*Original Research Article*

Cluster based Entrepreneurial Orientation Analysis among Mushroom Entrepreneurs in Meghalaya

**ABSTRACT**

Mushroom cultivation in Meghalaya has emerged as a promising avenue for rural income diversification, leveraging the region’s favorable agro-climatic conditions and growing market demand. This study employs a k-means cluster analysis to assess the entrepreneurial orientation of 200 mushroom entrepreneurs across five key dimensions: planning, production, marketing, leadership, and decision-making. Data were collected using a structured questionnaire and analyzed to identify low, medium, and high capability groups for each dimension. Results reveal that while a substantial proportion of entrepreneurs exhibit high capabilities in planning, production, leadership, and decision-making, significant gaps remain in innovation, labor productivity, systematic market intelligence, and especially technology adoption. Notably, only a minority consistently utilize market news or adopt new technologies, even among otherwise high-scoring individuals. These findings underscore the need for targeted interventions including market intelligence systems, innovation workshops, and digital skills training to move more entrepreneurs into the high capability clusters and ensure sustainable sectoral growth. The study highlights the importance of integrated training in market analysis and innovation management for maximizing the potential of mushroom entrepreneurship in rural Meghalaya.

**Keywords:** *Agribusiness, Cluster analysis, Entrepreneurial orientation, Mushroom entrepreneurship*

**1. INTRODUCTION**

Mushroom cultivation in Meghalaya has emerged as a transformative rural enterprise, capitalizing on the state’s unique agro-climatic conditions, abundant forest resources, and a growing demand for nutritious, sustainable food options (Verma, 2014). The sector’s adaptability to varied local conditions including humid subtropical valleys and temperate uplands enables year-round production and supports a broad spectrum of mushroom varieties, notably oyster, button, and shiitake mushrooms. This ecological advantage, coupled with Meghalaya’s tradition of community-based resource management, has established mushroom farming as an accessible and inclusive livelihood strategy for smallholder farmers, women, and rural youth (Government of Meghalaya, 2018).

The sector is particularly suited to smallholder farmers and rural youth, offering a low-investment, high-return model that requires minimal land and can be integrated with other farming activities (ICAR, 2025). The sector’s short production cycles and potential for value addition through processing and packaging further enhance its attractiveness for those with limited resources or landholdings. Additionally, reliance on locally available substrates such as paddy straw, sawdust, and agro-waste not only reduces input costs but also promotes environmental sustainability by recycling agricultural residues and minimizing waste.

Entrepreneurial success in this sector is driven by a complex interplay of planning, production, marketing, leadership, and decision-making capabilities (Clark et al., 2024; Kumar et al., 2022). Effective planning ensures timely procurement of quality spawn, substrate preparation, and prudent financial management. Technical production skills underpin yield optimization and product quality, while marketing acumen encompassing market intelligence, grading, storage, and consumer engagement enables entrepreneurs to access premium markets and respond to shifting demand patterns. Leadership and decision-making abilities foster innovation, effective team management, and adaptability, empowering entrepreneurs to navigate risks and seize emerging opportunities in a dynamic marketplace.

Recent research highlights that entrepreneurial orientation enables farmers to innovate, adopt new technologies, and respond proactively to market demands, ultimately enhancing farm revenues and livelihoods (Shahbaz et al., 2023; Apata, 2015). However, persistent challenges such as limited market access, weak value chain integration, and inadequate training in advanced production and processing techniques remain barriers to sectoral growth (ICAR, 2025; Hakim et al., 2016). Many entrepreneurs struggle to consistently access quality spawn, modern cultivation infrastructure, and timely market information, all of which are essential for maintaining competitiveness and profitability (Maring et al., 2023).

In response, the Government of Meghalaya and allied institutions have prioritized mushroom entrepreneurship as a key strategy for rural income diversification and food security. Initiatives such as the establishment of Mushroom Development Centres, targeted training programs, and cluster-based interventions have been launched to build capacity and foster innovation among local entrepreneurs (Government of Meghalaya, 2018). Despite these efforts, entrepreneurs in Meghalaya display diverse strengths and weaknesses across the core dimensions of entrepreneurial orientation. Understanding these variations through robust analytical approaches, such as cluster analysis, is essential for designing evidence-based policies and tailored training interventions that can further unlock the sector’s potential and ensure inclusive, sustainable rural development.

**2. MATERIALS AND METHODS**

A mixed sampling approach was adopted to ensure representation across the various mushroom based entrepreneurs. The study covered East Khasi Hills, Ri-Bhoi, West Garo Hills, and North Garo Hills, selected for their high production, institutional infrastructure (Mushroom Development Centres, KVKs), and ongoing entrepreneurship interventions (Government of Meghalaya, 2018). From each district, 50 entrepreneurs were sampled using snowball and purposive techniques. A structured questionnaire was administered to 200 mushroom entrepreneurs, measuring five entrepreneurial dimensions: Planning Orientation (6 items), Production Orientation (6 items), Marketing Orientation (5 items), Leadership Ability (5 items), Decision-Making ability (10 items). Total scores for each dimension were calculated per respondent and checked for completeness and accuracy. Item-wise means were computed for detailed analysis.

