International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 10 | Oct - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

Comparative Performance Evaluation of Online Delivery Platforms Using Fuzzy AHP

Mr. Navin Kumar U[1], Dr. Sweety Regina Mary S[2], Dr. T. Bharathi[3]

[1]Department of Mathematics, Patrician College of Arts and Science, Chennai;

[2]Department of Commerce, Patrician College of Arts and Science, Chennai;

[3]PG Research Department of Mathematics, Loyola College (Autonomous), Chennai

ABSTRACT

The rapid expansion of online food delivery (OFD) services across urban and semi-urban Indian markets has produced a highly competitive service ecosystem in which consumer platform preferences are shaped by subjective judgement, qualitative criteria, and decision ambiguity. This study applies the Fuzzy Analytic Hierarchy Process (FAHP) with triangular fuzzy numbers (TFNs) to evaluate and rank five prominent platforms—Swiggy, Zomato, Zepto, Blinkit, and Jio Mart—across ten consumer-facing attributes. Drawing on 95 survey respondents, the analysis indicates that Zepto attains the highest composite performance, followed by Zomato, Swiggy, Blinkit, and Jio Mart. Platform usability, delivery speed, and product quality emerge as the principal drivers of consumer satisfaction. All criterion weights are normalised to unity, and platform scores are computed through ratio normalisation, ensuring mathematical consistency; the ranking remains stable under ±20% perturbation of the three leading criteria.

Keywords: Fuzzy Analytic Hierarchy Process, Online Delivery Platforms, Consumer Evaluation, Multi-Criteria Decision-Making, Sensitivity Analysis.

INTRODUCTION

Digital ordering platforms compete along dimensions of usability, delivery speed, product quality, packaging, affordability, promotions, and customer support. Because consumers evaluate these attributes jointly, platform selection constitutes a multi-criteria decision problem. Online food delivery and quick-commerce services overlap in convenience but differ in product mix and service model. The comparative scores are therefore indicative of respondent perceptions and should not be regarded as universal measures of platform quality.

The Analytic Hierarchy Process (AHP) structures such decisions through pairwise comparisons, while Fuzzy AHP extends the framework by representing linguistic judgements as fuzzy numbers, thereby accommodating the ambiguity inherent in human assessment. The present study accordingly adopts an FAHP framework and rectifies three methodological inconsistencies in the source data, namely sample-size reporting, weight normalisation, and performance-score computation.

OBJECTIVES

The study aims

(i) to identify and prioritize consumer-facing criteria
(ii) to compare five platforms using the reported criteria and ratings
(iii) to assess whether the resulting ranking remains stable when the weights of the leading criteria are perturbed.

LITERATURE REVIEW

Online Food Delivery Industry Evolution

The OFD industry has undergone significant transformation since the emergence of platforms like Grubhub (2004) and Just Eat (2001) in Western markets. In India, the sector gained momentum with the launch of Foodpanda (2012), followed by the entry of Swiggy (2014) and Zomato's pivot from restaurant discovery to delivery (2015). Recent entrants including Zepto (2021) and Blinkit (2021) have disrupted the market with their quick-commerce focus.

Research has extensively documented the growth drivers of the OFD sector. Chen et al. (2018) identified convenience, time savings, and variety as primary motivations for online food ordering. Yeo et al. (2017) emphasized the role of perceived usefulness and ease of use in shaping consumer adoption, drawing on the Technology Acceptance Model (Davis, 1989).

Service Quality Dimensions in OFD

The SERVQUAL framework (Parasuraman et al., 1988) has been widely adapted to evaluate service quality in e-commerce contexts. For OFD platforms, researchers have identified several critical dimensions:

Table 1: Service Quality Dimensions in OFD

Dimension	Description	Key References
Tangibles	Food quality, packaging quality, and presentation	Wang et al. (2019)
Reliability	Delivery accuracy, order fulfillment, and timeliness	Prasad & Prasad (2020)
Responsiveness	Customer support responsiveness and issue resolution	Kim et al. (2019)
Assurance	Agent professionalism and safety standards	Lee et al. (2020)
Empathy	Understanding customer needs and personalization	Sharma & Agarwal (2021)

Recent studies have extended these dimensions to include technology-specific factors such as app interface design and ease of navigation (Tandon et al., 2020).

Multi-Criteria Decision Making in Consumer Choice

MCDM techniques have been extensively applied to consumer decision-making contexts. The Analytic Hierarchy Process (AHP) developed by Saaty (1980) has been particularly influential, enabling the structuring of complex decisions through pairwise comparisons. However, AHP's reliance on crisp judgments has been critiqued for failing to capture the vagueness in human preferences.

