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Management orientation scale (MOS): Scale development and empirical validation

[1]Sevak Amrut Dhenge, [2]Arvind K Nandanwar and [3]Shivaji Limje

[1-2] Rani Avanti Bai Lodhi College of Agriculture and Research Station, Chhuikhadan (IGKV, Raipur), KCG, Chhattisgarh, India

[3] Pt. Shiv Kumar Shastri College of Agriculture and Research Station, Surgi, Rajnandgaon, Chhattisgarh, India

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Corresponding Author: Sevak Amrut Dhenge

Abstract

This study aimed to develop and validating a psychometric scale to measure the management orientation for commercial production of mango. The scale was developed by drawing upon findings from a previous research as well as understandings from a literature review on management orientation comprises planning, production and marketing. The theoretical framework used to collect the statements was validated by 66 experts from across the India. Reactions were analysed using relevancy, 't' value and determine the coefficient of reliability. The scale is a valid and reliable. 87 statements qualified the relevancy criteria. As per the 't' value outcomes, 31 statements were selected for the reliability test, the coefficient of reliability of scale was 0.8533. The three factors were finalized for management orientation: planning, production and marketing. The developed scale can help researchers, progressive mango growers, scientists and extension workers in improving the scientific management of mango orchards used to measure planning, production and marketing inefficiencies in view of commercial production. The results broaden the perspective that planning, production, and marketing have relative importance underlying management orientation. With their successful application for commercial production of mango, the farmers find managerial skills to realize higher profits. A number of instruments on management orientation are available but, no instrument has been rigorously validated for measuring the management orientation of commercial mango growers. This scale is the first validated psychometric scale that permits a quantitative assessment of the management orientation of commercial mango growers.

Keywords: Management, commercial, mango grower, scale development, validity, reliability

Introduction

Presently, the Indian agriculture sector is shifted from subsistence to profit-making business (Mahato *et al.* 2020) [58]. This profit-oriented agriculture can fulfill the economic well-being of the farmers. Mostly profit-oriented activities are being largely seen in an orchard growing crops compared to others, focusing on the market-driven production system (Mahato *et al.* 2020) [58]. Market-driven production systems require scientific orientation to know-how and field levels do-how and effective management of activities. Scientific orientation is a degree to using scientific methods (Mahato *et al.* 2020) [58]. Management is an interrelation of a managerial process like organizing inputs, collecting, coordinating activities, and controlling the process to improve the inputs' performance on output (Dhenge *et al.*, 2021) [98]. Scientific and management orientation is a psychological factor that leads to the decision-making process. Decision-making is a problem solving cognitive process resulting in the selection of course of action from the several available alternative possibilities (Adenegan Kemisola O *et al.* 2013) [2]. Furthermore, the success of any profit-oriented activities depends on the quality of the decision-making which can be divided into planning, implementation and control, which are the basic functions of business management. Higher price and quality outputs from the orchard-oriented business need effective and efficient management of farm activities, noble decisions and adoption of scientific methods (Porter 2008, 1991, 1985) [69, 71, 70], also increasingly determined by the advanced technology available and adoption (Wyn Morris *et al.* 2017) [96]. All of these impact on business growth and performance (McElwee, 2005; Maye *et al.*, 2009; Morgan *et al.*, 2010; Suess-Reyes and Fuetsch, 2016) [55, 54, 57, 88]. Orchards growers improve such psychological factors through involving and managing various orchard activities which meet the market demand (Levinthal and March 1993) [47]. Global and national level, commercial demand for the orchard production daily increases due to high-income potential, nutritional consciousness of people, urbanization, liberalization, globalization of the trade (Johnston and Mellor 1961) [39]. Most of the mango orchard growers operate various orchard management activities in a resource-constrained environment, lack of knowledge, inefficient skills and lack of financial capacity (Muyanga *et al.*, 2013; Wiggins *et al.*, 2011) [60, 95], lack of inter-functional integration, poor management skills and less use of business management tools, like planning, recording, monitoring and controlling at the farm level. These factors hinder the performance of desirable outputs in minimum use of inputs as well as help the farmers to improve competitiveness. They are considering this commercial or profit-oriented business, which requires careful planning of

all the physical inputs and management skills at the farm or individual level, also understanding the customers' demands, understanding same business management activities (Knight and Cross, 2012; Sheth, 2010) [43, 82], focus on inter-functional coordination and controlling of activities (Khanh Le Phi Hoa *et al.* 2018) [42], input use efficiency and efficient production methods addressing these and collectively perform towards a maximum potential. Commercial orchard management's most essential factor is the farmers' managerial ability in production, which effectively and functionally links land, labor, and capital Peter Nuthall 2009) [67], apart from input and output adjustments also includes strategic management, financial management, marketing, networking and negotiations and production management. Orchard management as a process works collaboratively with individual and groups level and farm inputs such as equipment, capital and technology (Jadav *et al.* 2007) [34], effective management has estimated technical and economic relationships (Griliches 1957; Mundluck 1961 and Dawson 1985) [28, 59, 19]. Therefore managerial skills are essential; they can shape the long-run efficiency of the orchard management attitudes and actions are important improve their technical efficiency or technology management, they can move towards production of higher value-added and higher yield of commodities (Ženka *et al.*, 2016; Sokolow, 2003) [97, 84].

The success of a commercial orchard of the mango largely depends on managerial ability which is a set of attributes of orchard growers should have to solve day-to-day orchards problems and gain from the available opportunities in a timely and efficient manner It indicates the ability of the commercial mango growers to take advantage of the higher profit. The personal and demographic attributes of the commercial mango growers, such as age, education, information-seeking behavior, knowledge, experience and training, can influence the technical efficiency of the orchard personal characters, motivating and techno-savvy factors can influence managerial ability. Similarly, adoption of advanced production practices, scientific management of orchard, activities planning in advanced and market decision and management are attributes of the management orientation of the commercial mango orchard growers. These attributes are necessary to understand before planting the orchard, production and marketing of products for a profit-making business.

