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# Strengthening the agricultural entrepreneurship: Insights on transformative influence

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ABSTRACT

Agri-entrepreneurship being very important component of attracting youth to agriculture, the efforts made by different public agencies in India in this direction through various interventions and enterprises needed to be studied. Mushroom production is one of the most popular enterprises promoted to pursue this objective throughout India. This study considered 2016–17 as the base year and 2020–21 as the assessment year. Mushroom production in India almost doubled during the assessment period (1.29 lakh tonnes in 2016–17 and 2.59 lakh tonnes in 2020–21) at a robust compound annual growth rate of 19.17%. The net agricultural income of the respondents at national level (other than mushroom income) was ₹1.25 lakh/annum during 2020–21 while their net income from mushroom cultivation was 2.48 lakh/annum. On an average 532 man-days of employment per unit was generated by the mushroom entrepreneurs at national level with considerable variation in income and employment generation across the states/UTs. Age of the entrepreneur was found having negative effect on employment generation, validating the relevance of attracting rural youth to agriculture in India. The lack of ability of resource centres for building capacity of the entrepreneurs for generating net income to the level of sizeable proportion of their annual expected livelihood was observed to be the strong reason for higher attrition rate in this enterprise. The insights suggest that redesigning of capacity building programs and institutional supports as per the current challenges in entrepreneurship development can better influence the ultimate outcomes.

**Keyword**: Entrepreneurial competencies index, Livelihood capital score, Log-linear regression, Mushroom

Agriculture in India is a significant component of the economy, accounting directly or indirectly for about 55% of employment in the country (Anonymous 2016) and 18.3% of GDP (MoSPI 2023). However, due to lower net income in agriculture, leading to poor standard of living, majority of the farmers do not want their children to take up agriculture as an occupation and encourage them to migrate to urban areas for better livelihood alternatives (Maurya *et al.* 2021).

The present challenges in Indian agriculture require innovative thinking and dynamism for their redressal. Youth being the most efficient human resource for nation's development including agriculture, the participation of youth in agriculture has been strongly emphasised for its transformation (Geza 2021). The engagement of youth in agriculture was also reported decreasing over two decades or more as a problematic sign for sustainability of agriculture in the long run in Thailand by Ruiz Salvago *et al*. (2019). In Indonesia, the proportion of youth (up to 35 years of age) employed in agriculture has decreased from about 20% during the year 2003 to 12.9% during 2013 (Susilowati 2014). Ruiz Salvago *et al*. (2019) also reported that the employment of persons less than 45 years in Thailand decreased from 2.6 million during 2003 to 1.4 million during 2013. With the result the average age of farmers is

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gradually increasing in Asian region (Chomik and Piggott 2015, Ruiz Salvago *et al*. 2019).

Farming can attract and retain youth, only if it becomes financially and intellectually more rewarding (Som *et al.* 2018). Availability of low-cost inputs, technical support, opportunities for capacity building, state of the art machinery, fair markets, value-addition, promotion of export-oriented farming are important to make farming financially more viable and enticing for youth to take up agriculture (Pemandu 2013). Young farmers often opt for high-tech and high-return agricultural enterprises such as protected agriculture, production of nursery and planting material and commercial poultry, etc. (Bhat *et al*. 2015). Further, large scale cultivation of mushrooms, bee keeping, value addition, floriculture, fishery, pig farming, goat farming etc. are also the favourable choices of a person having innovative and dynamic approach (Bhat *et al*. 2015). These agri-enterprises are imperative for generating adequate employment to attract and retain youth in agriculture (Singh *et al.* 2016, Nain *et al.* 2019).

The National Commission on Farmers, led by renowned scientist and the father of India's green revolution, M S Swaminathan, emphasised first the necessity for engaging youth in agriculture in its fifth and final report in 2006 (Swaminathan 2007). Indian Council of Agricultural Research (ICAR) launched a programme on attracting rural youth in agriculture during 2015–16 to recognise the significance of rural youth in agricultural development, particularly from a perspective of the nation's food security and to empower rural youth. In the initial phase, the initiative was implemented in 25 Krishi Vigyan Kendras (KVKs) spread over 25 states/UT's. The proposal was designed to promote rural development as well as socio-economic empowerment of the aspiring entrepreneurs through capacity building and technical assistance.

