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A SCALE TO MEASURE THE ENTREPRENEURIAL BEHAVIOUR OF TOMATO GROWERS

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ABSTRACT

The present study was conducted to develop and standardize a reliable and valid scale to measure the entrepreneurial behavior of tomato growers. The Normalized Rank Order Method, as recommended by Guilford (1954), was used for scale development. A total of eight indicators were selected from fourteen, based on their relevance percentage, weightage, and mean relevance scores. The scale values for each selected indicator were obtained through the rank order method. Furthermore, 55 sub-items corresponding to these indicators were identified through a relevancy test. To ensure the robustness of the developed scale, both validity and reliability tests were conducted. Internal consistency techniques were applied to assess the scale's validity, while the test-retest method was used to confirm its reliability (test-retest coefficient: 0.901). These statistical techniques ensured that the scale accurately and consistently measured entrepreneurial behaviour among tomato growers. The standardized scale can serve as a valuable tool for researchers, policymakers, and agricultural extension workers to assess and enhance entrepreneurial skills in tomato cultivation. Its application will contribute to better decision-making, targeted training programs, and improved agricultural entrepreneurship in the sector.

Keywords*: entrepreneurial behaviour, tomato grower, scale, guilford, rank order*

INTRODUCTION

Entrepreneurship in agriculture has emerged as a key driver of rural development, economic growth, and food security. It is widely believed that the entrepreneurial function is a vital component in the process of economic growth (Schumpeter, 1950; Reynolds *et al.* 1994). Among various agricultural enterprises, tomato cultivation holds significant importance due to its high commercial value, nutritional benefits, and growing market demand. Tomatoes occupy an area of about 4.73 million hectares with a production of 163.96 million tons in the world (FAO, 2017). After China, India is the largest producer of tomatoes globally and produces 11 per cent share globally. Tomato growers, especially in developing countries, face numerous challenges, including fluctuating market prices, input costs, pest and disease management, and access to credit and technology (FAO, 2021; Chouhan et al., 2019; Van der Valk & van der Roest, 2009). In this dynamic environment, there is necessary for farmers to identify opportunities and seize them. Their production decisions should be based on what is possible. The farmer must be entrepreneurial in adapting to threats; innovating and developing strategies to ensure the farm business remains profitable and viable. (Lichtenstein *et al.,* 2004).

Entrepreneurship is the key to rapid growth of a country. Entrepreneurship is very crucial for the overall social change and advancement of the society (Patel *et al.,* 2023) Tomato growers play a vital role in Indian agriculture as an agri-entrepreneur (Chouhan *et al*. 2021). Entrepreneurial behavior plays a crucial role in determining the success and sustainability of tomato farming enterprises. Entrepreneurship in agriculture reflects complex interactions between the individual and the situation, which has to be dynamic because the situations are always changing. Entrepreneurial behavior in agriculture is a multidimensional concept that encompasses various attributes such as innovation, risk-taking ability, decision-making skills, and market orientation. (Kahan, 2012). Minzberg (1976) stated that entrepreneurial behaviour is characterised by active search, expansionist outlook and decision-making. Heredero (1979) described agricultural entrepreneur as a person, who introduces changes, which directly or indirectly lead to higher agricultural products.

The entrepreneurship is affected by the entrepreneurial behaviour of the individual. Entrepreneurial behavior is defined as identifying possibilities and putting

good ideas into action. The entrepreneurship is characterized by their entrepreneurial behaviour which includes various components such as innovativeness, achievement motivation, risk orientation, technical competency, decision making ability, economic motivation, marketing orientation, scientific orientation, management orientation, and leadership ability (Bhople & Vaidya, 2009, Kumar *et al*. 2013, Tikariha & Soni, 2018). When a farmer thinks and acts as a businessman, he will dare to take risks. Farmers so far have thought of ways to increase the productivity of their land. When they see themselves as an entrepreneur, their focus will shift towards profitability and building a sustainable enterprise. Furthermore, the importance of studying and analysing entrepreneurial behaviour lies with the fact that the relationship between human capital and various outcomes associated with entrepreneurship may be mediated by entrepreneurial behaviour (Baron and Kenny, 1986; Cohen, 2003).

