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Principal Component Analysis of Entrepreneurial Attitude among CUTM Agriculture Students, Odisha

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HIGHLIGHTS

- Agriculture students showed favourable attitude towards entrepreneurship and self-employment.
- PCA extracted five major dimensions of entrepreneurial attitude i.e. Entrepreneurial Management Orientation, Production and Resource Management Orientation, Technical and Monitoring Orientation, Entrepreneurial Career Orientation, and Risk and Marketing Orientation.
- The KMO value (0.808) and significant Bartlett's Test result (χ^2=671, $p < 0.001$) confirmed that the data collected were suitable for PCA.
- Entrepreneurship training is essential for strengthening agripreneurship among students.

ARTICLE INFO

Keywords: Agripreneurship, Factor analysis, JAMOVI, Rural youth, Self-employment, PCA analysis.

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ABSTRACT

The study analysed the entrepreneurial attitude of agriculture students of Centurion University of Technology and Management, Odisha, using Principal Component Analysis (PCA). Data were collected from 83 final-year agriculture students through a pre-tested interview schedule comprising entrepreneurial attitude statements. The reliability of the instrument was assessed using Cronbach's alpha, which yielded a value of 0.861, indicating good internal consistency. The suitability of the data for PCA was examined using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO value (0.808) and significant Bartlett's Test result (χ^2 = 671, $p < 0.001$) confirmed the adequacy of the dataset for component extraction. PCA with Varimax rotation extracted five major dimensions of entrepreneurial attitude, namely Entrepreneurial Management Orientation, Production and Resource Management Orientation, Technical and Monitoring Orientation, Entrepreneurial Career Orientation, and Risk and Marketing Orientation. The five retained components explained 62.52% of the total variance. The students generally possessed positive attitudes towards self-employment, enterprise management, production efficiency, technical guidance, and market orientation. However, comparatively lower interest in challenging entrepreneurial vocations indicated hesitation towards adopting entrepreneurship as a primary career option. The need for strengthening entrepreneurship-oriented education, experiential learning programmes, start-up incubation support, and market linkage initiatives was felt.

INTRODUCTION

Entrepreneurship is widely recognized as a key driver of economic growth, employment generation, innovation, and rural development. In India, entrepreneurship has gained increasing policy attention due to rising unemployment among educated youth and the need for sustainable livelihood opportunities. Government initiatives such as Startup India, Skill India, and Atmanirbhar Bharat

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have promoted entrepreneurial development by encouraging innovation, skill enhancement, and enterprise creation among young people. Entrepreneurship has also emerged as an effective strategy for improving livelihood security and strengthening rural economies through self-employment and enterprise development (Baishya et al., 2021; Akther, 2023).

In the agricultural sector, entrepreneurship plays a crucial role in addressing challenges such as shrinking landholdings, disguised unemployment, and increasing market competition. Agripreneurship facilitates value addition, agribusiness development, technology adoption, and rural employment generation. Agriculture graduates possess technical knowledge and innovative capabilities that can contribute significantly to the development of successful agricultural enterprises. However, despite expanding opportunities in agribusiness, many agriculture students continue to prefer salaried employment due to perceived risks, financial constraints, uncertainty of returns, and limited entrepreneurial confidence (Banerjee et al., 2020; Sargani et al., 2020; Hou et al., 2026).

Entrepreneurial attitude is considered a critical determinant of entrepreneurial intention and entrepreneurial behaviour. It encompasses an individual's confidence, managerial orientation, risk-bearing ability, innovativeness, and willingness to engage in enterprise creation. Previous studies have reported that entrepreneurial attitude is influenced by entrepreneurship education, family support, institutional environment, leadership ability, and exposure to entrepreneurial training programmes (Gupta et al., 2014; Fragoso et al., 2019; Su et al., 2021; Kusumojanto et al., 2021; Satriadi et al., 2022). Similarly, experiential learning and entrepreneurship-oriented educational interventions have been found effective in strengthening entrepreneurial competencies among agriculture graduates (Lekang et al., 2016; Bochalya et al., 2025).