Cluster analysis was performed using k-means clustering (k=3) separately for each dimension’s total score, categorizing respondents into Low, Medium, and High capability groups (Kaufman & Rousseeuw, 1990). Cluster means (centroids) were recorded for each group, and thresholds for category assignment were set as midpoints between cluster means.

Where,

||xi - vj|| = the Euclidean distance between xi and vj.,

ci = the number of data points in ith cluster,

c = the number of cluster centres.

**3. RESULTS AND DISCUSSION**

The k-means cluster analysis of entrepreneurial orientation among 200 mushroom entrepreneurs in Meghalaya revealed distinct capability groups across five core dimensions: Planning, Production, Marketing, Leadership, and Decision-Making. Table 1 summarizes the cluster means and the number of individuals in each category.

**Table 1. Cluster Means and Frequency by Entrepreneurial Dimension**

|  |  |  |  |
| --- | --- | --- | --- |
| Dimension | Cluster Category | Cluster Mean | Frequency |
| Planning | Low | 2.77 | 44 |
| Medium | 4.00 | 69 |
| High | 5.09 | 87 |
| Production | Low | 2.79 | 53 |
| Medium | 4.00 | 81 |
| High | 5.08 | 66 |
| Marketing | Low | 0.94 | 18 |
| Medium | 2.00 | 59 |
| High | 3.30 | 123 |
| Leadership Ability | Low | 10.50 | 34 |
| Medium | 12.00 | 39 |
| High | 13.72 | 127 |
| Decision-Making Ability | Low | 20.50 | 18 |
| Medium | 22.66 | 50 |
| High | 25.16 | 132 |

**Table 2. Item-wise Mean Scores for Each Dimension**

|  |  |  |  |
| --- | --- | --- | --- |
| Dimension | Item | Statement | Mean |
| Planning | PL1 | Each year, I review the performance of my mushroom enterprise. | 0.87 |
| PL2 | It is not necessary to decide in advance about launching new mushroom products. (reverse) | 0.18 |
| PL3 | I assess the amount of spawn, substrate, and other inputs needed well ahead of time. | 0.80 |
| PL4 | I estimate the costs involved in mushroom production before each cycle. | 0.78 |
| PL5 | I do not need to consult experts for planning my mushroom business. (reverse) | 0.81 |
| PL6 | Careful production planning increases my returns from mushroom cultivation. | 0.78 |
| Production | PD1 | Timely use of mushroom spawn and raw materials ensures good returns. | 0.87 |
| PD2 | I use as much substrate and inputs as I like, regardless of recommendations. (reverse) | 0.18 |
| PD3 | Planning for required inputs in mushroom production saves money and time. | 0.79 |
| PD4 | I always ensure my mushrooms meet quality and approved standards. | 0.87 |
| PD5 | I strictly follow technical recommendations in mushroom cultivation. | 0.77 |
| PD6 | I utilize labor in my mushroom unit with the goal of maximizing productivity. | 0.57 |
| Marketing | MO1 | Market news is not useful for my mushroom business. (reverse) | 0.14 |
| MO2 | Grading my mushrooms helps me get a better price. | 0.75 |
| MO3 | Proper storage facilities help me secure better prices for my mushrooms. | 0.83 |
| MO4 | I buy mushroom production inputs only from shops my relatives use. (reverse) | 0.22 |
| MO5 | I focus on mushroom products that have higher demand in the market. | 0.77 |
| Leadership Ability | LED1 | I participate in group discussions on new mushroom cultivation practices. | 2.70 |
| LED2 | I initiate discussions about new mushroom practices with colleagues. | 2.59 |
| LED3 | Others regard me as a good source of information on mushroom production. | 2.77 |
| LED4 | I assign mushroom enterprise work to family members. | 2.28 |
| LED5 | I offer new approaches to solve problems in my mushroom business. | 2.52 |
| Decision-Making Ability | DM1 | Decision on adopting new mushroom cultivation practices. | 2.36 |
| DM2 | Decision on purchasing mushroom production inputs. | 2.56 |
| DM3 | Decision on planning mushroom production cycles. | 2.65 |
| DM4 | Decision on marketing harvested mushrooms. | 2.51 |
| DM5 | Decision on managing labor in the mushroom unit. | 2.77 |
| DM6 | Decision on financial management for the mushroom business. | 2.60 |
| DM7 | Decision on risk management in mushroom production. | 2.53 |
| DM8 | Decision on adopting new technology for mushroom cultivation. | 1.29 |
| DM9 | Decision on expanding the mushroom business. | 2.60 |
| DM10 | Decision on collaboration with other mushroom entrepreneurs. | 2.28 |

**Planning Orientation**

Among the 200 mushroom entrepreneurs, 44 were classified as low, 69 as medium, and 87 as high in planning orientation, with cluster means of 2.77, 4.00, and 5.09, respectively as indicated in Table 1. and Fig. 1. Nearly half of the sample falls into the high planning group (n=87), indicating a strong culture of annual review, input planning, and cost estimation (PL1, PL3, Table 2). This pattern supports the findings of Covin and Wales (2019), who emphasize that strategic planning enhances both resilience and profitability in entrepreneurial ventures. However, the presence of a substantial number of entrepreneurs in the low and medium categories (n=113) suggests that not all are leveraging planning for innovation or business growth. This echoes Hakim et al. (2016), who argue that while planning is necessary, it is insufficient on its own without adaptation to market changes and opportunities.

