis) is indigenous to Asia (Walker, 1975). Prater (1971) describes 2 sub-species, *A.a.axis* on the Indian sub-continent and *A.a. ceylonensis* found in Sri Lanka. Axis deer has also been successfully introduced to other areas like Hawaii and Texas where population now exceed several thousand individuals (Graf and Nichols 1966).

On basis of experienced in Australian farm, Chital (*Axis axis)* is a beautiful deer with reddish color, chestnut coat with prominent white spots, with the spots present from birth in all age groups all year around. The throat, belly and inside of legs are white and there is a black strip along the spine. The tail is quit long and has a white fringe. Chital

stags have long slender, three tined antler with a rough equation between antler length and age up to the fifth year. Most stags with antlers 27-50 cm long will be 2-3 old, 50-75 cm probably 3-4 years old and those over 75 cm at least 4-5 years old (English, 1988).

Table-II

Weight of Chital in different stages

Class of animal	Weight in kg.		
	Birth	Yearling (12-15 months)	Mature
Stag	3.6±0.35	30-45	70-90
Hind	3.4±0.50	22-40	40-50

Source: English, 1988

Chital, do not have well defined breeding season of red and fallow deer and calves may be born all around. Hinds are capable of producing 3 calves in 26 months when mating is not restricted. However, there is some degree of seasonality in that most Chital stags are on hard antler in the period Jan-Sep and it would seem that a majority of conceptions occur in that period. There is tendency therefore most calves to be born between July and December with a gestation length of 7.5 months. The oestrous cycle is about 3 weeks long. (English, 1988)

While in hard antler Chital stags will rub trees in the same way that the males of the temperate species do, but not in such a period as is the case with latter. Chital stags will fight each other vigorously during this period especially when confined in yards or ends but they are not aggressive to man (unless perhaps when they have been hand reared, as is the case with the male of any species of deer). (English, 1988)

Chital stags produce semen when in the velvet antler phase and conceptions may be achieved all year round. The potential for selecting a calving from a group of hinds is perhaps one of the major attributes of Chital as a farm species. Despite their reputation as a nervous, highly excitable animal, Chital deer can be handled in suitable yards with care and patience. A crush or cradle is absolutely necessary for the restraints of individual deer they cannot be physically handled in the same way as is commonly done with fallowed deer, which are of similar size (English, 1988).

FAO, 1986 have provided some available statistics to pinpoint the value of deer products:

- In New Zealand one deer carcass can bring us$ 1,000 and a stag can yield as much as US$ 5,000 in antler velvet harvests in its life time of approximately 15 years. A mature red deer stag can produce over 2 kg. of velvet per year.
- Velvet from New Zealand can fetch as high as $1,000 per kg. In the retail market in Hong Kong ($160 per kg, for the farmer). Under New Zealand

conditions, one deer can bring a gross return of over $3,000 per ha., even without slaughtering the males.

- Deer farming is an important cash crop in Chinese communes and one kilo of sliced, dried deer antler fetches approximately US$ 150.
- In Thailand one kg. of deer meat fetched between $4 and one kg. of sliced velvet $120.

The forest types govern the population of deer management. The forest has many characteristics attractive to the deer population. The gentle terrain interlocked with natural drainage system containing water, food, escape cover and salting areas or salt licks are well suited for the management of deer farming (Shrestha, 1981).

Wildlife ranching/farming is a land-use system that by its nature is non-destructive. It doesn't disrupt the natural ecosystem and is therefore a key use for the survival of badly threatened, degrading lands (FAO, 1986).

Most scientists agree that ranching a variety of game animals on a given piece of land will provide more meat and hides per area unit than the use of just cattle (FAO, 1986).

Indigenous ruminants expend far less energy than introduced livestock do to overcome the harsh elements of vegetation, disease, and temperature and weather conditions. Thus, more energy is available for growth (FAO, 1986).

In addition to the comparative immunity to disease shown by wild ungulates, a variety of wild fauna is able to maintain productivity in areas unsuitable or marginal to domestic stock because of their ability to make use of a much wider range of vegetation. Therefore large areas of now unproductive or marginal lands could be developed for economic returns (FAO, 1986).

Although deer farming is not aimed at the protection of endangered species, nevertheless, among the 27 deer species and sub-species, which are considered threatened by extinction, there are two which have been maintained on farms, namely the Himalayan musk deer and the Formosa Sika. In other words, deer farming can and does play a role in wildlife conservation (FA0, 1982).

OBJECTIVES

The following were the general objectives of the study:

1. To find out the interest of the people towards deer farming,
2. To provide information about feasibility of spotted deer farming in Nepal,

The specific objective of the study was:

3. To find out the financial return of spotted deer farming,

CHAPTER-II

METHODS

Following methods were used to achieve the results.

a. Productivity and cost of farming from establishment to harvesting were taken from field study and record from private farm of Mr. Ramesh Acharya in Rasuwa District, Musk Deer Research Centre, Godawari and Central Zoo, Jawalakhel. Cost of expenditure was put according to the market rate in Kathmandu. Construction cost and other expenditure will base on the price of the Kathmandu.

b. Market survey was done to know the interest of people towards deer farming, proposed rate and consumption of deer products by questionnaire (Appendix I) in the 5 (Five) city of country in each region i.e. Biratnagar of Eastern zone, Kathmandu of Mid zone, Pokhara of Western zone, Nepalgunj of Mid-western zone and Dhangadhi of Far-western zone. 50 respondents were taken in each city and 250 in total were taken. Respondents were selected according to their caste and occupation. It is assumed that consumption is high in urban area, on the basis of per capita income.

c. Benefit cost analysis was calculated from benefit-cost ratio and internal rate of return (IRR) were calculated. IRR is a simple measure of profit. It has the advantage that it can be directly compared with the rate of return expected by investors. It represents the financial yield or profit in terms of a percentage rate of interest. This has been calculated using following formula:

$$\sum \mathrm{Rt} \frac{1.0}{(1.0+\mathrm{i})^{\mathrm{t}}} = \sum \mathrm{Ct} \frac{1.0}{(1+\mathrm{i})^{\mathrm{t}}}$$

Where,
IRR = the internal rate of return,
R_t = the revenues or positive cash flows in year t,
C_t = the cost of negative cash flows in year t,
t = the year in which cash flow occurs,
i = the interest rate when above equation is true and is the IRR.

For calculation, the Net Present Value (NPV) is first calculated for an interest rate that is estimated to be close to IRR. The NPV is then calculated for the next highest interest rate if the first answer was positive or the next lowest rate if the answer was negative. This continues until both a positive and a negative NPV have been obtained. The actual IRR is then estimated by interpolating between the positive and negative NPV. This is only an approximation because the interest rate formulas are nonlinear but the interpolation is linear.