Entrepreneurial attitude is multidimensional in nature and shaped by behavioural, managerial, technical, and psychological factors (Mei et al., 2020; Cui, 2021; Iqbal et al., 2022). Identifying these underlying dimensions is important for designing targeted entrepreneurship development programmes. Principal Component Analysis (PCA) is a widely used multivariate technique for reducing a large number of interrelated variables into a smaller set of meaningful dimensions and has been successfully applied in entrepreneurship and behavioural studies (Shirur et al., 2019; Mensah & Dadzie, 2020; Ilies et al., 2023).

Although several studies have examined entrepreneurial attitude and entrepreneurial intention among students and entrepreneurs, most have focused on overall attitude levels rather than identifying the underlying dimensions that shape entrepreneurial behaviour. Furthermore, empirical evidence on the dimensional structure of entrepreneurial attitude among agriculture students in Odisha remains limited. Odisha is predominantly an agrarian state where agriculture graduates have significant potential to contribute to agribusiness development, start-up creation, and rural employment generation. Understanding the major dimensions of entrepreneurial attitude among future agricultural professionals is important for developing effective entrepreneurship education and capacity-building interventions. Therefore, the study was undertaken among agriculture students of Centurion University of Technology and Management, Odisha, to identify and analyse the major dimensions of entrepreneurial attitude using Principal Component Analysis and to generate insights for strengthening agripreneurship development among rural youth.

METHODOLOGY

The present study was conducted in Odisha during the academic year 2024–25 to identify the dimensions of entrepreneurial attitude among agriculture students of Centurion University of Technology and Management using Principal Component Analysis (PCA). An *ex-post facto* research design was adopted, as the variables under study had already occurred and were analysed without any experimental manipulation.

The respondents comprised final-year undergraduate agriculture students enrolled at the university, as they had successfully completed courses on Entrepreneurship Development, Business Communication, and Experiential Learning Programme. Out of a total population of 275 students, 83 respondents (51 females and 32 males), representing approximately 30 per cent of the population, were selected through simple random sampling.

Therefore, an interview schedule consisting of 47 statements covering eight dimensions, namely Entrepreneurial Mindset, Risk Orientation, Planning, Production Management, Marketing Management, Credit and Finance, Achievement Orientation, and Socio-cultural Orientation, was developed through an extensive review of literature and consultation with experts in agricultural extension and entrepreneurship. The draft instrument was pre-tested among 20 agriculture students from a non-sample institution to assess the clarity, relevance, ambiguity, and redundancy of the statements. Based on expert judgement and pre-test feedback, 24 statements were excluded due to duplication, poor clarity, limited relevance, or difficulty in interpretation, resulting in 23 statements for the final survey instrument.

Data were collected through personal interviews using a three-point Likert scale consisting of Agree (3), Undecided (2), and Disagree (1). The internal consistency of the scale was assessed using Cronbach's alpha coefficient, which yielded a value of 0.861, indicating good reliability of the instrument. For interpretation of mean scores, the class interval method was employed, wherein mean scores ranging from 1.00–1.66 were categorized as unfavourable, 1.67–2.33 as moderately favourable, and 2.34–3.00 as favourable entrepreneurial attitude.

The collected data were coded, tabulated, and analysed using Jamovi (Version 2.6.44). Descriptive statistics such as mean and standard deviation were used to summarize the responses. Prior to PCA, the suitability of the dataset for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The KMO value of 0.808 and a significant Bartlett's Test result ($\chi^2 = 671$, df = 136, $p < 0.001$) confirmed the adequacy of the sample and the suitability of the correlation matrix for component extraction. Although larger sample sizes are generally preferred in factor analytic studies, acceptable factor solutions can be obtained with relatively smaller samples when communalities are adequate and factor loadings are sufficiently high (MacCallum et al., 1999).