Mushroom enterprise was promoted for income generation for rural youth with small land holding or no land as mushroom cultivation offers several advantages like high food production per unit area, low input costs (Muruganantham and Roshini 2021) and ability to provide reasonable income in small spaces (Islam *et al*. 2013, Easin *et al*. 2017). Additionally, mushrooms are highly nutritious (Vinceti *et al*. 2013) and have a high demand in both domestic and international markets. Under the initiative of attracting rural youth to agriculture training, technical support and financial assistance was provided to young entrepreneurs for promoting mushroom cultivation. The promotion of mushroom enterprises is helping to create employment opportunities for the rural youth, improve their livelihoods and also furthering the cause of sustainable agriculture practices and production of nutritious food for the population.

The results of the mushroom entrepreneurship under this ICAR initiative were quite encouraging. In order to assess overall socio-economic impact of mushroom cultivation and associated entrepreneurship development, this study was designed through a network project in 2020.

## MATERIALS AND METHODS

*Study area*: This study is a part of National Network Research Project on 'Impact of ARYA on promotion of agri-preneurship and alternative livelihoods'. The ARYA project, in its first phase, covered 25 KVKs of India falling under 25 states/UTs and all 11 ICAR-ATARIs of India.

*Selection of sample*: The ARYA project was implemented through KVKs of respective ATARIs. Each ARYA KVKs had multiple enterprises to facilitate entrepreneurship development among the rural youth, in which mushroom production enterprise was promoted by the KVKs in 12 states/UTs. A sample of 147 functional business units was selected for this study using proportionate random sampling. As the ARYA project started in the KVKs of India during 2016–17, this year was considered as the benchmark year for the study. As the impact evaluation study is based on the data of the year 2020–21, this year was considered the year of assessment.

*Data collection process*: Primary data were collected on various socio-economic aspects of the entrepreneurial household using google form. The project staff personally visited each selected respondent for collecting the data. Time series (secondary) data on states/UTs wise mushroom production were taken from the ICAR-Directorate of Mushroom Research (DMR), Solan, Himachal Pradesh. FAOSTAT does provide country level time series mushroom production data for India, but those data grossly differ from the data updated recently by DMR. Based on the evidences compiled from spawn sale and mushroom productivity in India, the data of DMR seem more convincing and authentic.

*Data analysis*: The collected data were analysed to estimate entrepreneurial competencies index, livelihood capital score, key indicators of financial health, measures of dispersion and interdependence of various factors related to livelihood enhancement among respondents and various growth trends using following tools like compound annual growth rates, correlation analysis and regression analysis.

*Entrepreneurial competencies index*: The basic scale of entrepreneurial competencies (BSEC) developed by Cardenas-Gutierrez *et al*. (2021) was used with slight modification to assess the entrepreneurs' operations and marketing (OM), socio-business and legal organization (SBLO), and economic and financial (EF) competencies. An entrepreneurial-competencies index (ECI) was computed by dividing the sum of the actual score obtained by the total possible entrepreneurial-competency score (14), expressed as a percentage:

$$\text{ECI} = \sum_{t=1}^{n} \frac{\left[(OM) + (SBLO) + (EF)\right]}{14} \times 100$$

*Livelihood capital score*: The household-livelihood assessment tool developed by Minh *et al*. (2019) was used to estimate five capital-based livelihoods providing the basis for development of livelihood capital score of the entrepreneurs. Age, academic qualification and gender were quantified using standard procedures. Communication score was estimated based on the frequency of contact of

different sources of information i.e. local (family, friends, neighbours, progressive farmers/entrepreneurs and village leaders etc.), cosmopolitan (private agencies, field workers, government officers, SMSs of KVKs and experts from SAUs/research institutes etc.), mass-media (newspapers, publications, radio, and television etc.), information and communication technology (web browsing and portals etc.) and social-media platforms (YouTube, WhatsApp, and mobile advisories etc.).

*Compound annual growth rates (CAGRs)*: CAGRs were estimated to study the rate of growth in mushroom production for various states/UTs over the years using the following mathematical expression:

$$Y_t = Y_o(1+r)^t$$

$$\text{or } \ln Y_t = \ln Y_0 + \ln(1+r)t$$

$$\text{or } Y_t = A + B*t \qquad [A = \ln Y_0 \text{ and } B = \ln(1+r)]$$

$$r = \exp(B) - 1$$

where r, CAGR; exp, Exponential value; ln, Natural log; t, Time period in years for which CAGRs are calculated. The mathematical expressions for estimation of CAGRs have been taken from Rana *et al*. (2014).

*Correlation*: Karl Pearson Correlation Coefficients (r) were also estimated in order to have better understanding of interdependence of various variables.

*Regression*: For assessing the impact of various variables on the net income of mushroom growers, regression analysis was carried out. First, simple non-linear regression was run to see the power of influence of various independent variables on the variable of impact indication i.e. net income of the mushroom growers. At the second stage a stepwise regression was carried out in order to ensure best form of the regression model. Due to very wide variation in the values of the variable of impact indicator, a log-linear regression model was carried out in this study.