Tomato cultivation is highly perishable, price-volatile, and input intensive which demands a unique set of entrepreneurial competencies. While previous scales designed for general farming, mixed vegetable cultivation and have been developed in different regions, whose farmers may differ significantly in access in market, literacy, extension contacts which is not adequately capture tomato-specific challenges like market price fluctuations, post-harvest loss management, and high cost of cultivation (Chouhan et al., 2019; Nadhika & Krishnankutty, 2023; Bhople & Vaidya, 2009). Therefore, a context-specific and well-defined measurement tool is essential to assess the entrepreneurial capabilities of tomato farmers, identify gaps, and develop targeted interventions to enhance their entrepreneurial skills. Taking into consideration this, a study was conducted to develop and standardize the reliable and valid scale to measure the entrepreneurial behaviour of tomato growers in western Uttar Pradesh. The proposed scale will quantify key entrepreneurial traits and serve as a valuable tool for policymakers, researchers, and extension agencies to formulate targeted strategies for promoting entrepreneurship in tomato farming. By systematically identifying and evaluating the entrepreneurial behaviour of tomato farmers, the study contributes to a deeper understanding of agripreneurship and its significance in achieving sustainable agricultural development.

METHODOLOGY

According to Noll (1957), a standardized test is one that has been carefully developed by experts in alignment with well-defined objectives. The procedures for administration, scoring, and interpretation are specified to ensure comparability of results and the establishment of predetermined standards across different age groups, regardless of when or where the test is conducted. In line with this definition, a standardized entrepreneurial behaviour scale was developed to measure the entrepreneurial behaviour of tomato growers using the Normalized Rank Order Method recommended by Guilford (1954) and later applied by Patil *et al*. (2024) and Patil *et al*. (2021). The method follows a structured set of steps to develop the scale effectively.

Identification of indicators

The possible indicators of Entrepreneurial Behaviour were identified after reviewing the related literature. After thorough scrutiny and comprehensive understanding, these indicators were consulted with the experts. Finally, fourteen possible indicators that determine the entrepreneurial behaviour of tomato growers were included for the scale construction and standardization. The selected indicators are Innovativeness, Risk Orientation, Scientific Orientation, Economic Motivation, Management Orientation, Decision-Making Ability, Leadership Ability, Achievement Motivation.

Selection of judges

A group of 50 experts consisting of social scientists and extension educationists from different agricultural universities across the country, traditional universities, heads of Krishi Vigyan Kendras were selected as judges to develop and standardize the Entrepreneurial Behaviour scale.

Judges' opinion

An official letter, along with a request letter, was sent to all selected judges, seeking their valuable opinions on the relevance and importance of the listed indicators for developing and standardizing the entrepreneurial behavior scale. Judges were asked to rate each indicator's relevance on a five-point scale: Most Relevant (5), Relevant (4), Somewhat Relevant (3), Less Relevant (2), and Not Relevant (1). The collected responses were then scored accordingly.

Relevance of scale items

From the data so gathered were tabulated and analyzed to calculate "Relevancy Per cent," "Relevancy Weightage" and "Mean Relevancy Score" for all fourteen indicators by using the following formulae:

$$\text{Relevancy \%} = \frac{(MR \times 5)+(R \times 4)+(SWR \times 3)+(LR \times 2)+(NR \times 1)}{\textit{Maximum Possible score}} \times 100$$

$$\text{Relevancy Weightage} = \frac{(MR \times 5)+(R \times 4)+(SWR \times 3)+(LR \times 2)+(NR \times 1)}{\textit{Maximum Possible score}}$$

$$\text{Mean Relevancy Score} = \frac{(MR \times 5)+(R \times 4)+(SWR \times 3)+(LR \times 2)+(NR \times 1)}{\textit{Number of judges responded}}$$