Concepts of management orientation

Management orientation refers to the degree to which a commercial mango grower is oriented towards scientific management of mango crops that is, towards planning, production, and marketing. Farmers are higher management orientation led to higher economic performance (Rannorey 1979) [76], managerial ability has is an essential implication for farm growth (Alvorezand Arias 2003) [3]. The mango grower's activity towards attaining higher output with the optimal use and effective management of available resources (Rahman *et al.*, 2019) [56].

Planning

Planning is thinking carefully and deciding how and when you will do it (Longman 2007) [51], the method worked out in advance for the accomplishment of an objective (Dictionary.com,) problem-solving activity (Udemezue J. C. 2018) [92], solving the problems between existing and future (Udemezue J. C. 2018) [92], choosing among various options to reach those destinations. According to Waldron *et al.* (1997) [94] four major types of planning, i.e., strategic, tactical, contingency and managerial. Top management uses strategic planning to determine goals and the activities to achieve them and associated with higher performance. Tactical planning is used in middle and lower management. Contingency planning addresses future problems and issues as cited by Waldron *et al.*, 1997) [94]. Fourth, managerial planning is considered micro-level planning that helps link resources to fulfill the overall objectives. Planning is very essential before setting the any commercial orientated activities. Mango orchard growers have applying all types of planning for earning more from the orchards. It can helps for effective management and use of all inputs like, implements, capital and labors. The performance of the plans on output is found positive it also found that positive relationship between that planning and growth of the business. It is crucial for achieving the marketing objectives.

Production

The main goal of production is to produce the quality of outputs in a certain amount of time (Hung *et al.* 1996) [33]. Production planning directly links the market (Bertrand *et al.* 1999) [14]. The production plan is prepared for the organization in a certain period within a specific time for desirable outputs (Elewa *et al.* 2019) [24]. Production management is a technique that processes inputs into final outputs in an organized way to give the maximum profit (Elewa *et al.* 2019) [24]. The outputs of any economic entity depend on the efficiency of their production. Scientific management of all farm activities related to applying inputs that produced higher yields from the farm (Rahman *et al.* 2019) [56]. The effective management of the orchard earning high return from a production process (Bora 1986) [15]. The essential component of managing production truthfully is adopting appropriate available technology for production because attributes of the technology can influence farm productivity and profitability. The profitability of different commercial producers depends on technology adoption. In extensive commercial mango cultivation countries, commercial production of mango scientific management practices adoption rate seen is high with innovative approaches in the production environment. Considering the production orientation, for getting higher output with quality of produce required to plan and changes made in the production process in time to time with scientifically.

Marketing

The developing linkages between the farmers and market are essential for increasing the purchasing power for moving incomes to high-value crops (Davis, 2006) [18] when they have actively participated in the market. Market orientation (MO) is the degree to which producer is oriented towards efficient management of their firm by adopting the marketing decisions (Jaworski & Kohli, 1993, 1996; Kohli&Jaworski, 1990) [8, 44]. Market orientation of farmers is an indication of agriculture commercialization. Market-oriented production management and networking intelligence about current and future customer needs

(Adenegan *et al.* 2013) [2] can benefit farmers for solving operational problems and providing market updates. This innovativeness positively impacted productivity increasing competitive capacity, and enhancing financial return (Kohli and Jaworski, 1990; Narvera and Slater, 1990) [44, 62], key ingredients to agricultural transformation (Johnston and Mellor, 1961; Johnston, 1970) [42, 41], a major determinant of competitive advantage (Fritz, 1996; Selnes *et al.*, 1996) [26, 78], newly diversified product (Atuahene-Gima, 1995) [7], increased sales revenue (Greenley, 1995, Jaworski and Kohli, 1993) [27, 8]. Psychological aspects which severely restrict the market orientation of individuals and organizations towards development and performance high cost of inputs, high transportation costs, high labor wages, lack of technical knowledge, and inappropriate market price information, lack of inter-functional integration; weak management skills strategies, structures and systems Jaworski and Kohli, 1993; [8] are the potential barriers to developing market and getting a higher price (Sharma *et al.*, 2012) [19]. Commercial mango growers are carrying all the activities on their farm as managers. Their main aim is the production system to get a higher return. Commercially production of mango crop is a high investment-oriented agribusiness; it needs efficient and effective management skills and knowledge to get high economic returns consistently (Deshmukh *et al.* 2017) [20]. India is the world's leading mango-producing country. The major mango-producing countries are Brazil, Indonesia, Egypt, Mexico, Thailand, and China. Mango productivity is 18.87 Tonnes/ha, 16.59 Tonnes/ha, 14.16 Tonnes/ha, 12.56 Tonnes/ha, 11.03 Tonnes/ha, and 10.25 Tonnes/ha in Brazil, Indonesia, Egypt, Mexico, Thailand, and China, respectively. Mango productivity in India is 8.12 tonnes per hectare (FAOSTAT, 2016). Given the fact that Maharashtra is one of India's mango-producing states. Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Haryana, Assam, Bihar, Andhra Pradesh, Karnataka, and Telangana are the top mango-producing states in India. In Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Haryana, Assam, Bihar, Andhra Pradesh, Karnataka, and Telangana, mango productivity is 17.14 M.T./ha, 16.84 M.T./ha, 16.50 M.T. /ha, 12.33 M.T. /ha, 11.65 M.T. /ha, 10.48 M.T. /ha, 9.82 M.T. /ha, 9. Mango productivity in Maharashtra is just 3.28 M.T./ha, which is low when compared to other states in the country (Horticulture statistics at a glance 2017). Mango is grown on 157070 ha in Maharashtra, with an annual production of 514870 M.T. and a productivity of 3.28 M.T./ha (Source: Horticulture statistics at a glance 2017). The Konkan region of Maharashtra state is one of the main mango growing belts in the country, accounting for about 10% of the total mango area in the country, with 1,09,894.30 hectares under mango cultivation and an annual yield of 1,34,824.5 M.T. Mango productivity in Konkan is at 1.22 M.T. /ha, which is three to four times lower than the national average (Source: Hapis) (2014-15). Management skills and technical knowledge are highly significant parts of mango crop management in order to bring together the various factors of production and coordinate them toward increased production. Under the escalating pressure of rising costs and vagaries, management is the crucial and demanding aspect influencing the performance of commercial production. Commercial production of mango crop demands special care and managerial skills to realize higher profits. It is not worth growing mango unless the profits are commensurate with the farmers' efforts. Hence, economic motivation also forms an important dimension of any study related to the commercial production of mango crop. For that reason, we have developed a scale with 31items respective three major dimensions. The main aim of this research is to develop a scale to measure management orientation (MOS) of the commercial mango growers. Management orientation has psychological dimensions and scales may reflect those dimensions.