Principal Component Analysis with Varimax rotation was performed to identify the underlying dimensions of entrepreneurial

attitude among agriculture students. Components with Eigenvalues greater than one were retained following Kaiser's criterion. The scree plot also supported the retention of five principal components. Statements with factor loadings of 0.50 or above and uniqueness values below 0.60 were retained, whereas statistically unsuitable statements exhibiting weak factor loadings, low communalities, or substantial cross-loadings were excluded from the final solution. Consequently, six statements were removed during PCA and 17 statements were retained for interpretation. The retained statements were grouped into five major dimensions, namely Entrepreneurial Management Orientation, Production and Resource Management Orientation, Technical and Monitoring Orientation, Entrepreneurial Career Orientation, and Risk and Marketing Orientation. The five retained components collectively explained 62.52 per cent of the total variance, indicating satisfactory representation of the entrepreneurial attitude construct among agriculture students.

RESULTS

Descriptive statistics of entrepreneurial attitude statements

The descriptive statistics such as mean and standard deviation for the seventeen statements related to the entrepreneurial attitude of agriculture students are presented in Table 1. The mean scores of the statements ranged from 2.28 to 2.73, indicating generally positive attitudes towards entrepreneurship among the respondents. Among all the statements, "Positive thinking to manage adverse situation" recorded the highest mean score (2.73), followed by "Motto for self-employment" (2.68), "Timely use of required inputs and materials" (2.67), and "Proper management of the enterprise to minimize risk" (2.66).

Similarly, "Timely repayment of instalments" (2.64), "Proper insurance coverage" (2.61), and "Collecting marketing information regularly" (2.61) also recorded comparatively higher mean values. The statements "Ensuring timely availability of production inputs" (2.60) and "Close supervision and monitoring of production activities" (2.58) reflected favourable attitudes towards production management practices.

On the other hand, lower mean scores were observed for "Interest for challenging vocation" (2.28), which may reflect students' preference for employment security and their perception of entrepreneurship as a relatively risky career option. Similarly, "Interest to provide employment to others" (2.40) also recorded a comparatively lower mean score, indicating limited inclination among students towards assuming the responsibilities associated with enterprise expansion and job creation. The standard deviation values indicated moderate variability in the responses of the students across the entrepreneurial attitude statements.

Suitability of data for principal component analysis

The suitability of the data for Principal Component Analysis (PCA) was assessed using the Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The results revealed a KMO value of 0.808, which is well above the recommended threshold of 0.50, indicating that the sample size was adequate and the data were appropriate for factor extraction. Furthermore, Bartlett's Test of Sphericity was found to be highly significant ($\chi^2 = 671$, df = 136, $p < 0.001$), suggesting that the correlation matrix was not an identity matrix and that sufficient intercorrelations existed among the variables. These findings confirm that the dataset satisfied the necessary assumptions for conducting Principal Component Analysis and was therefore suitable for identifying the underlying dimensions of agriculture students' attitudes towards entrepreneurship.

Principal component analysis of entrepreneurial attitude

Principal Component Analysis with Varimax rotation extracted five major components with Eigen values greater than one. The rotated component matrix grouped the seventeen entrepreneurial attitude statements into five meaningful dimensions (Table 1).

Table 1. Descriptive statistics, component loadings, uniqueness and dimensions of entrepreneurial attitude among agriculture students

Dimension	Statement	Mean	SD	Component Loading	Uniqueness
Dimension-1 (Entrepreneurial Management Orientation)	Challenging attitude to overcome the loss	2.58	0.528	0.719	0.368
	Positive thinking to manage adverse situation	2.73	0.445	0.682	0.387
	Motto for self-employment	2.68	0.501	0.671	0.437
	Proper management of the enterprise to minimize risk	2.66	0.493	0.611	0.434
	Proper insurance coverage	2.61	0.522	0.634	0.520
Dimension-2 (Production and Resource Management Orientation)	Timely use of required inputs and materials	2.67	0.490	0.770	0.309
	Ensuring timely availability of production inputs	2.60	0.492	0.686	0.457
	Capacity building of the employee	2.53	0.517	0.678	0.419
Dimension-3 (Technical and Monitoring Orientation)	Close contact with the experts	2.52	0.578	0.775	0.340
	Close supervision and monitoring of production activities	2.58	0.528	0.736	0.363
	Timely repayment of instalments	2.64	0.530	0.642	0.346
Dimension-4 (Entrepreneurial Career Orientation)	Interest for challenging vocation	2.28	0.621	0.785	0.317
	More comfortable in developing own business	2.59	0.586	0.784	0.306
	Interest to provide employment to others	2.40	0.583	0.731	0.380
Dimension-5 (Risk and Marketing Orientation)	Adequate risk bearing ability	2.50	0.534	0.778	0.210
	Collecting marketing information regularly	2.61	0.538	0.641	0.377
	Prior agreement with the input dealers	2.53	0.517	0.624	0.399

