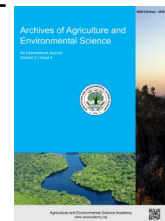This content is available online at AESA

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ORIGINAL RESEARCH ARTICLE

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Economic analysis of mushroom enterprise in Chitwan district, Nepal

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ABSTRACT

The majority of the population (66%) in-country "Nepal" are engaged in agriculture. However, domestic production finds it difficult to meet the annual demand of the people. Hence, people are moving from subsistence agriculture to embrace mushroom farming. This study focuses on economic analysis and analysis of the present status of mushroom farming and enterprise in this country. The study was conducted in the land area of Kalika Municipality and Bharatpur Metropolitan City. 30 mushroom farmers with two huts and at least three years of experience were selected from the study area. The primary data were collected through face-to-face interviews with the farmers, focus group discussion (FGD) and key informant interviews (KII). The secondary data was collected through various published articles and documents. The data analysis was done using basic statistics and a regression function. The benefit-cost ratio is 2.54 and a high gross margin is NRs.490,876.65 per kattha per year. The return to scale (RTS) is 0.80. Five marketing channels are present among which wholesalers and local collectors contributed the highest percentage of the share. However, the dominance of the intermediaries, timely unavailability of inputs, price fluctuation, disease and pest infestation were the major constraints. Disease and pest control, formation of the producer organization, improvised cultivation practices, timely and affordable availability of quality can be the major solution measures. Whereas, suitable climatic conditions, high productivity and growing market demand are the strengths of mushroom production in this study area. Mushroom farming is found to be a profitable business concerning competitive and comparative markets.

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INTRODUCTION

Mushroom is a macro-fungus with a distinctive fruiting body, which can either be epigeous or hypogeous and large enough to be seen with the naked eyes and to be picked by hand. Mushroom consumption is assumed to have started from the prehistoric period and its consumption as food and medicine was also done long ago in Nepal (Poudel and Bajacharya, 2011). But mushroom cultivation is a relatively new concept in Nepal. 'White Button Mushroom' was introduced initially in 1974 by Nepal Agriculture Research Council (NARC). Then, the plant pathology division of NARC started distributing spawn. Oyster mushrooms were introduced to farmers in 1984 (Pokhrel, 2016). Mushrooms are highly valued for their taste and utility. There are about 1.5 million species of mushrooms identified all over the world among which only 2,327 species are identified as edible or medicinal mushrooms. Naturally, Nepal is very rich in mushroom diversity but only 1150 mushroom species have been recorded so far. Among them, 147 are said to be edible, while 100 species are poisonous and 73 have medicinal values (Raut, 2019). Among them, only around 20 species are cultivated whereas only five of them are cultivated on an industrial scale; White Button Mushroom, Oyster Mushroom, Shiitake, Straw Mushroom and Ganoderma. Currently, mushroom production is dominated by Oyster mushrooms occupying 86% of total production which is followed by the white button 10 % and Shitake 2% (Raut, 2019). In 2015/16 the production rose to 9300 mt and there is a 600 percent rise in the production of mushroom from 2011 to 2016 (Pokhrel, 2016).
Mushrooms provide a rich addition to the diet in the form of

protein, carbohydrate, valuable salts and vitamins (Kumar *et al.,* 2020, 2021). 100 g of fresh mushrooms contains 5.3-14.8 g of dry matter, 1.5-6.7 g of carbohydrates, 1.5-3.0 g of protein and 0.3-0.4 g of fat (Singh, 2017). There is many nutritional, economic and health benefits of mushrooms. Mushroom farming is emerging and Chitwan is among the major mushroom producing districts of Nepal. Although the demand for mushrooms is increasing day by day, the farmers are less interested in this business. Many farmers are afraid to start mushroom farming because they do not have knowledge about the investment, profit and loss of this enterprise (Shrestha, 2014). There are not sufficient studies and researches in the field of mushroom production and marketing in Nepal. No policies have been yet formulated specifically for mushroom farming (Pokhrel, 2016). There seems to be a requirement of proper and scientific research about the production analysis, market conditions, constraints and solution measures. So, this study tends to bridge the research gap. The main objective is to assess the strengths, weaknesses, opportunities and threats and benefit-cost ratio that helps the farmers to estimate the production costs, profit margins and farmer's share in mushroom production.