CHAPTER-III

RESULT AND DISCUSSION

1. FEASIBILITY OF DEER FARMING

Table-III
Demand of Chital products

Place	No.of Respondents	Vegetarian	Non-vegetarian	Prefer deer meat		Purpose to use antler & skin			Wanted to farm deer
				Yes	No	Rel.	Dec.	Lux.	
Biratnagar	50	5	45	28	16	11	22	7	19
Kathmandu	50	2	48	34	12	4	36	5	16
Pokhara	50	6	44	31	13	7	7	32	18
Nepalgunj	50	4	46	41	5	22	9	7	27
Dhangadhi	50	3	47	36	9	5	28	7	24
Total	250	20	230	170	55	49	102	58	104
Average	50	4	46	34	11	9.8	20.4	11.6	20.8

- Note

Rel= Religious
Dec= Decoration
Lux= Luxurious purpose

Table III shows that, 8% i.e. 20 respondents were vegetarian and rest 92% i.e. 230 were non-vegetarian. Out of 230 non-vegetarian, 73.91% (170) respondents were ready to use the meat of deer, 23.91% (55) were not interested and rest 2.17% (5) have no rigid answer about their interest toward it. Most people were fill questionnaire with justification that meat of chital is better than that of other because it contains lower amount of fat. They were ready to buy meat of chital in cost more than the cost of mutton. In total, 68% (170 out of 250) people interested to consume meat of chital, 22% (55 out of 250) were not interested and 10% (25 out of 250) have no clear answer.

Among the vegetarian, all were interested for use of antler and skin of chital. Out of total respondents 209 or 83.6% were ready to use skin and antler of chital for different purposes and 41 or 16.4% were not interested. Out of 209 respondents who were ready to use antler and skin of chital 102 respondents or 48.8% were for decorative, 49 or 23.22 for religious and 58 or 27.75% for luxurious purposes. It shows that people were interested towards other products of chital than meat.

Among these 250 respondents 104 respondents or 41.6% were interested for commercial farming of chital. They have keen interest in farming.

Among these five cities, people of Nepalgunj i.e.41 out of 50 or 82% were interested for meat. Biratnagar, having lowest percentage of people i.e. 28 out of 50 or 56%.

It shows if there is legal provision for farming, people are really interested for farming, and consumption of deer products. Non-vegetarian were also interested for antlers and skin except meat. It shows the wide scope of deer (chital) farming in Nepal.

2. ECONOMIC ASPECTS

Evaluation of the economics of deer farming

It is difficult to make an accurate economic evaluation of deer farming because many factors cannot be quantified. It is, however possible on the basis of various assumptions.

Capital costs include:
- Cost or rent of land;
- Purchase price of the deer;
- Expenditure on land improvement (buildings, fences, water, holding pens);
- Contingencies include (packing facilities, transportation, marketing);

Fixed costs include:
- Working expenses (repair, maintenance, etc);
- Machine replacement and maintenance;
- Management charges;
- Labor costs;
- Veterinary costs;
- Running and maintenance of vehicles;
- Costs of marketing;
- Feeding cost of deer.

Revenue include:
- Meat (prices can be obtained on the basis of the animal on the hoof, kg/dressed carcass weight and market prices);
- Skins (either cured or finished product);
- Other products (antlers in velvet, tail, penis, etc).

(Revenue from local sales will be much less than revenues from export sales.)

Deer farming has two economic advantages, namely: (1) a return of investment can be achieved within a short time through the sale of animal products and (2) investment costs may be less than for cattle farming. (FAO, 1986)

In order to adequately evaluate the costs/benefits of deer farming, certain production coefficients should be obtained, to include averages of the following coefficients:
- Useful life (in years),
- First offspring (in years),
- Breeding percentage,
- Weaning percentage,
- Slaughter age (in years),
- Live weight (in kg.).

The annual off-take can be computed from there data.

In addition, the following data should be obtained:

- Mortality losses,
- Number of saleable animals,
- Dressing out percentages,
- Saleable weight in kg.

Although, as indicated, certain factors can only be approximated, cost/benefit ratios should be worked out on the basis of the best available data in order to obtain at least some indication of the economic viability of an individual deer farm.

Assumption made in a cost/benefit analysis

It should be stressed that the following analysis of cost/benefit is partly based on assumptions, which may or may not approach the true figures.

The following assumptions have been taken into consideration in deriving the financial analysis of deer farming in two ha.

- That the input is following recommended practices;
- That prices will remain constant over the period of analysis;
- That the species of deer chosen for stocking is Chital,
- That animals reach their full weight within two years,
- That a sex ratio of one male to four females adequate for reproductive purposes (on the basis of experience of the farm supervisor of Rasuwa);
- That reproductive success less calf mortality results in 90% calf survival up to reproductive age;
- That the sex ratio of calves is balanced;
- That the natural mortality rate for both males and females is 5%;
- That deer fodder will be planted in paddocks and that deer will be rotated between paddocks and extra food will be supplied;
- That the size of the deer farm will be 2 ha., 50 male and female were stocked per ha;
- The average fresh meat weight of the male carcasses is 80 kg. and female 45 kg;
- That the females reach sexual maturity at 1 year;
- That at the start of year 7 culling rates can be increased for males to 90% and for females to 50%;
- That the culling of the male population will be to the extent of keeping the adult male/adult female ratio at 1 to 4 and for female 25%; and
- Feeding cost is taken according to the practice in private deer farm, Laharepauwa, Rasuwa.
- One farm supervisor and one workman will need for one ha farm and after expansion of farm to two ha it needs one more workman. Salary of farm supervisor will NRs 7,500.00 per month (as salary of HMG/N gazetted officer) and salary of workman as salary of HMG/N non-gazetted Peon i.e. NRs. 3,000.00 per month.

- Cost of meat inspection and slaughtering is as cost of goat in Kathmandu valley i.e. NRs 300.00,

Based on the above-mentioned assumptions, an analysis was made of herd management on a commercial deer farm of 2 ha. The data are shown in Table IV.

Also based on the above these assumptions, as well as on known capital and fixed costs, a cost-benefit analysis was made of herd management on a commercial deer farm of 2 ha. deer farm. The data are shown in Table VIII. The internal rate of return, based on these data, is 20.14 percent.

This figure needs to be accepted with caution as it depends on a fairly high return for meat. However, the return on the investment is likely to exceed criteria for both public and private sector investments in year 13 and the culling rate for females will be increased to just under 65% in order to stabilize the population to about 40 adult females, 10 males and the current years off-spring of both sexes.

HERD MANAGEMENT

Herd management requires a detailed knowledge of both deer behavior and needs, as well as knowledge of the location, distribution, abundance and use of the various deer foods on any particular range.

Husbandry decisions which farmers have to make include how many animals should be slaughtered and what the male-female ratios should be for a satisfactory herd increase. They must also assess calving mortality and range conditions, and ensure the elimination of diseased stock.

The question of herd composition is of major concern to a farmer who wishes to obtain the highest possible returns. Naturally the structure of herds-the number of male and female deer of different ages- will vary, depending on the objectives of management.

Although farmed deer may appear quite tame, they are potentially dangerous to the people who handle them. As pointed out elsewhere, this is particularly true for chital stags during the rutting season.

When segregating deer in enclosures, it should be kept in mind that in most species males and females associate in separate groups during the greater part of the year. There should be enough paddocks to handle the different the different age and sex groups of animals to be reared.

Females in an advanced state of pregnancy should not be moved: when at Invermay, New Zealand, red deer hinds were taken to new enclosure shortly before calving, considerable calf mortality occurred, partly because they were trampled by the adults Kelly and Whateley, 1975).

