A decision tree classifier approach for predicting customer's inclination toward use of online food delivery services

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Abstract In today's world, demand for online food delivery (OFD) applications has been boosted because of people's busy schedules and aspirations for comfortable and smooth lifestyles. The purpose of the study is to provide knowledge of consumer behavior to the OFD Service providers. Primary data has been collected from 410 users of OFD applications. Decision Tree Classifier approach has been used to predict the consumer inclination toward use of OFD services.
The study concludes by presenting the Decision Tree by which Online Service Providers can predict the consumer behavior and based on which they can make better decisions. Major finding reveals that, dinner is the most preferred meal for OFD services across different income and age groups. Offers and discounts play a vital role in influencing the behavior of majority of OFD consumers. Practical implications: This paper offers a guidance to the Online Food Delivery Aggregators for better decision making.

Keywords: consumer behavior, online food delivery applications, decision tree classifier

1. Introduction

Online food delivery (OFD) services have become increasingly popular in recent years (Chakraborty, 2022), driven by factors such as the increasing penetration of smartphones, rising urbanization, and changing consumer preferences providing customers with convenient access to a wide variety of cuisines and restaurants without the need to leave their home or office (Thamaraiselvan, 2019).

According to a report by Statista, the global online food delivery market was valued at US$136.4 billion in 2020 and is projected to reach US$182.3 billion by 2024. According to a report by Allied Market Research, the use of mobile apps for online food ordering is expected to increase at a CAGR of 25% between 2021 and 2030. The Asia-Pacific region is the largest market for online food delivery, with China and India being the largest contributors to growth.

Online food delivery services are platforms or mobile applications that allow customers to order food from local restaurants and have it delivered to their doorstep (Saad, 2021). These services typically provide customers with a range of options from different restaurants, along with menus, prices, and delivery time estimates (Charlene Li, 2020). Customers can browse the available options, place an order, and pay online using a credit card or other electronic payment method. Once the order is confirmed, the restaurant prepares the food, and a delivery person picks it up and delivers it to the customer's address.

The COVID-19 pandemic has also accelerated the adoption of online food delivery services in India (Gani, 2023), as consumers have become more reliant on home delivery options due to lockdowns and social distancing measures. Many restaurants and food businesses have also shifted their focus to online channels to reach customers and stay competitive (Mason et al., 2020)

Consumer behavior is the actions, decisions, and reactions of individuals or groups of people when purchasing, using, and disposing of goods and services. It encompasses a wide range of psychological, social, and economic factors that influence how consumers perceive, evaluate, and select products and services. Some key factors that can affect consumer behavior include personal factors such as age, gender, and income; psychological factors such as motivation, perception, and learning; social factors such as culture, family, and reference groups; and situational factors such as time and location (Ramya & Ali, 2016).

By studying consumer behavior, businesses can gain insights into how consumers make purchasing decisions, what influences their behavior, and how they can improve the customer experience to build loyalty and drive sales (Prasad & Vishwajeet, 2009).

A decision tree classifier is a type of machine learning algorithm that can be used to predict the value of a target variable based on a set of feature variables (such as gender, age, and income) (Jadhav, 2016).

The decision tree works by recursively splitting the dataset into subsets based on the values of the feature variables, with the goal of creating groups that are as homogeneous as possible in terms of the target variable. The tree structure can then be used to make predictions about new data by following the path from the root node to a leaf node that corresponds to the predicted value (Barros et al., 2015).

However, decision trees can be a useful tool for exploring the relationships between different variables and making predictions about target variables, especially in cases where there are many possible feature variables and complex interactions between them (Lu, 2015).

The online food delivery industry is experiencing rapid growth, with an increasing number of consumers opting for the convenience of ordering meals online. However, a critical gap exists in our understanding of the factors influencing consumer meal choices in this digital landscape. Current research lacks a comprehensive exploration of the intricate dynamics surrounding preferred meal choices, the impact of promotional offers, and the effective strategies employed by online food delivery aggregators. This knowledge gap hinders businesses from making informed, data-driven decisions to enhance their offerings, improve customer experience, and maximize profitability. Without a deeper understanding of these factors, the industry faces challenges in adapting to evolving consumer preferences and optimizing decision-making processes. Addressing these gaps is essential for the sustainable growth and success of businesses in the online food delivery ecosystem. Thus, the objective of this research is to determine the preferred meal choices of consumers when ordering food online, which will help businesses make data-driven decisions to enhance their offerings, customer experience, and profitability. It will also determine the influence of offers and discounts provided by online food applications on consumer behavior, which enables businesses to make informed decisions, increase customer engagement, and boost sales. The study will also identify effective strategies for online food delivery aggregators to enhance their decision-making processes and improve business outcomes. These objectives collectively provide valuable insights into consumer preferences, promotional strategies, and operational enhancements for businesses in the online food delivery industry, with the ultimate goal of improving their performance and success in the market.

