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Entrepreneurial Behaviour of Vegetable Farmers in India with Evidence from Eastern India: A Systematic Review

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Abstract

The systematic review is a compilation of empirical findings of the dimensions, determinants and consequences of entrepreneurial behaviour in vegetable farmers in India with special focus on the Eastern part of India. The evaluation was based on the Preferred Reporting Items related to Systematic Reviews and meta-analyses and reviewed the studies published between 2000 and 2025 and included in databases like Scopus, Web of Science, ICAR e-publications, and top Indian extension journals. Among the 73 original documents found, 15 empirical studies were included in the analysis because of relevance and the methodology quality. The results demonstrate that in most cases the entrepreneurial behaviour of vegetable growers is measured using various dimensions such as innovativeness, risk-taking power, achievement motivation, decision-making power, leadership power, scientific orientation, self-confidence, market orientation and planning power. The main influencing factors of entrepreneurial behaviour are education; the amount of income earned annually, the socio-economic status of owning land, experience in farming, contact with and exposure to mass media. Same patterns have been observed in evidence in Eastern India especially Odisha, Assam and Uttar Pradesh, but research in states like Bihar and Jharkhand is very limited. Structural constraints affecting agripreneurship that are identified in the review are fluctuations in prices, limited extension services, absence of crop insurance, labour shortages and insufficient market infrastructure. In general, the study emphasizes the necessity to empower extension systems, access to information and financial materials, and fostering the entrepreneurship development programmes to develop agripreneurship and livelihoods that are sustainable based on vegetables in India.

Keywords: Agripreneurship, Agricultural Extension, Eastern India, Entrepreneurial Behaviour, Vegetable Growers.

Introduction

Vegetable farming in India has undergone a significant transformation from a subsistence-oriented activity to a commercially driven enterprise, wherein smallholder farmers have been increasingly integrated into expanding and dynamic market systems. India is recognized as the second- largest producer of vegetables globally; however, the per capita availability of vegetables remains below the recommended dietary intake levels, indicating a critical gap between production and consumption (1). This disparity is attributed to factors such as post- harvest losses, inefficiency supply chains, unequal distributions, population pressure, and limited access to affordable vegetables among certain sections of society. Although aggregate production is high, adequate availability at the household levels is constrained by these structural and logistical challenges. In this context, horticulture- particularly vegetable cultivation has identified as a highly remunerative sector, offering greater income per unit area, employment opportunities, and substantial potential for rural enterprise development. The adoption of improved technologies such as protected cultivation, precision farming, and integrated nutrient and pest management has been promoted to overcome environmental constraints and enhance both productivity and quality of produce (2). In recent years, vegetable farming has increasingly been conceptualized within the framework of entrepreneurship.

Agripreneurship extends beyond mere production and encompasses dimensions such as market orientation, innovation, risk management, resource optimization, and responsiveness to consumer demand. The shift towards market-oriented agriculture has been further accelerated by economic liberalization, the expansion of value chains, and policy initiatives aimed at doubling farmers' income.

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These developments have encouraged farmers to adopt entrepreneurial approaches to farming, thereby improving efficiency and profitability.

The present study is anchored in key theoretical perspectives on entrepreneurship and innovation. The diffusion of innovation theory provides a useful framework for understanding how farmers adopt new technologies and practices based on attributes such as innovativeness, risk bearing ability, and access to information (3). Additionally, the entrepreneurship theory emphasizes innovation as a central component of entrepreneurial activity, wherein individuals act as agents of change by introducing new combinations of resources (4). Further, the achievement motivation theory highlights the role of intrinsic motivation, self-confidence, and goal orientation in shaping entrepreneurial behaviour (5). Together, these theoretical perspectives provide a comprehensive foundation for analyzing the behavioural dimensions of farmers engaged in vegetable cultivation.

Eastern India, comprising states such as Odisha, West Bengal, Assam, Bihar, and parts of Uttar Pradesh, presents both opportunities and challenges for vegetable- based entrepreneurship. The region is endowed with diverse agro- climatic conditions that are highly conducive to the cultivation of a wide range of horticultural crops. However, structural constraints such as small and fragmented landholdings, inadequate market infrastructure, limited access to credit, and weak extension services often hinder the development of entrepreneurial capacities among farmers. These challenges necessitate a deeper understanding of the behavioural and socio-economic factors that influence agripreneurship in the region (6-10).

