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Factors Influencing Consumer Choices and Organic Food Production in Haryana: Insights from Farmers

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HIGHLIGHTS

- Identified key factors: Benefits, Characteristics, and Promotional Tools, explaining 63.83 per cent of consumer behaviour variance.
- Forecasted organic food production in Haryana using polynomial regression ($R^2 = 0.60$).
- Insights guide sustainable agricultural practices and policy planning for organic food sector development.

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ABSTRACT

The study examined consumer behaviour dynamics in Haryana related to organic food purchases and forecasted production, in 2023-2024. The research employed area sampling; representing four districts based on organic food store availability, and surveyed 300 consumers during 2024. Three key factors influencing purchasing decisions were identified: benefits of organic food, characteristics of organic food, and promotional tools. The Benefits of organic food, explaining 30.461 per cent of the variance, was the most significant, emphasizing health advantage, environmental protection, and trust in organic labels. Characteristics of organic food contributed 19.197 per cent of the variance, focusing on quality, affordability, and chemical-free production. Promotional tools; accounting for 14.172 per cent, highlighted discounts, taste, and online marketing. These factors collectively explained 63.830% of consumer decision-making, with health and environmental benefits emerging as primary motivators. The study forecasted organic food production in Haryana from 2011-12 to 2022-23 using polynomial regression analysis, with a moderate model fit ($R^2 = 0.60$). The findings revealed significant production fluctuations due to external factors, suggesting the need for continued research to improve forecast accuracy.

INTRODUCTION

Organic food production and consumption become increasingly prominent globally, driven by concerns regarding food safety, environmental sustainability, and public health (Liu et al., 2020). In the context of India, with its rich agricultural heritage and diverse food culture, understanding the dynamics of organic food production and consumption is of paramount importance (Nakamura et al., 2019). India stands as one of the largest countries in terms of both wheat production and consumption, indicating the significance of its agricultural sector on the global stage (FAO, 2020).

Alongside the conventional agricultural practices prevalent in India, the organic food sector is gaining traction, driven by increasing consumer demand for healthier and environmentally sustainable food options (Pingali, 2015). Organic farming practices emphasize the use of natural inputs, avoidance of synthetic pesticides and fertilizers, and the promotion of biodiversity and soil health (Pretty et al., 2006; Gills et al., 2013; Gills et al., 2021). Despite the growing

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interest in organic food, there remains a need for comprehensive research to understand the dynamics of organic food production, especially within specific regions such as Haryana, India. Studies indicate that organic farming is one of the several approaches to sustainable agriculture, which is a necessity in today's unstable and degrading environment (Nain et al., 2020; Jangid et al., 2022). Additionally, the ecological, economic, and social sustainability of organic farming practices are well-documented, further highlighting their importance for sustainable development (Ahmed et al., 2021).

Haryana, a state in northern India, is known for its substantial agricultural output. The state is a major contributor to the country's food grain production, and its farmers increasingly adopt organic farming practices. This transition is crucial for several reasons. Firstly, organic farming in Haryana helps address environmental challenges such as soil erosion, water scarcity, and loss of biodiversity, which are exacerbated by conventional farming methods (Pingali, 2015). Organic farming offers multiple benefits to farmers in Haryana, from improving soil health and promoting biodiversity to opening new market opportunities. The growing demand for organic produce, both within India and globally, presents farmers with the opportunity to earn higher prices and diversify their income sources. However, despite the increasing interest in organic farming, the sector faces significant challenges. These include a lack of sufficient research on regional organic farming practices, variability in production trends, and barriers to market access.

This study aims to address this gap by focusing on the factors that influence purchasing decisions and forecast organic food production in Haryana, a state known for its significant agricultural contributions. By employing regression analysis over a period spanning from 2011-12 to 2022-23, this research uncovers the underlying trends, fluctuations, and factors influencing organic food production in the region. The findings of this study are expected to provide valuable insights for policymakers, stakeholders, and researchers to devise strategies aimed at promoting sustainable growth and stability in the organic food sector in Haryana and beyond.