2. Literature Review

In this study, different determinants, such as performance expectancy, trust, food safety risk perception, effort expectancy, and social influence, which affect customers' purchase intention toward OFD services, are discovered based on the use of technology and the unified theory of acceptance. A total of 392 responses were collected for the study. The results show that customer buying intention toward OFD services was positively affected by social influence, performance expectancy and trust. The relationship between buying intention and determinants was significantly controlled by usage frequency (Hong, 2023).

The purpose of this study is to identify the interaction of stakeholders in OFD platforms, which includes delivery systems, restaurants, platforms and effects on sales. The study was conducted by using one of the top OFD platforms in China. Panel Vector Autoregressive (PVA) Model Analysis has been used to verify the interaction among the abovementioned parameters. In this study, it has been found that restaurants' service performance, OFD platforms and delivery systems influence each other. Sales have been positively affected by OFD platforms, restaurant service performance and delivery systems (Jiao et al., 2022).

This study aims to enable decision makers to find sustainable strategies in OFD platforms by demonstrating the dynamic performance management (PMM) framework and system dynamics simulation model. This study shows the requirement for adopting a dynamic perspective in PMM, especially in complex and tempestuous environments. The findings also show that to develop an efficient PMM for food delivery platforms, elements such as key determinants affecting platform attractiveness must be considered because network effects may not be sufficient to reach a necessary number of users (Bivona & Enzo, 2022).

This study aims to validate the effect of three important drivers, i.e., marketing, technological and behavioral, on online food delivery orientation. Based on these three drivers, a conceptual framework has been developed. Cross-sectional surveys and quantitative methods were used to achieve the objective of the study. These data were collected from 150 respondents, and data analysis was performed using various statistical tools and software, such as SPSS and AMOS. It has been found that all the major drivers, i.e., marketing, behavioral and technological, positively predict OFD orientation, and the model was valid (Ayat et al., 2022).

Analyze the different factors that influence the consumer to choose OFD services. According to the study, Zomato is the most preferred app for ordering food online, as it provides the fastest delivery. Cash on Delivery is the most preferred mode of payment. Due to the COVID-19 pandemic, most people feel that ordering food online is a much safer way than physically visiting restaurants. Offers and discounts are the most influential factors when ordering food online. The study

recommends that service providers include environmentally friendly packaging materials while delivering the services. A sample size of 205 respondents was used for the study (Jadeja & Shubham, 2021).

Found that the shift in the trend of traditional dine-out systems to ordering food online is due to the easy availability of the internet at low cost, the increasing use of electronic devices and the changing lifestyle of consumers. According to the study, the most influencing factor for OFD services is offers provided by the service providers. Swiggy is the most preferred OFD application. Convenience and ease of payment are other important factors when considering OFD services. A sample size of 250 respondents was taken from Kerala State (Prabhash, 2020).

The purpose of this study is to recognize the benefits and various risks of customer usage and selection of OFD apps. Primary data were collected from 337 respondents. For data analysis, exploratory factor analysis was performed. It has been found that the usage and selection behavior of the consumer are influenced by the perceived risk and benefit factors. An increase in benefit perception and a decrease in risk perception positively influence consumers' overall attitudes toward the use of online food delivery applications (Duggal et al., 2020).

According to this study, researchers have identified various factors that influence customers to order food online, including a growing urban population and changes in eating habits, a shortage of time, changes in preferences, the growth of the smartphone culture, easy and flexible payment gateways, restaurant reviews, increasing income and consumption, positive lifestyle changes and a rising number of working women. In this study, researchers identified various pros and cons of OFD applications. This study was based on secondary data, and data were collected from various research papers, journals, websites and articles (Rani, 2020).

Based on the summaries of the previous studies on online food delivery services, several patterns, trends, and gaps in knowledge can be identified. These insights can help justify the need for current research in this area:

Positive Influencers on OFD Services:

- Social influence, performance expectancy, and trust are identified as positive determinants influencing customers' purchase intention toward OFD services (Hong, 2023).
- OFD platforms, restaurant service performance, and delivery systems positively affect sales (Jiao, 2022).
- Marketing, technological, and behavioral factors positively predict OFD orientation (Ayat, 2022).

Technology and Performance Management:

- The importance of technology is emphasized in influencing customer behavior in OFD services (Hong, 2023; Ayat, 2022).
- Dynamic performance management (PMM) frameworks and system dynamics simulation models are proposed for sustainable strategies in OFD platforms (Bivona, 2022).

