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Prioritizing Online Food Delivery Systems in Hyderabad Through Analytical Hierarchy Process

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Abstract: ***This study aims to utilizing the Analytic Hierarchy Process (AHP) technique, is proposed to prioritize online food delivery systems. This methodology is applied to several prominent online food delivery systems. By comparing the data from each criterion, the delivery companies could also improve their services for better experience. Analytical Hierarchical Process (AHP) was utilized in order to determine the weights and decision of each factor to the study. The data was gathered through google forms survey questionnaires at Hyderabad, India. Based on the computed weighted alternatives, Swiggy is considered as the top alternative, Zomato as the next one, Uber Eats at the at the third position, Food panda at fourth position and Dunzo at last.***

Keywords: Online food delivery systems (OFS), Analytical hierarchy process (AHP).

1. Introduction

The online food delivery system (OFS) (we considered online food systems as mobile apps, websites and other online platforms) has experienced significant growth since the mid-2000s, driven by advancements in internet technology, a general shift towards e-commerce, increasing urbanization, and changing social dynamics. Food delivery has become an integral aspect of urban living, allowing customers to conveniently order from a diverse selection of restaurants and receive their meals at home with just a tap on their mobile devices. Online food delivery platforms provide numerous options, convenience, cashback rewards, incentives, attractive offers, and discounts. Prior to the widespread impact of COVID-19, the OFS industry was already benefiting from technological advancements and a variety of delivery applications. The pandemic, however, has accelerated consumer adoption of these services, leading to a notable rise in new users, especially in developing countries .While many sectors, particularly education, aviation, tourism, and hospitality, fashion industry, real estate faced severe challenges and substantial revenue declines due to the pandemic, but the OFS industry saw exponential growth in India as revenue in the Online Food Delivery market is projected to reach US$54.97bn in 2025 and revenue is expected to show an annual growth rate (CAGR 2025-2030) of 13.26%, resulting in a projected market volume of US$102.43bilion by 2030[1]. Hyderabad, often referred to as 'Cyberabad', is a prominent information technology hub in India, ranking second to Bangalore in IT exports. The city has a substantial and skilled workforce, with more than 900,000 professionals engaged in the IT and IT-enabled services sector. It hosts a variety of IT firms, including major global corporations such as Microsoft, Google, and Amazon and people from different parts of the country and world are staying/working at Hyderabad, it leads to increase/demand in different areas, one of them is online food delivery.

In contemporary society, technology has experienced significant growth, with even the oldest generations adapting to this new reality. While some individuals find it uninteresting and somewhat distracting, others are entertained and satisfied by the offerings of the modern world. Technology can often appear irrational or excessive, presenting peculiar innovations that may be deemed unreliable or questionable. Many users exhibit a form of addiction or restraint regarding their use of devices such as mobile phones, tablets, and computers, which raises concerns about its impact on their perception of reality. This reliance can lead to social isolation, reduced interactions, and an inability to appreciate what lies beyond the screen. However, it is important to acknowledge that technology also has its advantages. Over the years, it has evolved to a point where previously unimaginable innovations, such as robots, electric vehicles, 3D printing, e-cigarettes, gene editing, and digital assistants, have become a reality. Initially, technology served primarily for communication, data recording, and retrieval, cloud computing, internet access, analytics, immersive and augmented reality, and automation. Today, it has become so engaging that individuals can enjoy meals from their favourite restaurants without leaving their homes, thanks to food delivery systems, which provide a variety of dining options in their vicinity.

2. Objective of the study

Since the onset of the pandemic, individuals in India have increasingly turned to websites, applications, and businesses that provide online and delivery services for various needs, including groceries, food, and parcels. This shift has proven to be more convenient and safer, significantly reducing the risk of virus transmission. During the quarantine, people have capitalized on modern technological advancements, effortlessly placing orders through their smartphones or tablets, which are then delivered to their doorsteps. Consequently, there has been a rise in companies offering these services. These delivery firms have not only assisted numerous individuals but have also provided many riders with income opportunities during the height of the quarantine. As the online selling and delivery market expands, it is crucial

for consumers to remain vigilant and discerning regarding their choices, taking into account various factors such as security, safety, and customer service.