METHODOLOGY

The study was conducted during the year 2023-2024 across the National Capital Region (NCR) of Haryana, covering four districts: Gurugram, Faridabad, Panipat, and Sonipat. These districts were chosen for their diverse economic and demographic profiles, significant presence of organic food stores, and a mix of urban (Gurugram and Faridabad) and semi-urban (Panipat and Sonipat) areas. The area sampling technique was used, with proportional representation from each district based on the number of organic food stores. To assess factors influencing consumer purchase decisions and to forecast organic food production, data were collected through both surveys and secondary sources. Primary data were gathered using a semi-structured questionnaire, which was administered to 300 consumers. The questionnaire featured 26 statements, each measured on a five-point Likert scale, focusing on various factors impacting consumer choices regarding organic food. The KMO measure was computed to evaluate whether the sample size was adequate for factor analysis. Bartlett's Test was performed to examine whether the observed correlation matrix significantly deviates from an identity matrix, indicating that correlations among variables are sufficient for factor analysis. Cronbach's Alpha was calculated to determine the extent to which the 26 items on the scale measure a single underlying construct consistently. The secondary data was obtained from APEDA and India stat which included production data of Haryana over a period of 12 years, from 2011-12 to 2022-23 was analysed using a polynomial regression model. Data from 2011-12 to 2020-21 was used for model fitting, while 2021-22 and 2022-23 were used for validation. The polynomial regression equation used is $y = -113.69 x 2 + 1616.4x + 64.763y$, where y represents the organic food production in MT, and x denotes the year. The model's fit, indicated by R^2 value of 0.60, explains 60 per cent of the variability in organic food production. Accuracy was assessed using the relative deviation (RD) percentage, calculated as RD (%) = (forecasted yield – actual yield)/ actual yield × 100. By calculating the RD percentage, the study aimed to compare the forecasted production values generated by the polynomial regression model against the actual production figures.

RESULTS

According to Table 1, the data is appropriate for factor analysis with a Kaiser-Meyer-Olkin Measure of Sampling Adequacy score of 0.779. The Bartlett's Test of Sphericity result is significant, and the p-value of.000 indicates that the connections between the variables are sufficiently large to support factor analysis. Furthermore, Cronbach's Alpha coefficient was figured to be 0.902, signifying high internal reliability among the statements included in the analysis.

Table 1. KMO and Bartlett's Test (Factors influencing)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.779
Bartlett's Test of Sphericity	Approx. Chi-Square	8528.715
	df	325
	Sig.	0.000
Cronbach's Alpha		0.902
No of Items		26

The components were rotated using the Varimax method to achieve a simpler structure and easier interpretation. The loadings of each variable on the extracted factors after rotation were presented in the rotated component matrix, Table 2. These loadings represent the correlations between variables and factors, with higher loadings indicating stronger relationships. Two statements were deleted as they were found to be very weak. Therefore, the three factors were named as Benefits of Organic Food, Characteristics of Organic Food, and Promotional Tools.

Factor 1 "Benefits of Organic Food"- items loading heavily on this factor (e.g., statements on environmental safety and nutritional value) suggest that this factor significantly influences consumer purchase decisions. Explained 30.46 per cent of the variance with a Cronbach's Alpha of 0.936, emphasizing the importance of perceived benefits in consumer choices.

The second factor "Characteristics of Organic Food, " encompasses aspects such as the natural processing and quality of organic food. It reflects consumers' concerns about production methods and inherent qualities and accounted for 19.20 per cent of the variance with a Cronbach's Alpha of 0.914, highlighting the role

Table 2. Rotated Component Matrix (a)

S. No.	Statements	Components				
		1	2	3	4	5
1.	Organic food is environmentally Safe	0.891	0.124	-0.173	0.047	0.025
2.	Organic food offers good value for money	0.889	0.048	0.087	0.104	0.216
3.	Organic food supports organic movement and sustainability	0.883	0.130	-0.156	0.095	-0.106
4.	Location of organic stores	0.858	-0.245	-0.209	0.081	-0.108
5.	Organic food helps to save resources for the next generations	0.824	0.147	0.032	0.249	-0.146
6.	Organic food variety availability	0.785	-0.020	0.293	-0.136	0.228
7.	Consumers choose to purchase organic food because they are concerned about pesticides and chemical residues in conventionally grown food	0.747	0.078	-0.165	0.311	0.195
8.	Organic foods have good nutritional value	0.680	0.139	0.519	0.254	-0.017
9.	Trusted Organic labelling and certifications	0.614	-0.103	0.116	0.500	-0.174
10.	Advise and opinions from family & friends to choose organic food	0.576	0.156	-0.173	0.547	0.322
11.	Better shelf life of organic food	0.575	0.319	0.008	0.087	0.012
12.	Easy availability and accessibility at retail stores and supermarkets	0.504	-0.023	-0.478	0.469	0.265
13.	It is processed without any chemicals	-0.009	0.926	0.138	-0.036	0.149
14.	No preservatives are used to enhance its shelf life	0.044	0.837	0.291	-0.166	0.150
15.	Have the financial capability to buy organic food	-0.032	0.809	0.064	0.159	0.052
16.	Organic food production is a natural way of environmental protection	0.506	0.682	-0.141	-0.068	-0.019
17.	Organic foods are healthy and safe for consumption	-0.165	0.669	0.418	0.383	-0.043
18.	Organic food more expensive than conventionally grown food	0.161	0.652	0.435	0.068	-0.240
19.	Supreme quality of organic food	0.543	0.547	0.397	-0.028	0.068
20.	Trustworthy production process and standards	0.442	0.543	0.498	0.124	0.108
21.	Organic food has more vitamins and minerals than conventional foods	0.424	0.537	0.335	-0.279	-0.159
22.	Offers & discounts on its purchase	-0.215	0.143	0.859	0.103	0.173
23.	Superior taste of organic food	0.126	0.333	0.807	-0.182	0.102
24.	Organic food presence on online platforms	-0.258	0.357	0.611	-0.020	0.136
25.	Adequate promotion of organic food benefits & originality	0.291	0.024	0.036	0.753	-0.188
26.	Advertising and marketing influence your perceptions of organic food and whether you choose to purchase it	0.122	0.144	0.389	-0.150	0.801