Shifts in Consumer Behavior:

- The shift from traditional dine-out systems to OFD is attributed to the easy availability of the internet, increased use of electronic devices, and changing lifestyles (Prabhash, 2020).
- Factors such as convenience, ease of payment, and offers provided by service providers influence the choice of OFD services (Prabhash, 2020; Singh, 2021).

Risk and Benefit Perception:

- Consumer behavior in OFD services is influenced by perceived risks and benefits (Duggal, 2020).
- Increasing benefit perception and decreasing risk perception positively influence consumer attitudes toward OFD applications (Duggal, 2020).

Factors Influencing OFD Adoption:

- Factors influencing the adoption of OFD services include a growing urban population, changing eating habits, a shortage of time, and positive lifestyle changes (Rani, 2020).

Gaps and Areas for Further Research

- There is a focus on technology and positive influencers, but specific nuances in consumer behavior and preferences may need further exploration.
- The role of sustainability, environmental concerns, and ethical considerations in OFD services is not explicitly addressed in the summaries.
- The impact of external factors, such as economic conditions or global events (e.g., pandemics), on OFD services may be worth investigating.

3. Research Methodology

The research is both qualitative and quantitative in nature. The secondary data were collected from a systematic literature review of various research papers, journals, websites and articles. Primary data were collected by using structured questionnaires. The scope of the study was limited to Tier 1 and Tier 2 cities of Maharashtra State of India, as the study likely aims to understand urban dynamics, challenges, or opportunities specific to Tier 1 and Tier 2 cities. A random sampling method was used to select the sample. The adequate sample size for the unknown population is considered to be 384, but in

this study, a total of 410 responses were collected. For data analysis, a decision tree classifier was used in which the researcher considered different feature variables, such as gender, age, monthly income, willingness to spend an amount and target variables, such as preferred meal, role of offers and discounts, and buying from unknown restaurants.

4. Objectives

1. To identify the preferred meal of consumers while ordering food online.
2. To explore the impact of offers and discounts on consumer behavior with reference to online food applications.
3. To identify the strategies for online food delivery aggregators to make better business decisions.

5. Data Analysis and Interpretations

The accuracy of the decision tree model can be influenced by factors such as the size and quality of the dataset, the specific algorithm used, and the tuning of hyperparameters. For this study, the accuracy of the decision tree classifier model for predicting the target variable over the feature variable was calculated by performing a prediction accuracy check in Orange Data Mining software, as shown below in Figure 1. We also checked the prediction accuracy of different models, such as random forest, logistic regression, and naïve Bayes, for the same dataset, and the results are shown below in Table 1 and Table 2.
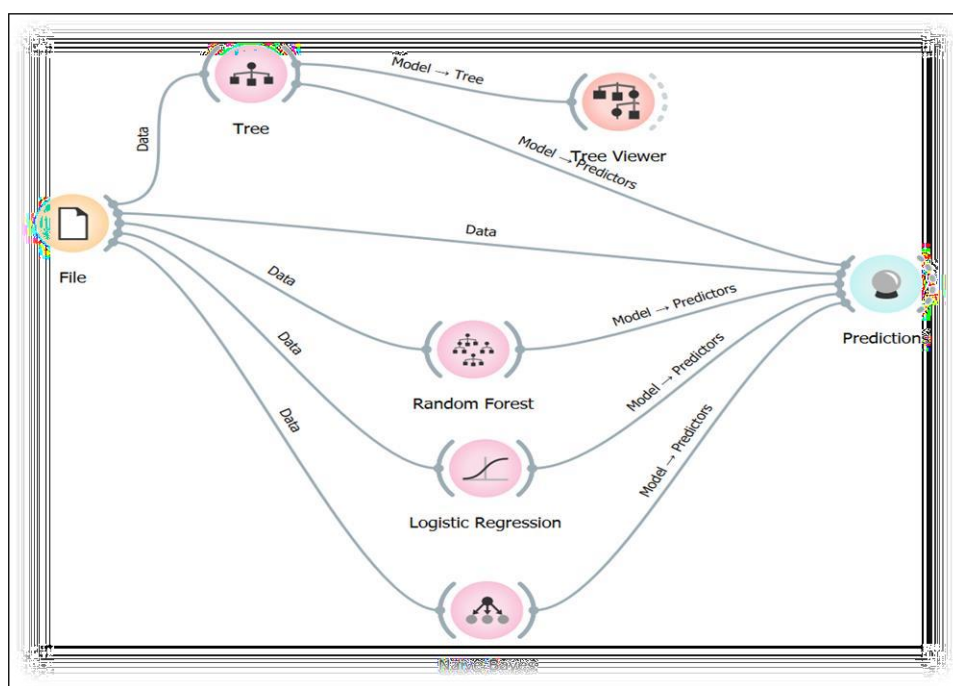

Figure 1 Prediction Accuracy Model.