Food delivery services operate similarly to courier services, as they involve the delivery of ordered meals to clients by either restaurant staff or delivery agents. The method by which a customer places an order influences the overall process. Meals can be ordered from a food cooperative or restaurant via telephone, mobile applications, websites, or the establishment's online platforms and aggregator applications. Typically, customers incur a standard delivery fee, which may be waived based on the items ordered. Since the onset of the pandemic, contactless delivery has gained significant popularity. Additionally, advancements in technology have enhanced the accessibility of food delivery services for consumers. In India, the rise in demand for online food delivery systems (OFS) has garnered attention as a viable option for several years.

As the demand for food delivery services increases, numerous online food delivery companies are expanding their offerings. While these companies provide similar advantages in fulfilling customer orders through online platforms, their delivery fees, cashback options, promotional offers, and additional customer benefits vary significantly. Consequently, it is essential for customers to make well-informed choices regarding which online food delivery services will most effectively meet their requirements. This evaluation represents a multifaceted decision-making process aimed at identifying the most sustainable services within the online food delivery system.

This study aims to identify the primary factors influencing consumer choices and satisfaction regarding applications, including aspects such as Economy, Service Quality, Technology, Privacy and security, availability of restaurant choice. These criteria will be elaborated upon in the methods section. Understanding these factors can lead to strategies for bridging existing gaps. Enhancing business operations attracts more consumers and boosts profits. The competitive landscape of food delivery services is a significant aspect, and this study provides owners of online food delivery (OFS) applications with opportunities to refine and improve their offerings. Additionally, this research will inform consumers about the companies, especially the leading applications, that they can trust for such services. Ultimately, the insights gained from this study will assist delivery companies in enhancing their offerings Each comparison will be conducted using the analytical hierarchy process (AHP).

3. Literature Review

The Internet has transformed from a basic communication medium into a comprehensive and interactive marketplace for goods and services, attracting over 5.52 billion users worldwide. India's e-commerce sector [2] is projected to attain a value of US$ 325 billion by 2030, supported by 500 million consumers and improved internet connectivity, particularly in rural regions. By 2026, it is anticipated that more than 1.18 billion individuals will possess smartphones, facilitating digital transactions. Demand will predominantly stem from rural areas, accounting for over 60%, especially from tier 2 to tier 4 towns. The Indian e-commerce market is forecasted to expand at a compound annual growth rate (CAGR) of 27%, reaching US$ 163 billion by 2026.

So, The Internet has the prospective to directly sell products and services to customers, to provide an electronic aid for communications and to process business transactions such as orders and payments. Nowadays it becomes popular practice among businesses to sell their product or service directly to customer over the internet.

One of the online sector is the food delivery system, it is built on technology that integrates order kiosks within smartphones. It offers various features such as maps for locating nearby restaurants, detailed menus, and access to past orders. Additionally, it includes a calling feature for placing phone calls. The system comprises two main components: one designed for administrators and another for customers. Customers require access to their profiles, order history, menus, and courier information, while the admin section necessitates data on restaurants, orders, menus, and customers.

AHP is a method for organizing and analysing complex decisions based on math and psychology [3]. Previous literature [4] shows that many researchers have adopted AHP and fuzzy AHP methodology in various fields such as, security systems in social media platforms [5] selecting facility location [6], safety management system [7], project selection [8], e-government [9], risk assessment [10], and service quality [11]. This method has been chosen for its versatility and high efficiency in solving different types of decision-making problems [12] AHP has also been successfully used in various fields of human resource management [13] such as selecting employees [14], project delivery [15].

AHP is widely used in evaluation of online food delivery such as, AHP to compare food delivery systems [16], comparison of different factors in online food delivery [17], quantifying decision factors in selection of online food [18], AHP-TOPSIS for evaluating online food delivery [19], evaluation and selection of online food delivery through FUZZY-TOPSIS [20].