*Other tools/techniques*: Benefit-cost ratio, mean, coefficient of variation, standard deviation and percentages etc. were also estimated to arrive at suitable conclusions.

## RESULTS AND DISCUSSION

Mushroom enterprises were established in 12 states out of the total 25 states in which the ARYA project was implemented. These 12 states were Andhra Pradesh, Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Manipur, Nagaland, Odisha, Punjab and Uttarakhand. Production of mushroom, in tonnes, for different states of India over the five-year period i.e. 2016–17 to 2020–21 has been presented (Table 1). The overall mushroom production in India witnessed significant enhancement from 1.29 lakh tonnes in 2016–17 to 2.58

Table 1 CAGRs of mushroom production in various states of India (2016–17 to 2020–21)

| State | Production of mushroom (tonnes) | | | | | Absolute enhancement@ | CAGR (%) |
|---|---|---|---|---|---|---|---|
| | 2016–17 | 2017–18 | 2018–19 | 2019–20 | 2020–21 | | |
| Andhra Pradesh# | 3515 | 3650 | 3650 | 3650 | n/a | 135 | 1.14*** |
| Bihar | 2600 | 5600 | 15280 | 20080 | 28000 | 25400 | 82.77*** |
| Chhattisgarh | 344 | 540 | 1050 | 11400 | 13900 | 13556 | 184.28** |
| Goa | 4220 | 4470 | 6400 | 6400 | 6500 | 2280 | 13.01*** |
| Gujarat | 11200 | 12000 | 14000 | 14200 | 14500 | 3300 | 7.09*** |
| Haryana | 15100 | 20050 | 20050 | 19000 | 21200 | 6100 | 6.45*** |
| Himachal Pradesh | 9150 | 14505 | 15600 | 14733 | 14800 | 5650 | 10.27*** |
| Jharkhand | 220 | 1000 | 3000 | 3500 | 5020 | 4800 | 111.87** |
| Madhya Pradesh | 15 | 500 | 500 | 500 | 1500 | 1485 | 151.19* |
| Maharashtra | 12050 | 18380 | 19000 | 20250 | 25600 | 13550 | 17.40*** |
| Manipur# | 60 | 70 | 70 | 70 | n/a | 10 | 4.73*** |
| Nagaland | 325 | 405 | 405 | 422 | 1640 | 1315 | 38.80*** |
| Odisha | 15986 | 19532 | 19532 | 22000 | 25000 | 9014 | 10.66*** |
| Punjab | 18000 | 12750 | 18000 | 18500 | 19150 | 1150 | 5.09*** |
| Rajasthan | 1300 | 1400 | 13400 | 15800 | 18400 | 17100 | 116.48** |
| Tamil Nadu | 10000 | 11475 | 11475 | 11780 | 12660 | 2660 | 5.11*** |
| Uttarakhand | 10236 | 11670 | 14200 | 13923 | 12400 | 2164 | 5.76*** |
| Uttar Pradesh | 7100 | 7600 | 9700 | 11900 | 19800 | 12700 | 28.40*** |
| West Bengal | 2050 | 3000 | 7500 | 7000 | 9500 | 7450 | 47.91*** |
| Other | 6311 | 6956 | 8276 | 10816 | 9210 | 2899 | 12.72*** |
| India | 129782 | 155553 | 201088 | 225924 | 258860 | 129078 | 19.17*** |

Source: DMR (2023), Sharma *et al*. (2017).

CAGR, Compound annual growth rate. #, CAGR based on 4 years data (2016–17 to 2019–20); @, Production enhancement during 2016–17 and 2020–21; ***, **, * represents significance at 1, 5, 10% level, respectively.

lakh tonnes in 2020–21 i.e. doubling of production in the specified time period [Compound Annual Growth Rates (CAGR) = 19.17%]. Bihar experienced an outstanding increase in mushroom production from 2,600 tonnes in 2016–17 to 28,000 tonnes in 2020–21 at CAGR of 82.77%. This might be attributed to the increasing demand for mushroom cultivation in the state and other parts of the country. Punjab had the highest mushroom production in 2016–17, however, its growth was quite low (CAGR = 5.09%) when compared to the national average and CAGRs of some other states. Incidentally all other states having higher level of mushroom production during 2016–17, viz. Maharashtra, Odisha, Haryana, Gujarat, Tamil Nādu and Uttarakhand etc., also had CAGRs of mushroom production lower than the national CAGR. Even the states like Andhra Pradesh, Goa, Manipur and group of other states have lower than the national CAGR in spite of their lower levels of mushroom production in 2016–17 (Table 1).

