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Suitability of Large Cardamom Farming as Business in Eastern Corridor of Nepal

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ABSTRACT

Background: Black gold popularly renounced for Large cardamom which is world's oldest and third expensive spice following, saffron and vanilla. The study was to assess suitability of large cardamom farming as business in eastern Nepal.

Methods: Eastern Nepal, subdivided as Koshi corridor (Sankhuwasaba and Tehrathum) and Mechi corridor (Taplejung and Panchthar), were purposively selected as a research site. About 480 Households were selected randomly. An interview schedule was prepared for cost of production and other expenses incurred along with production and price received by farmers.

Result: During the 7-year cycle, the total fixed cost was NRs 115,663. The breakeven point for large cardamom was calculated to be 157.45 kg. The average price per kilogram of large cardamom was NRs 1274.6. The average variable cost per kilogram of large cardamom was NRs 621.01. Financial indicator like net present value (NPV), benefit cost ratio (BCR) and internal rate of return (IRR) were 1,536,006, 2.14 and 71.31. The Return on Investment (ROI) and Payback period (PBP) were 138.45 and 5.6 years. Under worse scenario, The NPV declined to 977,115.1, the BCR fell to 1.60, the IRR fell to 50.02 and the ROI fell to 78.84. The PBP has risen to 6.8 years. This scenario demonstrated that simultaneous negative increases in cost and income had a greater impact on the profitability of large cardamom farming. Finally, the study's findings highlighted the sensitivity of financial indicators in large cardamom farming to changes in production costs, income and delays. This helpful information could be used by stakeholders to make decisions and develop strategies to improve sustainability of large cardamom growing in the research area.

Key words: BCR, Black gold, Business, Internal rate of return, Large cardamom, NPV, Payback period, Profitability, Return on investment.

INTRODUCTION

Large cardamom is the world's oldest and third most costly spice, behind saffron and vanilla and is commonly referred to as "black gold" (Tangjang and Sharma, 2018). Perennial, evergreen herbaceous plant cultivated on a hill slope facing north (Shrestha *et al*., 2018). In the Himalayan region, encompassing Nepal, India and Bhutan, large cardamom is a spice crop suitable for cash generation (Sharma *et al*., 2000). Nepal is the world's greatest producer of huge cardamom (Partap *et al*., 2014). Farmers first planted it in four districts of Nepal, namely Ilam, Taplejung, Panchthar and Bhojpuri (ITC, 2017). Commercial cultivation began in the Ilam area in 1953, following the formation of Nepal's large cardamom Development Centre. Large cardamom was brought to Nepal by Nepali workers and persons married in India around 1865 from Sikkim (MoCS, 2010). Its cultivation has now spread to more than 51 districts, up from 41 in 2013/14 and 37 in 2007/08 (Shrestha *et al*., 2018). Large cardamom is classified as one of Nepal's exportable commodities (MoCS, 2010), as well as an important source of revenue for hill farmers. The Agriculture Development Strategy (2015-2035) has also prioritized large cardamom as the 12th sub-sector among fifteen designated sub-sectors for agribusiness development in Nepal using a value chain approach (MOAD, 2015).

In personnel communication with traders in Birtamod port, Nepalese large cardamom is chosen over Indian for its quality. It might be improved by value-added activities such as cleaning, tail cutting and grading. At the moment, the majority of value-added operations are carried out in the market of Siliguri, India (ITC, 2017). Large cardamom was cultivated on 17,002 ha, with 12,508 ha under productive area and the yield was 6,521 tonnes (t) with a productivity of 522 kg/ha (Shrestha *et al*., 2018). It is a high-value, low-volume crop with the highest export value in terms of generating foreign currency in Nepal (Sharma *et al*., 2016; Bhandari and Bhandari, 2018). It has been the primary source of revenue for the majority of farmers in the eastern hill (Shrestha *et al*., 2018).