4. Methodology

The Analytical Hierarchy Process (AHP) is a decision-support framework developed by Saaty.TL [21-25]. Its main aim is to assess the relative importance of a defined set of alternatives using a ratio scale, which is based on the decision-maker's judgment. This methodology highlights the importance of the intuitive assessments made by the decision-maker and the need for consistency when comparing alternatives during the decision-making process. Since decision-makers depend on their expertise and experience to make judgments and ultimately decisions, the AHP framework is well-suited to their behavioural tendencies. A significant benefit of this method is its capacity to systematically arrange both measurable and non-measurable factors, providing a structured yet relatively simple approach to addressing decision-making issues. Additionally, by logically breaking down a problem from a broader viewpoint

to more specific details, one can create links between the smaller components and the larger context through straightforward paired comparison judgments. Saaty.TL. [21-25] outlined the following steps for implementing the AHP:

1) Define the problem and determine its goal.
2) Structure the hierarchy from the top (the objectives from a decision-maker's viewpoint) through the intermediate levels (criteria on which sub- sequent levels depend) to the lowest level which usually contains the list of alternatives.
3) Construct a set of pair-wise comparison matrices (size n×n) for each of the lower levels with one matrix for each element in the level immediately above by using the relative scale measurement shown in Table 1. The pair-wise comparisons are done in terms of which element dominates the other.
4) There are n(n-1)/ 2 judgments required to develop the set of matrices in step 3. Reciprocals are automatically assigned in each pair-wise comparison.
5) Hierarchical synthesis is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy.
6) Having made all the pair-wise comparisons, the consistency is determined by using the eigenvalue, λ_{max}, to calculate the consistency index, CI as follows: $CI=(\lambda_{max}-n)/(n-1)$, where n is the matrix size. Judgment consistency can be checked by taking the consistency ratio (CR) of CI with the appropriate value in Table 2. The CR is acceptable, if it does not exceed 0.10. If it is more, the judgment matrix is inconsistent. To obtain a consistent matrix, judgments should be reviewed and improved.
7) Steps 3-6 are performed for all levels in the hierarchy.

Table- 1: The fundamental scale of absolute numbers

Numerical rating	Verbal judgments of preferences
9	Extremely preferred
8	Very strongly to extremely
7	Very strongly preferred
6	Strongly to very strongly
5	Strongly preferred
4	Moderately to strongly
3	Moderately preferred
2	Equally to moderately to more
1	Equally preferred

Fortunately, there is no need to implement the steps manually. Professional commercial software, **Expert Choice**, developed by Expert Choice, Inc. [26], is available in the market which simplifies the implementation of the AHP's steps and automates many of its computations.

Table 2: Average random consistency (RI)

Size of matrix	1	2	3	4	5	6	7	8	9	10
Random consistency	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

In this study, primary data were gathered using questionnaires distributed to online consumers. A structured questionnaire was employed to facilitate data collection for the research. The design of the questionnaires was precisely crafted to ensure the highest level of accuracy in the information obtained and to enhance the respondents' comprehension. Subsequently, the Analytic Hierarchy Process (AHP) was applied to the collected data to fulfil the objectives of the current research. Many researchers evaluated online food delivery by using different criteria like speed of delivery, service quality, online tracking customer service, variety of dishes, privacy and security [27-36], In this study we considered five essential criteria were initially identified for evaluation, deemed necessary for the assessment. The selected criteria are discussed below

1) **Economy:** This includes the charge by the company which include transportation, labour and administration costs, discounts and offers, cash back offers, reward points, minimum order amount, membership offers and delivery fee.
2) **Service Quality**: This includes Time saving of ordering, pick-up, and cleanliness of the food, eco-friendly packaging, carbon footprint, Timeliness of order arrival, Timeliness of SMS, WhatsApp alert, order accuracy, response of customer service and delivery staff.
3) **Technology: T**his includes a calling feature for placing phone calls, Time taken for online tracking, Smart technology to track the location of the order, user interface, accessibility of the system, flexibility of payment system like debit card, credit card payments, UPI payment system, wallet facility, internet banking facility and cash on delivery facility.
4) **Privacy and security:** The important criteria during online transactions/placing orders is privacy and security. This includes Title of the customer, phone number, mailing address, bank statement, email address, password, and other personal details are examples of personal information. Consumers are becoming more concerned with how and where their sensitive information is used during internet transactions as a result of many high-profile news stories about data breaches by well-known businesses.so the online food delivery apps should give the assurance about the privacy and security.
5) **Availability of restaurant choice:** Another important criterion is menu which contains availability of restaurant choice, variety of dishes. Credibility of the OFS refers to the level of trust worthiness of information, as well as the reliability and accuracy of the platform. This can be assessed through the variety of food and restaurant options available. The credibility of an online food delivery service is influenced by the consistency of the food selections provided, the range of restaurants accessible, and their pricing.