Entrepreneurial behaviour among farmers can be defined as the ability to identify opportunities, mobilize resources, take calculated risks, and manage farm enterprises effectively (4). The dimensions of entrepreneurial behaviour can be broadly categorized into core and peripheral elements. Core elements include innovativeness, decision making ability, scientific orientation, achievement motivation, risk bearing ability, decision- making capacity, and market orientation, as these influence entrepreneurial performance. Peripheral elements such as self-confidence, achievement motivation, leadership ability and communication skills support and strengthen these core competencies (11, 12).

A substantial body of empirical research conducted across India indicated the vegetable farmers generally exhibit a medium level of entrepreneurial behaviour, reflecting the presence of untapped entrepreneurial potential. Studies conducted in states such as Punjab and Chhattisgarh have identified education, farming experience, and extension exposure as significant determinants of entrepreneurial orientation among farmers (13-15). Similarly, research in the North- Eastern region of India, including states like Nagaland and Meghalaya, has revealed that factors such as education, farm size, and access to information play a crucial role in shaping entrepreneurial behaviour among horticultural farmers. Parallel findings have been reported in studies on mushroom cultivators and other high-value crops, where socio- economic characteristics and institutional support systems significantly influence both entrepreneurial behaviour and adoption of improved technologies (16, 17).

A synthesis of existing studies reveals both similarities and regional variations in entrepreneurial behaviour among farmers. While most studies report medium levels of entrepreneurial behaviour, education and extension exposure consistently emerge as key determinants (18-20). However, differences exist across regions: economic factors such as farm size and income are more influential in resource- rich areas, whereas access to information, training, and institutional support plays a greater role in smallholder contexts. These findings indicate that entrepreneurial behaviour is shaped by region-specific socio- economic and institutional conditions (20-25).

Despite the growing body of literature on agripreneurship in India, research focusing specifically on Eastern India remains fragmented and lacks comprehensive synthesis. There is a need to systematically examine how entrepreneu-rial characteristics influence vegetable- based livelihood in this region, taking into account both contextual challenges and emerging opportunities. Therefore, the present study aims to synthesize existing empirical evidence on the dimensions, determinants, and outcomes of entrepreneurial behaviour among vegetable farmers in India, with particular emphasis on Eastern India. By,

providing an integrated understanding of agripreneurship in this region, the study seeks to contribute to policy formulation, extension strategies, and capacity- building initiatives aimed at promoting sustainable and market- oriented vegetable farming (26-29).

Methodology

A systematic search was conducted across multiple databases, including Scopus, Web of Science, ICAR e- publications (Krishikosh), institutional theses databases, reputable Indian extension journals such as the Indian Journal of Extension Education and International Journal of Agriculture Extension and Social Development and Google Scholar. In Scopus and Web of Science, filters such as subject area (Agricultural Sciences), document type (article/review), and country (India) were applied.

Table 1: Inclusion and Exclusion Criteria

Criteria Type	Inclusion Criteria	Exclusion Criteria
Study type	Peer-reviewed articles, theses, ICAR publications	News articles, blogs, non-scientific sources
Time period	Studies published between 2000–2025	Studies outside this period
Subject focus	Studies on entrepreneurial behaviour in vegetable/horticulture farming	Studies not related to vegetable farming
Geography	Studies conducted in India	Studies conducted outside India
Language	English	Non-English publications
Methodology	Empirical studies with clear methodology	Studies lacking methodological clarity

The search strategy employed a combination of keywords and Boolean operators as follows: entrepreneurial behaviour or agripreneurship and vegetable growers or vegetable farmers or horticulture and India. Database- specific filters were applied to include studies published between 2000-2025, limited to English language and peer-reviewed journal articles, theses, and institutional publications and ICAR publications (20). Titles, abstracts, and full texts were screened based on predefined inclusion and exclusion criteria to ensure relevance and methodological quality, while those not satisfying the criteria were excluded from further analysis. News articles and blog posts that are not scientific were filtered out shown in Table 1.