Table 1: Relevancy per cent, relevancy weightage and mean relevancy score of the components of entrepreneurial behaviour of tomato growers as opinioned by experts (n=50)

Sr. No	Indicators	Relevancy %	Relevancy weightage	Mean Relevancy Score	Remarks
1	**Innovativeness**	92.50	0.93	4.63	Selected
2	**Risk Orientation**	89.30	0.89	4.47	Selected
3	**Scientific Orientation**	91.20	0.91	4.56	Selected
4	**Economic Motivation**	87.90	0.88	4.40	Selected
5	**Management Orientation**	85.70	0.86	4.28	Selected
6	**Decision-Making Ability**	88.50	0.89	4.43	Selected
7	**Leadership Ability**	86.20	0.86	4.31	Selected
8	**Technical competency**	55.30	0.55	2.77	Not-Selected
9	**Achievement Motivation**	80.10	0.80	4.00	Selected
10	**Autonomy**	53.80	0.54	2.69	Not-Selected
11	**Cosmopoliteness**	47.50	0.48	2.38	Not-Selected
12	**Self-confidence**	52.60	0.53	2.63	Not-Selected
13	**Knowledge about tomato cultivation**	54.20	0.54	2.71	Not-Selected
14	**Networking and Collaboration**	49.80	0.50	2.49	Not-Selected

Ranking of the selected indicators

To determine the rank of the selected indicators in the scale, 50 judges were asked to rank them based on their relative importance in measuring Entrepreneurial Behaviour.

Item analysis

After receiving the judges' responses, the data was transformed and organized into a master table based on their rankings. As shown in Table 2, the r_i column represents the assigned ranks, followed by R_i, which denotes the reversed rankings. The ranking frequency for each component was systematically tabulated.

For example, in the case of the indicator *Innovativeness*, the fifty judges ranked it first nine times, second twelve times, third seven times, fourth eight times, fifth six times, sixth twice, seventh four times, and eighth twice, as presented in Table 2.

Table 2: Method of working the scale values based on the ranks given by fifty judges on eight variables

ri	Ri	Innova-tiveness	Risk Orientation	Scientific Orientation	Economic Motivation	Management Orientation	Decision-Making Ability	Leadership Ability	Achievement Motivation		P	C
1	8	10	11	14	9	11	6	7	3	50	93.75	8
2	7	13	14	6	7	5	9	8	4	50	81.25	7
3	6	7	9	12	10	11	9	5	6	50	68.75	6
4	5	6	8	7	12	9	10	9	5	50	56.25	6
5	4	5	7	3	13	12	11	4	7	50	43.75	5
6	3	4	3	9	7	6	9	10	14	50	31.25	5
7	2	3	5	4	7	5	6	14	12	50	18.75	4
8	1	2	3	2	3	4	3	9	18	50	6.25	4
Σfji		50	50	50	50	50	50	50	50	400	-	
Σfji		310	324	290	288	286	269	245	238	2250		
MC=Ri		6.20	6.48	5.80	5.76	5.72	5.38	4.90	4.76	45		
Rc (Scale value)		7.80	8.10	6.90	6.40	6.30	5.80	4.70	4.00			

1. ri= Rank given by judges to ten variables
2. Ri= rank values (in the reverse order of ranks i.e., rank one getting eight, rank two getting seven)
3. Σ=total number of judges (frequency distribution) among several variables
4. P=centile value= $\frac{(Ri-0.5)}{n}$ x100
   Where Ri=rank value; n=number of variables ranked; C=values determined to each centile value.
5. Σfji=Total number of judges who have ranked eight components.
6. Σfjic= Ca or C_J
7. Rc=2.357XRj-7.0

Computing the scale values

To determine the scale value of each item, ranked by judges, the centile position "P" based on the method suggested by Guilford (1954) was worked out. The "C" value (value determined to each centile value), R_j value and finally scale value, i.e., R_c value, were worked out by using the following formula:

$$R_c = 2.357R_j - 7.01$$

The procedure for calculating scale value of indicators was explained by taking the example of the indicator 1 'Innovativeness'.