Fuzzy AHP, introduced by Van Laarhoven and Pedrycz (1983) and refined by Buckley (1985), addresses this limitation through the use of linguistic variables and fuzzy numbers. The methodology has been successfully applied in various consumer choice contexts including:

- E-commerce platform selection (Sahu et al., 2020)
- Hotel selection for tourism (Han et al., 2021)
- Food delivery app selection (Kumar & Singh, 2021)
- University selection (Al-Harbi, 2001)

Research Gap

While previous studies have examined OFD platform preferences, few have systematically compared multiple platforms using a comprehensive set of criteria incorporating fuzzy methodologies. Moreover, the dynamic nature of the Indian OFD market, with its unique combination of established players and quick-commerce entrants, necessitates context-specific analysis. This study addresses these gaps by applying F-AHP to evaluate five major platforms on ten performance criteria.

RESEARCH METHODOLOGY

Design and sample

The study uses a quantitative, cross-sectional questionnaire and convenience sampling. The source manuscript states that 95 respondents had experience with at least one online delivery platform. The demographic table supports this sample size: gender frequencies (76 female and 19 male) sum to 95, and the reported percentages use 95 as the denominator. The abstract's reference to 100 respondents has therefore been corrected to 95.

Questionnaire and criteria

The questionnaire covered demographic characteristics, platform usage and ratings on a five-point satisfaction scale (1 = highly dissatisfied; 5 = highly satisfied). Ten criteria were retained from the original manuscript.

Code	Criterion	Operational meaning
EU	Ease of use	User-friendliness of app interface
DT	Delivery time	Perceived speed of delivery
QL	Quality	Quality of food/products received
PK	Packaging	Condition and quality of packaging
CR	Cost reasonableness	Perceived value for money
OD	Offers/discounts	Availability of promotions
CS	Customer support	Responsiveness and issue resolution
RR	Return/refund	Ease of return or refund process
AB	Agent behavior	Professionalism of delivery agents
HG	Hygiene	Perceived hygiene standards

Fuzzy Analytic Hierarchy Process (F-AHP)

The F-AHP methodology employed in this study follows the approach proposed by Chang (1996) and involves the following steps:

Triangular Fuzzy Numbers (TFNs)

A triangular fuzzy number is represented as (l, m, u) where:

- l = lower bound (smallest possible value)
- m = most promising value
- u = upper bound (largest possible value)

Fuzzy AHP Steps

Step 1: Define the Hierarchical Structure

The decision hierarchy comprises three levels:

- Goal: Selection of best OFD platform
- Criteria: Ten performance attributes
- Alternatives: Five OFD platforms (Swiggy, Zomato, Zepto, Blinkit, Jio Mart)

Step 2: Construct Pairwise Comparison Matrices

Pairwise comparisons are performed using linguistic terms converted to triangular fuzzy numbers (TFNs) using the scale presented in Table 2.

Table 2: Fuzzy AHP Scale

Linguistic Variable	**Abbreviation**	**TFN (l, m, u)**
Equally Important	EI	(1, 1, 2)
Weakly Important	WI	(1, 2, 3)
Fairly Important	FI	(2, 3, 4)
Strongly Important	SI	(3, 4, 5)
Absolutely Important	AI	(4, 5, 6)

Step 3: Calculate Fuzzy Geometric Mean

For each row i, the fuzzy geometric mean is calculated as:

$$\tilde{r}_i = \left[\prod_{j=1}^{n} \tilde{a}_{ij}\right]^{\frac{1}{n}}$$

where $\tilde{a}_{ij}$ represents the fuzzy comparison value between criteria i and j.

Step 4: Compute Fuzzy Weights

The fuzzy weight for each criterion is calculated as:

$$\tilde{w}_i = \tilde{r}_i \otimes [\tilde{r}_1 \oplus \tilde{r}_2 \oplus \ldots \tilde{r}_n]^{-1}$$

Step 5: Defuzzification and Normalization

The fuzzy weights are defuzzified using the Center of Area (COA) method:

$$W_i = \frac{l_i + m_i + u_i}{3}$$

Step 6: Determine Platform Performance Scores

For each platform, the performance score is calculated as:

$$S_{platform} = \sum_{i=1}^{n} W_i \times R_{i,platform}$$

where $R_{i,platform}$ represents the normalized rating of the platform on criterion i.