Catching of deer entails and should, therefore, be minimized as much as possible. Any disruption in daily routines, or in constituents of the diet, may cause a state of stress with a reduction in productivity. Maintaining very regular daily routines is important so that the animal's own space-time relationship is not disrupted (Fox, 1967).

Training should be enhanced by social facilitation, where untrained animals may be motivated to follow the actions of trained ones.

Culling of deer should be enhanced by practiced: those, which are not thriving or give trouble when moving a herd should be culled.

Table-IV
Analysis of herd management on a commercial deer farm in 2 ha. land

	Population at start of 10 months period						Population at the end of 10 mths period			
Mths.	Adults		Calves born		Animals slaughtered during period		Adult mortality		Calf mortality	
	M	F	M	F	M 80%	F 25%	M 5%	F 5%	M 10%	F 10%
10	3	12	6	6	-	-	3	12	5	5
20	8	17	8	8	-	-	8	16	7	7
30	15	23	11	11	6	4	8	18	10	10
40	18	28	14	14	6	4	11	23	13	13
50	24	36	18	18	8	6	15	28	16	16
60	31	44	22	22	12	7	18	34	20	20
70	38	54	27	27	15	8	22	44	24	24
80	46	68	34	34	18	11	27	54	31	31
					90%	50%				
90	58	85	42	42	24	27	32	55	38	38
100	70	93	46	46	29	28	39	62	41	41
110	80	103	51	51	35	31	43	68	46	46
120	89	114	57	57	38	34	58	76	51	51

(Number of deer stocking in enclosure given in appendix II)

The above table shows that stocking is started with 4 male and 12 female with sexually mature i.e. at least 1 year old. Animal will be reached in harvesting weight at 2 years old. So, there is no slaughtered in first 20 months. The mortality rate was 5% for adult male and female both and calf mortality was 10% for both sexes. Animal was slaughtered from 3rd year. Slaughtered will done by 80% of male and 25% of female from total number in previous after the mortality with 5%. At the end of the 7th year, population of the chital will reach in maximum number and slaughtered rate will be increased by 90% to male and 50% to female.

REQUIREMENT FOR THE ESTABLISHED OF DEER FARM

Farm layout and design have an important bearing on the workability of a farm and the ease of stock management. Attention should be given to:

- Paddock design: A farm should be sub-divided into paddocks to allow for segregation of herds by age and sex.
- Gate sitting: Gates should be located in such a way that stock will move readily from one paddock to the next.
- Water management: Each paddock should access to drinking water. Earth dam can be erected across streams to provide water through plastic piping into drinking troughs.

Based on the experience obtained in Rasuwa and Godawari, an economically viable deer farm should be simple but suitable for local condition. Assuming a carrying capacity about 50 deer per ha. under good management, the deer farm of 2 ha. in size required minimum and laid out as detailed in the following models:

The farm should be sub-divided into 4 paddocks of 5000sq. m. each, and deer should be rotated between these paddocks. Gates should connect all paddocks. Posts should be made of re-inforced concrete, 2m long and spaced 5m apart. Gabion wire used for farm is mesh wire of 10 swg and S. wire of 7 swg. Concrete post use in every 5m. interval.

In one paddock, compartment of 20×50 sq. m. should be roofed by wire, which provide shelter for night and saved from predators. area of 20×20 sq. m. should separate for fawns and pregnant hinds.

A water tank will make inside the compartment of size 5m×20m with providing water 24 hours. Two small water tanks of size 1m×1m each will made in night rest compartment and compartment for calves and pregnant hinds. If farm is near water source it will be more suitable. (Layout and cost estimation of farm in appendix-III).

Enclosure will make in 1 ha. land for first year. It needs NRs. 121,000.00 total cost. We already assumed that carrying capacity of 1ha. enclosure is 50 deer. So, after increasing the number of deer population in 4^{th} enclosure will be expanded in 2^{nd} one ha land. The costs of construction for this will NRs.72, 101.00. The total cost for construction of enclosure in 2 ha land will NRs193, 101.00.

MARKETING OF DEER PRODUCTS

Deer have a high dressing put percentage. The meat is virtually fat-free. It can provide much needed protein, vitamins and minerals to people whose economic ability to purchase their vital dietary components in the market place is very limited. A high proportion of a whole deer carcass can be packed as saleable meat. The by-products from slaughter are valuable. These comprise skin, tail, pizzle, ligaments and blood (FAO, 1986).

Market studies of deer products provide information not only on demand of each product in specified areas or market, but it also deal with trends in prices and volume of trade. By the study of people in five major cities of the country shows the interest towards deer products, their feeding habit, amount of consumption and interest for farming. In the study, average family of six members would consume one-kilo meat once at a week. It shows the large amount of consumption of meat.

Table-V

Proposed price for deer products

Place	No. of Respondents	Vegetarian	Non-vegetarian	Cost of products could afford (in NRs)		
				Meat	Ant.	Skin
Biratnagar	50	5	45	250	315	565
Kathmandu	50	2	48	300	536	1015
Pokhara	50	6	44	247	574	1291
Nepalgunj	50	4	46	262	439	910
Dhangadhi	50	3	47	244	736	1550
Total	250	20	230		2600	5331
Average	50	4	46		520	1066.2

Proposed price for antler and skin were very vast gap between lowest and highest. Highest price was NRs.5, 000.00 for skin and NRs.2, 500.00 for antler and lowest price was NRs.15.00 for both. The highest average proposed price for both skin and antler per chital was in Dhangadhi i.e. NRs.736.00 and NRs.1550.00 respectively and lowest proposed price for both were in Biratnagar i.e. NRs.315.00 and NRs.565.00 respectively. Total average proposed price for skin and antler was approximately NRs.1, 000.00 and 500.00 respectively.

Price for meat is taken according to place, because it is assumed that price of other products than meat will same and of meat will different according to place.

FEEDING AND FOOD UTILIZATION

Knowledge of the feed requirement of farm animals can assist greatly in management. In there food habits deer are always selective. They seek out the highly palatable food in preference to food of medium or low palatability. Their utilization of food is influenced considerably by the seasons: maximum food intake occurs during the spring when plants generally have their highest protein content, and minimum intake during the winter, when food is scarce. During the rut males ingest little of no food.

Deer cam digest large quantities of medium-quality feed, thanks to symbiotic microorganisms. Event if digestion is incomplete, they still obtain sufficient energy if the range is in good condition.

Where the range has a high carrying capacity throughout the year-, which may be the case in tropical areas, or where winters are not severe – there is no real need for supplementary feeding. Obviously, additional food should only be provided when it is warranted on the basis of economic considerations (FAO, 1982).

In feeding operations consideration should be given to the growth pattern, efficiency of food utilization for carcass production and the needs for maximum velvet production and reproductive performance. One major advantage of supplementary feeding is that it accustoms the animals concerned to human presence.

Care should be taken that there is always sufficient water available: water shortage decreases the digestibility of food, especially of cellulose and deer loses weight.

During spring, young stock should be given preferential treatment in supplementary feeding and stags growing velvet should also be provided with good quality food. Under-nutrition during spring increases the possibility of metabolic disease in breeding females and growth and consequently poor reproductive performance. It also results in poor carcass production; depressed velvet yields and hence lowered profitability. In Scotland (Sharman, 1978), hinds are given supplementary feed only during the last month of pregnancy and the first month of lactation FAO, 1982).