Nepal is the world's leading producer and exporter of LC (ITC, 2017; Kaini, 2018,) with a market share of roughly 68%, whereas India has a 22% share (Joshi and Piya, 2019). The terminal market in India, specifically Siliguri, West Bengal, determined the price (Timsina *et al*., 2012). The price was quite volatile. However, few researches have been

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conducted on the suitability and sustainability of large cardamom growing operations. As a result, this study was created to conduct a financial analysis of the large cardamom farming industry in Nepal and to advise growers on whether the enterprise is lucrative or not in Nepal, even when prices fluctuate.

MATERIALS AND METHODS

Eastern Nepal was purposively selected as a research site which ranks first position in terms of production of large cardamom in Nepal (MOALMC, 2017). Research sites were subdivided in Koshi corridor (Sankhuwasaba and Tehrathum) and Mechi corridor (Taplejung and Panchthar). By consulting Local Bodies' Administration, Agriculture Knowledge Centre and Federal Large Cardamom Entrepreneur Nepal representative. Data were collected from December 2021 to April 2022. MOALMC (2017) reported that about 21960 households in 51 districts were involved in farming. These were considered as population of study. Sample households were selected randomly. An interview schedule was prepared for cost of production and other expenses incurred along with production and price received by farmers. Sampling frame was prepared for selected area. To determine sample size, the following calculation was made:

Sample size (n) = N\(1 + Ne2)

(Yamane, 1967)

Where,
N = Required sample.
N = Study population.
e = Error (0.05).

Various sources and technique were used for the gathering relevant information. Data were obtained through household survey, before field survey, Structured questionnaire was prepared and pre-tested. Household survey was carried out from January to February 2022. Primary data were collected through face-to-face interview. Data collected from survey was coded and directly entered and analysed in MS EXCEL. The cost of large cardamom production, the study considered only variable costs. The variable cost included were labour (land preparation, mannuring, fertilization irrigation plant protection, intercultural operation harvesting transportation and postharvest activities), manure, plant protection, irrigation and other costs, if included. Total variable cost was calculated by summing all the variable cost items as in the following:

$$\text{Cost of production (Nrs)} = C_{\text{land Preaparation}} + C_{\text{planting_material}} + C_{\text{harvesting}} + C_{\text{postharvet}} + C_{\text{fertilizer}} + C_{\text{protection}} + C_{\text{intercultural_operation}} + C_{\text{others}}$$

Financial analysis

The following procedures were adopted during analysis of large cardamom in this study. There were two approaches *viz*. discounted (NPV, BC ratio, IRR) and undiscounted measure (ROI and PBP. The details explanation of indicators was given as follows:

Net present value

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1 + r)^t} - C_o \ldots$$

Where,
C_t = Incremental cash inflow in t year (NRs).
C_0 = Initial Investment (NRs).
R = Interest rate (Discount rate, %).
T = Life span of business.

Internal rate of return (IRR)

Internal rate of return (IRR) was a tool to project potentiality of investments. IRR is a discount rate which makes the NPV becomes zero from particular business.

Benefit cost ratio (BCR)

Benefit cost ratio provides values that are incurred and receipted. It was ratio of discounted cash outflow to discounted cash inflow.

$$BCR = \frac{\text{Disounted cash out flow}}{\text{Discounted cash in flow}}$$

Payback period

This approach was considered as simple calculation for time required covering investment from cash return from over period of time.

Return on investment (ROI)

ROI was used as a measurement of the efficiency of investment or efficiency of competitive business. To calculate ROI the following formula was used:

$$ROI = \frac{\text{Gain from cash out flow - Cost of cash in flow}}{\text{Cost of cash in flow}}$$

Sensitivity analysis

Sensitivity analysis is used to treatment of uncertainty of business. This approaches was to analysis the situation of business if/and more uncertainty like; increase cost of production (20%) decrease in projected income (10%), both increased cost and income decreased and delaying implementation by one year.