Table 1 Prediction accuracy for the preferred meal variable using different models.

Model	AUC	CA	F1	Precision	Recall
Random Forest	0.791	0.668	0.605	0.689	0.668
Logistic Regression	0.654	0.605	0.485	0.559	0.605
Naïve Bayes	0.616	0.595	0.516	0.571	0.595
Decision Tree	0.676	0.607	0.51	0.459	0.607

The accuracy of the decision tree classifier model for predicting the target variable, i.e., preferred meal, over the feature variable used over the data in this research context is 60.7%, as shown in Table 1.

The accuracy of the decision tree classifier model for predicting the target variable is considered a question: do offers and discounts influence you to buy extra? as a target variable over the feature variable used over the data in this research context is 69.5%, as shown in Table 2.

Orange Data Mining Tools are used to analyze the data given by the 410 respondents. After analyzing the data, the output is generated in the form of a decision tree, as shown in Figure 2 above.

Figure 2 shows the decision tree classifier approach with respect to preferred meals. From this analysis, the author seeks to identify the most preferred meal of the consumer while using OFD services. For this approach, the author identified

4 different variables: age, gender, monthly income, occupation considered a feature variable and preferred meal as a target variable.

<div align="center">Table 2 Prediction accuracy for the offers and discounts variable using different models.</div>

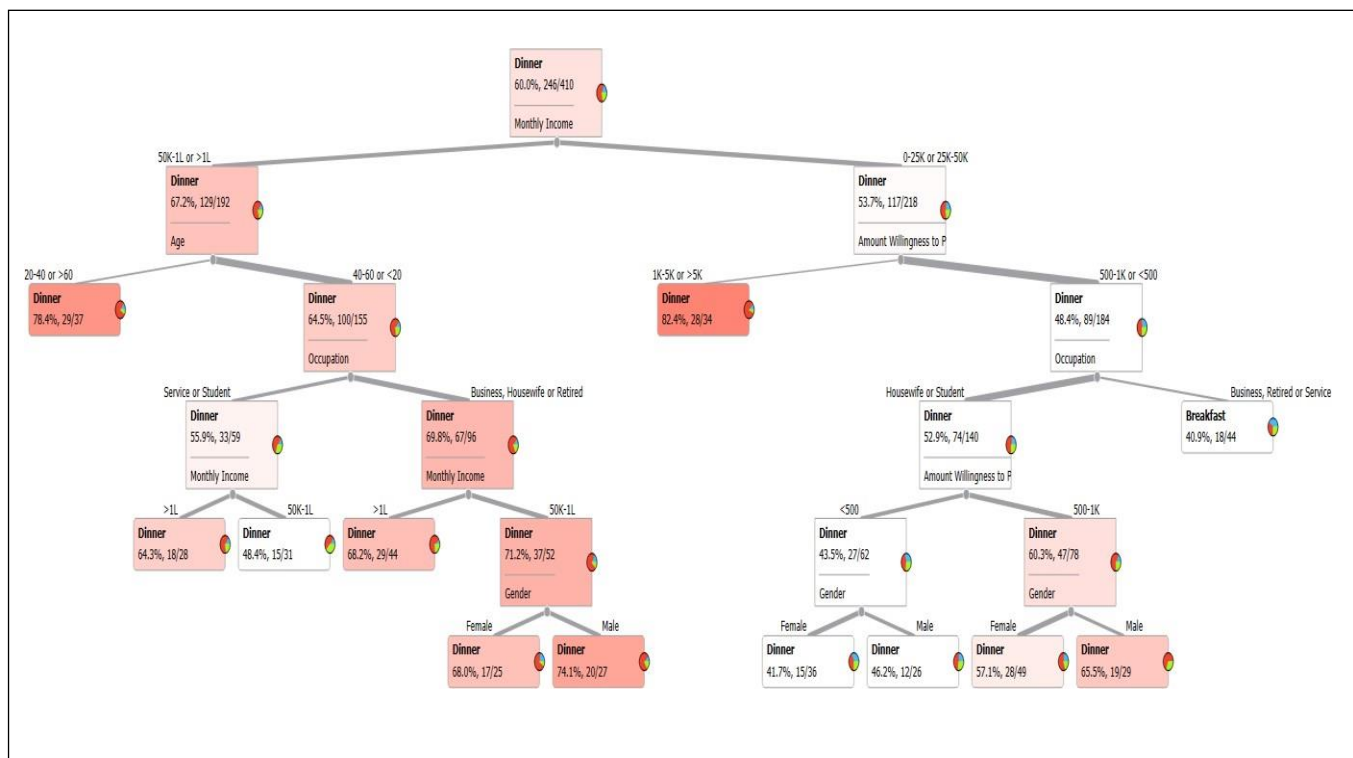| Model	AUC	CA	F1	Precision	Recall
Random Forest	0.948	0.8	0.793	0.798	0.8
Logistic Regression	0.858	0.695	0.681	0.682	0.695
Naïve Bayes	0.838	0.698	0.687	0.685	0.698
Decision Tree	0.85	0.695	0.675	0.659	0.695