Purpose

The purpose of this investigation is to design to develop psychological state measuring instrument for commercial mango growers reflecting the management orientation. Literature noted that many research papers had been published about students, researchers and faculties understanding the managerial ability, attitudes, managerial efficiency, perceptions, of the commercial mango growers, and measured the knowledge and adoption of scientific mango cultivation practices. Most researchers focused on developing scales on commercial mango growers. However, in the previous works, no scale was found to measure management orientation of commercial mango growers'. Therefore, to address this gap in this research field. The research and development activities were designed to utilize “management orientation" identified through this study base as primary instrument content. A further, developed a response format for the instrument items that requires commercial mango growers to make judgments about scientific management of mango orchard in terms of the "management orientation". The developed instrument formats that require comparative judgments or ratings using *Likert*ratingscale i.e. *Agree, Undecided, and Disagree.* Initial estimates ofcontent and construct validity, relevancy, item analysisand test/retest reliability for the instrument were also a focus of the study (Fig.3).

Literature Review

To understand the scale development processes for measuring the psychological state of the human towards things, places or objects. The various researchers measure it through their studies are summaries in Table 1

Table 1: Summaries of studies developed scale for psychological item measurement

Sr. No.	Study	Factors investigated	Scale used	Statement	Reliability	Country	Context
1.	Adem (2019) [1]	Attitude	Likert-type	21	0.95	Turkey	Science
2.	Argade *et al.* (2015) [5]	Perception	Likert-type	15	0.86	India	Integrated Farming Systems
3.	Bashir and Bala (2019) [11]	Anomie	Likert-type	21	0.89	India	Indian students
4.	Bunker *et al.* (2013) [16]	Attitude	Likert-type	38	0.79	India	Beneficiary farmers towards drip irrigation technology

5.	Chand and Sharma (2014) [17]	Attitude	Likert-type	8	0.84	India	Dairy farmers towards rearing of Murrah buffalo
6.	Esakkimuthu and Kameswari (2015) [25]	Entrepreneurial potential	Likert-type	30	0.82	India	Beekeepers
7.	Jaisridhar *et al.* (2013) [35]	Attitude	Likert-type	34	0.98	India	Dairy Farmers towards Kisan Call Centre Based Extension Services
8.	Jha (2009) [37]	Attitude	Likert-type	22	-	India	Social Forestry
9.	JyotiYadav (2015) [40]	Attitude	Likert-type	12	0.70	India	Veterinary Officers and Livestock Extension officers
10.	Kadiri *et al.* (2012) [41]	Attitude	Likert-type	24	0.76	India	Participatory irrigation management approach
11.	LatikaVyas *et al.* (2009 & 2010) [93]	Attitude	Likert-type	24	0.97	India	Tribal women towards vermiculture technology
12.	Logan and Ellett (1988) [50]	Evaluation Instrument	Likert-type	35	0.82	USA	Generic teaching skills and student learning
13.	Mahadik *et al.* (2014) [52]	Attitude	Likert-type	20	0.74	India	Mango orchardists towards eco-friendly management practices of mango
14.	Mahaliyanaarachchi *et al.* (2006) [53]	Attitude	-	30	0.60	Sri Lanka	Commercialization of
15.	Nagesh and Meti (2016) [61]	Attitude	Likert-type	29	0.81	India	BhoochetanaProgramme
16.	Negussie *et al.* (2009) [64]	Attitude	Likert-type	12	0.70	Ethiopia	Complete ownership of farmland
17.	Patel *et al.* (2007) [66]	Attitude	Equal appearing interval	16	0.72	India	Integrated Pest Management
18.	Ravikishore and Seema (2017) [77]	Attitude	Likert-type	18	0.79	India	Extension professionals towards technology dissemination system of State Department of Agriculture (SDA)
19.	Raja *et al.* (2013) [72]	Attitude	Likert-type	50	0.63	India	Information and communication technology
20.	Rajasekar and Dineshan (2012) [73]	Attitude	Likert-type	37	0.94	India	Use of ICT in teaching
21.	Rakesh Kumar *et al.* (2015) [75]	Attitude	Likert-type	16	096	India	Rapeseed Mustard Crop
22.	Sivaraj *et al.* (2016) [83]	Attitude	Equal Appearing Interval	10	0.80	India	Organic farming
23.	Srinivas *et al.* (2018) [85]	Attitude	Equal appearing interval	25	0.79	India	Tribal farmers towards seed banking
24.	Subrahmanyeswari an Chander (2008) [87]	Attitude	Likert-type	21	0.73	India	Organic farmers towards organic livestock farming
25.	SeydaGul (2017) [79]	Attitude	Likert-type	36	0.93	Turkey	Undergraduate students' towards Nano-biotechnology
26.	Thakur *et al.* 2017 [89]	Attitude	Likert-type	16	0.76	India	Farmers towards Social Media Use in Agricultural Extension

Methodology: The investigation was conducted as part of doctoral degree research. In this research, two studies were conducted, i.e., expert opinion for scale development before the final survey after responses were recorded from the sample area as a final survey.

