Food Delivery Cost and Profitability Analysis

DONE FOR

Project Report Submitted in partial fulfilment of the requirement of
PONDICHERRY UNIVERSITY for the award of the degree of
MASTER OF BUSINESS ADMINISTRATION

By

POLKAM SRIDEVI
(Reg. No. 22401024)

Under the Guidance of

Dr. S. AMOLAK SINGH
Assistant Professor
&
PARAS GROVER
CEO, Unified Mentor

DEPARTMENT OF MANAGEMENT STUDIES
SCHOOL OF MANAGEMENT
PONDICHERRY UNIVERSITY
PONDICHERRY-605014

January – May 2024


Issued Date: 01-03-2024
CIN No- U85500HR2023PTC115118
CERTIFICATE
OF INTERNSHIP
UNIFIED MENTOR
YOUR SKILL, SUCCESS & JOURNEY
AICTE
Sridevi Polkam
For successfully completing one month internship as Data Analyst Intern at Unified Mentor Pvt Ltd. Dated from 01-02-2024 to 01-03-2024
During the internship we found him/her consistent & hard-working. We wish them all the best for their future endeavors.
Verify at:
Paras Grover
Paras Grover
Director
CERTIFIED ISO 9001:2015 COMPANY
Sanket Patil
Sanket Patil
Awarded By
AN ISO 9001:2015 Certified Company

DEPARTMENT OF MANAGEMENT STUDIES
SCHOOL OF MANAGEMENT
PONDICHERRY UNIVERSITY
PONDICHERRY-605014

CERTIFICATE

This is to certify that this project report entitled **" Food Delivery Cost and Profitability Analysis"** done for Unified mentor is submitted by **Polkam Sridevi (Reg.No:22401024),** II MBA (DA) to the **DEPARTMENT OF MANAGEMENT STUDIES, SCHOOL OF MANAGEMENT, PONDICHERRY UNIVERSITY** in partial fulfilment of the requirements for the award of the degree of **MASTER OF BUSINESS ADMINISTRATION (DATA ANALYTICS)** and is a record of an original and bonafide work done under the guidance of **Dr. S. Amolak Singh**, Assistant Professor, Department of Management Studies, Pondicherry University. This report has not formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title to the candidate and that the report represents an independent and original work on the part of the candidate.

Dr. S. Amolak Singh
Assistant Professor and Project Guide
Department of Management Studies

Dr. R. Kasilingam
Professor and Head
Department of Management Studies

Date:
Place: Pondicherry 605 014

DECLARATION

I hereby declare that the project titled, **"Food Delivery Cost and Profitability Analysis"** is an original work done by me under the guidance of **Dr. S. Amolak Singh, Assistant Professor, Department** of Management Studies, Pondicherry University, and **PARAS GROVER CEO, Unified Mentor**. This project or any part thereof has not been submitted for any Degree / Diploma / Associateship / Fellowship / any other similar title or recognition to this University or any other University.

I take full responsibility for the originality of this report. I am aware that I may have to forfeit the degree if plagiarism has been detected after the award of the degree. Notwithstanding the supervision provided to me by the Faculty Guide, I warrant that any alleged act(s) of plagiarism in this project report are entirely my responsibility. Pondicherry University and/or its employees shall under no circumstances whatsoever be under any liability of any kind in respect of the aforesaid act(s) of plagiarism.

Polkam Sridevi
Reg. No. 22401024
II MBA (DA)
Department of Management Studies
Pondicherry University

Date:
Place:

Acknowledgements

First and foremost, praises and thanks to the God, the Almighty, for His showers of blessings throughout my internship to complete the project successfully.

I express my heartfelt gratitude to ***Dr R. KASILINGAM****, Head of the Department, Department of Management Studies, Pondicherry University, for his constant encouragement and support.*

I would like to express my sincere gratitude to my research guide ***Dr. S. AMOLAK SINGH,*** *Assistant Professor, Department of Management Studies, Pondicherry University for his incessant encouragement and support extended throughout the research period.*

Special thanks to Unified Mentor Pvt. Ltd. for their contributions and support. Their expertise greatly enhanced the quality of this project. I am also deeply thankful to the team at Unified Mentor Pvt. Ltd. who provided a collaborative and nurturing environment. I must express my gratitude to the organization for providing access to the necessary resources, datasets, and tools that enabled me to carry out my projects effectively.

I thank all my classmates of Pondicherry University who had given me moral support. I am extremely grateful to my family who had to tolerate late night work, and curtailed weekends & vacations. The support and encouragement of my parents gave me the energy and inspiration to complete the project.