Ca or Cj = (9 X 8) +(12 X7) +(7 X 6) + (8 X 6) +(6 X 5) +(2 X5) +(4 X 4) +(2 X 4) = 310

Rj value is calculated by dividing Ca or Cj value of particular indicator to the total number of judges.

Rj = 310/50

Rj = 6.20

For calculating Rc (Scale value),

Rc = 2.357 X Rj -7.01

= 2.357 (6.20)-7.01

Rc= 7.80

The computed scale values for all eight selected components are shown in Table 3.

Table 3: The computed scale values for eight components

Sr. No.	Components	Scale value
1	**Innovativeness**	7.80
2	**Risk Orientation**	8.10
3	**Scientific Orientation**	6.90
4	**Economic Motivation**	6.40
5	**Management Orientation**	6.30
6	**Decision-Making Ability**	5.80
7	**Leadership Ability**	4.70
8	**Achievement Motivation**	4.00

Relevancy of sub-items of the indicators of entrepreneurial behaviour of tomato growers.

The scale to measure the entrepreneurial behavior of tomato growers included eight components. For each component, sub-items were developed and evaluated by thirty judges to assess their relevance. Judgment sheets with clear instructions were provided, and the judges rated each item on a five-point scale: Most Relevant (5), Relevant (4), Somewhat Relevant (3), Less Relevant (2), and Non-Relevant (1). Based on the judges' responses, relevancy weightages were calculated for all statements. Subcomponents with a relevancy percentage above 75%, a relevancy weightage greater than 0.75, and a mean relevancy score exceeding 3.75 were selected. Ultimately, 55 statements were finalized for inclusion in the scale. The calculated relevancy per cent, relevancy weightage and mean relevancy score of those sub-components of group dynamics effectiveness are indicated in Table 4.

Table 4: Relevancy per cent, relevancy weightage and mean relevancy score of the sub-components of entrepreneurial behaviour of tomato growers as opinioned by experts (n= 30)

Sr. No.	Items	Obtained scores	Relevancy %	Relevancy weightage	Mean relevancy score
(A) Innovativeness					
1	My peers often ask me for advice or information. (+)	122	0.81	81.33	4.07
2	I enjoy trying new ideas. (+)	140	0.93	93.33	4.67
3	I seek out new ways to do things. (+)	132	0.88	88	4.40
4	I am generally cautious about accepting new ideas. (-)	144	0.96	96	4.80
5	I frequently improvise methods for solving a problem when an answer is not apparent. (+)	111	0.74	74	3.70
6	I am suspicious of new inventions and new ways of thinking. (-)	132	0.88	88	4.40
7	I rarely trust new ideas until I can see whether the vast majority of people around me accept them. (-)	142	0.95	94.67	4.73
8	I feel that I am an influential member of my peer group. (+)	110	0.73	73.33	3.67
9	I consider myself to be creative and original in my thinking and behavior. (+)	132	0.88	88	4.40
10	I am aware that I am usually one of the last people in my group to accept something new. (-)	126	0.84	84	4.20