MATERIALS AND METHODS

Study area, sample size and sampling technique
The study was conducted in Chitwan district located in the southern flat land area of Nepal. The survey was conducted in Bharatpur Metropolitan city and Kalika Municipality of the district. The survey was conducted purposely among 30 farmers currently involved in mushroom cultivation. The farmers who have at least two huts for mushroom cultivation with more than three years of experience were selected for interviews using both structured and unstructured questionnaires. Details about the number of mushroom farmers with other necessary information were collected from the DADO office and the Chitwan mushroom producer's association.

Source of data collection and survey design
The study was based on both primary as well as secondary data. Primary data was collected from structured and semi-structured pretested questionnaires through face-to-face interviews with the farmers, focus group discussion (FGD) and key informant interviews (KII). Secondary data was collected from Nepal Agricultural Research Council and the Ministry of Agriculture and Livestock Development, Nepal. 30 farmers currently involved in mushroom production with two huts and at least three years of experience were selected from the study area. Informed consent was obtained from each respondent and stakeholder while collecting data.

Data analysis
The collected information from the field survey was collected, tabulated and analyzed using Microsoft Office Excel -2010. Descriptive statistics using percentages, averages and frequency tables were used in the analysis for the socio-economic

characteristics of the respondents. The problems and the solution measures through the respondents were arranged in the merit order. And the orders of the merit were converted into merit orders using the formula. The economic analysis of the mushroom production was done with different analytical tools and formulas.

Cost of production
Cost of production is the sum of all expenditure involved in the production process for the enterprise (Shephard, 2015). Total cost (TC) includes the sum of total fixed cost and total variable cost. Total variable costs (TVC) are that cost that varies as per the production conditions and capacity of the farm that keeps on changing day by day. Labor cost, spawn cost, straw cost, ropes cost, plastics, chemical fertilizers and soil are the variable costs. The land rent cost, the spraying equipment and depreciation of assets comes under fixed cost (TFC).

$$TC = TFC + TVC$$

Total revenue (gross revenue) is the product of the total quantity and unit price of the mushroom.

$$Gross\ revenue = Price \times Total\ quantity\ sold$$

Benefit cost analysis
Benefit-cost analysis is the ratio obtained when the present worth of the benefit stream (gross return) is divided by the present worth of the cost of stream/total cost (Marglin, 2014). The cost of production is the summation of variable and fixed costs. It presents the monetary gain through an investment. The higher BCR indicates the better investment.

$$B/C = \frac{Gross\ return}{Total\ cost}$$

Gross margin
Gross margin is the difference between gross return of the enterprise and the total cost of production (Holland, 1998). The gross margin provides a simple and quick method of analyzing a farm business. The higher gross margin represents higher profitability.

$$Gross\ margin = Gross\ return - Total\ Cost$$

Cobb-Douglas production function
The Douglas production function is the most widely used in agricultural research and is convenient for the comparison of the partial elasticity coefficient (Prajneshu, 2008). The following form of Douglas production function was used to determine the contribution of different factors on production and to estimate the efficiency of the variable factors of mushroom production.

$$Y = A * L\alpha * K\beta$$

Strength's weaknesses, opportunities and threats (SWOT) analysis

A SWOT analysis is useful for understanding strengths, weaknesses, opportunities and threats. The primary objective of a SWOT analysis is to help organizations develop a full awareness of all the factors involved in making a business decision. SWOT analysis assesses internal and external factors, as well as current and future potential. The strengths and the weaknesses arise from the organization itself whereas opportunities and threats are from the external source.