However, on the basis of absolute enhancement in mushroom production during 2016–17 and 2020–21, states like Bihar (25400 tonnes) followed by Rajasthan (17100 tonnes), Chhattisgarh (13556 tonnes), Maharashtra (13550 tonnes) and Uttar Pradesh (12700 tonnes) had the higher contribution to the national production enhancement (1.29 lakh tonnes). Chhattisgarh (184.28%) had the highest CAGR followed by Madhya Pradesh (151.19%), Rajasthan (116.48%) and Jharkhand (111.87%) showed extra-ordinarily high CAGR in mushroom production mainly due to lower levels of mushroom production during initial years i.e. 2016–17 onwards. Interestingly, the absolute enhancement of CAGR in mushroom production in some of the states was very high, viz. Madhya Pradesh, and Jharkhand was quite low (1485 and 4800 tonnes, respectively) against 25400 tonnes in Bihar (Table 1).

In spite of the rapid growth in mushroom production in India, the annual average per capita mushroom production in India was 33.2 g versus 2500 g in China (Shirur *et al.* 2018), therefore, a strong mechanism is required to promote mushroom production through capacity building, marketing solutions, infrastructure development and policy support to ensure health and nutrition to the Indian masses (Shirur *et al.* 2017, 2019).

Change in the percentage contribution of various states to mushroom production in the country during 2016–17 and 2020–21 has been depicted in Fig. 1. Some states experienced growth, while others saw a decline or remained relatively stable in their contribution to the overall mushroom production. In 2016–17, Punjab had the highest contribution to mushroom production, accounting for 14% of the national production. Odisha and Haryana followed closely with a contribution of 12% each while Gujarat and Maharashtra contributed 9% each. Himachal Pradesh, Tamil Nadu and Uttarakhand contributed 7%, 8%, and 8%, respectively to the national mushroom production while the rest of the states contributed from 0% to 3% during 2016–17.

State-wise mushroom production scenario in terms of their proportionate share in national production changed by the year 2020–21. Bihar emerged as the leader with its contribution increasing from 2% during 2016–17 to 11% during 2020–21. Maharashtra and Odisha had 10% share in national mushroom production, while this share was 8% for Haryana (12% in 2016–17) and UP (5% in 2016–17). Punjab's contribution declined to 7% in 2020-21 from 14% in 2016–17 while Rajasthan's share increased from 1% in