RESULTS AND DISCUSSION

Socioeconomics characterization of large cardamom farmers

According to Table 1, which presented the socioeconomic characterization of large cardamom farmers in the study area in 2021, out of the total 483 households surveyed, 362 (75.4%) were headed by males and 118 (24.6%) were headed by females. Additionally, 371 (77.3%) households had *kacchi* and *semi pakki* type houses, while 109 (22.7%) had *pakki* type houses. In context of family type, 345 (71.9%) households were nuclear, while 135 (28.1%) were joint families. Regarding the education level of household heads, 248 (51.7%) had basic education, while 152 (31.7%) were

illiterate. Moreover, 191 (39.8%) households belonged to the Brahmin/Chhetri ethnicity group, while 254 (52.9%) were from the Aadibasi/Janajati group. In terms of members abroad, 302 (62.9%) households had no members abroad, while 178 (37.1%) had at least one member abroad. Furthermore, 405 (84.4%) households had access to irrigation facilities, while 75 (15.6%) did not. Resource sharing was practiced by 342 (71.3%) households, while 138 (28.7%) did not share resources. In terms of planting materials, 358 (74.6%) households used their own source of planting materials, while 122 (25.4%) obtained them from other sources.

It is worth noting that the chi-square test was applied to test the association between each variable and the two study corridors, Koshi and Mechi. The results showed that family type and members abroad had a statistically significant association with the study corridors at the 0.05 level of significance, with chi-square values of 4.545 and 6.036, respectively. On the other hand, the remaining variables did not show any significant association with the study corridors.

Table 2 presented the socio-economic characteristics of large cardamom farmers in two corridors, Koshi and Mechi, in Nepal and provided data on continuous variables such as household head age, years of schooling, average family size, member involvement, land ownership, *khar bari*, lease, large cardamom area, farming experience and livestock standard units (LSU). Each variable was compared between the two corridors using mean difference and t-value. For instance, the mean household head age in the Koshi corridor was 51.21 years, while in the Mechi corridor, it was 53.23 years, resulting in a mean difference of -2.02 and a significant t-value of -2.03 at a 5% level Similarly, the mean

Table 1: Socioeconomic characterization of large cardamom farmers in study area 2021.

Variables	Corridors		Total	Chi square value
	Koshi	Mechi		
Gender of household head				
Female	64 (26.70)	54 (22.50)	118 (24.60)	1.124
Male	176 (73.30)	186 (77.50)	362 (75.40)	
Type of house				
Kacchi and semi pakki	182 (75.80)	189 (78.80)	371 (77.30)	0.582
Pakki	58 (24.20)	51 (21.30)	109 (22.70)	
Type of family				
Joint	57 (23.80)	78 (32.50)	135 (28.10)	4.545**
Nuclear	183 (76.30)	162 (67.50)	345 (71.90)	
Education level of household head				
Illiterate	64 (26.70)	88 (36.70)	152 (31.70)	
Literate	8 (3.30)	13 (5.40)	21 (4.40)	10.55**
Primary level	42 (17.50)	40 (16.70)	82 (17.10)	
Secondary level	91 (37.90)	75 (31.30)	166 (34.60)	
Basic education	133 (55.40)	115 (47.90)	248 (51.67)	
High school	29 (12.10)	23 (9.60)	52 (10.80)	
University level	6 (2.50)	1 (0.40)	7 (1.50)	
Ethnicity				
Brahmin/Chhetri	96 (40.00)	95 (39.60)	191 (39.80)	0.278
Aadibasi/Janajati	128 (53,30)	126 (52.50)	254 (52.90)	
Dalit	16 (6.70)	19 (7.90)	35 (7.30)	
Members abroad				
No	164 (68.30)	138 (57.50)	302 (62.90)	6.036**
Yes	76 (31.70)	102 (42.50)	178 (37.10)	
Irrigation facility				
Yes	204 (85.00)	201 (83.30)	405 (84.40)	0.142
No	36 (15.00)	39 (16.30)	75 (15.60)	
Resource sharing				
No	66 (27.50)	72 (30.00)	138 (28.70)	0.366
Yes	174 (72.50)	168 (70.00)	342 (71.30)	
Source planting material				
Own source	173 (72.10)	185 (77.10)	358 (74.60)	1.583
Others source	67 (27.90)	55 (22.90)	122 (25.40)	