Sr. No.	Items	Obtained scores	Relevancy %	Relevancy weightage	Mean relevancy score
(B) Risk orientation					
1	A farmer should grow more number of tomato crops to avoid greater risks involved in growing one or two crops. (-)	139	0.93	92.67	4.63
2	A farmer should rather take risk for making larger profit than to be content with a smaller, less risky profits. (+)	109	0.73	72.67	3.63
3	A farmer who is willing to take greater risks than the average farmer usually has better financial condition. (+)	119	0.79	79.33	3.97
4	It is good for a farmer to take risks when he knows his chance of success is high. (+)	127	0.85	84.67	4.23
5	It is better for a farmer not to try new methods of tomato farming unless most other farmers have used them with success. (-)	126	0.84	84.00	4.20
6	Trying an entirely new method in tomato farming by a farmer involves risk, but it is worth. (+)	138	0.92	92.00	4.60
(C) Scientific orientation					
1	Improved cultivation practices give better results to tomato grower than the old methods. (+)	110	0.73	73.33	3.67
2	Even the tomato grower with lots of experience should use Improved cultivation practices of farming. (+)	126	0.84	84	4.20
3	Though it takes time for a tomato grower to learn improved cultivation practices in farming it worth the efforts. (+)	128	0.85	85.33	4.27
4	A good tomato grower experiments with new ideas in cultivation. (+)	130	0.87	86.67	4.33
5	Traditional methods of cultivation have to be changed in order to raise the standard of living of tomato growers. (+)	111	0.74	74	3.70
6	The way tomato grower's fore fathers farmed is still the best way to farm today. (-)	139	0.93	92.67	4.63
(D) Economic motivation					
1	A farmer should work towards larger yields and economic profits. (+)	131	0.87	87.33	4.37
2	The most successful farmers are one who makes the most profit. (+)	120	0.8	80	4.00
3	A farmer should try any new farming idea which may earn him more money. (+)	142	0.95	94.67	4.73
4	A farmer should grow commercial tomato crops to increase monetary profits in comparison to growing other crops for home consumption. (+)	110	0.73	73.33	3.67
5	It is difficult for the farmer's children to make good start unless he provides them with economic assistance. (+)	132	0.88	88	4.40
6	A farmer must earn his living but the most important thing in life cannot be defined in economic terms. (-)	126	0.84	84	4.20
(E) Management orientation					
1	Each year one should think afresh about tomato crops to be cultivated in each type of land. (+)	126	0.84	84	4.20
2	It is not necessary to make prior decision about the variety of tomato crops to be cultivated. (-)	138	0.92	92	4.60
3	The number of seed, fertilizer and plant protection chemicals needed for raising a tomato crop should be assessed before cultivation. (+)	142	0.95	94.67	4.73
4	It is not necessary to think ahead about the cost involved in raising tomato crop. (-)	148	0.99	98.67	4.93
5	One need to consult a horticulturist for tomato crop Planning. (+)	107	0.71	71.33	3.57

Sr. No.	Items	Obtained scores	Relevancy %	Relevancy weightage	Mean relevancy score
6	It is possible to increase the yield through proper farm production plan. (+)	132	0.88	88.00	4.40
F. Decision Making Ability					
1	To try new crop varieties (+)	122	0.81	81.33	4.07
2	Borrow money for the farm (+)	119	0.79	79.33	3.97
3	To buy farm equipment (+)	137	0.91	91.33	4.57
4	Choose the kind of fertilizers. (+)	122	0.81	81.33	4.07
5	To attend Agril. Meeting. (+)	143	0.95	95.33	4.77
6	Subscribe to farm publication. (+)	111	0.74	74.00	3.70
7	Hire farm workers. (+)	142	0.95	94.67	4.73
8	To try new farm practices (+)	123	0.82	82.00	4.10
9	To increase or decrease crop acreages (+)	126	0.84	84.00	4.20
10	To switch to a new cropping plan (+)	130	0.87	86.67	4.33
G. Achievement motivation					
1	Work should come first even if one cannot get proper rest to achieve one's goals. (+)	129	0.86	86.00	4.30
2	It is better to be content with whatever little one has, than to be always struggling for more. (-)	137	0.91	91.33	4.57
3	No matter what I have done I always want to do more. (+)	128	0.85	85.33	4.27
4	I would like to try hard at something really difficult even if it proves that I cannot do it. (+)	134	0.89	89.33	4.47
5	The way things are nowadays discourage one from working hard. (-)	128	0.85	85.33	4.27
6	One should succeed in occupation even if one has to neglect his family. (+)	109	0.73	72.67	3.63
H. Leadership Ability					
1	Did you participate in group discussions on new tomato farm practice (+)	124	0.83	82.67	4.13
2	Whenever you see/hear a new tomato farm practice did you initiate discussion about it with your colleagues (+)	119	0.79	79.33	3.97
3	Do village people regard you as good source of information on new farm practice (-)	126	0.84	84.00	4.20
4	Do you assign the farm work to your family members (+)	130	0.87	86.67	4.33
5	Do you offer new approaches to problems(+)	136	0.91	90.67	4.53

