



Comparative analysis of entrepreneurial traits of maize growers in Purnea region of Bihar

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ABSTRACT

Maize (*Zea mays* L.) is an important cereal crop, ranking 3rd after rice and wheat for socio-economic development of the Indian farmers. The cultivation of winter (*rabi*) maize has increased significantly over the last decade in Bihar; consequently entrepreneurial opportunities in this sector are also expanding. Against this backdrop, the present study was carried out during 2022 and 2023 to compare entrepreneurial traits of the maize growers across all the four districts of Purnea region: Purnea, Araria, Katihar and Kishanganj. Data were collected by conducting face to face interview with randomly selected 120 farmers with the help of pre constructed semi-structured interview schedule. The results revealed that 34.16% of maize growers in Purnea region possessed medium high level of entrepreneurial traits, while 30.00% and 5.38% of the maize growers displayed high and very high level of entrepreneurial traits, respectively. ANOVA results indicated significant differences among the districts. Katihar ranked first in terms of adoption leadership and independency whereas Araria was ranked first based on risk bearing capacity, achievement motivation, self-control and competitiveness. Maize growers in the Purnea district showed significantly higher score based on innovativeness. The study suggests that education combined with larger landholdings under maize cultivation and an improved irrigation index, will enhance the entrepreneurial behaviour of the maize growers in Purnea region.

Keywords: Entrepreneurial traits, Farming, Independency, Innovativeness, Maize based enterprise

Maize (*Zea mays* L.) is one of the most important cereal crops cultivated widely around the world. India is the 5th largest producer and 14th largest exporter in the world. According to third advance estimate of 2023–24, India's maize production was 35.67 mt from 11.0 mha of land. The state of Bihar has emerged as a major maize growing state with the productivity of 52.4 q/ha in 2021–22 (Khan 2023). It is cultivated in all 38 districts of Bihar, but the 'Maize Road' constitutes 75.3% of the state's total maize area and 79.5% of the total maize production of the state in 2016–17. This includes 11 districts falling on the north of the river Ganges and both sides of the Koshi, Gandak and Bagmati rivers. Bihar has also been awarded 'Krishi Karman Award' for highest maize production in India in 2016–17 (Sinha 2018). Under the National policy on biofuels 2018, India's expected target is 20% blending of ethanol in petrol by 2029–30 (Choudhary and Dass 2024). This creates an opportune condition for maize cultivation and business because of its multifarious use as food, feed, fodder and

raw material for large number of industrial products, viz. starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceuticals, cosmetic film, textile, gum, package and paper industries. Thus, it is critical that farmers need to be more entrepreneurial, developing new skills and functional capabilities for being competitive across maize value chains in order to reap more economic benefits. Therefore, this study was carried out to understand, measure and compare entrepreneurial traits of maize growers of the selected districts across the Purnea region of Bihar. The factors underlying entrepreneurial behaviour was also assessed for understanding.

MATERIALS AND METHODS

In Bihar, the only notified market is the Gulab Bagh market, located at the Purnea division headquarters. It serves as India's largest maize market and trading center, often referred to as the "Maize Hub of India" (Sinha 2018). Of the estimated 1,000,000 MT of warehouse capacity in Bihar, 500,000 MT is located within Gulab Bagh alone. Consequently, the Purnea region was selected for the present study, encompassing all four constituent districts: Purnea, Katihar, Araria, and Kishanganj. The sampling frame comprised farmers who participated in entrepreneurship training conducted by the respective district Krishi Vigyan

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Kendras (KVKs). Specifically, the frame was narrowed to trainees of entrepreneurship development programmes who were actively engaged in maize cultivation. Using a simple random sampling method, 30 respondents were selected from each district, resulting in a total sample size of 120 maize farmers. Data were collected through face-to-face interviews using a semi-structured interview schedule. To ensure logical consistency and ease of response elicitation, the schedule was pre-tested in 2022 in Kathaili village, Purnea district. The primary data collection phase spanned from 2022–2023 across the selected locales.