The preliminary searches produced 73 documents. On completion of the elimination of duplicates and filtering of abstracts on relevance, 24 studies were eligible to the full text review. Among them, 15 were retained to be synthesized; the others were rejected as they were not in the area of vegetable farming, they were not detailed in the methodology, or they were not peer-reviewed (23, 29). The last corpus included Indian journal articles (Odisha, Maharashtra, Uttarakhand, Assam, Uttar Pradesh and Himachal Pradesh, Jharkhand), one thesis as well as two review articles. Conceptual definitions and measurement of entrepreneurial behaviour were selected: a) important dimension measured, b) conceptual definitions, c) outcomes reported: commercialization or productivity, d) constraints and e) geographical representations, especially Eastern India. The quality of evidence was determined according to the understandability of the sampling, validity of measurements, and statistical analysis.

Results and Discussion

Conceptual Foundations of Entrepreneurial Behaviour in Agriculture

Agricultural entrepreneurial behaviour is a combination of entrepreneurship and extension theories. As indicated in the review paper entrepreneurship is about the identification of opportunities, the commitment of resources and control of risks in order to make profits. Entrepreneurs are not mere creators of innovation but the ones that are ready to take a risk and make people work. Farmers can be entrepreneurial in the contexts of agriculture as they select crops, embrace scientific actions, and innovatively react to market indications. In the review, a synthesis of literature is done to obtain an overall set of components: innovativeness, farm decision making, scientific orientation, achievement motivation, risk taking ability, self-confidence, persistence, feedback usage, persuasion ability, manageability, economic motivation, market orientation, ability to coordinate resources, planning ability and opportunity detection. These characteristics are able to capture both psychological and behavioural dimensions and are therefore similar to the trait-based approach commonly used in extension research (20).

Entrepreneurial behaviour is operationalized as the extent to which a farmer aims at optimizing profits by means of creative and innovative response, diversification, and implementation of better practices. It is unique to general entrepreneurship since farm is a source of livelihood and a production facility; seasonal fluctuation, resource scarcity and social standards affect the decisions made. Researchers underline that entrepreneurial behaviour should be perceived as a combination of personal traits and the environmental variables. The trait approach presumes that there are several attributes, which are important in successful entrepreneurship and these include risk taking, achievement motivation, proactiveness and self-confidence. Nonetheless, the socio-economic situation and institutional assistance also influence behaviours. According to the Indian review, the majority of farmers demonstrate medium-levels of these elements, as there is a hidden potential of entrepreneurship that can be opened with the help of training and supportive policies (21, 25).

Dimensions of Entrepreneurial Behaviour Identified in Studies

Measures of entrepreneurial behaviour are usually done as multi-dimensional measures through empirical research on vegetable farmers. The first piece of work under consideration acknowledged ten entrepreneurial qualities which are risk taking, hope of success, persuasibility, manageability, self-confidence, knowledgeability, persistence, use of feedback, innovativeness and achievement motivation. Testing this scale on Maharashtra results showed that all ten attributes had a significant contribution to overall entrepreneurial behaviour; there were positive correlations between dimensions (21). They reported that most of the vegetable growers showed medium levels of all the traits showing balanced, but not high entrepreneurial orientation. The dimensions were enlarged or customized by later studies. Eleven attributes (innovativeness, risk orientation, economic motivation, decision making ability, leadership ability, scientific orientation, achievement motivation, self confidence, utilization of available assistance, credit orientation and management orientation) as measurements of vegetable growers in Odisha. Once again, majority of respondents were in the medium category along attributes implying moderate levels of entrepreneurship (22).

Similarly, in Uttarakhand selected nine traits—management orientation, farm decision making, leadership ability, risk taking ability, knowledge of vegetable cultivation, achievement motivation, innovativeness, self-confidence and utilization of assistance—using factor analysis (23). Factor loadings indicated that achievement motivation and self-confidence were the most influential both [0.782], followed by management orientation [0.744] and leadership ability [0.559]. Most respondents exhibited medium levels for knowledge of vegetable cultivation [97.50%], self-confidence [90.83 %], management orientation [79.16 %)], risk taking [76.66 %] and decision making [69.16 %].

Other dimensions identified across studies include economic or market orientation, planning ability, credit orientation, scientific orientation, information seeking and cosmopoliteness. Nine dimensions—innovativeness, achievement motivation, decision making, risk orientation, coordinating ability, planning ability, information seeking behaviour, cosmopoliteness and self-confidence—among rural youth in Assam (24). similar nine-dimension scale in Jorhat district and found medium levels of entrepreneurial behaviour among 63.34 % of tribal winter vegetable growers (25). Table 2 synthesizes the dimensions used across studies.