Subsequently, five leading online food delivery systems (OFS) swiggy, zomato, Uber Eats, Food panda, and Dunzo in Hyderabad, India are compared based on the chosen criteria by organizing the decision-making process into a three-tier hierarchy consisting of Goal, Criteria, and Alternatives. Overview of this process is shown in the following figure-1 and after structuring the goal in hierarchy AHP process is applied to find the priority ranking of OFS.

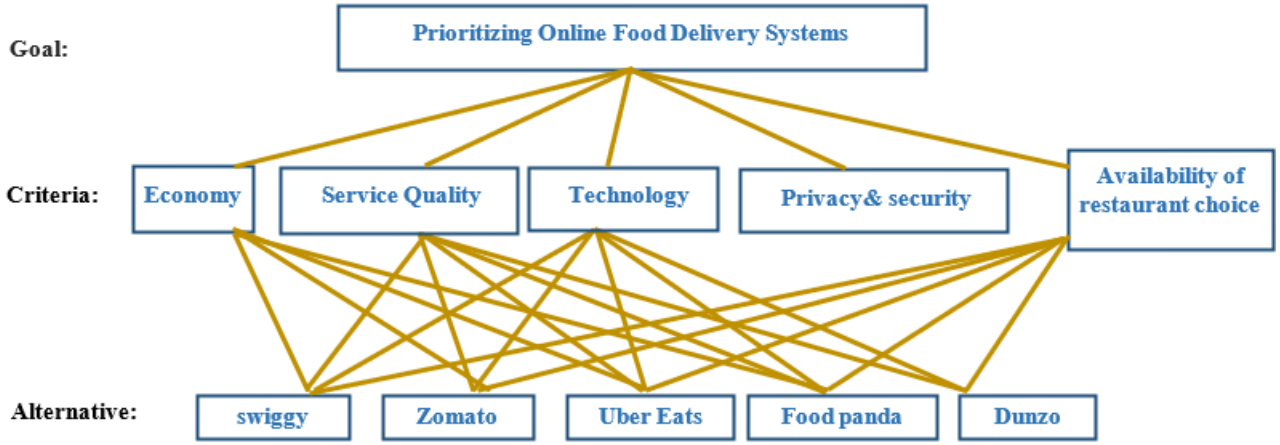

Figure 1: Proposed Model

The AHP calculations are given in table 3 to 9

Table 3: Pair-wise comparison matrix for all criteria

	Economy	Technology	Service quality	Privacy and security	Availability of restaurant choice	Priority vector
Economy	1	1/6	1/7	2	3	0.07937
Technology	6	1	1/4	5	7	0.26552
Service quality	7	4	1	9	9	0.56591
Privacy & security	1/2	1/5	1/9	1	2	0.05322
Availability of restaurant choice	1/3	1/7	1/9	1/2	1	0.03598
λ_{max} = 5.27705, CI = 0.0692622, R1 = 1.12, CR = 0.061 < 0.1						

Table 4: Pairwise comparison matrix for "*Economy* "

	Uber eats	Zomato	Swiggy	Foodpanda	Dunzo	Priority vector
Uber eats	1	1/5	1/6	3	2	0.08971
Zomato	5	1	1/4	5	7	0.25967
swiggy	6	4	1	9	9	0.55530
Food panda	1/3	1/5	1/9	1	3	0.05817
Dunzo	1/2	1/7	1/9	1/3	1	0.03718
λ_{max} = 5.38489, CI = 0.0962235, R1 = 1.12, CR = 0.008 < 0.1						

Table 5: Pairwise comparison for "service quality"

	Uber eats	Zomato	Swiggy	Foodpanda	Dunzo	Priority vector
Uber eats	1	1/5	1/7	2	3	0.08276
Zomato	5	1	1/4	5	7	0.25568
swiggy	7	4	1	9	9	0.57096
Food panda	1/2	1/5	1/9	1	2	0.05408
Dunzo	1/3	1/7	1/9	1/2	1	0.03651
λ_{max} = 5.23395, CI=0.0584885, RI=1.12, CR=0.05<0.1						

Table 6: Pair-wise comparison matrix for "*Technology*"