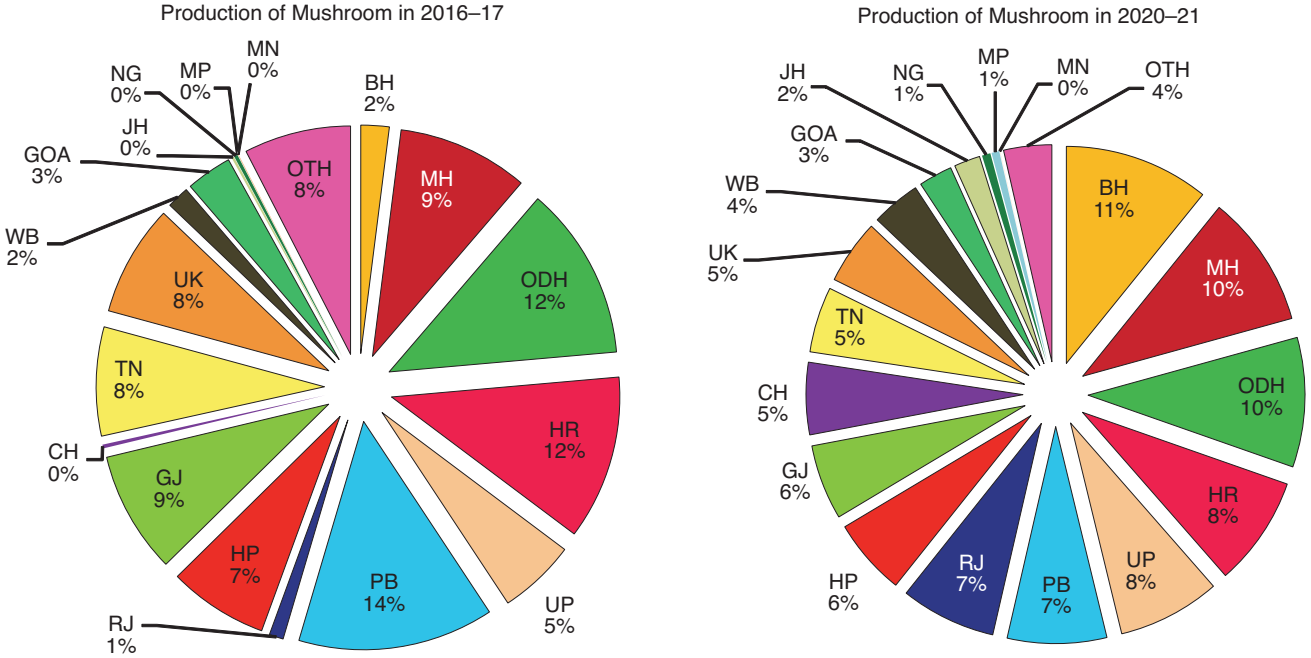


Fig. 1 Contribution of different states in mushroom production during 2016–17 and 2020–21.
MH, Maharashtra; ODH, Odisha; HR, Haryana; UP, Uttar Pradesh; PB, Punjab; RJ, Rajasthan; HP, Himachal Pradesh; GJ, Gujarat; TN, Tamil Nadu; UK, Uttarakhand; WB, West Bengal; JH, Jharkhand; NG; Nagaland; MP, Madhya Pradesh; MN, Manipur; BH, Bihar; CH, Chhattisgarh; OTH, Others.

2016–17 to 7% in 2020–21. Gujarat (9% in 2016–17) and Himachal Pradesh (7% in 2016–17) contributed 6% each to the national mushroom production during 2020–21. Uttarakhand and Tamil Nadu showed a decline in their share in national mushroom production to 5% each from their share of 8% in 2016–17 (Fig. 1).

Net income, age, education, operational days, employment days, number of persons engaged and gender were the key elements for regression analysis. The estimated mean net income was ₹2,52,739 with a standard deviation of ₹3,65,519 due to very wide range between the lowest and the highest value. High coefficient of variation for net income (1.45) also indicates abnormally high variation among the observations. The standard deviations for other variables were also considerably high.

The average cultivated land of respondents varied considerably across the states e.g., it varied from 1 acre to 6.71 acres in Chhattisgarh. The overall average land holding of the respondents was 2.23 acres (Table 2).

The ARYA entrepreneurs, considered for this study were already involved in farming and ARYA entrepreneurship was introduced to supplement their family income. In order to assess impact of mushroom farming on the income of conventional farming of the entrepreneur, the net income from conventional farming was estimated (Table 2). There was wide variation in net income per family across the states as it was as low a ₹61300 in Himachal Pradesh and as high as ₹2.23 lakh in Madhya Pradesh during 2020–21. However, the overall net income per family was ₹1.25 lakh.

The livelihood capital score of the respondents was quite consistent over the states and varied from 16.50 in Chhattisgarh to 22.38 in Madhya Pradesh with the overall average of 19.35. However, there was wider variation in the communication score of the respondents which varied from 16.07 in Andhra Pradesh to 96.06 in Nagaland with an average value of 59.56 (Table 2). The Karl Pearson correlation coefficients between net income from cultivated area and livelihood capital score was as high as 0.73 indicating direct influence of the later on the former. However, communication score didn't have any significant effect on the net income of the respondents.

Operational duration (man days), growth (%), and employment generated (man days) over the years in 12 states, where mushroom cultivation was promoted under the ARYA have been presented in Table 3. The operational duration of the respondents who adopted mushroom cultivation, varied from 221 days/unit (Kerala) to 755 days/unit (Himachal Pradesh). Further, there was considerable variation in growth of operational duration of mushroom enterprises which varied from as low as 0.64 in Haryana to 51.76 in Andhra Pradesh. The overall average operational duration of mushroom enterprises under the ARYA project was 474 man-days/unit while the average overall employment generated was 532 days/unit.

Employment generation through adoption of mushroom cultivation enterprises was the highest in Odisha (1027 man-days/unit) followed by Manipur (627 man-days/unit) and Nagaland (601 man-days/unit), Bihar (589 man-days/unit) and Punjab (543 man-days/unit) generating higher than the average overall employment of 532 man-days/unit in 12 states under ARYA intervention. In Madhya Pradesh, Uttarakhand, Haryana, Himachal Pradesh, Chhattisgarh, Andhra Pradesh and Kerala, the employment generation was below the overall average. Further, growth of employment generation ranged from the lowest 85% in Himachal Pradesh to 357% in Odisha. Other states with high growth in employment generation were Nagaland, Uttarakhand, Bihar, Punjab, and Manipur. However, the overall growth of employment generation at national level was 229% (Table 3).