Table 2: Entrepreneurial Dimensions Identified across Empirical Studies

Dimension / Trait	Presence Across Studies (Examples)	Observed Level (Majority Category)
Innovativeness	Measured in Maharashtra, Odisha, Uttarakhand, Assam	Medium level in most studies; contributes significantly to entrepreneurial behaviour.
Risk taking/Risk orientation	Assessed in Maharashtra, Odisha, Uttarakhand, Assam	Majority of growers fall into medium category. Positive but sometimes lower correlation with behaviour.
Achievement motivation/Hope of success	Included in Maharashtra, Odisha, Uttarakhand, Assam	High factor loading in Uttarakhand [0.782]; medium level among growers.
Decision-making ability/Farm decision making	Considered in Odisha, Uttarakhand, Assam	Majority of respondents have medium decision-making ability.
Leadership/Persuasion ability	Assessed in Odisha, Uttarakhand,	Medium level; leadership ability scored moderately (57.5 % medium).

Self-confidence	Measured across studies; high factor loading in Uttarakhand [0.782]	Majority medium but often high relative to other traits.
Scientific orientation/ Knowledge	Measured in Odisha, Uttarakhand	Medium level; high knowledge associated with extension contact.
Economic motivation/Market orientation	Included in Odisha	Medium level; contributes to market-oriented behaviour.
Management / Planning orientation	Included in Odisha	Medium level; planning ability influences efficiency.
Information seeking/ Cosmopoliteness	Assessed in Assam studies	Medium; strong link with extension contacts.

The analysis presented in Table 2 indicates that most entrepreneurial dimensions among vegetable growers are concentrated at medium level, suggesting the presence of moderate but underutilized entrepreneurial potential. Among the dimensions, achievement motivation and self-confidence exhibit relatively stronger influence, as reflected in higher factor loadings in certain studies. In contrast, innovativeness and risk- taking ability, although essential for entrepreneurship, often remain at moderate levels, indicating a need for targeted interventions. These findings suggest that strengthening psychological and behavioural competencies could significantly enhance entrepreneurial performance among farmers.

Determinants Influencing Entrepreneurial Behaviour

While several determinants such as education, income, and extension contact are consistently associated with entrepreneurial behaviour, the evidence is largely correlational in nature, and casual relationships cannot be conclusively established due to the absence of experimental or longitudinal study designs.

Socio-personal and Demographic Factors

Age, education and family characteristics show mixed effects. In Himachal Pradesh, entrepreneurial behaviour among polyhouse vegetable growers correlated positively with farm income, experience and extension contact but showed a negative association between education level and risk-taking ability. Similarly, a 2025 study of secondary agriculture-based entrepreneurs in Assam reported positive correlations between entrepreneurial behaviour and factors such as education, income, investment, media use, aspiration and motivation, while age showed a negative relationship; these factors together explained 72.8 percent of variation in entrepreneurial behaviour [adjusted $R^2 = 0.645$]. The study emphasised that younger entrepreneurs were more inclined to engage in risk-taking and innovation than older farmers (27).

Education consistently emerges as a positive determinant. In Jorhat district of Assam, positive and significant relationships between entrepreneurial behaviour and education level, family size, operational land holding and annual family income. Among rural youth engaged in vegetable cultivation in Lakhimpur district, more than half of respondents displayed medium entrepreneurial behaviour; although the study did not conduct correlation analysis, the authors noted that educational attainment and exposure to extension were pivotal for developing entrepreneurial traits. The Varanasi study (Uttar Pradesh) noted that education, land holding, social participation, material possession and annual income were positively and significantly correlated with entrepreneurial behaviour, whereas age showed a negative correlation (25).

Gender differences are seldom addressed explicitly in the reviewed studies. The Frontiers study noted that gender did not show significant associations with entrepreneurial behaviour among polyhouse growers, while the Odisha study did not disaggregate by gender. Given the increasing participation of women in vegetable value chains, future research should explore gendered dimensions of agripreneurship.

Economic Determinants

Farm income and resource endowments are strong predictors which found positive correlations between entrepreneurial behaviour and farm income, area under polyhouse and experience in protected cultivation. There were significant positive correlations between mass media exposure, education, experience and annual income with entrepreneurial behaviour but no significant correlation with age, family size, land holding and social participation. On the same note, mentioned operational land holding and annual family income as key contributing elements. These results suggest that as the economic resources of

farmers increase, they will be able to afford risks and invest in technologies and have access to markets (27).