	Uber eats	Zomato	Swiggy	Foodpanda	Dunzo	Priority vector
Uber eats	1	1/3	1/4	2	5	0.13452
Zomato	3	1	1/3	5	7	0.28839
swiggy	4	3	1	4	6	0.45856
Food panda	1/2	1/5	1/4	1	2	0.07589
Dunzo	1/5	1/7	1/6	1/2	1	0.04263
λ_{max} = 5.28004, CI = 0.0700104, R1 = 1.12, CR = 0.062 < 0.1						

Table 7: Pair-wise comparison matrix for "*Privacy and security*"

	Uber eats	Zomato	Swiggy	Foodpanda	Dunzo	Priority vector
Uber eats	1	1/5	1/4	2	3	0.11557
Zomato	5	1	4	5	5	0.50978
swiggy	4	1/4	1	3	3	0.23313
Food panda	1/2	1/5	1/3	1	2	0.08196
Dunzo	1/3	1/5	1/3	1/2	1	0.05957
λ_{max} = 5.35089, CI = 0.0877236, R1 = 1.12, CR = 0.07 < 0.1						

Table 8: Pair-wise comparison matrix for "*Availability of restaurant choice"*

	Uber eats	Zomato	Swiggy	Foodpanda	Dunzo	Priority vector
Uber eats	1	7	3	2	7	0.43776
Zomato	1/7	1	1/4	1/2	3	0.08169
swiggy	1/3	4	1	1/3	5	0.17346
Food panda	1/2	2	3	1	7	0.26944
Dunzo	1/7	1/3	1/5	1/7	1	0.03765
λ_{max} = 5.32811, CI = 0.0820273, R1 = 1.12, CR = 0.07< 0.1						

Table 9: Final priority table

	Economy	Service quality	technology	Privacy and security	Availability of restaurant choice	Final priority vector	Rank
	0.07937	0.26552	0.56591	0.05322	0.03598		
Uber Eats	0.08971	0.08276	0.13452	0.11557	0.43776	**0.12712**	**3**
Zomato	0.25967	0.25568	0.28839	0.50978	0.08169	**0.28178**	**2**
Swiggy	0.55530	0.57096	0.45856	0.23313	0.17346	**0.47383**	**1**
Food panda	0.05817	0.05408	0.07589	0.08196	0.26944	**0.07598**	**4**
Dunzo	0.03718	0.03651	0.04263	0.05957	0.03765	**0.04129**	**5**

5. Results

The present study focuses on the comparative assessment of five online food delivery systems in Hyderabad based on various factors, including Economy, Service Quality, Technology, Privacy and security and availability of restaurant choice. The findings indicate that **SWIGGY (0.47)** ranks highest in terms of overall suitability among all evaluated systems, following **ZOMATO (0.28),** emerges as the second most popular one, with **UBER EATS (0.127)** in third place, **FOOD PANDA (0.07)** in fourth, and **DUNZO (0.04)** in last position. The results highlight that SWIGGY and **ZOMATO** are the two leading online food delivery systems.

6. Conclusion

The aim of this research is to assess and rank five prominent online food delivery (OFS) systems in Hyderabad, specifically Swiggy, Zomato, Uber Eats, Food panda, and Dunzo, based on specific criteria. The criteria evaluated include Economy, service quality, privacy & security, technology and availability of restaurant choice. The research engaged participants from Hyderabad, aged 21 to 45, who have utilized online food ordering services at least thrice weekly and possess experience with all five companies. The results reveal that the foremost factor affecting customers' selection of Online Food Services (OFS) is service quality, which includes order fulfilment, delivery speed, and overall service performance, is identified as the most crucial factor for respondents when choosing an Online Food Delivery provider. Technology is considered the second significant factor, with location tracking being the most valued feature. In conclusion, the Analytic Hierarchy Process (AHP) model assists individuals in making well-informed choices in complex situations. Future investigations could integrate additional criteria and sub-criteria for a more thorough analysis. Since the participants in this study are solely within the 21-45 age range, it would be interesting to examine results across different age groups. For future research, multi-criteria decision-making (MCDM) methods such as PROMETHEE, Fuzzy PROMETHEE, AHP-ANP, VIKOR, TOPSIS and Fuzzy TOPSIS may be employed.

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