CONTENTS

Figures

Chapter – 1

INTRODUCTION

1.1 Introduction

The food delivery industry has witnessed unprecedented growth and transformation in recent years, driven by the increasing demand for convenient dining solutions. As technological advancements continue to reshape consumer behaviour and preferences, the food delivery sector has become a pivotal component of the modern dining experience. The emergence of various delivery platforms and the digitization of logistics have not only revolutionized the way food is transported and consumed but have also presented an intricate web of operational intricacies and financial considerations for stakeholders within the industry.

The aim of this comprehensive "Food Delivery Cost and Profitability Analysis" is to delve deep into the multifaceted landscape of food delivery, meticulously scrutinizing the intricate cost dynamics and profitability factors that underpin the operations of food delivery services. By undertaking a rigorous examination of the cost structures associated with food delivery, encompassing aspects such as packaging, transportation, labor, and overhead expenses, this analysis seeks to shed light on the financial underpinnings that contribute to the complex ecosystem of food delivery. Furthermore, by juxtaposing these cost factors with the revenue streams and profitability metrics inherent to food delivery services, this study endeavours to offer invaluable insights into the financial viability and sustainable growth prospects of food delivery businesses.

In addition to the financial scrutiny, this analysis will also consider the broader impact of food delivery operations on the overall dining landscape, including the implications for restaurant partners, delivery personnel, and end consumers. Understanding the cost and profitability dynamics within the food delivery sector is crucial not only for food delivery service providers but also for restaurateurs and investors seeking to discern the financial implications of engaging with delivery platforms. Moreover, as the food delivery industry continues to undergo paradigm shifts, this analysis seeks to contribute to the ongoing dialogue surrounding the sustainable evolution and optimization of food delivery operations, with the ultimate goal of fostering a financially resilient and beneficial ecosystem for all stakeholders involved.

Through a meticulous examination of the cost and profitability intricacies within the food delivery space, this analysis endeavours to provide actionable insights and informed recommendations that can serve as a guiding compass for businesses, entrepreneurs, and industry professionals navigating the complex terrain of food delivery services. By uncovering

the fiscal nuances and profitability determinants that shape the food delivery landscape, this analysis aims to not only contribute to the overarching understanding of the industry but also to empower stakeholders with the knowledge necessary to drive informed decision-making, and pave the way for sustainable growth and value creation within the burgeoning realm of food delivery.

This introduction sets the stage for a comprehensive exploration of the intricate cost structures and profitability dynamics within the food delivery industry, aiming to provide valuable insights that can serve as a foundation for critical decision-making and strategic direction within this evolving sector.

1.2 Review of Literature

- Research by Smith et al. (2019) highlighted the significant cost components in food delivery services, emphasizing the importance of labor costs, food costs, delivery vehicle expenses, and platform commission fees in determining the overall cost structure.

- Jones and Lee (2020) explored the role of technology and operational efficiency in reducing delivery costs and improving profitability. Their study demonstrated how investments in route optimization software and delivery tracking systems can enhance efficiency and reduce operational expenses.

- A study by Chen and Wang (2018) delved into customer preferences in food delivery and their influence on pricing strategies. Understanding customer behavior and preferences is crucial for setting competitive prices while maintaining profitability.

- Recent studies by Green et al. (2022) investigated the sustainability aspects of food delivery services, highlighting the importance of eco-friendly practices in reducing costs associated with environmental regulations and fostering a positive brand image.

- Research by Lee and Kim (2021) focused on the competitive landscape of the food delivery industry and its impact on profitability. Analyses of market dynamics, such as the entry of new competitors and pricing wars, provide valuable insights into maintaining profitability amidst intense competition.

- Studies by Brown and Garcia (2019) emphasized the role of regulatory compliance in food delivery services and its cost implications. Compliance with food safety standards, labor regulations, and tax policies can significantly impact overall costs and profitability.

- Study by Wang and Liu (2021) explored the relationship between consumer behavior and delivery costs in the food delivery industry. The research highlighted the impact of

order frequency, basket size, and delivery distances on overall delivery costs and profitability.

- Research by Garcia et al. (2020) examined cost optimization strategies for food delivery platforms through dynamic pricing models and delivery network design. The study emphasized the importance of real-time data analytics in reducing costs and enhancing profitability.

- Analysis by Patel and Sharma (2023) investigated the role of quality control measures in ensuring cost efficiency and profitability in food delivery services. The study highlighted the link between food quality standards, customer satisfaction, and long-term cost savings.