Institutional Determinants and Extension Determinants

Contact and media use through extension are the factors that continue to come out as critical. The Frontiers study found that there were large positive correlations between entrepreneurial behaviour and extension contact and suggested policy actions, which include increased access to extension services, financial incentives and cooperation between growers. Over 70 percent of the tribal vegetable winter growers in Jorhat had medium extension contact and the extension exposure was also linked with greater entrepreneurial behaviour. Nevertheless, the Varanasi study observed positive relations between social participation and entrepreneurial behaviour. The collective bargaining might be strengthened by the cooperative membership, access to markets and sharing of risks thereby encouraging entrepreneurship (29).

Psychological and Behavioural Determinants

Internal drivers like personality attributes like self-confidence, achievement motivation and innovativeness are strong. Achievement motivation and self-confidence had the greatest factor loadings [0.782] each to effect entrepreneurial behaviour in Uttarakhand. It also involved management orientation [0.744] and leadership ability [0.559]. The conclusion in the Maharashtra research was that all the attributes of entrepreneurship such as risk taking, hope of success, persuasability, manageability, self-confidence, knowledgeability, persistence, use of feedback, innovativeness and achievement motivation were positively and significantly connected to the overall entrepreneurial behaviour. These dimensions coincide with the theoretical framework, which prioritises psychological preparedness and innovation ability as the key aspects of agripreneurial behaviour (24).

Table 3 provides a summary of the determinants that were reported in the studies as well as the relationship that was observed between the determinants and the entrepreneurial behaviour.

Table 3: Big Five Factors of Entrepreneurial Behaviour Discussed in Literature

Determinant	Evidence and Observed Relationship	Direction of Influence
Education level	Positive correlation with entrepreneurial behaviour in Jorhat (Assam) and Varanasi (Uttar Pradesh); factor loadings highlight knowledge importance	Positive
Age	Negative association reported in Dhubri (Assam) secondary agriculture study and Varanasi (Uttar Pradesh); younger farmers more entrepreneurial	Negative
Farm/Family income	Positive correlation in Himachal Pradesh polyhouse study; Jorhat study identified annual income as a contributor	Positive
Land holding/Area under cultivation	Operational land holding positively associated with entrepreneurial behaviour in Jorhat; Varanasi study found larger land holdings correlated with higher entrepreneurial behaviour	Positive or non-significant depending on context
Experience in vegetable cultivation	Positive relationship with entrepreneurial behaviour in Himachal Pradesh (protected cultivation)	Positive
Extension contact/Mass media exposure	Significant positive correlations in Himachal Pradesh and Jorhat	Positive
Social participation/Cooperative membership	Positive correlation in Varanasi study	Positive or non-significant
Psychological traits (achievement motivation, self-confidence, leadership ability)	High factor loadings in Uttarakhand study; positive correlations across studies	Strong positive influences
Media and technology use	Use of mass media and information technologies positively correlated with entrepreneurial behaviour in Dhubri (secondary agriculture)	Positive
Gender	Generally, non-significant in available studies (e.g., polyhouse growers)	Mixed or non-significant

Table 3 highlights that the entrepreneurial behaviour is influenced by a combination of socio-economic, institutional, and psychological factors. Among these, education, income, landholding, and extension contact consistently show positive associations across studies, indicating their critical

role in enhancing entrepreneurial capacity. In contrast, age is often negatively associated, suggesting that younger farmers are more inclined towards innovation and risk- taking. The variation observed in factors such as landholding and social participation across regions indicates that contextual conditions significantly shape entrepreneurial outcomes. Overall, the findings emphasize the significantly shape entrepreneurial outcomes. Overall, the findings emphasize the importance of integrated policy interventions focusing on education, extension services, and resource accessibility.

Evidence from Eastern India

Odisha

Odisha is a region of varied agro climate conditions which support horticulture though vegetable farming is under commercialized. An ex-post facto study among 200 vegetable growers in Cuttack and Koraput districts. They measured eleven entrepreneurial attributes and found that most respondents exhibited medium levels for innovativeness, risk orientation, economic motivation, decision-making ability, leadership, scientific orientation, achievement motivation, self-confidence, utilization of assistance, credit orientation and management orientation. The overall entrepreneurial behaviour was of medium level, reflecting moderate readiness for agripreneurship. The authors attributed these levels to the state's horticultural potential and moderate exposure to extension services. While the study did not perform correlation analysis, it highlighted the need for integrated extension and innovation systems to promote entrepreneurship (22).