During summer, lactating females require a high food intake to maintain lactation and body weight for mating. Good pasture should be provided to the young deer to allow for rapid weight grains. Adult males should be kept at peak body weight in preparation for matingFAO, 1982).

Winter-feeding should aim at continued growth of young stock, maintenance of body weight in breeding females and sustain or improve the condition of adult males. Provision of high quality winter feed to young males advances the time of pedicle development. In order to increase antler growth beyond what is normally attained in the wild, it is necessary to provide supplementary forage (FAO, 1982).

If economical supplementary feed could be developed, together with methods of feeding designed to maintain considerably larger herds through the winter, deer farming could be rendered significantly more profitable than it is at the moment. This would be particularly true for reindeer (Kurkela, 1976).

Grain can be fed to good advantage, but too much causes acidosis and tympany (Wobeser & Runge, 1975).

In Nepal, mainly in three places viz. Central zoo, Musk Deer Research Center and private farm in Rasuwa, for rearing Chital in enclosure. In first two, food materials are mainly grain and in private farm it is fodder. I evaluate that by mortality, condition of deer and expenditure, last practice is better. So, in this analysis I am using the cost of feed according to the practice in private farm. (Feeding amount of chital in Godawari and zoo were given in Appendixes IV & V respectively). Most of the fodder used in Rasuwa of local species mostly *Ficus sps.* For collection of fodder two workmen were recruited. Other feeding materials were given in table VI.

Table VI

Feeding practice (in gram**)**

	Item	Dry Season	Green Season
1	Corn	125	100
2	Soybean	125	100
3	Gram	75	50
Axis 4	Wheat bran	200	150
— 5	Mineral mixture	10	10

This feeding practice prefer to the green fodder than other. In dry season, other diet will be increased due to the shortage of green fodder. Mostly local fodder will be provided. Fodder trees within in the enclosure must be wired because it checks the debarking by antler, when it became hard. It may better if we construct cement posts within the enclosure to rub the antler.

Table VII
Feed Budgeting of Chital

Period of the year	Corn	Gram	Soybean	Wheat bran	Min. Mixt.
Dry Season					
Scale/day (gm)	125	75	125	200	10
Qty./month (kg)	3.75	2.25	3.75	6.00	0.30
Qty./6 month (kg.)	22.50	13.50	22.50	36.00	1.80
Green Season					
Scale/day (gm)	100	50	100	150	150
Qty./month (kg)	3.00	1.50	3.00	4.50	0.30
Qty./6 month (kg)	18.00	9.00	18.00	27.00	1.80
Total qty/year (kg)	40.50	22.50	40.50	63.00	3.60
Rating (NRs/kg)	8.50	22.00	21.00	6.00	15.00
Transport @NRs. 1/kg	40.50	22.50	40.50	63.00	3.60
Cost/year/animal	384.75	517.50	891.00	441.00	57.60
Total cost /animal/year NRs.2, 291.85					

In above calculation of feeding budgeting, it is assumed that dry and green season consists of the equal halves of the year. Feeding budget was calculated according to the local price in Kathmandu.

Scales haven't been differentiated as per age, sex and status of the animal. All deer are given same diet.

DISEASESE

Deer at low population densities on natural range are generally not affected by disease to any significant extent. However, they are susceptible to many diseases and hence disease becomes an important factor in the intensive management of deer. Deer often die extremely rapidly –in many cases within 24 hours of the onset of clinical signs (FAO, 1982).

The age and condition of deer population affects the level of parasitism and disease. Generally speaking, as the number of animals held in capacity increases, so do losses due to diseases, if measures are not taken to prevent them. Deer in their first 12-15 months of life are more susceptible to disease than adults.

Treatment of sick deer is analogous with that of domestic animals. Prevention of disease by nutritional management, testing, vaccination, drenching and dipping, is more important than treatment. The routine use of anthelminthics and avoidance of overstocking best achieve prevention of disease and parasitism, as the incidence of disease often increases with high-density stocking. Newly acquired stock should be isolated from other deer, treated if necessary, and not released with other deer until they all appear in a healthy condition.

In Nepal, it is not economic to recruit veterinarian in deer farm permanently. We have no trend to farm in large number. So, veterinary facility will provide periodically or when necessary. So, cost of veterinarian services is no regular or uniform and it is mentioned under the heading contingencies.

COST- BENEFIT ANALYSIS

Cost-benefit analysis of chital farm in 2 ha is calculated on the basis of cash flow in 10 years period. Cash flow in 10 years period will be given in table VII. It is based on the assumption describe above.

Table:VIII

Cost-benefit analysis for a 2 Ha deer farm in NRs. (1 US $-73.65 NRs)

Year	Costs		Benefits	
0 (Construction of an enclosure of a 1ha.)	**Land**			
	Acquisition (government land)	600		
	Construction of enclosure 1ha.	121,323		
	Labor			
	1 workman at 3000/month/ workman	36,000		
	Staff			
	Salary of farm supervisor 7,500/month	90,000		
	Deer acquisition			
	15 deer at 10,000 per animal	150,000		
	Feeding cost @ 2,291.85 of 20 deer	45,837		
	Contingencies, say	50,000		
		493,760		
1	Land	660	Fresh meat,2 males, each 80kg. at 300 per kg	48,000
	Labor		Fresh meat, 2 females, each 45 kg 300 per kg.	27,000
	1 workman	36,000	4 skins, at 1000 per skin	4,000
	Staff		Antler, 2 males, each at 500m	1,000
	Salary of farm supervisor	90,000		80,000
	Harvesting			
	Slaughtering and meat inspection cost, at 300/ animal	1,200		
	Feeding cost of 35 deer	80,215		
	Contingencies	50,000		
		258,075		
2	Land	726	Fresh meat, 8 males	1,92,000
	Labor		Fresh meat, 4 females	54,000
	1 workman	36,000	12 skins	12,000
	Staff		Antler, 8 males	4,000
	Salary of farm supervisor	90,000		2,62,000
	Harvesting			
	Slaughtering and meat inspection costs	3,600		
	Feeding cost of 51 deer	116,884		
	Contingencies	50,000		
		297,210		
3 (Construction of an enclosure of a 1 ha.)	Land	1,398.6	Fresh meat, 8 males	1,92,000
	Construction of 2nd 1 ha. enclosure	72,101	Fresh meat, 7 females	94,500
	Labor		15 skins	15,000
	1 workman	36,000	Velvet, 8 males	4,000
	Staff			3,05,000
	Salary of farm supervisor	90,000		
	Harvesting			
	Slaughtering and meat inspection costs	4,500		
	Feeding cost of 66 deer	151,226		
	Contingencies	50,000		
		405,225.6		