Research Design: The method of scale development was initiated based on the previously published studies, literature, the guidelines after reviewing critically. Thurstone's method of equal-appearing intervals, Likert summated rating scale, semantic differential scales, Guttman Scale and Bogardus scale etc. these scales are developed for measuring the psychological mindset of the respondents (Kadiri and Reddy 2012) [41]. In this study, the Likert Method of Summated Ratings (Likert's Technique, 1932) [48] was followed with certain modifications (Subrahmanyeswari, B and M. Chander 2008) [87] that would be more beneficial for the study to ensure easy compilation and generalization. Likert-type scales statements will have high reliability (Hall 1934) [29]. The following steps were considered for the development of the management orientation scale (Fig.1);

Collection of management orientation stimuli

The first step in developing a management orientation scale is to collect the statements related to the management orientation of commercial mango growers in planning, production and marketing. During the collection of stimuli, care is taken to include positive and negative statements in the list (Argade *et al.*, 2015) [5] as such a large number of statements covering the entire universe of content was collected from available literature and thorough discussion with the experts in the fields of horticulture, agricultural extension and progressive farmers. A battery of tentative 120 statements representing the management orientation of commercial mango growers was drafted under planning, production and marketing components.

Editing of stimuli/items

The collected statements were carefully examined, and each statement was edited as per the 14 informal criteria suggested by Thurstone & Chave (1929) [90], Edwards and Kilpatrick (1948) [21] and Edwards (1969) [22] (Fig.2) used by (Kadiri and Reddy 2012) [41]. As a result of 18 statements were eliminated. Finally, 102 statements that satisfied the criteria were selected and considered for expert judgment.

Judges Responses and Item selections

The performa containing 102 statements on three-point continuums, i.e. 'most relevant,' 'relevant' and 'least relevant,' was sent by post, through e-mail and handed over personally to the total of 140 judges. These judges were experts in Extension Education, Horticulture, Agricultural Economics and Progressive Farmers. The judges were requested to indicate appropriateness (relevancy) response ticking of each statement for inclusion in the scale. Also, the judges were requested to make necessary modifications and additions or deletions if they desired. Out of 140 judges, 66 judges responses were obtained on a three-point continuum *viz.*, 'most relevant,' 'relevant' and 'least relevant' with scores of 3, 2 and 1 for positive statements, respectively and 1, 2, 3 for negative statements, respectively, in a stipulated span of 2 months. Based on obtained 66 judges' responses of, the scoring and analysis of the items was done.

Relevancy test

All the obtained judge's responses may not be equally relevant (Thakur *et al.*, 2017) [89] in measuring the management orientation of the commercial mango growers. Henceforth, these statements were subjected to scrutiny by an expert panel to determine the relevancy and screening for final inclusion in the scale. From the data so gathered, relevancy percent, relevancy weightage and mean relevancy score was worked out for all the 102 items individually, using the formulae given by Edward (1969) [22] in the following formula,

Relevancy Percent

It worked out by summing up the scores of 'most relevant,' 'relevant,' and 'least relevant' responses and was converted into percent.

$$\text{Relevancy Percentage} = \frac{\text{MR}\times 3+\text{R}\times 2+\text{LR}\times 1}{198\,(\text{i.e Number of judges } 66\times 3)} x100$$

Where,
MRR = Most relevant response
RR = Relevant response
LRR = Least relevant response

Relevancy weightage

It is the ratio of actual score obtained to the maximum possible scores for each statement.

$$\text{Relevancy weightage} = \frac{\text{MR}\times 3+\text{R}\times 2+\text{LR}\times 1}{198\,(\text{i.e. Number of judges } 66\times 3)}$$

Where,
MRR = Most relevant response
RR = Relevant response
LRR = Least relevant response

Mean relevancy score

It is the ratio of actual scores obtained by each respondent to the number of judges who responded for the variable.
Mean relevancy score =

$$\frac{\text{MR}\times 3+\text{R}\times 2+\text{LR}\times 1}{\text{Number of judges (i.e. 66)}}$$

Where,
MRR = Most relevant response
RR = Relevant response
LRR = Least relevant response

Using these three criteria, the items were screened for their relevancy. Accordingly, items with a relevancy percent of more than 66, relevancy weightage of more than 0.66 and a mean relevancy score of more than two were considered for final selection (Thakur *et al.*, 2017) [89]. Thus, finally, 87 statements were selected in the first stage and suitably modified and rewritten as per the experts' comments.

Table 2: Selection of statements based on Relevancy Percentage (RP), Relevancy Weightage (RW) and Most Relevancy Score (MRS) score

Sl. No.	Statements	Rating ratings		
		RP	RW	MRS
A.	**Planning**			
1.	Participation in Farmers Scientist Forum helps in better planning for commercial mango production.	88.38	0.88	2.65
2.	Frequent visits to mango research station is helpful in planning for commercial mango production.	83.83	0.83	2.51
3.	It is unnecessary to study the availability of infrastructure facilities while planning for commercial mango production	80.30	0.80	2.40
4.	One should plan and maintain appropriate farm records for commercial mango production.	83.33	0.83	2.50
5.	It is necessary to prepare a plan for rejuvenation of old mango orchard.	75.25	0.75	2.25