Table 3. Factors and Variance Explained

Factors	Cronbach Alpha Value	Eigen Value	Percentage Variance	Cumulative Percentage
Benefits of Organic Food	0.936	7.920	30.46	30.46
Characteristics of Organic Food	0.914	4.991	19.20	49.66
Promotional Tools	0.830	3.685	14.17	63.83

of product characteristics. The third important factor "Promotional Tools" - includes elements like discounts and online presence, indicating that marketing and promotional strategies also impact consumer decisions. This factor explained 14.17 per cent of the variance with a Cronbach's Alpha of 0.830, underscoring the influence of marketing efforts on consumer behaviour. Table 4 indicates that collectively the total variance explained by these factors accounts for 63.83 per cent of the total variance, indicating a substantial role in shaping consumer purchase decisions regarding organic food.

The analysis of organic food production data in Haryana from 2011-12 to 2022-23 revealed significant trends and variability as shown in Figure 1. The production data, modeled using polynomial regression, provided insights into the predictive capabilities and accuracy of the model.

Polynomial regression model and fit and its validation

The polynomial regression model utilized in this study was $y= -113.69x2+1616.4x+64.763y$ with an R^2 value of 0.60. This indicated that 60 per cent of the variability in organic food production could be explained by the model, suggesting a moderate fit. The model was fitted using data from 2011-12 to 2020-21, and the fitted values closely followed the observed trend with some deviations. The model's predictive capability was validated using production data from 2021-22 and 2022-23. The relative deviation (RD) percentage was calculated to assess the prediction error for each year. The RD percentages for the validation period were -11.22 and 13.29 per cent for 2021-22 and 2022-23, respectively. These values indicated that the model's predictions were reasonably close to the actual production figures, with a slight overestimation in 2022-23.

Analysis of actual vs. fitted values

The actual and fitted production values, along with their RD percentages, were presented in Table 4. Key observations included- The model performed well in certain years, such as 2013-14 and 2015-16, with low RD percentages of 1.73 and 3.21 per cent, respectively. Significant deviations were observed in some years,