- Study by Park and Chang (2019) explored the significance of data-driven decision making in managing delivery costs and profitability. The research emphasized the use of predictive analytics and machine learning algorithms to optimize delivery routes and resource allocation.

- Research by Nguyen and Tran (2018) examined the impact of outsourcing delivery services on cost management and profitability for food delivery businesses. The study analyzed the benefits and challenges associated with outsourcing delivery operations.

- Investigation by Chen et al. (2022) studied the seasonal variability in delivery costs and profitability analysis. The research highlighted the importance of adjusting pricing strategies and operational plans to accommodate fluctuations in demand and costs.

- Study by Rodriguez and Gomez (2021) explored the role of partnerships and cost-sharing arrangements in reducing delivery costs and improving overall profitability for food delivery platforms. The research analyzed collaborative models within the industry.

1.3 Need for the Study

To understand the cost components and profitability metrics in the food delivery industry is crucial for businesses to ensure long-term sustainability and financial viability.

To study the cost and profitability factors in food delivery can provide valuable insights into consumer behavior, preferences, and willingness to pay, enabling businesses to tailor their services accordingly.

By conducting a thorough analysis of delivery costs and profitability, companies can gain a competitive advantage by optimizing their pricing strategies and overall business operations.

1.4 Statement of the problem

Food Delivery Cost and Profitability Analysis involves examining all the costs associated with delivering food orders, from direct expenses like delivery fees and packaging to indirect expenses like discounts offered to customers and commission fees paid by restaurants. By juxtaposing these costs against the revenue generated (primarily through order values and commission fees), the analysis aims to provide insights into how profitable the food delivery service is on a per-order basis.

Below is the process we can follow for the task of Food Delivery Cost and Profitability Analysis:

- Start by gathering comprehensive data related to all aspects of food delivery operations.
- Clean the dataset for inconsistencies, missing values, or irrelevant information.
- Extract relevant features that could impact cost and profitability.
- Break down the costs associated with each order, including fixed costs (like packaging) and variable costs (like delivery fees and discounts).
- Determine the revenue generated from each order, focusing on commission fees and the order value before discounts.
- For each order, calculate the profit by subtracting the total costs from the revenue. Analyze the distribution of profitability across all orders to identify trends.
- Based on the cost and profitability analysis, develop strategic recommendations aimed at enhancing profitability.
- Use the data to simulate the financial impact of proposed changes, such as adjusting discount or commission rates.

1.5 Objective of the Study

1. **Cost Analysis:** Identify major cost components, including direct and indirect costs.
2. **Profitability Evaluation:** Assess individual and overall profitability by examining commission fees vs. total costs.
3. **Strategic Recommendations:** Propose strategies to reduce costs and optimize commission/discount rates for improved profitability.
4. **Impact Simulation:** Forecast the financial impact of recommended strategies and how they could transform losses into profits.

Chapter – 2

Company Profile & Industry Profile

2.1 Company Profile

Legal Name: Unified Mentor Pvt. Ltd.

Headquarters: Gurgaon, Haryana, India

Business Model: B2C, B2B

Founded in: 2022

No. of Employees: 11 to 20

Key Persons: 1. **Paras Grover** - Co-Founder

2. **Sanket Patil** - Co-Founder & COO

Unified Mentor is a global online education platform, established in 2022 specializing in tech-related fields. They provide a comprehensive solution for career-driven individuals by offering certification courses in data science, digital marketing, and web development. These courses are designed and updated by industry experts to ensure students graduate with practical skills applicable to real-world job scenarios. Unified Mentor goes beyond just certifications by offering internship opportunities, allowing students to bridge the gap between theory and practice. Their focus on continuous improvement, industry relevance, and long-term career success positions them as a strong contender in the online education space. Beyond core offerings, there are additional aspects to consider. The learning format might involve pre-recorded lectures or live online sessions, catering to different preferences. While details are limited, some online education platforms provide discussion forums, instructor Q&A sessions, or even career guidance. Investigating such support from Unified Mentor would be beneficial. Cost structure is another consideration, as pricing details for courses and internships aren't readily available. Understanding the investment is crucial. Finally, explore if Unified Mentor offers an alumni network or career services. These resources can be invaluable for graduates

seeking job opportunities or industry connections. By delving deeper into these areas, you'll gain a more comprehensive understanding of the Unified Mentor experience and how it aligns with your educational and career goals.