Parenthesis indicate percentage; *, ** and *** indicate level of significant at 10%, 5% and 1%.

years of schooling in the Koshi corridor were higher than in the Mechi corridor, with a mean difference of 1.24 and a significant t-value of 3.01 at a 1% level. There was no significant difference between the two corridors in average family size, member involvement, land ownership, khar Bari, lease, large cardamom area, farming experience, or LSU. Table 3 gave an in-depth look at the socioeconomic features of major large cardamom producers in Nepal, highlighting the contrasts and similarities between the Koshi and Mechi corridors.

A cash flow analysis of large cardamom cultivation in the research area discovered variable and constant costs during the first year. The variable costs totaled Nrs. 163,935, which comprised expenses such as fertilizers, labor and other large cardamom production inputs. For the first year, the total expenditure was Nrs. 279,598. As the second year began, the variable expenses reduced drastically to Nrs. 38,503, indicating that farming practices and cost optimization were improving. Variable costs rose somewhat in the third year, reaching Nrs. 205,915, possibly due to variables such as inflation, changing market conditions and variable input costs. Variable costs soared in the fourth and fifth years, totaling Nrs. 222,528 and Nrs. 263,590, respectively.

As we started the sixth and seventh years, variable costs continued to grow, reaching Nrs. 342,841 and Nrs. 338,429, respectively. Despite increased expenses, the overall cost remained constant due to variable costs. The total value of the product from large cardamom production has demonstrated a positive trend when compared to the costs incurred. It increased to Nrs. 287,336 in the third year, indicating a significant increase in revenue over the previous year.

The findings suggested that large cardamom farming in the research area may be financially profitable, with revenues exceeding expenditures, resulting in increasing profits and improved farmer lifestyles. These findings emphasized the need for sustainable farming practices and strategic investments in the early phases of large cardamom cultivation to reap long-term advantages and maximize profitability.

Table 4 shown the mean values of key economic variables for the 7-year large cardamom production cycle in the research area. During the 7-year cycle, the total fixed cost was Nrs. 115,663. This cost comprised expenditures in seedlings, shade tree saplings, harvesting equipment, irrigation, drying and processing equipment. The entire variable cost throughout the 7-year period was Nrs. 1,575,746. Variable costs reflected expenses that vary with the degree of production and included fertilizers, labor, insecticides and other large cardamom cultivation inputs. During the 7-year cycle, the total income obtained from

Table 2: Socioeconomics characterization of large cardamom farmers (Continuous variable).

Variables	Corridors		Total	Mean Diff.	T value
	Koshi	Mechi			
Household head age (year)	51.21 (10.25)	53.23 (11.45)	52.22 (10.90)	-2.02	-2.03**
Year of schooling	6.31 (4.57)	5.07 (4.46)	5.69 (4.56)	1.24	3.01***
Average family size	6.18 (2.56)	6.42 (2.68)	6.3 (2.62)	-0.24	-1.01
Member involved	2.55 (1.11)	2.51 (1.12)	2.53 (1.11)	0.04	0.39
Land (Ropani)	31.55 (33.46)	30.54 (28.91)	31.05 (31.24)	1.02	0.36
Khar bari (Ropani)	7.16 (21.17)	7.03 (17.83)	7.1 (19.55)	0.13	0.08
Lease (Ropani)	1.97 (13.04)	0.95 (4.20)	1.46 (9.69)	1.03	1.16
Cardamom area (Ropani)	23.06 (20.51)	23.03 (20.37)	23.05 (20.42)	0.03	0.02
Farming experience (Year)	21.32 (13.11)	20 (11.77)	20.66 (12.46)	1.33	1.17
LSU	6.73 (4.40)	6.89 (5.07)	6.81 (4.74)	-0.15	-0.36

Parenthesis indicate standard deviation; * and ** indicate level of significant at 1% and 5%.