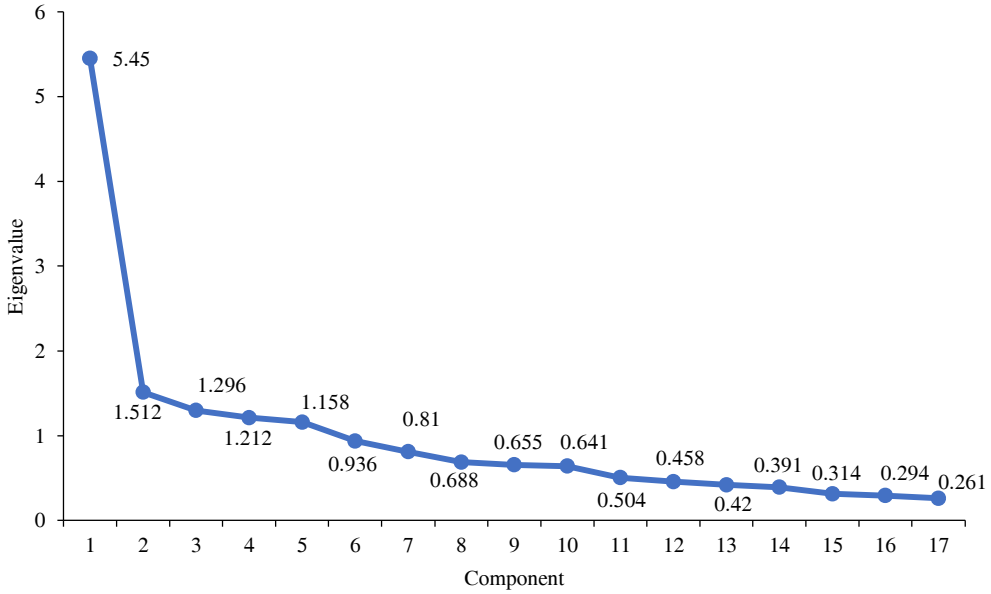

Figure 1. Eigen value of Attitudes of agriculture students towards Entrepreneurship

Eigen value distribution of components

The scree plot presented in Figure 1 indicated that five components possessed Eigen values greater than one. The Eigen values gradually declined after the fifth component, confirming the retention of five principal components for interpretation.

Final Dimensions of entrepreneurial attitude among agriculture students

The results presented in Table 1 reveal the final statements selected for measuring entrepreneurial attitude among agriculture students under five different dimensions and Table 2 depicts the Eigenvalues and Variance Explained by the Retained Components. Principal Component Analysis extracted five components with Eigenvalues greater than one, satisfying Kaiser's criterion for component retention. The first component recorded the highest Eigenvalue (5.45) and explained 32.06 per cent of the total variance. The second, third, fourth, and fifth components had Eigenvalues of 1.512, 1.296, 1.212, and 1.158, accounting for 8.89, 7.63, 7.13, and 6.81 per cent of the total variance, respectively.

The cumulative variance explained by the five retained components was 62.52 per cent, indicating that these components adequately represented the underlying structure of entrepreneurial attitude among agriculture students. The first component contributed the largest proportion of variance, while the remaining four components provided additional explanatory power for understanding the multidimensional nature of entrepreneurial attitude.

These dimensions were named as Entrepreneurial Management Orientation, Production and Resource Management Orientation, Technical and Monitoring Orientation, Entrepreneurial Career Orientation, and Risk and Marketing Orientation.