Independent variables were Age (X_1), Education (X_2), Family size (X_3), Occupational perception (X_4), Holding size (X_5), Land holding under maize cultivation (X_6), Annual income (X_7), Utilisation of information source (X_8), Irrigation index (X_9) and Credit load (X_{10}) whereas, dependent variable was entrepreneurial traits (Y). The various components of entrepreneurial traits were Adoption leadership

(Y_1), Independency (Y_2), Innovativeness (Y_3), Risk bearing capacity (Y_4), Achievement motivation (Y_5), Self-control (Y_6), and Competitiveness (Y_7). The Entrepreneurial traits estimated with the formula:

$$\text{Entrepreneurial traits (Y)} = \frac{(Y_1+Y_2+Y_3+Y_4+Y_5+Y_6+Y_7)}{7}$$

The operational definition and measurement procedure for entrepreneurial traits and its various components are given in Table 1. Entrepreneurial traits were categorised into number of classes. The exact number of classes has been determined using the Sturges' Rule $K = 1 + 3.322\log_{10}N$. Here, N is the total number of observation. The rounded integer nearest to K is selected to arrive at number of classes. The class interval width (C) has been found by dividing the range by number of classes (C). Collected data were compiled and analysed through ANOVA, correlation and other descriptive statistics by using SPSS.

Table 1 Operationalisation of variables

S. no.	Name of variables	Nature of variables	Operational definition	Measurement procedure
1.	Entrepreneurial traits (Y)	Dependant variable	Entrepreneurial traits are combination of different cognitive behaviours, viz. adoption leadership, innovativeness, independency, achievement motivation, self-control, risk bearing capacity and competitiveness displayed by the maize growers while involved in cultivation of maize and making profit from it.	Entrepreneurial traits have been measured by combining all the components taken for comparison and dividing them by the number of total components of entrepreneurial traits.
2.	Adoption leadership (Y_1)	Component of entrepreneurial traits	Degree of influence in taking decision to make use of technologies, ideas, concepts, methods etc related to maize based ventures in a social system.	Measured by 10 point Rating scale
3.	Innovativeness (Y_2)	Component of entrepreneurial traits	Propensity of the maize growers to adopt an innovation.	Measured by 10 point Rating scale
4.	Independency (Y_3)	Component of entrepreneurial traits	Degree of making own business decision by maize growers without approval of others.	Measured by 10 point Rating scale
5.	Achievement motivation (Y_4)	Component of entrepreneurial traits	Extent of efforts made by the maize growers for achievement of his or her entrepreneurial goals.	Measured by 10 point Rating scale
6.	Self-control (Y_5)	Component of entrepreneurial traits	Ability of the maize growers to manage self-behaviours in order to avoid temptations during maize farming business.	Measured by 10 point Rating scale
7.	Risk bearing capacity (Y_6)	Component of entrepreneurial traits	Extent of capacity of maize growers to take responsibilities and accepting the potential loss in business.	Measured by 10 point Rating scale
8.	Competitiveness (Y_7)	Component of entrepreneurial traits	Ability of maize growers to deliver better values to the customers than their competitors in maize farming business.	Measured by 10 point Rating scale
9.	Age (X_1)	Independent variable	Age of the maize growers are the number of the years rounded in the nearest whole number lived since his birth at the time of interview.	Measured in number of completed years
10.	Education (X_2)	Independent variable	The number of years of formal schooling acquired by the maize growers at the time of interview.	Measured in numbers of completed years

Contd.