Table 3: Estimation of cash flow for large cardamom farming in study area.

Cost particulars (Nrs)	I year	II year	III year	IV year	V year	VI year	VII year
Variable cost	163935	38503	205915	222528	263590	342841	338429
Fixed cost and initial investment							
Sapling	16586						
Shade tree sapling	1284						
Harvesting equipment	3184						
Irrigation scheme	74268						
Drying and processing equipment	20339						
Total fixed cost	115663						
Total cost	279598	38503	205915	222528	263590	342841	338429
Total value product			287336	946896	805511	746707	725683

large cardamom farming was Nrs 3,512,133. This figure represents the total money generated by the sale of large cardamom produce. The gross margin was Nrs. 1,820,724, defined as the difference between total income and total variable costs. This statistic indicated the earnings that helped to cover fixed costs and generate profits. The benefit-cost (BC) ratio was calculated to be 2.08, suggesting that there was an additional benefit of 2.08 units for every unit of cost incurred. Because it was greater than one, this ratio indicated that the enterprise was lucrative. The breakeven point for large cardamom was calculated to be 157.45 kg. This indicated the point in production where total costs matched total revenue, resulting in a profit of zero. Over a seven-year period, the average price per kilogram of cardamom was Nrs. 274.6. This was the average selling price of large cardamom per kilogram. Finally, throughout a seven-year period, the average variable cost per kilogram of large cardamom was Nrs. 621.01. This statistic showed the average cost per kilogram of large cardamom produced, including expenses such as labor, fertilizers and other inputs that fluctuated with output levels. These economic indicators provided useful insights into the financial success of large cardamom farming in the research area throughout a 7-year production cycle.

Table 5 provided an in-depth assessment of financial indicators and their sensitivity under various scenarios in the study on large cardamom farming in the study area. The researchers examined four sensitivity scenarios in order to better understand the potential consequences of large cardamom farming. If the cost of productions was increased by 20%, the financial indicators were decreased. The net present value (NPV) reduced from Nrs.1,536,006 to Nrs. 1,265,812, indicating impairment in predicted profitability. The benefit-cost ratio (BCR) decreased from 2.14 to 1.78, but it kept over one, indicating some level of profitability. Likewise, the Internal Rate of Return (IRR) dropped from 71.31 to 57.78, indicating a reduced rate of return. The ROI decreased from 138.45 to 98.71, suggesting lower profitability as compared to the base. Furthermore, the payback period (PBP) increased from 5.6 years to 6.4 years, implying that it will take longer to return the initial investment. However, when the income from large cardamom farming was reduced by 10%, the financial indicators suffered as well. The NPV was lowered to Nrs. 1,247,308.508, the BCR was dropped to 1.92, the internal rate of return was changed to 63.46 and the ROI was reduced to 114.61. The PBP has risen to 6.04 years. These findings suggested that a loss in income would Furthermore; a 20% rise in production costs combined with a 10% loss in income has compounding impacts on the financial metrics. The NPV declined to Nrs. 977,115.1, the BCR fell to 1.60, the IRR fell to 50.02 and the ROI fell to 78.84. The PBP has risen to 6.8 years. This scenario demonstrated that simultaneous negative increases in cost and income had a greater impact on the profitability of large cardamom farming.

Finally, a situation in which there was a one-year delay in getting returns from large cardamom farming. The NPV decreased to Nrs. 1,145,642, the BCR dropped to 1.97, the IRR decreased to 51.24 and the ROI declined to 126.25. The PBP has dropped to 6.3 years. Have an impact on the profitability and return on investment for large cardamom farming. This scenario demonstrated that delaying pampers encounters distinct effects on different indicators, with the BCR and ROI improving while the NPV and IRR were declining. Finally, the study's findings highlighted the sensitivity of financial indicators in large cardamom farming to changes in production costs, income and delays.