Validity of the scale

The validity of the developed scale was assessed using content validity. It was established through two approaches: first, the selection of scale items was based on an extensive literature review; second, expert opinions were sought to determine the suitability of the selected items for inclusion in the scale.

Reliability of the scale

To assess the reliability of the entrepreneurial behavior scale for tomato growers, the test-retest method was employed. The 55-item scale was administered twice to 20 respondents at a 15-day interval. These respondents were not previously interviewed and were not part of the final study sample. Two sets of scores were obtained for each respondent, and the coefficient of correlation between them was calculated to estimate the stability of the measurement, known as the stability reliability coefficient. The test demonstrated high stability and dependability, with a reliability coefficient of 0.901. The coefficient was computed using Rulon's formula, as suggested by Guilford (1979), confirming that the developed scale is highly reliable.

Administrating the scale

To minimize response bias and enhance the reliability and validity of the scale, 55 statements representing eight different indicators were randomly arranged in the final format. The scale consists of 55 statements, including 43 positive and 12 negative ones, structured on a five-

point Likert continuum: Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. Positive statements were scored as 5, 4, 3, 2, and 1, respectively, while negative statements were reverse-scored. The possible scores range from 55 to 275. This final entrepreneurial behavior scale was administered to a sample of tomato growers, who indicated their level of agreement with each statement by selecting one of the five response options.

RESULTS AND DISCUSSION

Developing the Entrepreneurial behaviour of tomato growers Index

After obtaining the scale values of individual components of Entrepreneurial Behaviour and total scale value as represented in Table 3, the Entrepreneurial behaviour of Tomato Growers Index was calculated by using the following formula:

$$ETB = [(R_1/M_1) \times S_1 /S + (R_2/M_2) \times S_2 /S + \ldots + (R_n/M_n) \times S_n /S] \text{ X } 100$$

Where,

ETB = Entrepreneurial behaviour of tomato growers of the respondent

R_1, R_2 …. R_n = Score obtained by the respondent as the particular entrepreneurial behaviour of tomato growers

M_1, M_2, M_3…. M_n = Potential score of the respondent as a particular entrepreneurial behaviour Indicator

S_1, S_2, S_3 …S_n = Scale value of the entrepreneurial behaviour of the tomato grower's indicator

S = total scale value of all indicators

CONCLUSION

This study successfully developed and validated a standardized scale to measure the entrepreneurial behavior of tomato growers, addressing a critical gap in agricultural entrepreneurship research. Using the Normalized Rank Order Method, eight key indicators were identified *i. e.,* Innovativeness, Risk Orientation, Scientific Orientation, Economic Motivation, Management Orientation, Decision-Making Ability, Leadership Ability and Achievement Motivation, which collectively capture the unique challenges of tomato cultivation. The scale demonstrates excellent reliability and has undergone rigorous validation, making it a robust tool for researchers, policymakers, and extension workers. Unlike existing generic agricultural entrepreneurship scales, this instrument specifically addresses tomato farming's distinct characteristics, including price volatility, perishability, and high input costs. The practical applications of this research are significant: it enables farmers to assess and enhance their entrepreneurial skills, assists policymakers in designing targeted interventions, and provides researchers with a validated measurement tool. Future applications across different tomato-growing regions will further strengthen the scale's validity and utility. Ultimately, this work contributes to the broader goal of fostering sustainable agricultural entrepreneurship by equipping tomato growers with the means to develop business acumen, manage risks effectively, and improve their economic outcomes in an increasingly competitive market environment.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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