4	**Land** ***1,538.46*** **Labor** 2 workman **Staff** Salary of farm supervisor **Maintenance** Upkeep and fences **Harvesting** Slaughtering cost *Feeding cost of 87 deer* *Contingencies*	 72,000 90,000 5,000 6,600 199,391 50,000 424,529.46	Fresh meat, 14 males Fresh meat, 8 females 22 skins Antler, 14 males	3,36,000 108,000 22,000 7,000 473,000
5	**Land** ***1,692.3*** **Labor** 2 workman **Staff** Salary of farm supervisor **Maintenance** Upkeep and fences **Harvesting** Slaughtering and meat inspection costs, *Feeding cost of 115 deer* *Contingencies*	 72,000 90,000 5,000 87,00 263,563 50,000 ***490,955.3***	Fresh meat, 19 males Fresh meat, 10 females 29 skins Antler, 19 males	456,000 135,000 29,000 9,500 629,500
6	**Land** ***1,861.53*** **Labor** 6 workman **Staff** Salary of farm supervisor **Maintenance** Upkeep and fences **Harvesting** Slaughtering and meat inspection cost *Feeding cost of 148 deer* *Contingencies*	 72,000 90,000 5,000 13,200 339,194 50,000 ***571,255.53***	Fresh meat, 24 males Fresh meat, 20 females 44 skins Antler, 24 males	576,000 270,000 44,000 12,000 902,000
7	**Land** ***2,047.7*** **Labor** 2 workman **Staff** Salary of farm supervisor **Maintenance** Upkeep and fences **Harvesting** Slaughtering and meat inspection costs *Feeding cost of 184 deer* *Contingencies*	 72,000 90,000 5,000 19,200 421,700 50,000 ***659,947.7***	Fresh meat, 31 males Fresh meat, 33 females 64 skins Antler, 31 males	744,000 445,000 64,000 15,500 1,269,000
8	**Land** ***2,252.45*** **Labor** 2 workman Salary of farm supervisor	 72,000 90,000	Fresh meat, 40 males Fresh meat, 36 females 76 skins Antler, 40 males	960,000 486,000 76,000 20,000 1,542,000

	Maintenance			
	Upkeep and fences	5,000		
	Harvesting			
	Slaughtering costs	22,800		
	Feeding cost of 211 deer	483,580		
	Contingencies	50,000		
		725,632.45		
9	**Land**		Fresh meat, 45 males	1,080,000
	2,477.7		Fresh meat, 40 females	540,000
	Labor		85 skins	85,000
	2 workman	72,000	Antler, 45 males	22,500
	Staff			1,727,500
	Salary of farm supervisor	90,000		
	Maintenance			
	Upkeep and fences	5,000		
	Harvesting			
	Slaughtering and meat inspection costs	25,500		
	Feeding cost of 240 deer	550,044		
	Contingencies	50,000		
		795,021.7		

Cost of land acquisition is according to the leasing rate of the HMG/N in mid-hill. Leasing rate of government for industry or business purposes is different for different areas. It is NRs. 200.00, 600.00 and 1,000.00 for Himal, mid-hill and Terai respectively. It will increase at the rate of 10% every year.

In this analysis, for first three years 1 ha. Land will be leased and from fourth year it is increased from 1 ha to 2 ha. So, lease cost is NRs. 600.00 for first year then 660.00 and 726.00 for second and third year by increasing 10% every year in compounding rate. In fourth, it will be NRs.1398.60 by NRs. 798.60 is 10% of NRs. 426.00 (Lease cost of 3rd year) plus NRs.600.00 of additional 1 ha. land taken from that year. Then it will be increased by 10% every year.

It is assumed that, chital of 1year old are stocked and they are 30-45 kg stag and 22-40 kg hind in that age (according to Australian farm). Costs of deer for stocking will NRs. 10,000.00, on the basis of cost of younger goat for husbandry and their weight.

In cost heading, contingencies include the cost of transportation of materials, veterinary services, marketing and promotion charges and other miscellaneous expenses. Slaughtering and meat inspection cost is considered as the slaughtering and meat inspection cost of goat in Kathmandu valley i.e. NRs.300.00 per animal. Maintenance of fences will be started from 5th year and cost will remain for all year i.e. NRs.5, 000.00.

There is no revenue in 1st year. Expenditure sill more than income up to 4th year and income will higher than expenses from 5th year. In this model, farm proprietor must able to afford loss of first four years.

Revenue includes only meat, skin and antler. In other countries, velvet is good protein containing material its cost is high. It can be extract from deer without killing and regularly every year. In Nepal, all people and hotels were unknown about it. If it will promoted well then it add income. In addition to these products penis, blood and tail are also source of income in other countries but due to the lack of practice in Nepal, people have no answer about it.

Table IX
Summary of Expenditures/Incomes

Year	Expenditures (NRs.)	Income (NRs.)
0	493,760.00	-
1	258,075.00	80,000.00
2	297,210.00	262,000.00
3	405,225.60	305,000.00
4	424,529.46	473,000.00
5	490,955.30	629,500.00
6	571,255.53	902,000.00
7	659,947.70	1,269,000.00
8	725,632.45	1,542,000.00
9	795,021.70	1,727,500.00
	5,121,612.74	7,190,000.00

Table IX, shows that expenditure is more than income till first four years. At the last of 10 years, total expenditure will be NRs 5,121,612.74 and income will be NRs 7,190,000.00. The internal rate of return (IRR) based on the above cash flows is 20.14%. Calculation of IRR is given in appendix VII.

CHAPTER-IV

SENSITIVITY ANALYSIS

Any financial analysis of expected costs and returns from deer farm is unavoidably subject to a considerable degree of uncertainty. There is no way which one can predict how the different costs and returns involved will evolve during the lifetime of the Chital. Therefore, sensitivity analysis was carried out. In this particular chital farm model, the analysis showed that the farm is sensitive in terms of construction of enclosure and salary of staffs. In this model, if income will constant and expenditure will be increased by 10% then IRR will decrease from 20.14% to 14.88%, and if increased by 25% then it is decrease to 7.15%. If expenditure will constant and income decrease by 10% then IRR decrease to 14.32% and income decrease by 25% then IRR will decrease by 3.42%. If income decrease by 10% and expenditure increase by 10% then IRR will 8.80%.

Summary of sensitivity analysis

- If the expenditures are 10% higher, IRR= 14.88%
- If the expenditures are 25% higher, IRR= 7.15%
- If the income is 10% lower, IRR = 14.32%
- If the income is 25% lower, IRR= 3.42%
- If 10% more expenditure is combined with 10% less income, IRR= 8.80%

CHAPTER-V

CONCLUSION

In this particular deer farm, the IRR was found to be 20.14%. In general, the cash flow analysis is negative unless the number of deer to be slaughtered will be 22. The cash flow and IRR clearly indicates that the IRR is medium.

Financial analysis of expected costs and returns from deer is unavoidably subject to a considerable degree of uncertainty. There is no way by which one can predict how the different costs and returns involved will evolve during the period of farming. Therefore, sensitivity analysis needs to be carried out.

Based on the analysis on present prices, here the assumptions were all costs and out-put will grow at the same rate. This is unlikely in practice. Therefore, it is important to examine the possible market fluctuations, labor costs and material availability, and other changes, which would affect the financial profit of any deer farm before one decides to take up such projects.

By the market survey in different cities of the country, it seems that people are interested to use deer products and to farm commercially. Proposed price of meat of chital is higher than that of mutton in every city. It is believed that if size of farm will large then it will be more profitable.