Table 1 (Concluded)

S. no.	Name of variables	Nature of variables	Operational definition	Measurement procedure
11.	Family size (X_3)	Independent variable	Operationalised as the total members in the individual family. In the present study only those members of the family considered, who were taking the meal from one chullah.	Measured in numbers
12.	Occupational perception (X_4)	Independent variable	Perceived importance given by maize growers to a particular occupation.	6 point rating scale was used
13.	Holding size (X_5)	Independent variable	Total area of land both cultivable and non-cultivable under possession of maize grower.	Measured in acres
14.	Land under Maize cultivation (X_6)	Independent variable	Total area under maize cultivation within possession of maize grower.	Measured in acres
15.	Annual income (X_7)	Independent variable	Operationally defined as the gross income from all the viable sources of income in a single year. The gross income is constituted by the total income generated from agriculture, dairy, poultry, fishery enterprises, business and services.	It was Measured in terms of rounded rupees
16.	Utilisation of information source (X_8)	Independent variable	Use of information sources both from outside and within the community for getting agricultural information by the maize growers.	Measurement procedure developed by Singh (1993) with some modification was adopted
17.	Irrigation index (X_9)	Independent variable	Percentage of land under irrigation within total land holding of a maize grower.	Area of the land under irrigation/ Total holding size \times 100
18.	Credit load (X_{10})	Independent variable	Operationalised as the outstanding amount of credit a maize grower had at the time of interview.	Amount of credit outstanding in Rupees

RESULTS AND DISCUSSION

Correlation coefficient of independent variables:

The data showed that education, holding size, land under maize cultivation, annual income, utilisation of information sources, and irrigation index were positively and significantly correlated at 0.01 level of significance with the entrepreneurial traits (Y) (Table 2). Singh *et al.* (2022) reported that education, land holding, social participation, material possession, annual income and occupation were positively and significantly correlated with entrepreneurial behaviour of vegetable growers of Varanasi district in Uttar Pradesh whereas Mavhungu *et al.* (2024) found no significant association between cultivation of maize with age and education. Kumar *et al.* (2019) revealed that self-confidence of the entrepreneurs was found to be positively and significantly correlated with age and land holding at 5% level of significance implying that with the increase of age self-confidence of the entrepreneurs also increases. Likewise with the increase in holding size self-confidence of the entrepreneurs also increases as large holding size gives more production which in turn gives more income and profitability. They also revealed that none of the socio-economic characteristics of the entrepreneurs were significantly correlated with the innovativeness of the respondents.

Entrepreneurial traits of maize farmers: It was found that the overall pattern showed high (31.66%) followed by very high (25.83%) level of self-control and medium high followed by high level of risk bearing capacity and

independency prevailed among maize farmers (Table 3). However, similar pattern (medium followed by medium high category) of adoption leadership, innovativeness and achievement motivation were also identified among maize growers. In terms of competitiveness, a different pattern emerges. Low medium (27.50%) level of Competitiveness dominated and followed by 20.83% possessed medium level of competitiveness among maize farmers of the region. Parveen (2021) indicated that majority of the maize farmers

Table 2 Correlation of entrepreneurial traits with independent variables of the maize growers of Purnea region

Independent variables	Correlation coefficient (r) value
Age (X_1)	-0.091
Education (X_2)	0.388**
Family size (X_3)	-0.065
Occupational perception (X_4)	0.033
Holding size (X_5)	0.312**
Land under Maize cultivation (X_6)	0.377**
Annual Income (X_7)	0.355**
Utilisation of Information Source (X_8)	0.252**
Irrigation index (X_9)	0.268**
Credit load (X_{10})	-0.047

**0.01 level of significance.

Table 3 Distribution of maize farmers of Purnea region based on entrepreneurial traits