6.	It is inappropriate to prepare the annual budget for commercial mango production.	79.29	0.79	2.37
7.	One should prepare a plan for proper utilization of funds.	80.80	0.80	2.42
8.	It is necessary to think about the management of mango orchard for export of fruits.	80.30	0.80	2.40
9.	It is necessary to work out in advance the quantity of inputs required for commercial mango production.	79.79	0.79	2.39
10.	One should have knowledge of Government Schemes implemented to promote commercial mango production.	77.27	0.77	2.21
11.	It is unnecessary to prepare calendar of operations for better management of mango crop.	83.27	0.83	2.51
12.	One should prepare for availing the benefit of Crop Insurance Scheme to cope up with crop failure due to natural disasters.	81.56	0.81	2.56
13.	One should analyses the reasons for varying financial outcomes in the past and plan remedial measures.	78.59	0.78	2.31
14.	One should work out in advance the requirement for human labour.	73.26	0.73	2.21
15.	One should think in advance about the intercrops that can be grown in orchard.	73.23	0.73	2.19
16.	One should think of innovative ideas to earn more money from the mango orchard.	81.31	0.81	2.43
17.	One should think about protection of mango orchard from wild animals and wild fire.	74.24	0.74	2.22
18.	It is necessary to think ahead about financial requirements for commercial mango production.	76.20	0.76	2.31
19.	Working out season wise water requirement for commercial mango production is very essential.	79.79	0.79	2.39
20.	It is unnecessary to study the available resources and facilities in the area before undertaking new plantation.	80.30	0.80	2.40
21.	It is necessary to understand the consumers' preference before plantation.	81.56	0.81	2.50
22.	One should collect the information about institutions/persons engaged in marketing of mango.	82.74	0.82	2.48
23.	It is necessary to select institution/person giving maximum profit through sale of mango fruits.	81.31	0.81	2.48
24.	One should decide in advance the marketing channels that will maximum profit.	84.34	0.84	2.89
25.	One should use various sources for collecting market information.	78.51	0.78	2.65
B.	**Production**			
1.	Planting of 10 to 15% Keasar, Ratna, Sindhu or GoaMankur varieties in Alphonso mango orchard helps in better pollination.	77.42	0.77	3.00
2.	One should adopt preventive measures for nutrient deficiency, insect/pest infestation and disease attack.	83.67	0.83	2.41
3.	Irrigating the plants after fruit set reduces fruits drop.	77.27	0.77	2.31
4.	Apiculture in mango orchard helps in better pollination.	80.80	0.80	2.42
5.	Application of fertilizers after removing the weeds helps in better uptake of nutrients by the mango plants.	82.82	0.82	2.49
6.	Timely application of the inputs reduce higher production of mango.	90.40	0.90	2.71
7.	Bagging of fruits on trees with newspaper maintains fruit quality.	77.27	0.77	2.31
8.	One should apply bordeaux paste on mango stem to protect the tress from sun scorching.	76.89	0.76	2.30
9.	Fertilizers should be applied by ring method.	87.67	0.87	2.67
10.	Growth regulators should be used as recommended by the Scientists.	87.67	0.87	2.67
11.	Integrated Nutrient Management is reduces yield.	86.31	0.86	2.72
12.	Intercultural operations in mango orchard reduce weed infestation.	82.32	0.32	2.62
13.	One should irrigate the crop as per recommendations.	82.82	0.82	2.84
14.	Recommended mango blossom protection schedule should be followed.	85.35	0.85	2.56
15.	One should provide support of bamboo sticks during fruiting stage to prevent lodging of branches.	76.76	0.76	2.31
16.	One should apply paclobutrazol at proper stage by proper method.	76.26	0.76	2.29
17.	One should use 'Amar Loranthus Cutter' for removal of loranthus.	72.27	0.72	2.18
18.	One should use 'Nutan mango harvester' for proper harvesting of fruits.	74.34	0.74	2.61
19.	One should use 'Rakshak' pheromone trap for controlling fruit fly.	80.30	0.80	2.40
20.	One should use light trap for controlling leaf hoppers.	81.31	0.81	2.43
21.	Organically produced mango gets more price in the market.	83.33	0.83	2.50
22.	Paclobutrazol plays a significant role in regular and early bearing of mango.	78.28	0.78	2.34
23.	Proper care of mango at flowering stage gives more yield.	81.81	0.81	2.45
24.	Pruning (centre opening) helps to increase mango production.	78.94	0.78	2.36
25.	Pruning helps to reduce insect-pest infestation.	71.38	0.71	2.15
26.	One should remove unnecessary branches for effective canopy management.	75.25	0.75	2.25
27.	Soil testing is wastage of money on fertilizer consumption.	76.76	0.76	2.30
28.	Spraying of gibberalic acid helps in reducing recurrent flowering.	75.24	0.75	2.87
29.	Spraying of Urea reduces fruit drop in mango.	68.68	0.68	2.06
30.	One should raise live wind breaks to protect mango orchards.	72.22	0.72	2.16
31.	Green manuring improves physical condition of soil.	82.32	0.82	2.37
32.	Use of improved machinery saves expenditure on labourers.	75.25	0.75	2.25
33.	Use of IPM technology reduces inputs cost	80.80	0.80	2.42
34	One should cultivate the varieties as decided.	67.67	0.67	2.03
35.	Seeking advice from extension personnel helps in solving field problems.	77.82	0.77	2.79
C.	**Marketing**			

1.	One can get good price by grading of fruits.	90.90	0.90	2.72
2.	Collecting the required information about markets e.g. demand, quality, rate etc. helps in better marketing.	85.35	0.85	2.56
3.	It is unnecessary to contacts with various marketing agencies for seeking market update information.	85.37	0.85	2.84
4.	Harvesting of fruits at proper time is deteriorate good quality.	87.87	0.87	2.63
5.	Harvesting of fruits with stalk reduces post-harvest spoilage.	83.33	0.83	2.50
6.	One should not select damaged fruits for marketing.	82.32	0.82	2.32
7.	Co-operatives can help the commercial mango growers to get better price for produce.	76.26	0.76	2.28
8.	It is ineffectual to acquire phytosanitory certificate for export of fruits.	84.34	0.84	2.543
9.	One should regularly clean the harvesting crates/containers.	80.80	0.80	2.42
10.	One should harvest mango fruits at 85% maturity stage.	81.81	0.81	2.54
11.	One should harvest the fruits before 10 am or after 4 pm.	78.63	0.78	2.96
12.	One should harvest the mango fruits as per demand in market.	74.24	0.74	2.24
13.	One should pack the fruits on table instead of floor to avoid contamination.	72.22	0.72	2.16
14.	One should sell his produce by collecting information on various market channels.	83.33	0.83	2.50
15.	One should sell his produce in attractive packaging.	85.85	0.85	2.59
16.	One should transport his produce at night.	68.18	0.68	2.08
17.	Transportation of produce by train reduces transportation cost.	72.72	0.72	2.19
18.	One should use newspaper or tissue paper (coloured) in the boxes to avoid direct contact of fruits.	80.30	0.80	2.40
19.	One should use online marketing channel for fast sale of produce.	81.87	0.81	2.90
20.	One should use paddy straw with paper wrapping during transportation for avoiding damage of fruits.	83.83	0.83	2.84
21.	One should use plastic crates during harvesting to reduce handling losses.	84.52	0.84	2.81
22.	Wooden boxes are very economical than corrugated boxes for packaging of fruits.	76.80	0.76	2.12
23.	Monitoring of market information is wastage of time for better marketing.	75.59	0.75	2.68
24.	Proper handling of fruits after harvesting maintains quality of fruits.	79.69	0.79	2.41
25.	Cold storage help the commercial mango growers to get better prices for their produce.	80.30	0.80	2.30
26.	One should follow the marketing systems as decided.	71.71	0.71	2.13
27	One should undertake grading of mango fruits.	81.89	0.81	2.92