CHAPTER-VI

RECOMMENDATION

- The existing wild life laws hindering to the development of wildlife enterprises must be amended as soon as possible;
- License should issue to those person, who have knowledge about ecology of deer;
- Permission should be given only those person or farm who have licensed;
- Data of farm must be up to date and checked by government officials;
- Provision of development loans for farms in the private sector;
- Training should be given to the farmer for deer husbandry;
- Deer for stocking at first should be provided by government;
- Government should provide forest in lease to deer farm.

Appendix-I
Questionnaire

Name of Respondent……
Sex……..Age……..
Address……VDC/Municipality…….Ward No…
Name of Household Head……..
Relation of Respondent with Household Head……..
Number of Family Member……..(Male…….Female……..)

1.Are you a vegetarian or a non- vegetarian?

a. Vegetarian b. Non-vegetarian

2.Which meat do you like the most?

a. Mutton b. Chicken c. Buff d. Pork

3.How often do you take meat in a week and in what amount?

4. In which festive occasions do you usually take meat?

5. How much do you take meat in those festivals?

6.Would you prefer to have Chital meat if you were given?

a. Yes b. No

7. How much will you pay for it if you are to buy it?

a. Cheaper than mutton b. More expensive than mutton

8. If it was more expensive than mutton, then how much will you pay for it?

9. For what purpose do you use the antler and skin of Chital?

a. Religious purpose b. Decoration c. Luxury item

10. How much do you pay for a Chital hide?

11. How much do you pay for the horns?

12. Have you reared any livestock for meat in your house?

a. Yes b. No

13. If you have, then what are those animals?

a. Goat b. Sheep c. Buffalo d. Pig

14. For what purpose have you reared them?

a. For household purpose b. For sale

15. How much do you earn when you sale them?

16. If rearing of Chital is made legal, then will you keep them?

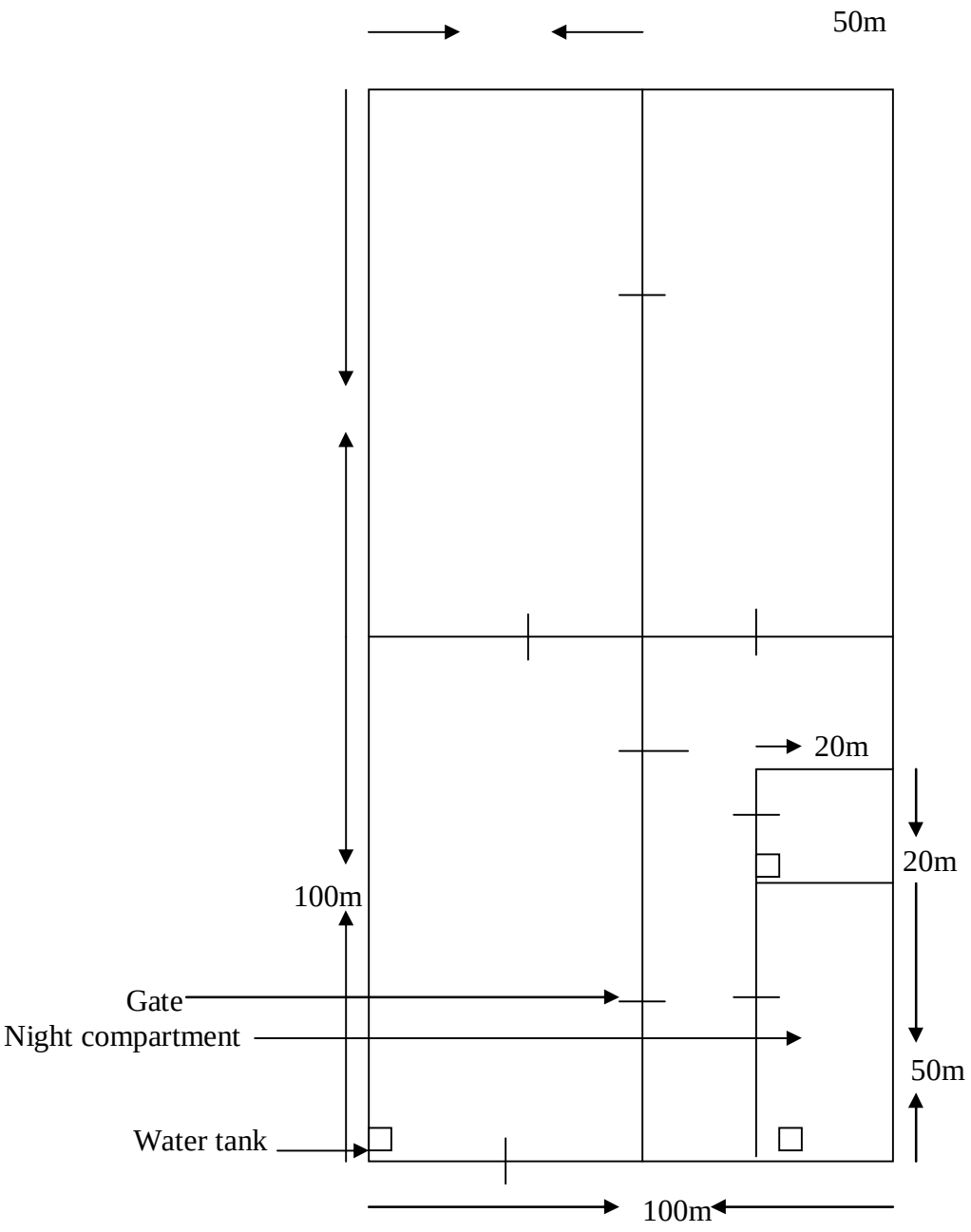
a. Yes b. No

Appendix II

Number of deer stocking in the enclosure

Year	Number of deer		
	Male	Female	Total
1	5	15	20
2	12	23	35
3	20	31	51
4	26	40	66
5	36	51	87
6	47	68	115
7	60	88	148
8	77	107	184
9	92	119	211
10	105	135	240

Appendix III
Layout of enclosure



Appendix IV
Cost of enclosure

Supply and making gabion

(Box size 2×1×1 m^3).

Mesh wire	10 swg
s. wire	7 swg

Labor

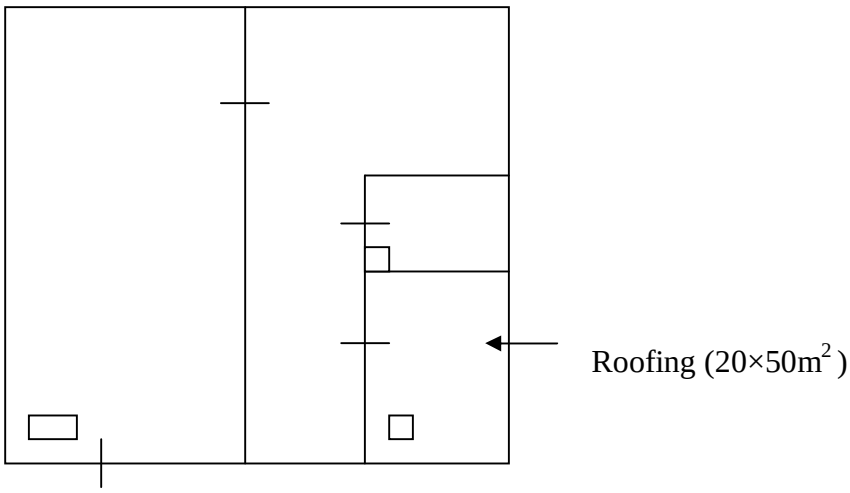
Skilled	0.5 no/165/day
Unskilled	0.2 no/100/day

Material

GI wire	28.4 kg	Rs 45/kg
S wire	3.15 kg	Rs 38/kg

Rate per box	NRs.1718.12
Rate /sq m	NRs. 17.18

Cost of enclosure for first 1 ha.