Components of entrepreneurial traits	Category	Range	Frequency	Percentage
Adoption leadership (Y ₁)	Very low	2.88–3.79	2	1.66
	Low	3.79–4.70	10	8.33
	Low medium	4.70–5.61	1	15.83
	Medium	5.61–6.52	35	29.16
	Medium high	6.52–7.43	31	25.83
	High	7.43–8.34	17	14.16
Independency (Y ₂)	Very high	8.34–9.25	6	5.00
	Very low	2.17–3.31	2	1.66
	Low	3.31–4.45	1	0.83
	Low medium	4.45–5.59	19	15.83
	Medium	5.59–6.73	20	16.66
	Medium high	6.73–7.87	46	38.33
Innovativeness (Y ₃)	High	7.87–9.01	24	20.00
	Very high	9.01–10.17	8	6.66
	Very low	2.22–3.24	1	0.83
	Low	3.24–4.27	3	2.5
	Low medium	4.27–5.30	13	10.83
	Medium	5.30–6.33	34	28.33
Risk bearing capacity (Y ₄)	Medium high	6.33–7.36	34	28.33
	High	7.36–8.39	28	23.33
	Very high	8.39–9.44	7	5.83
	Very low	1.83–2.99	1	0.83
	Low	2.99–4.14	2	1.66
	Low medium	4.14–5.31	14	11.66
Achievement motivation (Y ₅)	Medium	5.31–6.47	17	14.16
	Medium high	6.47–7.63	28	23.33
	High	7.63–8.79	37	30.83
	Very high	8.79–10.0	21	17.50
	Very low	3.78–4.63	6	5.00
	Low	4.63–5.48	16	13.33
Self-control (Y ₆)	Low medium	5.48–6.33	13	10.83
	Medium	6.33–7.18	27	22.50
	Medium high	7.18–8.03	25	20.83
	High	8.03–8.88	18	15.00
	Very high	8.88–10.00	15	12.50
	Very low	2.22–3.30	2	1.66
	Low	3.30–4.38	3	2.50
	Low medium	4.38–5.46	12	10.00
	Medium	5.46–6.54	24	20.00
	Medium high	6.54–7.62	31	25.83
	High	7.62–8.70	38	31.66
	Very high	8.70–9.83	10	8.33

Contd.

Table 3 (Concluded)

Components of entrepreneurial traits	Category	Range	Frequency	Percentage
Competitiveness (Y ₇)	Very low	2.83–3.78	6	5.00
	Low	3.78–4.73	20	16.66
	Low medium	4.73–5.68	33	27.50
	Medium	5.68–6.63	25	20.83
	Medium high	6.63–7.58	23	19.16
	High	7.58–8.53	10	8.33
Entrepreneurial traits (Y)	Very high	8.53–9.50	3	2.50
	Very low	2.82–3.7	1	0.83
	Low	3.7–4.58	3	2.50
	Low medium	4.58–5.46	13	10.83
	Medium	5.46–6.34	19	15.83
	Medium high	6.34–7.22	41	34.16
	High	7.22–8.10	36	30.00
	Very high	8.10–9.04	7	5.83

n=120.

had low creative potential, medium innovativeness, low level of competitor analysis, medium level of production planning and control, high level of purchase management, medium marketing orientation. Overall scenario indicated that the majority of maize farmers of Purnea region (34.16%) possessed medium high level of entrepreneurial traits (Y) followed by 30.0% of the maize farmers possessing high level of entrepreneurial traits (Y). So, there is evidence to suggest that maize farmers possessed entrepreneurial traits. However, comparatively lower level of competitiveness dominates over other components of entrepreneurial traits. So, entrepreneurship development training may focus on capacity building in competitiveness for promotion of entrepreneurial journey among maize farmers in Purnea region.

District wise comparison of entrepreneurial traits among maize growers: Various components of entrepreneurial traits were compared among all the four districts of Purnea region of Bihar (Table 4, 5 and 6).