Consistency Check

The consistency of pairwise comparisons is checked using the Consistency Ratio (CR):

$$CR = \frac{CI}{RI}$$

where:

- CI = (λmax - n) / (n - 1) (Consistency Index)
- λmax = Maximum eigenvalue
- n = Number of criteria
- RI = Random Index (from Saaty's table)

Table 3: Random Index Values (Saaty, 1980)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Acceptance Criteria: CR ≤ 0.10

Sensitivity Analysis

Sensitivity analysis is conducted to test the robustness of the results by varying weights:

1. **Scenario Analysis**: Vary top criterion weights by ±20%
2. **Rank Stability**: Check if rankings remain stable under different weight scenarios
3. **Threshold Analysis**: Identify weight thresholds at which rankings change

ANALYSIS AND DISCUSSION

Respondent profile and platform use

The 95 respondents were predominantly female (76; 80.0%) and aged 18–25 (82; 86.3%). Postgraduates accounted for 63 (66.3%), students for 58 (61.1%) and urban residents for 66 (69.5%). Platform-use responses were multiple-selection responses: Swiggy was used by 67 respondents (70.5%), Zomato by 64 (67.4%), Zepto by 57 (60.0%), Blinkit by 40 (42.1%) and Jio Mart by 11 (11.6%). These proportions describe this convenience sample and should not be generalized to all users.

CORRECTED CRITERION WEIGHTS

Rank	Criterion	Original reported weight	Corrected normalised weight
1	Ease of use	0.228	0.194
2	Delivery time	0.187	0.159
3	Quality	0.158	0.134
4	Cost reasonableness	0.122	0.104
5	Packaging	0.114	0.097
6	Offers/discounts	0.106	0.090
7	Customer support	0.088	0.075
8	Return/refund	0.065	0.055
9	Hygiene	0.059	0.050
10	Agent behavior	0.050	0.042

MEAN PLATFORM RATINGS

Criterion	Swiggy	Zomato	Zepto	Blinkit	Jio Mart
Ease of use	4.22	4.33	4.45	4.15	3.82
Delivery time	4.03	4.08	4.28	4.10	3.64
Quality	4.07	4.15	4.20	4.25	3.73
Packaging	4.18	4.20	4.22	4.18	3.82
Cost reasonableness	3.78	3.88	3.95	3.73	3.55

Offers/discounts	3.65	3.78	3.88	3.55	3.45
Customer support	3.75	3.82	3.92	3.60	3.45
Return/refund	3.52	3.65	3.78	3.48	3.36
Agent behavior	3.85	3.92	4.02	3.78	3.55
Hygiene	4.12	4.18	4.25	4.08	3.73

Zepto has the highest reported mean ratings for ease of use, delivery time, cost reasonableness, offers/discounts, customer support, returns/refunds, agent behavior and hygiene. Blinkit has the highest mean rating for quality, while packaging ratings are similar across Swiggy, Zomato, Zepto and Blinkit.

PLATFORM PERFORMANCE SCORES

For each criterion, the reported mean rating was divided by the highest mean rating across the five platforms. The resulting ratio-normalised ratings were multiplied by the corrected criterion weights and summed.

Platform	**Corrected overall score**	**Rank**
Zepto	0.998	1
Zomato	0.974	2
Swiggy	0.954	3
Blinkit	0.951	4
Jio Mart	0.877	5

FORMULA AND REPRODUCIBILITY

Let w_i denote the normalised weight for criterion i and x_{ij} the mean rating of platform j on criterion i. The normalized rating is $r_{ij} = \left(\frac{x_{ij}}{max j(x_{ij})}\right)$ and the platform score is $S_j = \Sigma_i w_i r_{ij}$. Since $0 < r_{ij} \leq 1$ and $\Sigma_i w_i = 1$, it follows that $S_j \leq 1$.

SENSITIVITY ANALYSIS

Sensitivity analysis was recalculated by changing one of the three highest-weighted criteria—ease of use (EU), delivery time (DT) or quality (QL)—by +20% or −20%, then renormalising all criterion weights to sum to one. All other weights and the normalised platform ratings were held constant. This provides six scenarios and avoids comparing scores generated from weights that do not sum to one.

Sensitivity analysis results

Scenario	**Swiggy**	**Zomato**	**Zepto**	**Blinkit**	**Jio Mart**	**Top rank**
EU +20%	0.954	0.974	0.998	0.950	0.876	Zepto
EU −20%	0.954	0.974	0.998	0.952	0.877	Zepto
DT +20%	0.954	0.973	0.998	0.951	0.876	Zepto
DT −20%	0.954	0.975	0.998	0.951	0.877	Zepto
QL +20%	0.954	0.974	0.998	0.952	0.877	Zepto
QL −20%	0.954	0.974	0.999	0.950	0.877	Zepto

The sensitivity analysis confirms that Zepto consistently maintains the top position across all scenarios, validating the robustness of the results.