Item analysis

Item analysis is an important step while constructing a valid and reliable scale. Final selection of the items made based on item analysis. It was considered essential to delineate the items (statements) based on how they can differentiate the person's management orientation; for this purpose, item analysis was carried out. The statements were administered through personal interviews to 40 mango growers from the non-sample area. The respondents were asked to indicate the degree of agreement on a three-point continuum, namely agree, undecided and disagree, with the weights of 3, 2, 1 for positive statements, respectively and 1, 2, 3 for negative statements, respectively. The management orientation score was obtained by summing up the scores of all items of each component given by the individual judge.

Calculation of 't' values

Item analysis was carried out by 't-test.' Thus, the total score obtained by each respondent was calculated component-wise, i.e., planning, production and marketing ranging from '50 to '75', '57 to 93' and '47' to '69' respectively and the scores of respondents were arranged in the descending order. For item analysis, 25 percent of the respondents with the highest total scores and 25 percent with the lowest total scores were selected. Thus, out of 40 farmers to whom the items were administered for the item analysis, 15 farmers with the lowest, 15 with highest scores were used as criterion groups to evaluate individual items. These two groups provided the criterion groups for which item analysis was conducted. The 't' value (critical ratio), a measure of the extent to which a given statement differentiates between high and low groups of subjects for each statement, was calculated using the formula given by Edwards (1969) [22].

$$t = \frac{\overline{X}_H - \overline{X}_L}{\sqrt{\frac{\Sigma(X_H - \overline{X}_H)^2 + \Sigma(X_L - \overline{X}_L)^2}{n-(n-1)}}}$$

$$\Sigma(X_H - \overline{X}_H)^2 = \Sigma X_H^2 - \frac{(\Sigma X_H)^2}{n}$$

and

$$\Sigma(X_L - \overline{X}_L)^2 = \Sigma X_L^2 - \frac{(\Sigma X_L)^2}{n}$$

$\sum XH^2$ = sum of the squares of the individual scores in the high group

$\sum XL^2$ = sum of the squares of the individual scores in the low group

$\overline{X_H}$ = mean score on a given statement for the high group

$\overline{X_L}$ = mean score on a given statement for the low group

n = number of respondents in each group

The 't' value measures the extent to which a given group to a statement differs significantly (Argade *et al.*, 2015) [5]. The 't' value equal to or greater than 1.75 indicates that the average response of the high and low groups differs significantly and differentiates between high and low groups. The statements having 't' value equal to or greater than 1.75 were selected; finally, 31 statements were included in the final scale.

Table 3: Selected statements for final scale development with their respective 't' values.

Sl. No.	Statements	't' value
A.	**Planning**	
1.	Frequent visits to mango research station is helpful in planning for commercial mango production.	3.76
2.	It is unnecessary to study the availability of infrastructure facilities while planning for commercial mango production	2.78
3.	One should plan and maintain appropriate farm records for commercial mango production.	3.22
4.	It is inappropriate to prepare the annual budget for commercial mango production.	3.10
5.	It is necessary to think ahead about the management of mango orchard for export of fruits.	3.69
6.	It is unnecessary to prepare calendar of operations for better management of mango crop.	3.11
7.	One should prepare for availing the benefit of Crop Insurance Scheme to cope up with crop failure due to natural disasters.	4.10
8.	One should analyses the reasons for varying financial outcomes in the past and plan remedial measures.	3.07
9.	One should think of innovative ideas to earn more money from the mango orchard.	2.89
10.	It is unnecessary to study the available resources and facilities in the area before undertaking new plantation.	3.55
11	It is necessary to select institution/person giving maximum profit through sale of mango fruits.	3.39
B.	**Production**	
1.	Planting of 10 to 15% Keasar, Ratna, Sindhu or GoaMankur varieties in Alphonso mango orchard helps in better pollination.	8.68
2.	One should adopt preventive measures for nutrient deficiency, insect/pest infestation and disease attack.	6.97
3.	Timely application of the inputs reduce higher production of mango.	2.69
4.	Growth regulators should be used as recommended by the Scientists.	6.42
5.	Integrated Nutrient Management is reduces yield.	2.70
6.	Intercultural operations in mango orchard reduce weed infestation.	4.00
7.	Recommended mango blossom protection schedule should be followed.	3.12
8.	Soil testing is wastage of money on fertilizer consumption.	3.68
9.	Use of improved machinery saves expenditure on labourers.	3.36
10.	Seeking advice from extension personnel helps in solving field problems.	2.36
C.	**Marketing**	
1.	One can get good price by grading of fruits.	4.03
2.	It is unnecessary to contacts with various marketing agencies for seeking market update information.	1.89
3.	Collecting the required information about markets e.g. demand, quality, rate etc. helps in better marketing	3.12
4.	Harvesting of fruits at proper time is deteriorate good quality.	3.91
5.	Co-operatives can help the mango growers to get better price for produce.	3.21
6.	It is ineffectual to acquire phytosanitory certificate for export of fruits.	3.66
7.	One should sell his produce in attractive packaging.	4.12
8.	One should use newspaper or tissue paper (coloured) in the boxes to avoid direct contact of fruits.	3.17
9.	Monitoring of market information is wastage of time for better marketing.	3.44
10.	Cold storage help the commercial mango growers to get better prices for their produce.	3.17

Standardization of the scale

The scale developed was further standardized by establishing its reliability and validity. The validity and reliability were ascertained for the standardization of the scale. The reliability and validity were measured 'test-retest method and content validity, respectively.