Figure 2 Decision tree classifier with respect to the preferred consumer meal while using OFD services.

Figure 3 shows that out of 410 respondents, a majority of 246 (60%) respondents prefer dinner, followed by 84 (20.5%) prefer lunch and 80 (19.5%) prefer breakfast while using online food delivery services.
As shown in Figure 2, the decision tree has been broadly classified into two groups, A and B. Group A contains people who earn 50 k to 1 lac and more than 1 lac monthly. In group B, a person who is earning 0 to 25 k or 25 k to 50 k monthly is present.
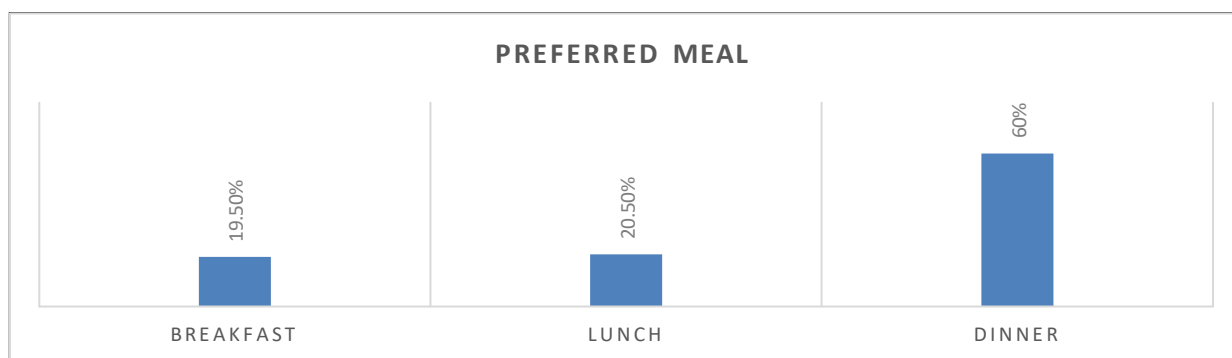

Figure 3 Most Preferred Meals.

Group A people are first classified on the basis of their age and then occupation, followed by gender. It has been found that irrespective of anything, dinner is the most preferred meal when using online food delivery services.
Group B people are first classified on the basis of the amount respondents are willing to spend using OFD services, then the occupation and gender of the respondents. In this group, it has also been found that irrespective of anything, dinner is the most preferred meal while ordering food online.

For better decision making, the probability of a selection of target variables was set at 65% or more.

According to group A, i.e., a person who is earning 50 k to 1 lac or more than 1 lac monthly, if the respondents fall under the age group of 20 to 40 or more than 60, then it is 78.4% possibility that he will prefer dinner while ordering food online.

If a person is in the age group of less than 20 or 40 to 60 and if he/she is doing business, retired or housewives, then there is a 69.8% chance that they prefer dinner while using OFD services.

It has also been found that if the customer is earning more than 1 lac and if he/she is students or doing services, then there is a 64.3% chance that he/she prefers dinner for ordering food online. If he/she is a Housewife and retired from doing business, then there is a 68.2% chance that he/she will prefer Dinner while using online food delivery services.

If the customer is earning 50 k to 1 lac monthly and falls in an age group of less than 20 or 40 to 60, and if he/she is doing business, the house is retired, then there is a 71.2% chance that the customer will prefer dinner. For females, there is a 68% chance that she prefers dinner for OFD ordering, and for males, there is a 74.1% chance that he prefers dinner while using online food delivery services.