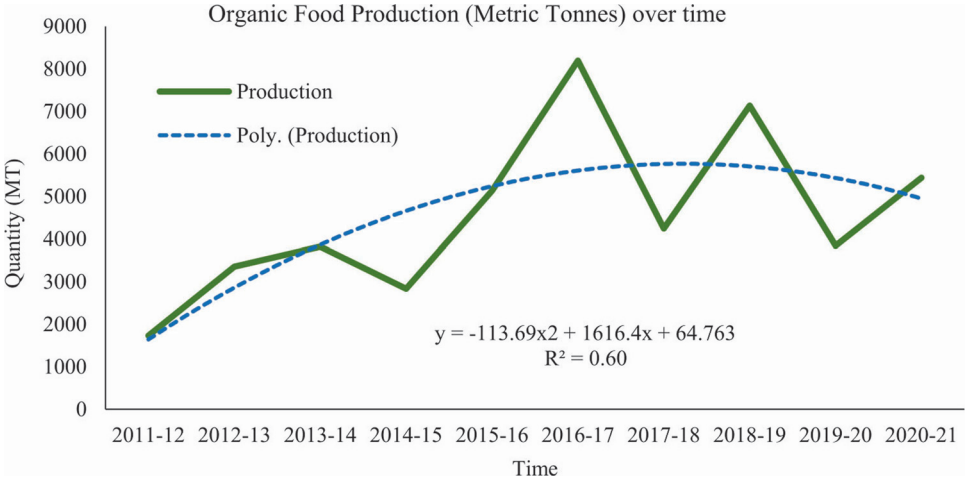

Figure 1. Polynomial regression analysis for organic food production in Haryana

Table 4. Actual and fitted values of organic production in Haryana

Year	Actual Production (MT)	Fitted Production (MT)	RD (%)
2011-12	1731.57	1567.473	-10.46
2012-13	3353.17	2842.803	-17.95
2013-14	3823.24	3890.753	1.73
2014-15	2833.38	4711.323	39.86
2015-16	5133.96	5304.513	3.21
2016-17	8192.76	5670.323	-44.48
2017-18	4245.48	5808.753	26.91
2018-19	7134.31	5719.803	-24.73
2019-20	3842.3	5403.473	28.89
2020-21	5439	4859.763	-11.91
Forecast Year 2021-22	4547.48	4088.673	-11.22
Forecast Year 2022-23	2679.58	3090.203	13.28

(*Source:* Indiastat.com), *Percent deviation (RD %) = (forecasted yield" actual yield) /actual yield × 100

notably in 2014-15 and 2016-17, where the RD percentages were 39.86 and -44.48 per cent, respectively. These discrepancies suggested potential anomalies or external factors influencing production in those years. The model tended to overestimate production in years such as 2019-20 and 2017-18, with RD percentages of 28.89 and 26.91 per cent, respectively, while underestimating it in years like 2012-13 and 2016-17. Overall, the polynomial regression model is useful for understanding the trends and variability in organic food production in Haryana. While the model demonstrated a moderate fit with an R^2 value of 0.60, it highlighted the complexity of agricultural production systems influenced by various factors. The validation results underscored the model's potential for forecasting but also indicated areas for improvement in predictive accuracy. Future research could focus on incorporating additional variables or refining the model to enhance its precision.

DISCUSSION

Understanding the complex dynamics of consumer behaviour and production patterns in the organic food market is crucial for driving sustainable agricultural development. This study delves into these intricacies within Haryana, offering valuable insights into the factors influencing organic food purchases and providing forecasts on production trends, which can guide both policymakers and farmers in optimizing practices to meet growing consumer demand. The study's insights into organic food production trends in Haryana, analyzed through polynomial regression, underline the significance of understanding production patterns and variability. Accurate forecasts and models are essential for optimizing production practices and responding to consumer demand. Organic farming's environmental benefits such as improved soil health, biodiversity conservation, and reduced chemical usage—align with global sustainability goals (Reganold & Wachter, 2016). The increasing consumer demand driven by health and environmental concerns necessitates reliable production data (Seufert, Ramankutty, & Foley, 2012).

For farmers in Haryana, understanding these organic production trends is particularly relevant. By analyzing and interpreting the trends in organic food production, they can align their farming practices with consumer preferences, improve their market competitiveness, and contribute to the broader goal of sustainable agricultural development. Organic farming has the potential to strengthen farmers' resilience to market fluctuations by offering higher-value products and tapping into a growing consumer base that is increasingly aware of environmental and health issues. Accurate forecasting, as demonstrated in this research, can also assist farmers in planning and mitigating risks associated with production variability, ensuring that they remain adaptive to changing market conditions. Policymakers can use these insights to develop support mechanisms, such as providing timely access to organic inputs, training, and insurance schemes (Badgley et al., 2007).

Consumer education and continuous research into organic farming methods are critical for sustaining growth in the organic sector. Educational programs can raise awareness about the health and environmental benefits of organic products, encouraging more consumers to choose organic food, thereby expanding the market. Sustained research into the economic and environmental impact of organic farming also supports broader goals of food security, environmental sustainability, and public health (Tilman et al., 2002; Yadav et al., 2024). There is a need to provide institutional support

in creating awareness in technological advancement of organic farming (Malik et al., 2022). Additionally, understanding farmers' perceptions of the benefits of organic farming is crucial for designing effective support mechanisms and policies (Malhan & Ram, 2023). By fostering a supportive environment for organic agriculture, Haryana can strengthen its position in the organic food market, benefiting both its agricultural sector and the broader community.

CONCLUSION

Factor analysis identified three key determinants: Benefits of Organic Food, Characteristics of Organic Food, and Promotional Tools, all of which significantly impact consumer behaviour. Polynomial regression analysis highlighted the need to understand production patterns and variability to optimize practices and meet demand. These findings emphasize the importance for farmers to align production with market trends and consumer preferences for competitiveness and sustainability. Policymakers can support organic farmers through targeted interventions, such as input access, training, and risk management, advancing Haryana's organic food sector and promoting sustainable agricultural development.

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