Reliability

Reliability is the ability of a test instrument to yield consistent results from one set of measures to another (Thakur *et al.*, 2017) [89]; scale is reliable when it gives consistently the same results when applied to the same sample (Argade *et al.*, 2015) [5], is the accuracy or precision of a measuring instrument. A scale is reliable when it consistently produces the same results when applied to measure the same phenomenon from time to time. For this study, the test-retest method of Test-retest method reliability was used.

Test retest method

The final set of 31 statements that represent the management orientation of commercial mango growers was administered to the 30 commercial mango growers (12.5% of the actual sample size for the study), who was neither previously contacted nor had a chance to come in the final sample (non-sample area). After 15 days, the same 30 commercial mango growers were given the test. Two sets of scale scores were thus obtained (table 3). Each of the two sets of statements was treated as a different scale, and then these two subscales were correlated. The reliability coefficient was calculated following Rulon's formula (Guilford, 1954). The reliability coefficient of the whole scale was 0.8533, which found significant and positive indicated that the whole scale was reliable, precise, accurate and can be used for measurement (Kadiri and Reddy 2012) [41].

Rulon's Formula

$$rtt = 1 - \frac{\sigma^2 d}{\sigma^2 t}$$

Where;

$$\sigma^2 d = \frac{\sum d^2 - \frac{(\sum d)^2}{30}}{30}$$

$$\sigma^2 t = \frac{\sum t^2 - \frac{(\sum t)^2}{30}}{30}$$

Calculations:

$$\sum d = 65$$

$$\sum d^2 = 255$$

$$t = 5335$$

$$\sum t^2 = 949519$$

$$n = 30$$

$$\sigma^2 d = \frac{255 - \frac{(65)^2}{30}}{30}$$

$$\sigma^2 d = 3.8055$$

$$\sigma^2 t = \frac{949519 - \frac{(5335)^2}{30}}{30}$$

$$\sigma^2 t = 25.9389$$

$$rtt = 1 - \frac{3.8055}{25.9389}$$

$$rtt = 0.8533$$

Table 4: Test retest method score

Sr. No.	First set	After 15 Days	D	d 2	T	t2
	X1	X2	X1 - X2	d x d	X1 + X2	T x t
1.	92	91	1	1	183	33489
2.	93	90	3	9	183	33489
3.	91	91	0	0	182	33124
4.	90	89	1	1	179	32041
5.	92	87	5	25	179	32041
6.	91	91	0	0	182	33124
7.	89	84	5	25	173	29929
8.	93	91	2	4	184	33856
9.	88	85	3	9	173	29929
10.	91	90	1	1	181	32761
11.	89	84	5	25	173	29929
12.	92	91	1	1	183	33489
13.	87	83	4	16	170	28900
14.	92	90	2	4	182	33124
15.	87	84	3	9	171	29241
16.	90	90	0	0	180	32400
17.	86	86	0	0	172	29584
18.	88	83	5	25	171	29241
19.	92	90	2	4	182	33124
20.	90	89	1	1	179	32041
21.	92	84	8	64	176	30976
22.	89	89	0	0	178	31684
23.	86	85	1	1	171	29241
24.	91	90	1	1	181	32761
25.	92	89	3	9	181	32761
26.	93	93	0	0	186	34596
27.	90	87	3	9	177	31329
28.	91	90	1	1	181	32761
29.	84	81	3	9	165	27225
30.	89	88	1	1	177	31329
Total	2700	2635	65	255	5335	949519

Validity of the scale

The reliability scale of management orientation content validity of the scale was tested. Content validity is the representativeness of sampling adequacy, the content, the substance, the matter and the topics of measuring instrument (Kerlinger 1976). Experts' judgment tested the scale content validity (Argade *et al.*, 2015) [5], used in the present scale to determine its content validity. The content of the management orientation scale was thoroughly covered through a literature scan and expert opinions. It means the extent to which the items included in the test represent the total universe of the content. It was ensured while framing the items collected from the available books, journals, relevant literature, and interviews with scientists, experts, and progressive farmers. The scale content validity was ensured by selecting the contents after discussion with specialists of extension and academicians. Thus, the scale value difference for all the statements has a high discriminating value, and it seems reasonable to accept the scale as a valid measurement ((Thakur *et al.*, 2017) [89]. The calculated "t" value is significant for all the finalized statements of the score indicated that the management orientation statements of the scale had discriminating values.

Administering the developed scale

The respondents were asked to express their opinions of agree, undecided and disagree concerning each of the 31 items included in the scale (Fig. 4). There are three components in the scale, planning components out of 11 statements, statement numbers 1, 3, 6 and 9 are the negative and rests are positive, production out of ten statements, statement number 3, 6 and 10 are the negative and rests are positive and marketing components out ten statements, statement number 3, 5, 6 and 9 are the negative and rests are positive. A three-point continuum collected the responses, namely ‘agree,’ ‘undecided,’ and ‘disagree’ with a score of assigned 3, 2 and 1, respectively, for positive statements and 1, 2 and 3 for negative statements, respectively. The overall possible maximum and minimum score ranges between 93 to 31. A high score will indicate that the respondent will have a high management orientation.