Under the dimension "Entrepreneurial Management Orientation," five statements were finalized, namely challenging attitude to overcome the loss, positive thinking to manage adverse situations, motto for self-employment, proper management of the enterprise to minimize risk, and proper insurance coverage. These statements indicate the managerial capability, confidence, and preparedness of agriculture students in handling entrepreneurial activities and enterprise-related risks.

The dimension "Production and Resource Management Orientation" included three statements such as timely use of required inputs and materials, ensuring timely availability of production inputs, and capacity building of the employee. These statements mainly focused on efficient utilization of resources, proper planning, and development of manpower for improving enterprise productivity and sustainability.

Similarly, the dimension "Technical and Monitoring Orientation" comprised close contact with the experts, close supervision and monitoring of production activities, and timely repayment of instalments. These statements reflected the importance of technical guidance, monitoring of enterprise activities, and financial discipline among the agriculture students.

The dimension "Entrepreneurial Career Orientation" consisted of interest for challenging vocation, more comfortable in developing own business, and interest to provide employment to others. These statements represented the career aspiration and entrepreneurial motivation of students towards self-employment and enterprise development.

Further, the dimension "Risk and Marketing Orientation" included adequate risk-bearing ability, collecting marketing information regularly, and prior agreement with the input dealers.

Table 2. Eigenvalues and Variance Explained by the Retained Components

Component	Eigenvalue	Variance Explained (%)	Cumulative Variance (%)
1	5.450	32.06	32.06
2	1.512	8.89	40.95
3	1.296	7.63	48.58
4	1.212	7.13	55.71
5	1.158	6.81	62.52

These statements highlighted the importance of market awareness, risk management, and business networking in entrepreneurial success.

DISCUSSION

The findings of the study revealed that agriculture students possessed a moderately favourable entrepreneurial attitude towards self-employment, enterprise management, production planning, technical guidance, and market orientation. The higher mean scores for positive thinking, self-employment orientation, and production management practices indicated that the students had favourable perceptions towards entrepreneurial activities. Similar findings were reported by Saravanan et al. (2025), who found that most final-year agriculture students exhibited a moderately favourable entrepreneurial attitude, while only a small proportion showed a highly favourable attitude.

The Kaiser–Meyer–Olkin (KMO) value of 0.808 indicated adequate sampling adequacy for Principal Component Analysis, as it was substantially higher than the recommended minimum value of 0.50. The obtained KMO value is in line with earlier studies that reported satisfactory PCA outcomes with similar levels of sampling adequacy, thereby confirming the appropriateness of PCA for analysing multidimensional behavioural and socio-economic constructs (Gupta et al., 2020; Yadav et al., 2026). For instance, Shirur et al. (2019) reported a KMO measure of sampling adequacy of 0.819, indicating that the dataset was suitable for variable reduction through Principal Component Analysis. The retention of five components with Eigenvalues greater than one confirms the multidimensional nature of entrepreneurial attitude among agriculture students. The first component alone accounted for 32.06 per cent of the total variance, indicating that entrepreneurial management-related attributes constituted the most influential dimension of entrepreneurial attitude. The substantial contribution of the first component suggests that positive thinking, self-employment orientation, risk management, and enterprise management play a dominant role in shaping entrepreneurial perceptions among students. The cumulative variance explained by the five retained components was 62.52 per cent, which surpassed the commonly accepted threshold for social and behavioural science research. This suggests that the retained components provided a satisfactory representation of the entrepreneurial attitude construct and accounted for a substantial proportion of the variability present in the data (Saha et al., 2026; Shirur et al., 2019). The gradual decline in Eigenvalues indicates that entrepreneurial attitude is shaped by multiple dimensions rather than a single factor. This highlights the need for entrepreneurship development programmes that strengthen managerial, technical, motivational, marketing, and risk-management competencies among agriculture students.

The first extracted component, namely Entrepreneurial Management Orientation, reflected the managerial preparedness and psychological confidence of students towards entrepreneurship. The higher loadings of statements related to risk minimization, positive thinking, and self-employment orientation indicated that students recognized the importance of managerial competency in enterprise success. This finding supports the observations of Nursyirwan et al. (2022), who reported that entrepreneurial attitude and confidence significantly influence entrepreneurial intention among university students.