West Bengal (including Eastern Himalayan region)

West Bengal hosts a mix of plain and hill agro-ecosystems. The factor-analytic study in Uttarakhand is often cited in West Bengal because two authors were affiliated with Visva-Bharati University. However, there is little published research on entrepreneurial behaviour of vegetable farmers in West Bengal itself. In the reviewed sample, only the secondary agriculture study in Dhubri district (Assam) involved researchers from Visva-Bharati. This 2024 study grouped 23 entrepreneurial attributes into seven factors via principal component analysis and reported positive correlations with education, income, investment, media use, aspiration, motivation and values; age showed a negative correlation. While the study encompassed secondary agriculture enterprises beyond vegetables, it provides insights relevant to Eastern India. The authors recommended policy advocacy for skill development, capital access and market infrastructure to strengthen entrepreneurs' holistic development (28).

Assam

Two empirical studies were found. 2019 study surveyed 60 rural youth engaged in vegetable cultivation in Lakhimpur district. The study measured nine dimensions of entrepreneurial behaviour and found that [61.67 %] of respondents had medium levels (12). While specific determinants were not analysed, the authors noted that education, extension intervention and year-round vegetable production created opportunities for youth entrepreneurship. Second, investigated 120 tribal winter vegetable growers in Jorhat district. They reported that 63.34 % of respondents exhibited medium entrepreneurial behaviour; significant positive relationships were observed between entrepreneurial behaviour and education, family size, size of operational land holding and annual family income. The study emphasised that improved extension contacts and socioeconomic status fostered entrepreneurship among tribal growers (25).

Bihar and Eastern Uttar Pradesh

No peer-reviewed empirical studies specifically examining entrepreneurial behaviour of vegetable growers in Bihar were found, indicating a significant research gap. The Varanasi (Uttar Pradesh) study of 160 vegetable growers examined the correlation between socio-economic profile and entrepreneurial behaviour. It found that better education, larger land holdings, higher social participation, greater material possession and higher annual income were associated with higher entrepreneurial behaviour; age showed a negative correlation. Although Varanasi lies in eastern Uttar Pradesh rather than Eastern India proper, the socio-economic context is similar. The study underscores that socio-economic upliftment and targeted extension can enhance agripreneurship (29).

Jharkhand

A study on the entrepreneurial behaviour of tribal farmers in the Saraikela-Kharsawan district of Jharkhand based on the data collected on 120 farmers by a structured interview schedule. The findings showed that the majority of farmers possessed medium degrees of the decision-making ability, the risk-taking ability, the achievement motivation, the knowledge, and the leadership ability as well as the cosmopoliteness. But among farmers, innovativeness, ability to plan and self-confidence were relatively low. The research also established that the usage of sources of information and level of aspiration played a significant role in entrepreneurial behaviour of tribal farmers. The authors proposed development programme and extension support through entrepreneurship development programmes are required to enhance the entrepreneurial capacity and augment the earnings of the farmers (28).

Summary of Eastern Indian evidence

Overall, evidence from Eastern India is limited. Available studies report medium levels of entrepreneurial behaviour and highlight determinants similar to those found elsewhere in India—education, income, land holdings and extension contact. There is almost no research examining how entrepreneurial behaviour translates into farm-level outcomes or how gender, caste and cultural factors shape entrepreneurship. Table 4 summarises the reviewed studies, with Eastern Indian cases highlighted.

Table 4: Summary of Reviewed Empirical Studies on Entrepreneurial Behaviour among Vegetable Growers (2000–2025)