**Production Orientation**

For production orientation, 53 entrepreneurs were in the low cluster, 81 in medium, and 66 in high, with means of 2.79, 4.00, and 5.08, respectively. The majority are in the medium or high clusters (n=147, Table 1, Fig. 1), reflecting strong technical discipline and a focus on quality standards (PD1, PD4, Table 2), a finding that aligns with Hakim et al. (2016), who noted that technical rigor directly boosts yields in agri-enterprises. However, labor productivity (PD6) remains only moderate, and some entrepreneurs still overuse inputs (PD2), suggesting inefficiencies. This supports Apata (2015), who found that technical routines alone do not guarantee scalability or profitability unless paired with resource optimization and effective labor management.

**Fig. 1. Overall Entrepreneurial Dimension wise analysis results**

**Marketing Orientation**

In marketing orientation, only 18 entrepreneurs were in the low cluster, 59 in medium, and a notable 123 in high, with means of 0.94, 2.00, and 3.30, respectively as depicted in Table 1 and Fig. 1. The majority being in the high marketing group suggests a strong awareness of grading, storage, and market demand (MO2, MO3, MO5, Table 2) among Meghalaya's mushroom entrepreneurs. This finding is somewhat contradictory to earlier research by Kumar et al. (2022), which identified marketing as the weakest dimension in mushroom entrepreneurship, possibly indicating recent improvements in value chain integration and market access. Nevertheless, a minority in the low and medium clusters (n=77) still lack systematic use of market news (MO1) and input diversification (MO4), confirming Apata's (2015) assertion that market orientation gaps persist in agri-entrepreneurship.

**Leadership** **Ability**

For leadership ability, 34 entrepreneurs were categorized as low, 39 as medium, and 127 as high, with cluster means of 10.50, 12.00, and 13.72, respectively as mentioned in the Table 1 and Fig. 1. The predominance of entrepreneurs in the high leadership cluster indicates strong peer engagement and information sharing (LED1, LED3, Table 2), supporting Verma (2019), who linked such leadership traits to greater innovation adoption. However, innovation and family delegation (LED5, LED4) remain only moderate, echoing Shahbaz et al. (2023), who argue that leadership must be paired with innovation and inclusive management for sustained competitive advantage.

**Decision-Making Ability**

In decision-making ability, 18 entrepreneurs were in the low cluster, 50 in medium, and 132 in high, with means of 20.50, 22.66, and 25.16, respectively from Table 1 and Fig. 1. The vast majority in the high decision-making group reflects a culture of autonomy and consultative decision-making (DM1–DM7, Table 2), which is consistent with Covin and Wales (2019) on the importance of adaptive and independent decision-making in entrepreneurship. However, technology adoption (DM8) remains low even among high decision-makers, highlighting a disconnect between decision-making autonomy and actual modernization. This finding is in line with Shahbaz et al. (2023), who found that risk aversion and lack of exposure can hinder modernization in agri-enterprises, even among otherwise capable entrepreneurs.

**4. CONCLUSION**

This study provides a comprehensive, data-driven assessment of entrepreneurial orientation among mushroom entrepreneurs in Meghalaya, employing k-means cluster analysis to reveal capability groupings across planning, production, marketing, leadership, and decision-making dimensions. The clustering results illuminate a sector that, while demonstrating notable strengths in strategic planning, technical production, peer leadership, and consultative decision-making, still faces critical developmental bottlenecks.

However, the analysis also uncovers persistent and consequential gaps. Innovation in product planning remains limited, with many entrepreneurs not engaging in proactive new product development or diversification. Labor productivity is moderate, indicating that resource optimization and workforce management are areas requiring further attention. While a majority of entrepreneurs recognize the importance of grading, storage, and market demand, systematic use of market intelligence and diversification of input sources are not yet universal practices. Most notably, technology adoption lags behind, even among those otherwise classified as high in decision-making autonomy, highlighting a disconnect between willingness to act independently and the actual uptake of modern tools and methods.

Targeted interventions such as prioritize integrated training that addresses both hard and soft entrepreneurial skills, tailor interventions to the specific needs of different capability clusters, and invest in infrastructure that supports market access and technology diffusion are needed to move more entrepreneurs into the high capability clusters across all dimensions. Capacity building programs should go beyond technical and operational training to include modules on innovation management, digital literacy, and advanced market analysis. Establishing robust market intelligence systems and facilitating exposure to new technologies through demonstrations and peer learning could bridge the gap between capability and practice. Additionally, fostering a culture of continuous innovation and encouraging inclusive leadership, where family and community members are more actively engaged can further enhance enterprise sustainability.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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