RESULTS AND DISCUSSION

Demographic characteristics of the respondent households

According to CBS report (2011), there is more female population (51.88%) in the Chitwan district. However, this study found that the majority of mushroom farming is done by males (70%). The average experience of mushroom growers is 8 years. The average number of huts was 5 and the average land used for the construction of each hut was 0.12 kattha. Previously farmers had been growing mushrooms for personal use but now with experience and increasing demand, they have switched to commercial mushroom farming (Table 1).

Socio-economic characters of the respondent households

The profile characteristics of the mushroom farmers presented in Table 2 show that most of the farmers are occupied by Janajati (54%), with primary school education (40%) and average family size is 8 with ranges between 4 to 8. The average male and female members of the sampled family were found to be equal (3) and 86% of the farmers were from economically active population groups. Among them, 83% of the farmers are intensively involved in mushroom farming. The number of farmers with university education was zero. This means farmers are involved through short training and experiences. But they require education as it makes a person more confident, strong and creates the ability to think and decide quickly.

Table 1. Demographic characters of the respondent households.

	Minimum	Maximum	Mean	Stdev
Family size	4	8	5	1.25
Number of huts	2	17	5	3.64
Area/hut (kattha)	0.01	1	0.12	0.25
Experience in Mushroom (years)	3	18	8	4.42
Owned land (kattha)	2	47	11.39	9
Rented land (kattha)	1	22	12	8
Land under mushroom cultivation (kattha)	1	22	5.23	5

Table 2. Socio-economic characteristics of respondent households.

Criteria	Category	Frequency	Percentage (%)
Ethnicity	Bhramin	9	30
	Chhetri	4	13
	Janajati	16	53
	Dalit	1	3
Education	Illiterate	6	20
	Primary schooling	12	40
	Secondary schooling	7	23.3
	Higher secondary schooling	5	16.7
Occupation other than mushroom cultivation	Agriculture	28	80
	Business	2	6
	Government services	5	14
Age (Years)	<16	14	8
	16-59	142	86
	>59	10	6

Table 3. Cost of mushroom production.

Cost heading	Average cost (NRs/kattha)	% of Total Cost
Fixed cost		
Land rent	15,377	1.03
Depreciation of equipment	97,430	6.50
Permanent labor	21,667	1.44
Total fixed costs	134,474	8.97
Variable cost		
Straw	134,450	8.97
Firewood	45,133	3.01
Spawn	1,149,833	76.67
Rope	15,123	1.01
Labor	4,560	0.30
Packing plastic	13,005	0.87
Water and irrigation cost	1,397	0.09
Lime and formalin	1,663	0.11
Total variable cost	1,365,164	91.03
TC	1,499,638	100.00

Economics of the oyster's mushroom

Cost of production: Table 3 illustrates that the highest cost (6.5%) was incurred in fixed cost through depreciation of the investment (paddy straw cutter, metal drum, spraying equipment, black covering plastic and bamboo). Among variable inputs, spawn cost was found to be highest (76.67%) followed by the cost of paddy straw and the cost of firewood, respectively. The average cost of production of a mushroom firm is 91.03% variable cost. This justifies that mushroom is a cash flow business.

Return from mushroom cultivation: The average production of the oyster's mushroom in the Chitwan district was 4,307.71Kg per Kattha. The gross return from oyster mushrooms was found to be NRs.808,966.61 while the total cost of production was NRs.318,089.61. The gross margin was NRs.490,876.65. The survey data and its analysis have revealed that the B:C ratio is 2.54, which is similar to another study (2.47) (Bhandari *et al.*, 2021). The unit price of the oyster's mushroom was found to be NRs.200. This result is similar to the DoIED, 2013 which was 150-200 per kg, however, the time of research and species of the mushroom and increase in numbers of suppliers can be taken into consideration in the variation of the price of the mushroom. Mushrooms in Nepal are cheaper than in foreign countries (Raut, 2019) (Table 4).