The second component, Production and Resource Management Orientation, highlighted the importance of timely input management and employee capacity building. Efficient resource utilization and production planning are essential for improving enterprise profitability and sustainability. Similar observations were reported by Stepanenko and Vlasenko (2022), who highlighted the role of supply chain-based inclusive business models in promoting efficient resource management and inclusive agricultural development.

The Technical and Monitoring Orientation component demonstrated that students considered expert guidance, monitoring behaviour, and financial discipline as important entrepreneurial attributes. Regular supervision and technical consultation are important for minimizing enterprise risk and improving productivity. Similar findings were reported by Vijayan et al. (2025), who highlighted the role of experiential learning and technical exposure in enhancing entrepreneurial competencies among agriculture students.

The Entrepreneurial Career Orientation component indicated that students showed preference towards independent business establishment and entrepreneurial professions. However, comparatively lower mean scores for challenging vocation and employment generation suggested hesitation among some students towards adopting entrepreneurship as a full-time career. Fear of risk, uncertainty, and inadequate practical exposure may be possible reasons for this hesitation. Similar findings were reported by Burnette et al. (2020), who found that a growth mindset significantly enhanced entrepreneurial self-efficacy and persistence among university students. This suggests that entrepreneurship education and experiential learning can strengthen students' entrepreneurial confidence and career aspirations.

The Risk and Marketing Orientation component reflected students' awareness of risk-taking ability, market intelligence, and business networking. These factors are critical for enterprise sustainability and profitability in agriculture. The findings are consistent with earlier studies highlighting the importance of market orientation and sound financial decision-making for entrepreneurial success (Ho et al., 2017; Modak et al., 2018; Saghaian et al., 2022).

Overall, the findings indicate that entrepreneurial attitude among agriculture students is multidimensional and shaped by managerial, technical, behavioural, and market-related factors. The results underscore the importance of entrepreneurship-oriented education, experiential learning, start-up incubation support, financial literacy, and market linkage training to promote agripreneurship among rural youth in Odisha. However, the study was confined to final-year agriculture students of a single agricultural institution, which may limit the generalizability of the findings. Future research involving larger and more diverse samples across different universities and regions is recommended to validate the extracted dimensions and strengthen the robustness of the results.

CONCLUSION

The study concluded that agriculture students of Centurion University of Technology and Management possessed a moderately favourable entrepreneurial attitude towards self-employment,

enterprise management, production efficiency, technical guidance, and marketing activities. Principal Component Analysis successfully reduced the entrepreneurial attitude statements into five major dimensions, namely Entrepreneurial Management Orientation, Production and Resource Management Orientation, Technical and Monitoring Orientation, Entrepreneurial Career Orientation, and Risk and Marketing Orientation. The findings indicated that entrepreneurial attitude among agriculture students is multidimensional and influenced by managerial, technical, behavioural, and market-related factors. However, comparatively lower interest towards challenging entrepreneurial vocations suggests the need for strengthening entrepreneurship-oriented education, experiential learning, startup incubation support, and financial literacy programmes to promote agripreneurship and rural employment generation among youth in Odisha.

DECLARATIONS

Ethical approval and consent to participate: Our study did not require ethical approval. However, the informed consent obtained from all respondents before data collection.

Consent of publication: Participants provided consent for publication.

Competing interests/author contributions: No competing interests were declared. Conceptualization and designing of research (RKB); Field survey and data collection (RKB, AK, CP); Analysis of data and interpretation (RKB, AK, CP); Preparation of manuscript (RKB, AK, CP).

Conflict of interest: No conflicts of interest among the authors. The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

Software used: Principal Component Analysis (PCA) was performed using *jamovi* version 2.6 (The jamovi project, 2024), which operates on the *R* statistical computing environment version 4.4 (R Core Team, 2024). Additional psychometric analyses were conducted using the *psych* package (Revelle, 2023).

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