Table 2 Respondents' selected socio-economic indicators

| State | Socio-economic factors | | | |
|---|---|---|---|---|
| | Cultivated area (acre/family) | Net income from cultivated area (₹/family)# | Livelihood capital score# | Communication score |
| Andhra Pradesh | 2.77 | 178000 | 20.60 | 16.07 |
| Bihar | 1.39 | 141894 | 21.90 | 64.70 |
| Chhattisgarh | 6.71 | 103500 | 16.50 | 51.40 |
| Haryana | 1.38 | 176714 | 18.25 | 39.63 |
| Himachal Pradesh | 1.36 | 61300 | 17.10 | 39.70 |
| Kerala | 1.25 | 127667 | 21.37 | 75.11 |
| Madhya Pradesh | 2.00 | 223333 | 22.38 | 75.63 |
| Manipur | 1.00 | 62400 | 17.00 | 44.00 |
| Nagaland | 2.25 | 135267 | 19.28 | 96.06 |
| Odisha | 2.04 | 67600 | 17.69 | 66.69 |
| Punjab | 2.35 | 177700 | 19.60 | 35.90 |
| Uttarakhand | 1.83 | 196815 | 20.50 | 56.83 |
| Average | 2.23 | 125437 | 19.35 | 59.56 |

# r=0.73

Table 3 State/UTs wise respondents' operational duration and employment generation

| Centre | Operational duration | | Employment generated | |
|---|---|---|---|---|
| | Man days/unit | Growth (%) | Man days/unit | Growth (%) |
| Andhra Pradesh | 325 | 51.76 | 238 | 136 |
| Bihar | 401 | 51.55 | 589 | 281 |
| Chhattisgarh | 301 | 28.44 | 292 | 99 |
| Haryana | 370 | 0.64 | 413 | 165 |
| Himachal Pradesh | 755 | 4.79 | 307 | 85 |
| Kerala | 221 | 0.73 | 193 | 159 |
| Madhya Pradesh | 364 | n/a | 439 | 127 |
| Manipur | 675 | n/a | 627 | 212 |
| Nagaland | 600 | 0.69 | 601 | 315 |
| Odisha | 658 | 35.92 | 1027 | 357 |
| Punjab | 420 | 4.44 | 543 | 261 |
| Uttarakhand | 566 | n/a | 431 | 282 |
| Average | 474 | 23.60 | 532 | 229 |

The data pertaining to total annual turnover, expenditure and net income of mushroom enterprise in different states under ARYA project are presented in Table 4. Highest turnover was recorded in Punjab with a turnover of ₹13.37 lakh/unit followed by Odisha (₹9.97 lakh/unit), Himachal Pradesh (₹7.34 lakh/unit), Haryana (₹6.51 lakh/unit) and Madhya Pradesh (₹5.49 lakh/unit). The overall total turnover of ARYA entrepreneurs was ₹5.09 lakh/unit. However, the growth of total turnover showed a considerable variation which ranged from a lowest level of 0.61% (Manipur) to 88.73 (Uttarakhand) with an overall average growth of 9.38. Other important states with higher growth of total turnover were Andhra Pradesh (51.87) followed by Odisha (50.53), Bihar (49.06), Himachal Pradesh (20.12), Kerala (19.48) and Chhattisgarh (14.55).

The highest expenditure incurred by the mushroom entrepreneurs under ARYA project was observed in Punjab (₹8.32 lakh/unit) followed by Odisha (₹5.83 lakh/unit) and Uttarakhand (₹3.48 lakh/unit). In contrast, the state with the lowest average expenditure on mushroom entrepreneurship was Bihar (₹10,960/unit). The state with the highest growth was Andhra Pradesh (188.14%) followed by Uttarakhand (125.88%) and Odisha (47.91%). The overall average expenditure of all the states having mushroom entrepreneurship under ARYA project was ₹2.60 lakh/unit, while the average overall growth in expenditure of ARYA enterprises was 6.16% (Table 4).

Net income with the adoption of mushroom enterprise was the highest in Punjab (₹5.04 lakh/unit) followed by Himachal Pradesh (₹4.41 lakh/unit) and Odisha (₹4.14 lakh/unit). In contrast, the state with the lowest net income was Bihar (₹83,935/unit). The overall average net income of all the states was ₹2.48 lakh/unit. The growth of net income ranged from the lowest of -20.52% in Madhya Pradesh to the highest of 54.39% in Odisha. The overall average growth of all the states was 13.07%. This information can be used to compare the financial behaviours of mushroom entrepreneurs in different states and in order to gain insights into their economic development and financial management (Table 4).