DISCUSSION

Zepto's leading score is driven by its consistently high reported mean ratings across most criteria. Zomato ranks second, while Swiggy and Blinkit are close in the corrected score (0.954 and 0.951, respectively); this small difference should not be overstated. Jio Mart has the lowest composite score in this sample. However, the platforms do not necessarily offer identical product categories or service models, which limits the interpretation of a single overall ranking.

The sensitivity analysis suggests that modest changes to each leading criterion's weight do not alter the order. The analysis does not test uncertainty in the underlying survey means, the choice of criteria, the fuzzy pairwise matrix, or differences between users who order prepared food and those who order groceries or essentials.

PRACTICAL IMPLICATIONS

Platform operators should prioritize a simple and reliable interface, predictable delivery and consistent product quality. Transparent pricing, effective promotions, careful packaging and responsive support may further improve perceived value. These implications should be treated as exploratory and tested with a broader, more representative sample.

CONCLUSION

This study uses F-AHP to organise consumer criteria and compare five online delivery platforms. The corrected analysis uses n = 95, normalises the reported criterion weights to sum to one, and recalculates platform scores using ratio-normalised mean ratings. Zepto ranks first, followed by Zomato, Swiggy, Blinkit and Jio Mart. The ranking remains unchanged when the weights of ease of use, delivery time and quality are individually varied by ±20% and renormalized.

REFERENCES

1. Al-Harbi, K. M. A. S. (2001). Application of the AHP in project management. International Journal of Project Management, 19(1), 19-27.
2. Buckley, J. J. (1985). Fuzzy hierarchical analysis. Fuzzy Sets and Systems, 17(3), 233-247.
3. Chang, D. Y. (1996). Applications of the extent analysis method on fuzzy AHP. European Journal of Operational Research, 95(3), 649-655.
4. Chen, Y. F., & Tsai, T. H. (2018). Service quality and customer satisfaction in the online food delivery industry. Journal of Hospitality and Tourism Technology, 9(4), 505-521.
5. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.
6. Han, H., Lee, J. S., & Ryu, K. (2021). Fuzzy AHP approach for hotel selection in tourism. Tourism Management, 82, 104204.
7. Kim, Y., Li, X., & Kim, M. J. (2019). Customer satisfaction and loyalty in online food delivery services. Journal of Retailing and Consumer Services, 51, 329-337.
8. Kumar, A., & Singh, M. (2021). Selection of food delivery apps using fuzzy AHP. International Journal of Fuzzy Systems, 23(5), 1542-1555.
9. Lee, J. Y., & Yoo, J. (2020). Service quality perceptions in online food delivery. Journal of Services Marketing, 34(6), 791-803.
10. Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64(1), 12-40.
11. Prasad, S., & Prasad, P. (2020). Logistics and service quality in online food delivery. International Journal of Logistics Management, 31(3), 589-607.
12. Redseer Consulting. (2025). Indian Online Food Delivery Market Report. Bengaluru: Redseer.
13. Saaty, T. L. (1980). The Analytic Hierarchy Process. New York: McGraw-Hill.
14. Sahu, S., Singh, R., & Kumar, N. (2020). E-commerce platform selection using fuzzy AHP. Journal of Electronic Commerce Research, 21(2), 85-101.
15. Sharma, S., & Agarwal, R. (2021). Consumer preferences in online food ordering: A review. Journal of Consumer Marketing, 38(4), 399-412.

16. Tandon, U., Kiran, R., & Sah, A. N. (2020). The impact of app design on consumer satisfaction in food delivery. Journal of Internet Commerce, 19(3), 287-304.
17. Van Laarhoven, P. J. M., & Pedrycz, W. (1983). A fuzzy extension of Saaty's priority theory. Fuzzy Sets and Systems, 11(1-3), 229-241.
18. Yeo, V. C. S., Goh, S. K., & Rezaei, S. (2017). Consumer experiences, attitude and behavioral intention toward online food delivery services. Journal of Retailing and Consumer Services, 34, 59-67.
19. Zadeh, L. A. (1965). Fuzzy sets. Information and Control, 8(3), 338-353.
20. Ministry of Consumer Affairs. (2024). Guidelines for E-Commerce Food Delivery. New Delhi: Government of India.