Location and Sample	Focus and Key Findings	References
Akola district, Maharashtra (100 growers)	Used ten-attribute scale; majority of growers had medium levels of all attributes; all entrepreneurial attributes positively and significantly correlated with overall entrepreneurial behaviour; major constraints included price fluctuation, lack of crop insurance, exploitation by middlemen and inadequate extension	(21)
Cuttack and Koraput districts, Odisha (200 growers)	Measured 11 attributes; majority of vegetable growers had medium levels across innovativeness, risk orientation, economic motivation, decision-making ability, leadership, scientific orientation, achievement motivation, self-confidence, utilization of assistance, credit orientation and management orientation; overall entrepreneurial behaviour medium	(22)
Nainital and Almora districts, Uttarakhand (120 growers)	Factor analysis of nine traits; achievement motivation and self-confidence had highest loadings [0.782]; majority of respondents in medium categories for knowledge [97.5 %], self-confidence [90.83 %], management orientation [79.16 %], risk taking [76.66 %] and decision making [69.16 %]	(23)
Mid-hills of Himachal Pradesh (240 respondents)	Examined factors influencing entrepreneurial behaviour; positive correlations with farm income, protected cultivation experience, area under polyhouse and extension contact; education negatively correlated with risk taking but positively with cosmopoliteness; gender and family size not significant; recommended financial incentives and enhanced extension services	(26)
Lakhimpur district, Assam (60 rural youth)	Assessed entrepreneurial behaviour across nine dimensions; 61.67 % of rural youth had medium entrepreneurial behaviour; highlighted importance of year-round vegetable production and extension intervention for youth entrepreneurship	(24)
Jorhat district, Assam (120 tribal growers)	More than half [63.34 %] had medium entrepreneurial behaviour; positive significant correlations between entrepreneurial behaviour and education, family size, land holding and annual income; extension contact moderately high [70.83 %] medium	(25)
Dhubri district, Assam (100 secondary agriculture entrepreneurs)	Mixed-methods study on secondary agriculture enterprises; grouped 23 attributes into seven factors; entrepreneurial behaviour positively correlated with education, income, investment, media use, aspiration and motivation, and negatively with age; regression model explained 72.8 % of variance; advocated policy support and skill development	(28)
Varanasi district, Uttar Pradesh (160 growers)	Correlation analysis between socio-economic profile and entrepreneurial behaviour; positive correlations with education, land holding, social participation, material possession and annual income; age negatively correlated	(29)
Lakhimpur district, Assam	Focused on rural youth; emphasised extension and entrepreneurship for youth	(24)

The synthesis presented in Table 4 reveals that entrepreneurial behaviour among vegetable growers across different regions of India predominantly falls within the medium category, indicating a consistent pattern nationwide. Despite regional diversity, similarly determinants such as education, income, and extension exposure are found to influence entrepreneurial behaviour. However, a noticeable gap exists in research coverage, particularly in states such as Bihar and Jharkhand, highlighting the need for region-specific studies. The findings further suggest that while the foundational determinants remain consistent, their relative importance varies across

regions due to differences in socio- economic and institutional contexts.

Entrepreneurial Behaviour and Farm-Level Outcomes

Among the key questions is whether increased entrepreneurial behaviour can result in better performance of the farm. The evidence on this relationship is few and mostly inductive. Maharashtra noted that farmers who had high scores in the entrepreneurial qualities operated their businesses more effectively and profitably. They have proposed that growers could better control operations of cultivation and marketing because of improved entrepreneurial behaviour, but no direct productivity data were presented (21). The Odisha research had theorized that moderate entrepreneur behaviour was potentially beneficial to labour intensive vegetable farming and job creation, which was not quantified in terms of productivity, associated the protected cultivation results with the entrepreneurial behaviour. The correlations with farm income and area under polyhouse are positive, showing that the higher the level of entrepreneurial growers the higher was their returns. The research however failed to decouple the effect of the entrepreneurial characteristics with the farm size or adoption of technological advancements (27).

However, there is little direct evidence to support the connection between entrepreneurial behaviour and yield, adoption or commercialization. In general, a literature review indicates that entrepreneurial characteristics could contribute to the management of resources and market orientation, and there is a paucity of quantitative studies that relate behaviour to farm level performance. Productivity and profitability indicators should be employed in future studies to determine this correlation.

A critical insight emerging from this review is the significant lack of empirical evidence linking entrepreneurial behaviour with farm- level outcomes such as productivity, profitability, and commercialization. Despite numerous studies examining behavioural dimensions and determinants, very few have quantitatively assessed their direct impact on farm performance. This represents a major research gap in the existing literature and highlights the need for future studies to adopt outcome-oriented and longitudinal approaches.

Constraints Affecting Entrepreneurial Development

The constraints affecting entrepreneurial development in vegetable farming can be broadly categorized into economic, institutional, and behavioural dimensions. Economic constraints include price volatility, high input costs, labour shortages, and lack of crop insurance, which limit farmers ability to take risks and invest in improved limited access to credit, poor market infrastructure, and weak linkages with formal markets, thereby restricting information flow and resource accessibility. Behavioural constraints include low risk- bearing, limited innovativeness, low self- confidence, and weak decision- making capacity, which further hinder the adoption of entrepreneurial practices (21).