The Entrepreneurial Competency Index is a matrix used to access the level of competency and readiness of entrepreneurs in a particular region to start and successfully run their enterprises. The Entrepreneurial Competency Index (ECI) for 12 different states in India where ARYA enterprises have been taken up ranged from the lowest of 20.63 in Nagaland to the highest of 100 in Haryana. The overall ECI for all the states was 58.94. This indicated that Haryana

Table 4 States/UTs wise respondents' annual total turnover, expenditure and net income

| State | Total turnover | | Total expenditure | | Net income | |
|---|---|---|---|---|---|---|
| | ₹ | Growth rate (%) | ₹ | Growth rate (%) | ₹ | Growth rate (%) |
| Andhra Pradesh | 118567 | 51.87 | 27920 | 188.14 | 90647 | 39.48 |
| Bihar | 94895 | 49.06 | 10960 | 32.39 | 83935 | 51.52 |
| Chhattisgarh | 128704 | 14.55 | 21210 | 17.74 | 107494 | 14.17 |
| Haryana | 651112 | 5.56 | 238498 | 5.62 | 412614 | 5.52 |
| Himachal Pradesh | 734000 | 20.12 | 292900 | 18.16 | 441100 | 21.40 |
| Kerala | 135013 | 19.48 | 17424 | 12.21 | 117589 | 20.68 |
| Madhya Pradesh | 549023 | n/a | 300131 | n/a | 248891 | -20.52 |
| Manipur | 346500 | 0.61 | 61805 | 1.93 | 284695 | 0.33 |
| Nagaland | 145500 | 4.01 | 47611 | 2.65 | 97889 | 4.69 |
| Odisha | 996952 | 50.53 | 583281 | 47.91 | 413671 | 54.39 |
| Punjab | 1336844 | n/a | 832060 | n/a | 504784 | 0.18 |
| Uttarakhand | 500833 | 88.73 | 348083 | 125.88 | 152750 | 41.67 |
| Average | 508586 | 9.38 | 260561 | 6.16 | 248025 | 13.07 |

Table 5 States/UTs wise respondents' entrepreneurial competencies and the economic performance of mushroom enterprise

| State | Entrepreneurial Competency Index | B:C Ratio | Per day income (₹) | Assets (₹) |
|---|---|---|---|---|
| Andhra Pradesh | 63.33 | 5.60 | 286 | 17867 |
| Bihar | 70.71 | 7.72 | 191 | 37910 |
| Chhattisgarh | 44.29 | 10.08 | 363 | 278820 |
| Haryana | 100.00 | 2.72 | 1362 | 850250 |
| Himachal Pradesh | 49.29 | 2.42 | 565 | 50000 |
| Kerala | 73.31 | 7.96 | 520 | 61805 |
| Madhya Pradesh | 74.11 | 3.03 | 466 | 91594 |
| Manipur | 42.86 | 5.61 | 422 | 267700 |
| Nagaland | 20.63 | 2.95 | 139 | 203611 |
| Odisha | 56.92 | 1.77 | 611 | 117016 |
| Punjab | 80.00 | 2.21 | 872 | 158595 |
| Uttarakhand | 41.67 | 1.57 | 276 | 455167 |
| Average | 58.94 | 4.29 | 496 | 167609 |

had the highest level of entrepreneurship capabilities, followed by Punjab, Madhya Pradesh, Kerala, Bihar, Andhra Pradesh, Odisha, Himachal Pradesh, Chhattisgarh, Manipur, Uttarakhand and Nagaland (Table 5).

The B:C (Benefit:Cost) ratio is a financial indicator that indicates the profitability of an enterprise under given financial resources. It represents the ratio of the benefits derived from an activity or investment to the costs incurred. The values of B:C ratio varied from 1.57 in Uttarakhand to 10.08 in Chhattisgarh, indicating different levels of profitability across the states affected by total expenditure on enterprise, state policies and financial support under different schemes. Further, average daily income earned by individuals engaged in mushroom cultivation in different states ranged from ₹139/unit in Nagaland to ₹1,362/unit in Haryana indicating differences in the scale of operations across the states (Table 5).

Assets available with the entrepreneurs as shown in the Table 5 represent total value of assets owned by ARYA mushroom growers in different states. Assets depicted in the Table ranged from ₹17,867/unit in Andhra Pradesh to ₹8.50 lakh/unit in Haryana, indicating variation in the economic prosperity of such farmers due to the adoption of mushroom as supplementary enterprise.

Correlation analysis of the key variables was carried out in order to understand the interdependence between them. Operational days and employment days have a moderate positive correlation coefficient (r = 0.387), indicating that as the number of operational days increases, so does the number of days of employment. Number of people engaged had a weak negative correlation with age (r = 0.082), indicating that as the age of the entrepreneur increases, the ability of the enterprise to engage people may fall (Table 6).