Figure 4 shows, according to group B, if the customer is earning 0 to 2k or 25k to 50k monthly and if he willing to spend 1k to 5k or more than 5k then it is 82.4% chance that the customer is prefer Dinner while ordering food online.
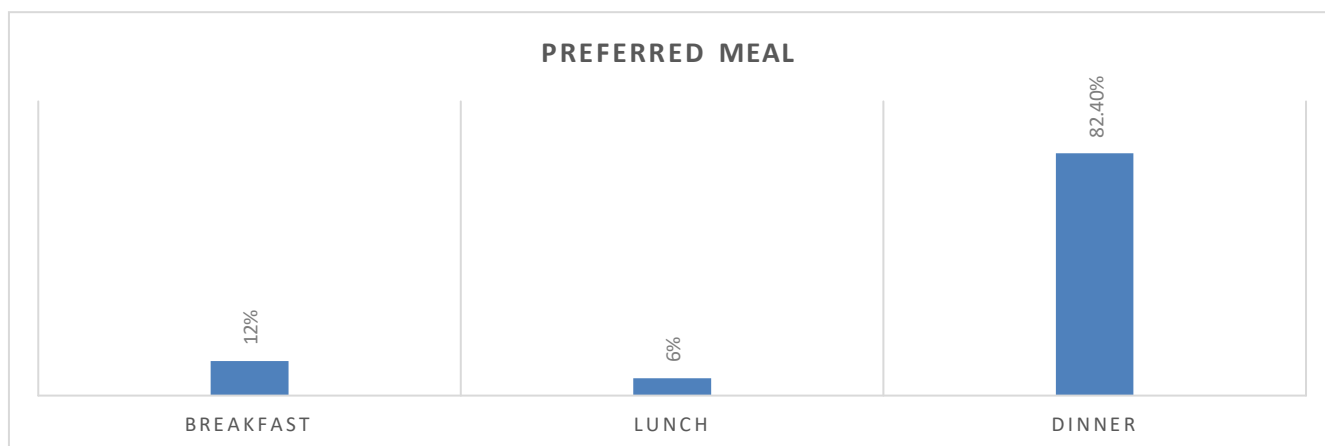

Figure 4 Preferred Meal on the basis of earning and willingness to spend.

If a person is earning 0 to 25 k or 25 k to 50 k monthly and if he is willing to spend less than 500 and 500 to 1 k monthly, then there is the highest possibility, i.e., a 40.9% chance that he/she will prefer Breakfast, followed by 15 (34.1%) prefer dinner and 11 (25%) prefer lunch while ordering food online, as shown in Figure 5.

If a person is male and earns monthly 0 to 25 k or 25 k to 50 k and if willing to spend 500 to 1 k monthly, then there is a 65.5% chance that he will prefer dinner, followed by Lunch (31%) and Breakfast (3.4%).

To identify the impact of offers and discounts on consumer behavior, a question was asked to consumers: Do offers and discounts influence you to buy extra? For the analysis, this question has been considered as a target variable, and variables such as Gender, Age, Monthly Income, Amount Willingness to spend, Occupation and Promotional offers and Discounts are the main reasons for Ordering Online considered as a feature variable.
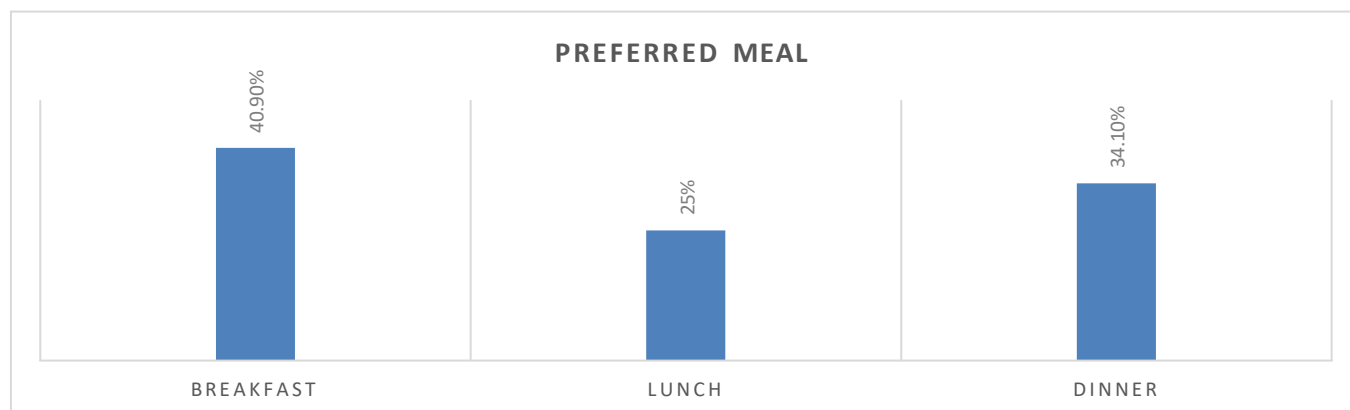

Figure 5 Preference for Breakfast.