The data indicated adoption leadership and independency traits dominated among the maize growers of Katihar district followed by Araria. But, risk bearing capacity, achievement motivation and self-control trait possession showed similar pattern where Araria ranked first and Kishanganj in last in terms of possession of these traits among the maize farmers. In terms of innovativeness, Purnea with Mean value 7.05 ranked first whereas Kishanganj with mean value 5.96 ranked last among the districts of Purnea region. Competitiveness trait possession among sample maize farmers showed that Araria ranked first and Purnea ranked last (Table 4). The results obtained can help in planning of maize-based enterprises for utilising full potential of entrepreneurial characteristics of maize growers of the

Table 4 Comparison of districts of Purnea region based on entrepreneurial traits possession by maize growers (n=120)

Entrepreneurial traits	Kishanganj		Araria		Purnea		Katihar	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Adoption leadership	5.73 (IV)	0.76	6.80 (II)	1.19	5.93 (III)	1.00	6.91 (I)	1.36
Independency	5.96 (IV)	0.95	7.40 (II)	1.08	7.22 (III)	1.18	7.65 (I)	1.72
Innovativeness	5.93 (IV)	0.93	6.63 (III)	1.00	7.05 (I)	1.32	6.67 (II)	1.50
Risk bearing capacity	6.30 (IV)	1.32	7.82 (I)	1.45	7.76 (II)	1.57	7.27 (III)	1.82
Achievement motivation	5.95 (IV)	1.06	7.82 (I)	1.41	7.74 (II)	1.30	6.66 (III)	1.345
Self-control	6.21 (IV)	1.11	7.42 (I)	1.43	7.06 (III)	1.19	7.08 (II)	1.592
Competitiveness	5.82 (II)	1.16	6.34 (I)	1.25	5.67 (IV)	1.44	5.81 (III)	1.558

Figures in parenthesis indicate rank based on possession of entrepreneurial traits.

Table 5 ANOVA of entrepreneurial traits among the districts of Purnea region

Entrepreneurial traits		Sum of Squares	df	Mean Square	F	Sig.
Adoption leadership	Between groups	32.698	3	10.899	9.039	0.000
	Within groups	139.884	116	1.206		
	Total	172.582	119			
Independence	Between groups	50.798	3	16.933	10.283	0.000
	Within groups	191.016	116	1.647		
	Total	241.814	119			
Innovativeness	Between groups	19.585	3	6.528	4.459	0.005
	Within groups	169.843	116	1.464		
	Total	189.429	119			
Risk bearing capacity	Between groups	44.924	3	14.975	6.240	0.001
	Within groups	278.376	116	2.400		
	Total	323.301	119			
Achievement motivation	Between groups	73.006	3	24.335	14.741	0.000
	Within groups	191.504	116	1.651		
	Total	264.510	119			
Self-control	Between groups	24.081	3	8.027	4.439	0.005
	Within groups	209.750	116	1.808		
	Total	233.831	119			
Competitiveness	Between groups	7.372	3	2.457	1.328	0.269
	Within groups	214.670	116	1.851		
	Total	222.042	119			

Purnea region. Similar study conducted by Agbolosoo and Anaman (2021) with the small holder potato farmers and reported medium level of risk-taking ability, proactiveness behaviour, innovativeness behaviour, cosmopolitaness behaviour, information seeking behaviour, decision making ability which in turn made them unable to perceive potato farming as profitable and viable agribusiness venture. Mubeena *et al.* (2017) observed that majority (69.16%) of the respondents had a medium level of innovativeness behaviour followed by low 18.13 % and high 12.50 %.

Table 5 indicated that except competitiveness all other components of entrepreneurial traits showed highly significant difference among districts of Purnea region. An in-depth analysis through Tuckey post hoc test for

specifying honest significant mean difference revealed inter-district comparative result (Table 6). Regarding independency, Kishanganj scored significantly lower than the other three districts with Araria ($p<0.001$), Purnea ($p=0.001$) and Katihar ($p<0.001$). In terms of Achievement motivation, Kishanganj was significantly outperformed by Araria ($p<0.001$) and Purnea ($p<0.001$). Similarly, regarding risk bearing capacity, Kishanganj differed significantly from Araria ($p=0.001$) and Purnea ($p=0.001$). Conversely, Araria scored significantly higher than Purnea in adoption leadership ($p=0.013$) and higher than katihar in achievement motivation ($p=0.004$). Purnea also showed significant mean difference with Katihar in both adoption leadership and achievement motivation. Overall, Araria and Katihar