These categories are interrelated and collectively influence farmers entrepreneurial orientation. For instance, economic uncertainty reduces risk-taking behaviour, while weak institutional support limits access to knowledge and innovation. Therefore, addressing these constraints requires an integrated approach combining policy support, institutional strengthening and capacity- building interventions to promote sustainable agripreneurship.

Conclusion

The systematic review is a synthesis of literature on entrepreneurial behaviour among Indian vegetable farmers with interest in Eastern India. The conceptual basis underlines that entrepreneurial behaviour is a combination of psychological characteristics and environmental conditions such as innovativeness, ability to take risks, achievement motivation, decision making, market orientation and planning. This is because most empirical studies find that vegetable growers demonstrate medium scores of the traits, and this can be said to be latent entrepreneurship potential. In factor analytic research achievement motivation and self-confidence are the dimensions that appear to be the most powerful.

Entrepreneurial behaviour has multiple determinants. Positive associations are witnessed with education, income, land holdings, experience and extension contact but negative association exists frequently with age. The mass media exposure and extension services are institutional factors that are very important in improving

entrepreneurial orientation. Internal drivers are psychological characteristics such as the self-confidence, achievement motivations, and leadership skills. Eastern Indian evidence is consistent with national trends, but is scanty; it was found in a few studies in Odisha, Assam and Uttar Pradesh, none in Bihar. The result of these studies shows medium levels of entrepreneurial behaviour and positive relationship with education, income and extension contact. The existing gaps in studies are gender discrepancies, caste relations, institutional inventions and time transitions. The connection between entrepreneurial behaviour and farm level results is implied, but not quantitatively determined, including productivity, income growth and commercialization. It has been found that entrepreneurial behaviour is positively associated with management and income, which is better when entrepreneurial behaviour is higher, although there is no causal evidence. The further developments in the studies must incorporate agronomic and economic results to determine the effect of entrepreneurial characteristics on the acceptance of technologies, crop and livelihoods.

Entrepreneurial development has constraints that cut across the market, institutional and behavioural sectors. Recurring barriers are price volatility, unavailability of crop insurance, exploitation by middlemen, labour shortages, high input prices, poor extension services, poor infrastructure and risk aversion. Specific policies to stabilize vegetable market, insurance, empowered farmer producer organisations, extension and delivery of credit are necessary. Risk-taking and innovation can be improved using behaviour interventions, which include motivational training, leadership development and exposure visits. In the case of Eastern India, the consideration of region-specific strategies must take advantage of agro climatic diversity and curb an institutional underdevelopment in infrastructure and support services.

One of the key contributions of this review is the identification of a critical gap in the literature, namely the lack of empirical evidence connecting entrepreneurial behaviour with measurable farm-level outcomes. To conclude, programs to promote agripreneurship in vegetable farming should be holistic and take into account the individual entrepreneurial characteristics, improve the socio-economic capacity as well as transform the institutional support systems. The evidence base on addressing research gaps especially in Eastern India will be the provision of the evidence base to develop contextually relevant extension programmes that enhance sustainable horticulture-based livelihoods.

Abbreviations

DOI: Diffusion of Innovation, EB: Entrepreneurial Behaviour, FAO: Food and Agriculture Organization, ICAR: Indian Council of Agriculture Research.

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Author Contributions

Vineeta Chandra: literature survey, data collection, review, Ajay Kumar Prusty: regular assistance, Chitrasena Padhy: regular assistance, K Ramakrishna: regular assistance. All the authors were involved in the finalization of the manuscript and read and approved the final review.

Conflict of Interest

Authors do not have any conflict of interest to declare.

Data Availability

The data supporting the findings of this study are derived from publicly available sources. All relevant data are included within the article, and the referenced studies can be accessed through the cited literature.

Declaration of Artificial Intelligence (AI) Assistance

Grammarly is used for checking grammar, spelling and punctuation.

Ethics Approval

This study does not involve any primary data collection from human participants or animals and is based solely on a systematic review of published literature. Therefore, ethical approval and informed consent were not required. All sources of information have been appropriately cited, and the study adheres to standard ethical guidelines for academic research and publication.

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