Mission

Empowering Futures through Knowledge

Utilizing Most Effective Training Methods

Developing Tomorrow's Tech Leaders

Vision

"To empower individuals worldwide to unlock their full potential through personalized mentorship."

2.2 Industry Profile

India has the largest population in the world in the age bracket of 5-24 years with 580 million people, presenting a huge opportunity in the education sector. India holds an important place in the global education industry. India has one of the largest networks of higher education institutions in the world. However, there is still a lot of potential for further development and improvement in the education system.

With increasing awareness, private Indian players are collaborating with international brands to provide an international standard of education. Private investments in the Indian education sector have increased substantially over the past two decades. The demand for specialised degrees is also picking up with more and more students opting for specific industry-focused qualifications. Higher education institutes in India are focusing on creating online programmes due to the increasing demand from consumers.

With cutting-edge technologies such as AI, ML, IoT and blockchain, India's education sector will redefine itself in the years to come. It has also embraced the Education 4.0 revolution, which promotes inclusive learning and increased employability. The government has implemented policies like the NEP, which will be fully implemented over the course of this decade starting from 2021-22 and will have a strong focus on high-quality vocational education.

Market Size

The education sector in India was estimated to be worth US$ 117 billion in FY20 and is expected to reach US$ 225 billion by FY25.

India has over 250 million school-going students, more than any other country. India had 43.3 million students enrolled in higher education in 2021-22 with 22.6 million male and 20.7 million female students.

According to UNESCO's 'State of the Education Report for India 2021', the Pupil Teacher Ratio (PTR) at senior secondary schools was 47:1, as against 26:1 in the overall school system.

The Number of colleges in India reached 50,734 in FY24 (as of March 4, 2024) and 43,796 in FY21, up from 42,343 in FY20. The number of universities in India reached 1,265 in FY24 (as of March 4, 2024), up from 760 in FY15.

Education Industry in India

India had 43.3 million students enrolled in higher education in 2021-22 with 22.6 million male and 20.7 million female students, as against 41.3 million students enrolled in higher education in 2020-21, with 21.2 million male and 20.1 million female students. In 2022-23, there are 8,902 total AICTE-approved institutes in India. Out of these 8,902 institutes, there are 3,577 undergraduate, 4,786 postgraduate and 3,957 diploma institutes.

The Indian edtech market size is expected to reach US$ 30 billion by 2031, from US$ 700-800 million in 2021. According to KPMG, India has also become the second largest market for E-learning after the US.

The online education market in India is expected to grow by US$ 2.28 billion during 2021-2025, growing at a CAGR of almost 20%.

Chapter - 3

Research Methodology

3.1 Source of Data

The dataset utilized in this project, named "Food Orders," was sourced from Unified Mentor. The dataset contains comprehensive details on food orders, including Order ID, Customer ID, Restaurant ID, Order and Delivery Date and Time, Order Value, Delivery Fee, Payment Method, Discounts and Offers, Commission Fee, Payment Processing Fee, and Refunds/Chargebacks. This data provides a foundation for analysing the cost structure and profitability of the food delivery service.

3.2 Summary of the Data

Number of Rows: 1000

Number of Columns: 12

3.3 Data Description

A food delivery service is facing challenges in achieving profitability across its operations. With a dataset of 1,000 food orders, the service seeks to understand the dynamics of its cost structure and profitability to identify strategic opportunities for improvement. This data provides a foundation for analysing the cost structure and profitability of the food delivery service.

The dataset contains comprehensive details on Food orders:

- Order ID: Unique identifier for each order.
- Customer ID: Unique identifier for each customer.
- Restaurant ID: Unique identifier for each restaurant.
- Order Date and Time: Date and time when the order was placed.
- Delivery Date and Time: Date and time when the delivery was made.
- Order Value: Total value of the order.
- Delivery Fee: Fee associated with the delivery.

- Payment Method: The method used for payment (e.g., Credit Card, Digital Wallet, Cash on Delivery).
- Discounts and Offers: Any discounts or offers applied to the order.
- Commission Fee: Fee charged as a commission.
- Payment Processing Fee: The fee associated with processing the payment.
- Refunds/Chargebacks: Any refunds or chargebacks associated with the order.

3.4 Research instrument

The main tools and libraries used are:

pandas: A powerful data manipulation and analysis library for Python. It is used for reading the CSV file, converting data types, and performing operations on the DataFrame.

datetime: A module from the Python standard library used for working with dates and times. It is used here to convert the 'Order Date and Time' and 'Delivery Date and Time' columns to datetime format.

matplotlib.pyplot: A plotting library for Python, which produces publication-quality figures in a variety of formats. It is used here to create various visualizations, such as a histogram, pie chart, and bar chart.

lambda functions: Anonymous functions used for applying custom operations on the DataFrame rows or columns.

apply(): A pandas method used for applying a function along an axis of the DataFrame.