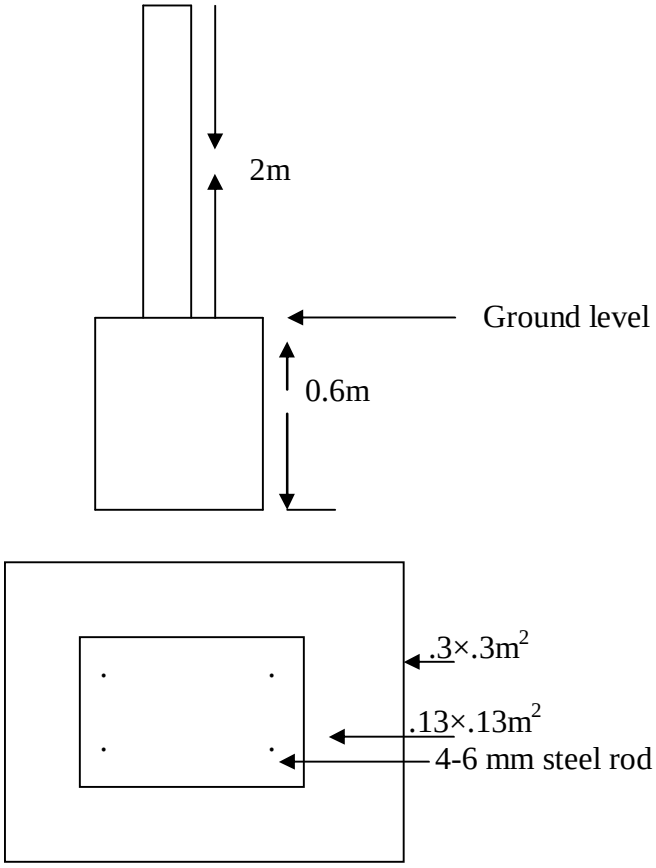


GI wire Net

Total Length = 600m.
Required net = 600m×2m= 1200m^2
For roof =50m×20m= 1000m^2
Total 2,200 m^2

Cost of GI net @ NRs 17.18/m^2
Total cost = 17.18×22,00 = NRs. 37,796.00

PCC Post



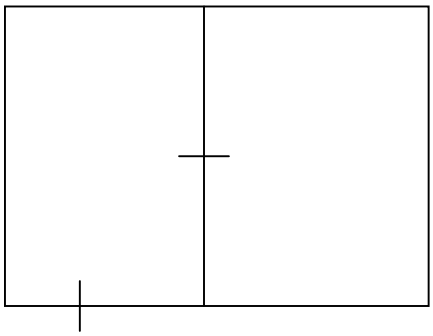
Plan of RCC post

No. of poles = 121 Nos. (in every 5m interval)
Volume = 121 (0.6×0.3×0.3)+121(0.13×0.13×2) m^3
= 10.62 m^3
Cost of poles = 10.62 m^3 × NRs. 4417.80/ m^3
= NRs. 46,934.00

Steel

Length = 2.80m
Diameter = 6mm
Volume = (2.80×4) ×121 ×0.23kg/m = 311.7 kg
Cost = 311.7×NRs. 40.4/kg = NRs. 12,593.00
Installation of RCC post = NRs. 9,000.00
Transportation of wire & post = NRs. 10,000.00
Miscellaneous =NRs. 5,000.00
Total Cost = NRs. 121,000.00

Cost of enclosure for 2nd 1 ha.



GI wire net

Total Length = 400 m
Required GI wire = 400m×2m=800 m^2
Cost of GI wire net = 800 m^2 @ NRs. 17.18/ m^2= NRs. 13,744.00

PCC Post
Number of posts = 80
Volume of 80 posts = 80(0.6×0.3×0.3)+80(0.13×0.13×2) m^3 = 7.024 m^3
Cost of 80 (7.024 $m^{3)}$ posts @ NRs.4417.8/m^3 = NRs.31, 031.00

Steel
Length =2.8m
Diameter = 6mm
Weight = 0.23 kg/m
Total weight= 80×(2.8×4)×. 23= 206.08 kg
Cost= 206.08 kg @ NRs.40.4/kg = NRs.8, 326.00
Installation cost of posts = NRs. 6,000.00
Transportation cost of wire & posts = NRs.8, 000.00
Total Cost = NRs. 72,101.0

Appendix-V

Deer feeding practice at Musk Deer Research Centre, Godawari

		Item	Dry Season
	1	Corn	200
	2	Soybean	200
	3	Gram	125
Axis	4	Wheat bran	500
—	5	Mineral mixture	007
	6	Table salt	005
	1	Corn	125
	2	Soybean	125
	3	Gram	100
Muntijak	4	Wheat bran	400
	5	Mineral mixture	005
	6	Table salt	005
All Seasons			
	1	Gram	100
	2	Soybean	050
	3	Carrot	200
Musk	4	Pumpkin	100
	5	Apple	200
	6	Potato	275
	7	Seasonal fruits	100
	8	Banana	100
	9	Cabbage	070
	10	Green Vegetable	300
	11	Mineral Mixture	005

Appendix VI
Diet of Chital (Zoo)

	22 deer/ day	1 deer/day
Maize	6.360 kg	289gm
Gram	3.330 kg	151 gm
Soybean	4.400 kg	200 gm
Bran	22.000 kg	1.00 kg
Mineral mixture	0.220 kg	10 gm

Appendix VII
Calculation of IRR

Year	Real Cash Flow		NPV at 20%		NPV at 21%	
	Expenditure	Income	Expenditure	Income	Expenditure	Income
1	493,760.00	-	493,760.00	-	493,760.00	-
2	258,075.00	80,000.00	215,062.50	66,666066	213,285.12	66,115.70
2	297,210.00	262,000.00	206,395.80	181,944.44	202,998.42	178,949.52
4	405,225.60	305,000.00	234,505.50	176,504.60	228,739.28	172,164.54
5	424,529.46	473,000.00	204,730.60	228,105.70	198,046.12	220,657.99
6	490,955.30	629,500.00	197,303.90	252,981.90	189,284.52	242,699.50
7	571,255.53	902,000.00	191,312.32	302,077.90	182,019.60	287,404.99
8	659,947.70	1,269,000.00	184,179.29	354,154.60	173,784.85	334,167.36
9	725,632.45	1,542,000.00	168,758.90	358,619.90	157,918.76	335,584.12
10	795,021.70	1,727,500.00	154,080.50	334,801.00	142,991.64	310,706.05
Total	5,121,612.74	7,190,000.00	2,250,089.51	2,255,856.77	2,182,828.31	2,148,449.54

NPV of 2 ha. Deer farm at 20 percent is:

NPV= Total NPV of Income – Total NPV of expenditure
= NRs.2,255,856.77-NRs.2,250,089.51
= NRs.5,767.26

A positive NPV of NRs. 5,767.26 at 20 percent indicates that the farm's true rate of return is higher than 20 percent. Let us try 21 percent as the discount rate. At 21 percent, the farm's NPV is:

NPV = NRs. 2,148,449.54 -NRs. 2,182,828.31
= -NRs.34,378.54

Since, a negative NPV of NRs. 34,378.54 indicates that the true rate of return of deer farm is lower than 21 percent. So, the true rate of return of return should lie between 20-21 percent. We can find out a close approximation of the rate of return by the method of linear interpolation as follows:

$$IRR = 20\% + (21\%-20\%)\frac{5767.26}{(5,767.26+34,378.54)}$$

= 20%+0.1%
= 20.14%

Appendix VIII

Sensitivity Analysis

1. If expenditure 10% higher and income remaining constant

Year	10% higher expenditure	NPV at 14%		NPV at 15%	
		Expenditure	Income	Expenditure	Income
1	543,136.00	543,136.00	-	543,136.00	-
2	283,882.50	249,019.73	70,175.43	246,854.34	69,565.21
3	326,931.00	251,562.78	201,600.49	247,206.80	198,109.64
4	445,748.16	300,867.31	205,866.31	293,086.65	200,542.45
5	466,982.40	276,491.06	280,053.97	266,998.70	270,439.28
6	540,050.83	280,485.47	326,942.57	268,500.70	312,972.75
7	628,381.00	286,281.93	410,939.06	271,666.44	389,959.49
8	725,942.47	290,113.70	507,139.76	272,908.66	477,064.10
9	798,195.69	279,814.72	540,562.06	260,931.58	504,082.53
10	874,523.87	268,923.03	531,219.97	248,594.26	491,063.31
Total	5,633,773.42	3,026,695.73	3,074,499.62	2,919,883.47	2,913,798.76
Diff= Total (income-expend)		47,803.89		-6,084.70	

IRR = 14% + $\frac{47,803.89}{(47,803.89+6,084.7)}$

= 14% +0.88%

= 14.88%

2. If expenditure 25% higher and income remain constant

Year	25% higher expenditure	NPV at 7%		NPV at 8%	
		Expenditure	Income	Expenditure	Income
1	617,200.00	617,200.00	-	617,200.00	-
2	322,593.75	301,489.48	74,766.35	298,697.91	74,074.07
3	371,512.50	324,493.34	228,840.94	318,512.08	224,622.77
4	506,532.00	413,480.99	248,970.85	402,101.43	242,118.83
5	530,661.82	404,839.36	360,849.43	390,052.27	347,669.12
6	613,694.12	437,555.42	448,824.79	417,669.90	428,427.12
7	714,069.41	475,814.59	601,040.68	449,984.85	568,413.00
8	824,934.62	513,727.82	790,269.42	481,341.42	740,449.31
9	907,040.56	527,905.86	897,458.03	490,045.79	833,094.61
10	993,777.12	540,548.90	939,645.54	497,135.97	864,180.09
Total	6,402,015.90	4,557,055.76	4,590,666.39	4,362,741.67	4,323,048.21
Differences		33,610.63		-39,693.46	

IRR = 7% + $\frac{33,610.63}{(33,610.63+39,693.46)}$

= 7% + 0.45%

= 7.15%

4. If income is 10% lower and expenditure remaining constant

Year	10% lower income	NPV at 14%		NPV at 15%	
		Expenditure	Income	Expenditure	Income
1	-	493,760.00	-	493,760.00	-
2	72,000.00	226,381.57	63,157.89	224,413.04	62,608.69
3	235,800.00	228,693.44	181,440.44	224,733.45	178,298.67
4	274,500.00	273,515.73	185,279.68	266,442.40	180,488.67
5	425,700.00	251,355.52	252,048.57	242,726.09	243,395.35
6	566,550.00	254,986.79	294,248.31	244,091.55	281,675.47
7	811,800.00	260,256.33	369,845.15	246,969.78	350,963.54
8	1,142,100.00	263,739.73	456,425.78	248,098.78	429,357.69
9	1,387,800.00	254,377.02	486,505.85	237,210.53	453,674.28
10	1,554,750.00	244,475.48	478,097.97	225,994.14	441,956.98
Total	6,471,000.00	2,751,541.61	2,767,048.79	2,654,440.14	2,622,418.87
Differences		15,507.18		-32,021.27	

IRR = 14% +$\frac{15,507.18}{(15,507.18+32,021.27)}$

= 14% +0.32

= 14.32

5. If income is 25% lower and expenditure remain constant

Year	25% lower income	NPV at 3%		NPV at 4%	
		Expenditure	Income	Expenditure	Income
1	-	493,760.00	-	493,760.00	-
2	60,000.00	250,558.25	58,252.42	248,149.03	57,692.30
3	196,500.00	280,148.93	185,220.09	274,787.35	181,675.29
4	228,750.00	370,838.82	209,338.65	360,244.08	203,357.91
5	354,750.00	377,188.92	315,190.78	362,889.56	303,241.78
6	472,125.00	423,502.35	407,259.17	403,529.46	388,052.33
7	676,500.00	478,417.51	566,558.09	451,471.54	534,647.77
8	951,750.00	536,597.87	773,859.84	501,506.01	723,251.77
9	1,156,500.00	572,820.95	912,951.77	530,212.52	845,043.22
10	1,295,625.00	609,317.93	992,988.67	558,571.70	910,288.93
Total	5,392,500.00	4,393,151.53	4,421,619.48	4,185,121.25	4,147,251.30
Differences		28,467.95		-37,869.95	

IRR = 3% + $\frac{28467.95}{(28,467.95+37,869.95)}$

= 3%+ 0.42%

= 3.42%

6. If 10% lower income combined with 10% higher expenditure

Year	10% higher expenditure	10% lower income	NPV at 8%		NPV at 9%	
			Expenditure	Income	Expenditure	Income
1	543,136.00	-	543,136.00	-	543,136.00	-
2	283,882.50	72,000.00	262,854.16	66,666.67	260,442.66	66,055.04
3	326,931.00	235,800.00	280,290.63	202,160.49	275,171.28	198,468.14
4	445,748.16	274,500.00	353,849.26	217,906.95	344,199.36	211,964.36
5	466,982.40	425,700.00	343,246.00	312,902.20	330,822.10	301,576.61
6	540,050.83	566,550.00	367,549.52	385,584.41	350,995.98	368,218.62
7	628,381.00	811,800.00	395,986.62	511,571.70	374,683.05	484,049.81
8	725,942.47	1,142,100.00	423,580.45	666,404.38	397,115.39	624,767.81
9	798,195.69	1,387,800.00	431,240.29	749,785.15	400,587.50	696,490.02
10	874,523.87	1,554,750.00	437,479.66	777,762.08	402,655.08	715,850.09
Total	5,633,773.42	6,471,000.00	3,839,212.59	3,890,744.03	3,679,808.40	3,667,440.
Differences			51,531.44		-12,367.90	

IRR= 8% + $\frac{51,531.44}{(51,531.44+12,367.90)}$

= 8% +0.80

= 8.80%

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