By analyzing the data using the Orange Data Mining Tool, the decision tree shown below, Figure 6 has been generated, i.e., the decision tree classifier with respect to the impact of the offers and discounts on consumer behavior.
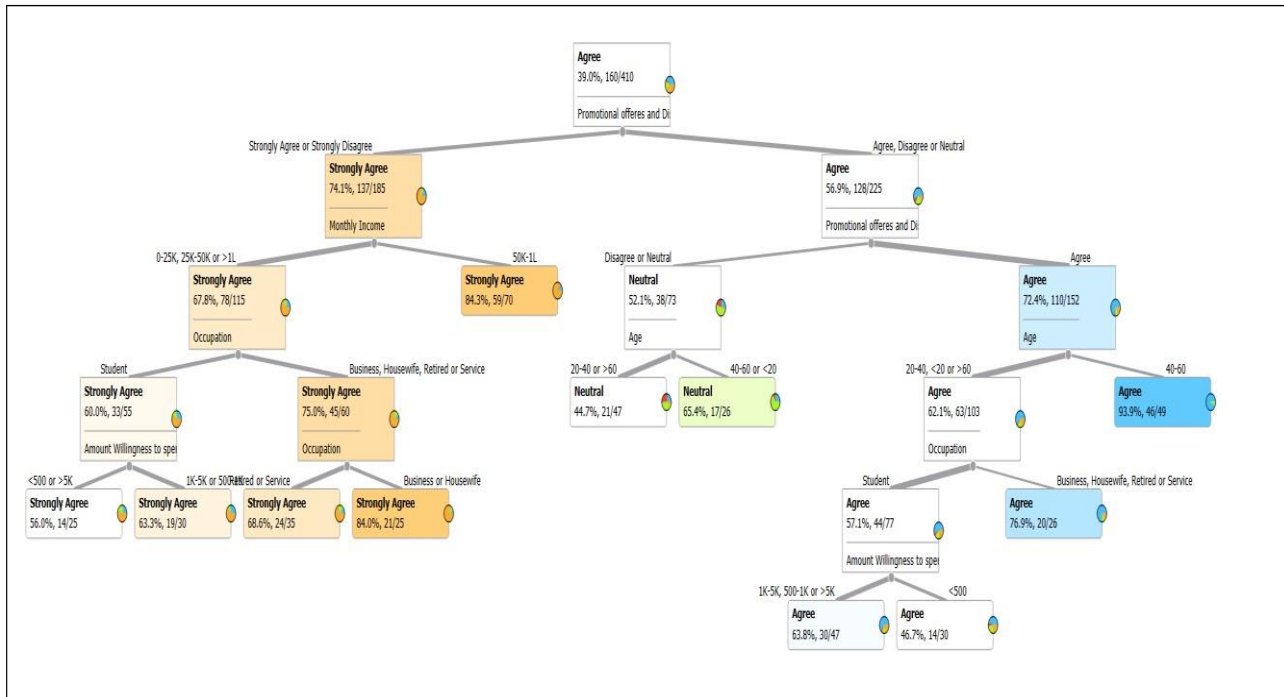

Figure 6 Decision Tree Classifier with respect to Impact of Offers and Discounts on Consumer Behavior.

For better decision making, the probability of a selection of target variables was set at 70% or more.

As per Figure 7, out of 410 respondents, the majority of respondents agreed that, because of promotional offers and discounts, customers' buying behavior influences, and they order extra than needed.
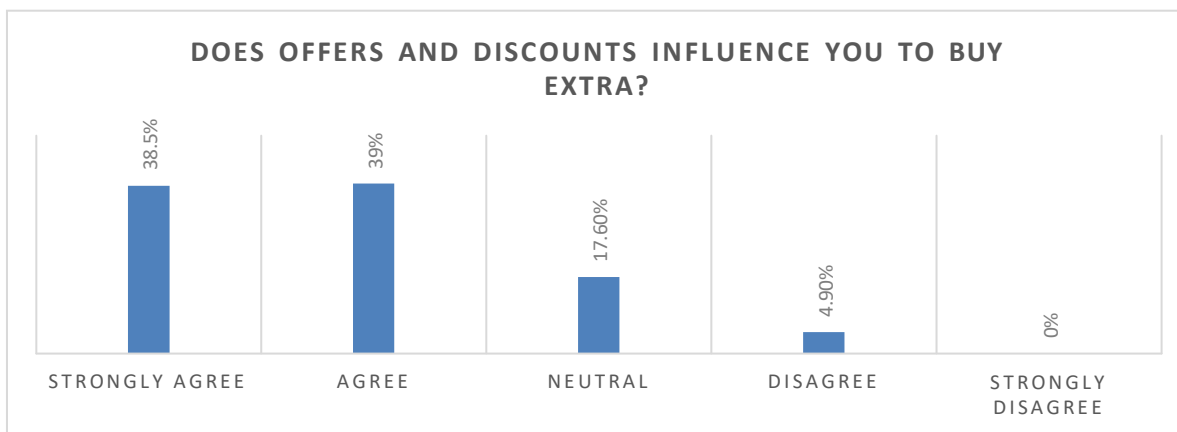

Figure 7 Does Offers and Discounts influence to buy extra.