Regression analysis is a strong tool for determining the impact of different variables on the variable of impact indicator i.e. the net income of mushroom farmers. Simple regression analysis was carried out in order to understand effect of different variables on the net income of mushroom growers.

Stepwise regression analysis was performed to include the most relevant variables in the regression model. Given the wide variation in the values of net income of different mushroom growers, a log-linear regression was considered appropriate where logarithmic form of net income of mushroom farmers was taken.

The results showed that in the first phase of a regression equation, the variable 'Operational days' had a significant and favourable effect on the entrepreneurs' net income. It explained 35.8% of the variations in net income. The addition of variable 'number of persons' raised the value of $R^2$ (46%). In the third step, the addition of variable 'Employment days' further improved the value of $R^2$ up to 48.5% The addition of variables 'Gender' and 'Age' increased the value of $R^2$ to 50.6 and 52.1%, respectively.

The final regression results showed that explanatory variables account for 52.1% of the variation in mushroom farmers' net income. Age of the mushroom growers had a positive coefficient of 0.023, indicating that as the age of the mushroom farmer increases their net income increases by 2.3%. During the survey it was found out that younger farmers were not satisfied with the income potential of this enterprise and they wanted to pursue financially more rewarding enterprises so some of them were running their enterprises half-heartedly. In addition to age of the entrepreneur, employment days, number of persons engaged, and male gender of the entrepreneur, all had positive regression coefficients, indicating that these variables had a positive impact on the net income of mushroom farmers.

Table 6 Correlation coefficients of respondents' important socio-economic variables

| Variable | Age | Education | Operational days | Employment days | No. of people engaged | gender |
|---|---|---|---|---|---|---|
| Age | 1.000 | | | | | |
| Education | -0.019 | 1.000 | | | | |
| Operational days | -0.008 | 0.077 | 1.000 | | | |
| Employment days | -0.047 | 0.012 | 0.387 | 1.000 | | |
| No of people engaged | -0.082 | -0.067 | 0.405 | 0.356 | 1.000 | |
| Gender | 0.070 | 0.093 | -0.020 | -0.136 | 0.053 | 1.000 |

Table 7 Abstract results of the log-linear multiple regression

| Variables/attributes | Coefficients | Standard error | t Stat | *P*-value |
|---|---|---|---|---|
| Intercept | 9.440 | 0.470 | 20.079 | 0.000 |
| Age | 0.023** | 0.011 | 2.129 | 0.035 |
| Education | -0.004 | 0.067 | -0.049 | 0.961 |
| Operational days | 0.006*** | 0.001 | 5.926 | 0.000 |
| Employment days | 0.001*** | 0.000 | 3.065 | 0.003 |
| No of people engaged | 0.291*** | 0.065 | 4.474 | 0.000 |
| Gender | 0.313** | 0.137 | 2.271 | 0.025 |
| $R^2$ | | 0.521 | | |
| Adjusted $R^2$ | | 0.501 | | |
| F value | | 25.066*** | | |

However, the regression coefficient for education of the entrepreneur had inconclusive findings with a tendency of lower liking of the educated youth to pursue this enterprise (Table 7).

*Conclusions and policy implications*

It could be concluded that the net-income of entrepreneurs varied in a wide range where it was not enough to provide economic motivation to the entrepreneur to continue on one hand to such a level where it required extraordinary managerial and technical competencies to establish a large business. The scale of operations worth generating sizable income, therefore, is important in the business of mushroom production. However, higher marketing risks arising simultaneously when one opts for scale enhancement needs to be professionally managed. Local demand *vis-à-vis* potential assessment of supplies and reliable price forecasting inputs from credible research institutions become imperative to ensure balanced and healthy growth of mushroom production in the country.

The states/UTs wise entrepreneurial competency index (ECI) of mushroom growers varied in a wide range across the states indicating considerable differences within states/UTs of India on this aspect due to socio-economic variations. In order to strengthen commercial mushroom production in all the potential states, capacity building of entrepreneurs need to be redesigned. The differential benefit cost ratio (B:C ratio) in mushroom production across the states/UTs observed to be caused by the different levels of investments. State level incentives to the mushroom enterprise in terms of technical, policy and financial support can strengthen the enterprenures.

*Ethical statement*

The entrepreneurs of this study explained about the aim of study and its probable outcomes in terms of digital and hard copies publications. Respondents of this study wished to remain anonymous and consented to use their information for the research and academic purpose.

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