Table 6 Mean difference among districts with respect to different entrepreneurial traits

Entrepreneurial traits	Comparison between districts		Mean Difference	Std. Error	Sig.#
Adoption Leadership	Kishanganj	Araria	-1.07400**	0.284	0.001
	Kishanganj	Katihar	-1.18600**	0.284	0.000
	Araria	Purnea	.87733**	0.284	0.013
	Purnea	Katihar	-.98933**	0.284	0.004
Independency	Kishanganj	Araria	-1.44167**	0.331	0.000
	Kishanganj	Purnea	-1.26100**	0.331	0.001
	Kishanganj	Katihar	-1.68367**	0.331	0.000
Innovativeness	Kishanganj	Purnea	-1.11933**	0.312	0.003
Risk bearing capacity	Kishanganj	Araria	-1.52900**	0.400	0.001
	Kishanganj	Purnea	-1.46600**	0.400	0.002
Achievement motivation	Kishanganj	Araria	-1.87133**	0.332	0.000
	Kishanganj	Purnea	-1.79333**	0.332	0.000
	Araria	Katihar	1.15600**	0.332	0.004
	Purnea	Katihar	1.07800**	0.332	0.008
Self-control	Kishanganj	Araria	-1.21400**	0.347	0.004

** Significant at 1% level of significance; # Other comparisons remain non-significant.

appeared to be the hubs of high entrepreneurial potential, particularly in motivation, risk-taking and leadership. In contrast, Kishanganj demonstrated a statistically significant deficit across almost all entrepreneurial dimensions, suggesting a need for targeted intervention and capacity-building programmes in that specific district. Manyise *et al.* (2023) revealed that commercial small holder farmers displayed heterogenous entrepreneurial behaviours, viz. non entrepreneurial, goal driven, means driven and ambidextrous. All categories of entrepreneurs also differed in their socio-economic characteristics, viz. gender, age, education levels, farm size, proximity to market and social connection. Kibirige (2022) identified farmers who are finding out opportunities was positively and significantly related to crop incomes, remittances, grants and pension and location of the irrigation scheme, while age had a negative and significant influence on farmers ability to recognise opportunities. Accordingly, policies need to focus on identified socio-economic factors to catalyse the shift from subsistence to more business oriented commercial farming. Ntow *et al.* (2023) identified need for achievement, self-efficacy, self-confidence, innovativeness, proactiveness, decision making ability, risk taking propensity, information seeking behaviour as key personal characteristics associated with farm entrepreneurs.

Around 71% of maize produced in India are processed for feed, milling and brewery industry and in Bihar only 8–10% of maize is processed and around 80% goes outside the state (Anonymous 2008). Processing value chain has created an important entrepreneurial opportunity to the maize farmers. Maize value chain was studied by Shruti *et al.* (2018) and they stressed on providing institutional support and single window delivery information system to agri-startups apart from setting up of community based

processing centre. Maize remains as one of the seven focus sector of Bihar agri-investment promotion policy and eligible for capital subsidy for establishment of agro-processing sector to increase agribusiness opportunity of the state. Sharma *et al.* (2024) suggested suitable training module focusing on various needs of maize farmers for becoming producer to entrepreneur.

The present study compared entrepreneurial traits among maize farmers of districts in Purnea region. Study identified competitiveness component of entrepreneurial traits consistently shows low scores across districts, which developmental practitioners may take into consideration in order to promote entrepreneurial characteristics among maize farmers during capacity building programmes. Moreover, study revealed maize farmers of Kishanganj district showed consistently low entrepreneurial traits whereas Katihar and Purnea showed higher entrepreneurial traits, indicating targeted capacity building programme. Landholding, land under maize cultivation, irrigation, annual income, education remains important socio personal indicators for maximising entrepreneurial traits among the maize farmers in districts of Purnea region.

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