As shown in Figure 6 and Figure 8, the next major split is based on promotional offers, and discounts are the main reason for ordering food online. It has been found that a majority of 137 (74.1%) respondents strongly agreed with the statement. This suggests that discounts and offers play a significant role in driving consumer behavior in the OFD market.

It has been found that a person who is earning 50 k to 1 lac monthly, according to them, a majority of 59 (84.3%) respondents strongly agreed that offers and discounts influence them to buy extra food while ordering food online. This implies that the influence of discounts and offers is even more significant for this income bracket.

It has also been found that if a person strongly agrees that promotional offers and discounts are the main reason for ordering food online and if he/she is earning 0 to 25k or 25k to 50k or more than 1 lac and if he/she is doing business or if she is a housewife, then according to them, a majority of 84.0% respondents strongly agree that they order/buy extra than needed by being influenced through offers and discounts.

If a person agrees with the statement that promotional offers and discounts are the main reason to order food online and if the age of that person is 40 to 60, then a majority of 93.9% of respondents agree that offers and discounts influence them to buy extra food, and if a person's age is less than 20, 20 to 40 or more than 60 and the occupation of that person is business, service, or retired of housewife, then 76.9% of respondents agree that offers and discounts influence them to buy extra food while using online food delivery services.

PROMOTIONAL OFFERS AND DISCOUNTS IS THE MAIN REASON FOR ORDERING FOOD ONLINE

STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
74.1%	17.3%	8.10%	0.50%	0%

Figure 8 Promotional offerings and discounts are the main reasons for ordering food online.

6. Findings

Dinner is the most preferred meal while ordering food online across all income groups and age groups.

Among those earning 50 k to 1 lac or more per month, there is a higher likelihood of preferring dinner while ordering food online, irrespective of their age group or occupation.

For those under the age of 20 or in the age group of 40 to 60 and doing business, retired or housewives, there is a higher probability of preferring dinner while using online food delivery services.

For those earning more than 1 lac per month and studying or working, there is a 64.3% chance of preferring dinner while ordering food online, while for those doing business, retired, or housewives, the probability increases to 68.2%.

For females earning 50 k to 1 lac monthly and falling under the age group of less than 20 or 40 to 60 and doing business, retired, or housewives, there is a 68% chance of preferring dinner for online food delivery services. For males, the probability increases to 74.1%.

Dinner is the most preferred meal for OFD services across different income groups and spending ranges, except for those who earn 0 to 25k or 25k to 50k monthly and are willing to spend less than 500 or 500 to 1k monthly, where breakfast is the most preferred meal.

This study identified that promotional offers and discounts are a strong motivator for consumers to order food online and buy more than they may have initially intended.

It also highlights the importance of such offers and discounts as a marketing strategy for OFD platforms.

It appears that there is a strong correlation between promotional offers and discounts and the decision to order food online, regardless of age or occupation.

7. Conclusion

The study highlights that dinner is the most preferred meal for online food delivery services across different income and age groups. However, there are variations in preferences based on gender, occupation, and income ranges. The study also indicates that promotional offers and discounts are a significant motivator for consumers to order food online, indicating their importance as a marketing strategy for online food delivery platforms. The data suggest that companies offering promotional offers and discounts are likely to see a positive impact on consumer behavior in the online food delivery market. Overall, the findings of this analysis provide insights into consumer behavior and preferences in the online food delivery market and can be useful for companies in developing targeted marketing strategies to attract and retain customers. This type of analysis can also help businesses better understand how to use offers and discounts to influence consumer behavior and increase sales.

8. Future Scope

One possible area of future research is to analyze the impact of social media and online reviews on consumer behavior in the online food delivery market. Consumers may rely on social media and online reviews to make decisions about which online food delivery platform to use, and this can influence their behavior and preferences.

According to Prediction Accuracy Model (1), the accuracy of the Random Forest Model is too high than that of the Decision Tree Model, i.e., 66.8% for the Preferred Meal variable and 80% for the Offers and discount variable; therefore, we can also use the Random Forest Model for predicting customers' inclination toward the use of online food delivery services for future research.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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