Production economics of mushroom: The average value of the benefit-cost ratio is positive i.e., 100% respondents recorded positive values. This indicates that the venture is a profitable business. The inputs like straw, spawn and labor are significant to the production of oyster mushrooms that gives RTS (Return to scale) of 0.80 which means if all inputs are increased by 100% the return from the mushroom enterprise will increase by 80%. The result is similar to another study (Shrestha, 2014), which reads the financial analysis of fresh mushroom production in Nepal indicated more than 50% internal rate of return. This leads to the fact that commercial mushroom cultivation is economically profitable (Table 5).

Value addition techniques: The study shows that the maximum number of farmers (42%) doesn't use any value addition techniques. Whereas 24% of farmers pack mushrooms in plastic after cleaning, 24% clean mushrooms and only 3% grade them to add value to the mushroom. Value addition leads to higher profit and hence there is a need to adopt value addition practices in the area. The training and workshops about the techniques would be fruitful and uplifting factors to enhance profitability in farmers (Table 6).

Marketing channel: The study revealed that there is a large number of market vendors involvement in mushroom marketing. The farmers of the Chitwan district mostly sell through the local collectors (44.12%) followed by the wholesalers (41.12%).

Table 4. Average return from mushroom production.

Description	Unit	Amount
Average production per Kattha	kg	4,307.71
Unit price	NRs/kg	200.00
Gross return	NRs/Kattha	808,966.27
Total cost	NRs/Kattha	318,089.61
Gross margin	NRs/Kattha	490,876.65
B:C Ratio		2.54

Table 5. Production economics of mushroom.

Explanatory variable	Coefficient	t-value
Straw cost	0.93	2.61
Spawn cost	0.03	0.30
Labor	1.07	4.06
R^2	0.65	
Adjusted R^2	0.61	
F-value	16.24	
RTS	0.80	

Table 6. Value addition techniques used by mushroom growers.

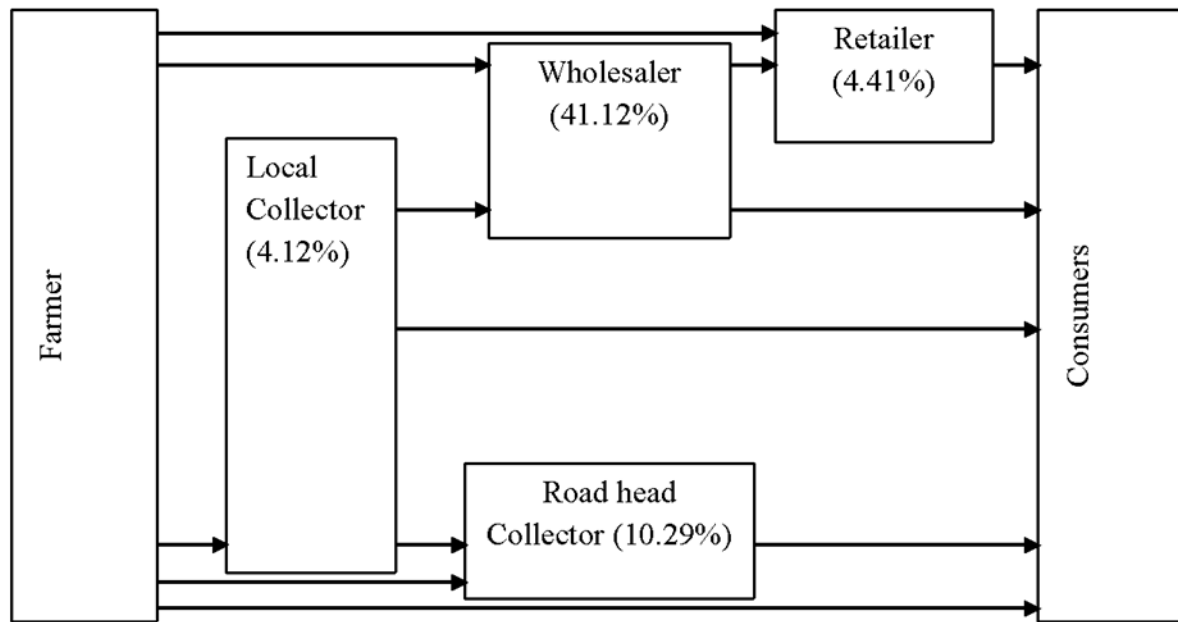| Value addition techniques	Number of farmers	Percentage (%)
Plastic packaging	8	24.24
Grading	3	9.09
Cleaning	8	24.24
None	14	42.42
Total	33	100