As per household head were male headed about 75.4% indicated most of large cardamom farming were dominated by male which was similar trend of national scenario. Even pace of development, near 3/4th of household had *kacchi* and *semi pakki* household. Still 31.7 percentages household head were illiterate. The study site were dominated by addibasi/janajati (52.9%) since Koshi province were belonging to *Kirat* civilization and origination. In later year Nepal has suffered from muscle and brain drained problem. In study area about 37% household had at least one member out migrated. Resource sharing practice especially labor was adopted or inherent from generation to generation which was about 74.6%. Most of farmer (74.6%) were used their own material.

Table 4: Mean of economic indicators of large cardamom production cycle for 7 year in study area.

Indicators	Value
Total fixed cost (Nrs)	115663
Total variable cost (Nrs)	1,575,746
Total Income (Nrs)	3,512,133
Gross margin (Nrs)	1,820,724
BC ratio	2.08
Breakeven point (kg)	157.45
Average price (Nrs/kg)	1274.6
Average variable cost (Nrs/kg)	621.01

Table 5: Financial indicator with sensitivity of large cardamom farming in study area.

Indicator	Normal	Sensitivity cost increased	Income decreased	Both	Delayed by year
NPV	1536006	1265812	1247308.508	977115.1	1145642
BCR	2.14	1.78	1.92	1.60	1.97
IRR	71.31	57.78	63.46	50.02	51.24
ROI	138.45	98.71	114.61	78.84	126.25
PBP	5.6 year	6.4 year	6.04 year	6.8 year	6.3 year

The setup cost of organic large cardamom was Nrs. 135482.27 per ha, while the operational cost was Nrs. 53998.01 per ha. The entire cost was Nrs. 926257.22 per ha over ten years, with a gross return of Nrs. 2025116.50 per ha. The results revealed that the per hectare NPV at a 12% discount rate was Nrs. 4,28,028.48 per ha. The NPV was positive, showing that investing in large cardamom is both financially and economically feasible. The benefit-cost ratio (BCR) at 12% for organic large cardamom was 1.78. The BCR was more than one, indicating that the crop is commercially and economically viable. The IRR significantly 43%, which was greater than the current interest rate (12%). As a result, investing in organic large cardamom is a viable option. The results showed that the pay back period (PBP) for recovering the full investment in the research area with a 12% interest rate was 5.07 (Golay and Singh, 2021). Large cardamom incubation time is over after 3 years and productivity will fall after 20 years. Filling the gaps left by wilting cardamom shrubs and selectively cutting old trees is insufficient. In the first year, planting material and labour cost roughly Nrs. 25000 per acre. In the second year, gap filling and weeding cost Nrs. 3500. Weeding, harvesting and postharvest labor expenditures are the only monetary inputs required for the system after the third year (Sharma *et al*., 2009).

CONCLUSION

These findings highlight the need of taking into account diverse scenarios and their potential effects on financial indicators in large-scale cardamom production. This useful information can be used by stakeholders to make educated decisions and build strategies to improve the sustainability of large cardamom farming in the research region. Stakeholders can better navigate possible problems and optimize their investment decisions by knowing the sensitivity of financial indicators to changes in production costs, income and delays.

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Ethical approval

No human and animal were used as research unit.

Data availability statement

Addition Information will be provided on request.

Author's contribution

Surya Mani Dhungana has prepared the research design and implementation a research plan. Moreover, he analyzed the data and prepared the manuscript. Prof. Dr. Punya Prasad Regmi, Prof. Dr. Nabaraj Devkota, Associate Prof. Dr. Shiva Chandra Dhakal advised and provided comments and feedback to finalize this manuscript. All authors approved the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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