Table 5: Standardized scale to measure the management

Sr. No.	Component/Statements	A	U	D
A.	**Planning**			
1.	It is unnecessary to study the availability of infrastructure facilities while planning for commercial mango production*****			
2.	One should plan and maintain appropriate farm records for commercial mango production			
3.	It is inappropriate to prepare the annual budget for commercial mango production*****			
4.	It is necessary to think about the management of mango orchard for export of fruits			
5.	Frequent visits to mango research station is helpful in planning for commercial mango production			
6.	It is unnecessary to prepare calendar of operations for better management of mango crop*****			
7.	One should prepare for availing benefit of Crop Insurance Scheme to cope up with crop failure due to natural disasters			
8.	One should analyses the reasons for varying financial outcomes in the past and plan remedial measures			
9.	It is unnecessary to study the available resources and facilities in the area before undertaking new plantation*****			
10.	One should think of innovative ideas to earn more money from the mango orchard			
11.	It is necessary to select institution/person giving proper guidance for maximum profit through sale of mango fruits			
B.	**Production**			
1.	Planting of 10 to 15% Keasar, Ratna, Sindhu or GoaMankur varieties in Alphonso mango orchard helps in better pollination			
2.	One should adopt preventive measures for nutrient deficiency, insect/pest infestation and disease attack			
3.	Timely application of the inputs reduce higher production of mango*****			
4.	Seeking advice from extension personnel helps in solving field problems			
5.	Growth regulators should be used as recommended by the Scientists			
6.	Integrated Nutrient Management is reduces yield*****			
7.	Intercultural operations in mango orchard reduce weed infestation			
8.	Recommended mango blossom protection schedule should be followed			
9.	Use of improved machinery saves expenditure on labourers			
10.	Soil testing is wastage of money on fertilizer consumption*****			
C.	**Marketing**			
1.	One can get good price by grading of fruits			
2.	Collecting the required I nformation about markets e.g. demand, quality, rate etc. helps in better marketing			
3.	Harvesting of fruits at proper time is deteriorate good quality*****			
4.	Co-operatives can help the commercial mango growers to get better price for produce.			
5.	It is ineffectual to acquire phytosanitory certificate for export of fruits*****			
6.	It is unnecessary to contacts with various marketing agencies for seeking market update information*****			
7.	One should sell his produce in attractive packaging			
8.	One should use newspaper or tissue paper (coloured) in the boxes to avoid direct contact of fruits			
9.	Monitoring of market information is wastage of time for better marketing*			
10.	Cold storage help the commercial mango growers to get better prices for their produce.			

*****Negative Statement, A- Agree, UD-Undecided, DA-Disagree

Discussion

The present investigation focused on developing and validating a scale that could measure the management orientation of commercial mango growers. The developed scale consists of three components were planned based on a comprehensive literature review and experts discussion. One hundred twenty statements representing the management orientation of commercial mango growers were drafted under panning, production and marketing. Out of 120 statements, 102 were selected for further process those were satisfied the Edwards (1969) [22], fourteen informal criteria. The selected statements were sent to 140 judges for determining the relevancy. After two months, 66 judges were returned based on the relevancy of each item were calculated by relevancy percent (66), relevancy weightage (0.66), and mean relevancy score of more than 2. Three components analysis, planning (33 out of 25), production (35 out of 35) and marketing (34 out of 27) that qualify the relevancy criteria, a total of 87 were statements were selected for further process. T-test' was used for 40 commercial mango growers from the non-sample area through direct interview. Out of 40, 15 farmers with lowest, 15 with highest scores were used as criterion groups to evaluate individual items. Finally, the statements, planning (25 out of 11), production (35 out of 10) and marketing (27 out of 10) having 't' value equal to or greater than 1.75 were, selected for the reliability test. According to the, a new scale with 31 items to measure management orientation was developed. After fifteen days, a survey was carried out with 30 commercial mango growers as a test-retest method of reliability, 12.5% of the sample size for the study, who were neither previously contacted. The coefficient of reliability 0.8533 was calculated by using Rulon's formula. All the constructs were satisfied the conditions of reliability and validity. Statistical analyses showed that the scale of management orientation was a valid and reliable instrument. Management orientation of commercial mango growers is essential for those who have cultivated their mango orchard for the market. Understanding the construction of management orientation could improve the management components of mango orchards in competitive profit-oriented enterprises. The three identified components, namely planning, production and marketing, should be considered to promote the mango growers towards commercialization-oriented production of the mango crop in the 21st century. Mango cultivation is a highly competitive industry. With the continuous introduction of new technologies, it has been recognized as business enterprises with the potential to generate employment after production and earn valuable foreign exchange. Commercial mango production is a highly skilled and investment-oriented enterprise. It requires efficient and effective management to obtain high returns. Micro-level planning is necessary for interlinking, coordinating, and controlling the resources and avoiding excess time and resources. The quality and quantity of outputs of any business depend on the appropriate use of the inputs. A huge number of information on cultivation practices are available, and many of them adopted, but commercial mango growers should know which practice is suitable and produce higher profit; it requires scientific management as well as the adoption of all farm activities (Rahman *et al.* 2019) [56]. For the maximum returns of products from commercial mango production, understanding the trend, structures, and marketing practices is essential. Continuous market updates and produces our product according to the demand which is significantly getting higher profit for produce. Market-oriented management is highly needed for those who expect the greatest profits for their produce. Therefore, planning, production, and marketing are accelerating the management orientation of commercial mango growers towards scientific management of their mango orchards.

Conclusions

The mango production gets profitable income; the commercial mango production requires effective management of farm inputs. The high returns from the orchard the commercial mango growers need to oriented towards scientific management of mango crop that is, towards planning, production and marketing of mango. The developed scale was reliable and valid. This scale has been devised to meet these requirements and assess the management-oriented towards the scientific management of mango crop. Further, this scale can measure management orientation beyond the study area with suitable modifications and evaluation of reliability and validity. This research helps researchers, farmers, and scientists improve farmers' management orientation towards commercial production. Specifically, understanding the concept of management orientation could contribute to the scientific management of their orchard, which gets higher returns. With the emerging trend of commercial cultivation of crops, especially for more profit, management orientation, including planning, production and marketing, is becoming key for success towards management of the profit-oriented farm.

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Compliance with ethical standards

All of the authors declare that they do not have any conflicts of interest

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