Figure 1. *Marketing channels practiced in mushroom marketing in Chitwan district.*

Table 7. Mushroom production constraints in Chitwan district.

Production problems	Percentage (%)	Rank
Dominance of intermediaries	21.64	1st
Timely unavailability of inputs (spawn, straw)	17.88	2nd
Price fluctuation	14.32	3rd
Post-harvest losses	11.51	4th
Disease and pest incidence	8.9	5th
Lack of adequate market information	8.77	6th
Inadequate expert inspection, training and exhibition	7.33	7th
Temperature fluctuation	6.25	8th
Water facilities	3.42	9th

Table 8. Mushroom production solution measures by the respondents.

Solution measure	Percentage	Rank
Disease and pest control	24.49	1st
Formation of producer organization	23.64	2nd
Improvised cultivation practices	19.05	3rd
Availability of quality inputs at an affordable price	15.81	4th
Timely availability of inputs	7.55	5th
Provision of subsidy, credit on demand, credits on low interest	6.28	6th
Others (specify)	3.81	7th

Whereas road-head collectors (10.29 %) and retailer markets (4.41%) share only a small portion of direct contact with the farmers. There were five different marketing channels involved in the marketing of the mushroom in Chitwan district (Figure 1).

Mushroom cultivation constraints and solution measures
The main production constraint of oyster's mushroom was the dominance of the intermediaries (21.64%) followed by timely unavailability of inputs (spawn, straw) (17.88%). Those problems must be addressed to enhance better production. The respondents mentioned the following solution measures to address the above problems, here disease and pest control (24.49%) is the main solution followed by the formation of the producer organization. These solution measures have to be applied effectively to increase profitability and encourage the farmer in commercial production. According to this study, the farmers think formation of producer organizations helps a lot more in coordination to manage disease and post-harvest losses help to strengthen price decisions, input availability, and present their strong opinion to the concerned authority, and many more (Tables 7 and 8)

Table 9. Main buyers of mushroom in the study area (% response from the Suggestions farmer).

Main buyer	Number	Percentage
Local collectors	30	44.12
Road head collectors	7	10.29
Wholesaler	28	41.18
Retailer	3	4.41
Total	68	100

Table 10. Price decision role on the mushroom.

Decides the price of a mushroom	Number	Percentage (%)
Themselves	1	3.85
Collectors	1	3.85
Wholesaler	1	3.85
Existing market price	23	88.46
Total	26	100

Table 11. Support institution in the study area.

Name of institution	Number	% Farmers receive information
DADO	15	31.25
NGOs	10	20.83
Farmer to farmer	15	39.58
Traders	4	8.33
Total	48	100

Table 12. Marketing constraints faced by farmers in the area.

Constraints	Percentage	Rank
Unorganized marketing	25.70	1st
Low price offered by the trader	24.09	2nd
Lack of market information	16.51	3rd
Lack of storage facilities	16.51	3rd
Lack of processing knowledge	11.28	4th
Lack of good road	5.91	5th

Table 13. Suggestions by farmers to solve a market problem.

Suggestions	Percentage	Rank
Cooperative marketing	22.59	1st
Reliable, timely market information	18.45	2nd
Provision of storage facilities	16.89	3rd
Provision of processing facilities	16.89	3rd
Marketing in group	15.17	4th

Marketing of mushrooms in the study area

The major buyers of the mushroom in the Chitwan district are local collectors (44.12%). In the study area, it is found that the maximum number (86.67%) of farmers contract an agreement before they sell their product whereas 13.33% don't sign any contract agreement. And the highest number of farmers (88.46%) sells their product according to the existing market price and 3.85% of them decide the price by themselves, 3.85% through collectors and 3.85% through wholesalers. The decisive power to the farmer and low market interventions would be a plus point to them (Tables 9-11)

Supporting institutions in the study area

Most of the farmers are getting support from the DADO (31.25%) through financial support and training whereas 20.83% are supported by NGOs through various training, seminars and seed distribution programs. Similarly, 39.58% of the farmers receive information through other farmers, 8.33% of them are getting support about the market information like demand and prices. The need for supporting institutions in the area is required to enhance production and encourage farmers (Table 10).

Table 14. SWOT analysis of mushroom enterprise.

Strengths	Weaknesses
• Suitable climatic conditions for mushroom cultivation. • High income of mushrooms in comparison to other crops. • Good infrastructure and better access to roads and transportation for marketing. • Employment in the sector through experience has built up the production potential. • An effective market chain from mushroom producers to the mushroom consumer exists. • Growing demand for mushrooms encourages the production of mushrooms throughout the year.	• High input cost and unavailability of inputs at the right time create many difficulties for the farmer in the business. • Mushroom farming is considered to have less social value as compared to other businesses. So, the farmer hesitates to cultivate mushrooms. • Being a perishable crop, the lack of storage and processing facilities makes the business a risky one. • Lack of technical know-how, marketing knowledge and market extension services are the constraints for the farmers. • Less priority on government subsidy somehow discourages the poor farmer from competing in the mushroom production and marketing process.
Opportunities	**Threats**
• Mushroom farming provides self-employment opportunities to the farmers. • Growing market demand is the growing opportunity for mushroom farmers. • Increased competition in the market has increased the opportunity for the betterment of mushroom cultivation. • Mushrooms provide the return in a short period. • It is the best opportunity for the farmer as they can pay the debt of loan in a short period	• High fluctuation in the market price has increased the risk in the mushroom business. • Mushroom productivity fluctuates due to diseases and pest problems. • Lack of sufficient information in marketing, market demand and price fixation to the mushroom farmers. • Mushroom farming is a very risky business and maybe a total loss to farmers. • Lack of coordination between producer and marketing sector is acting as a misbalance in the production process.

SWOT analysis of mushroom production

SWOT analysis is a simple but useful framework for analyzing a stakeholder's strengths, weaknesses, opportunities, and threats. It helps to identify areas of your business that are performing well. Identifying these strengths can help you make sure you maintain them so that you don't lose your competitive advantage. After the study in Chitwan, we found that mushroom production has the following strengths, weaknesses, opportunities and threats (Table 14).

Marketing constraints and solution measures

The unorganized marketing (25.70%) is the major problem followed by the low price offered by the traders (24.09%), lack of market information (16.51%), lack of storage facilities (16.51%), lack of processing knowledge (11.28%) and lack of good road (5.91%). Table 13 shows the suggestions by respondents in which 25% believe that cooperative marketing is the major solution followed by reliable, timely market information (18.45%), provision of storage facilities (16.89%), provision of processing facilities (16.89%) and marketing in groups (15.17%). The effective and proper adoption of the measures helps the farmers in more production. Farmers think that group marketing will solve the existing market barriers and conflicts in price decisions, inputs availability and other market problems (Tables 12 and 13).

Conclusion

The mushroom enterprise was found profitable in these study areas with a benefit-cost ratio of 2.54 (greater than 1). Spawn cost occupies the highest percentage of investment, followed by straw cost and depreciation of equipment. Farmers were facing a lot of problems with the timely availability of spawn in their area since the spawn was obtained from the other district. The insurance facilities, cold storage facilities, training, workshop and exhibition when conducted in the area boost production at the national and international level. If the government or the respective authority works with training, finance and market assumptions then mushroom cultivation has large profitability and is recommended to perform in huge commercial quantities.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this manuscript.

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