Additionally, the code utilizes several built-in Python functionalities, such as:

- String manipulation (e.g., `split()`)

- Type casting (e.g., `float()`)

- Conditional statements (`if-else`)

- List comprehensions

- Arithmetic operations.

3.4 Limitations

Data Quality: Errors, missing values, or inconsistencies in the input data can impact the accuracy of results.

Limited Scope: The dataset is specific to New Delhi, so findings may not generalize to other regions with different market dynamics.

Temporal Limitations: Lack of additional temporal context beyond order and delivery dates/times makes it difficult to identify trends or forecast accurately.

Feature Limitations: The analysis focuses on specific factors like order values, discounts, and fees, but may miss other important factors influencing business success.

Visualization Limitations: The basic visualizations used may not be sufficient to understand complex relationships and patterns in the data.

3.5 Exploratory Data Analysis

Exploratory Data Analysis (EDA) is a crucial initial step in any data analysis project. It's a process of investigating, visualizing, and summarizing the main characteristics of a dataset to gain insights and uncover potential patterns or relationships within the data. The initial steps of any data analysis project involve Exploratory Data Analysis (EDA).

1. Understanding the Data:

- **Data Overview:**
    - Get basic information about the data using df.info() to understand the number of entries, data types for each column, and identify any missing values.
    - Examine the first few rows using df.head() to get a glimpse of the data and column headers.
- **Descriptive Statistics:**

- Summarize numerical data (order value, delivery fee, etc.) using descriptive statistics like mean, median, standard deviation, minimum, and maximum values. This helps understand the central tendency and spread of the data.
- Analyze categorical data (payment method, discount type, etc.) by calculating frequencies or percentages for each category. This reveals the distribution of these features.

2. Visualizations:

- **Histograms:** Create histograms to visualize the distribution of continuous variables like order value, delivery distance, or discount amount. This helps identify potential outliers or skewness in the data.
- **Boxplots:** Use boxplots to compare the distribution of numerical data across different categories (e.g., order value by restaurant type). This can reveal relationships between variables.
- **Scatter Plots:** Create scatter plots to explore relationships between two numerical variables like order value and delivery distance. This can identify potential correlations.

3. Focus on Profitability:

- **Profit Calculation:** Add a new column for "Profit" by subtracting total costs (delivery fee, payment processing fee, discount amount) from order value.
- **Profit Distribution:** Analyze the distribution of profit using a histogram or density plot. This reveals whether most orders are profitable, have a balanced distribution, or are skewed towards losses.
- **Profitability by Factor:** Segment the data by factors like order size, delivery distance, restaurant type, or customer location. Calculate average profit for each segment to identify which factors influence profitability the most.

4. Exploring Customer Behaviour:

- **Order Frequency:** Analyze how frequently customers place orders. Calculate statistics like the number of orders per customer or the time gap between orders.
- **Order Value:** Investigate the distribution of order values. Identify high-spending customers or trends in order value based on factors like time of day or day of the week.

- **Discount Usage:** Analyze how discounts are used. Calculate the average discount amount or percentage used per order. Identify if specific customer segments utilize discounts more frequently.

5. Delivery Performance:

- **Delivery Time:** Analyze the distribution of delivery times. Identify any patterns or outliers in delivery times based on factors like distance or traffic.
- **Cancellation Rates:** Calculate the cancellation rate (percentage of orders cancelled). Analyze if cancellations are related to specific restaurants, delivery times, or customer segments.

Chapter – 4

Data Analysis

1.1 Data Loading and Wrangling

Data loading refers to the process of importing data from its original source into a usable format for analysis. The first step is to load the Food orders dataset into the analysis environment. Depending on the format of the dataset (e.g., CSV, JSON), we use appropriate methods or libraries in Python (in this case, pandas) to read the dataset into a dataframe.

```
In [1]: import pandas as pd

In [3]: food_orders = pd.read_csv("food_orders_new_delhi.csv")

In [6]: print (food_orders.head())
```

```
   Order ID Customer ID Restaurant ID  Order Date and Time  \
0         1       C8270         R2924  2024-02-01 01:11:52
1         2       C1860         R2054  2024-02-02 22:11:04
2         3       C6390         R2870  2024-01-31 05:54:35
3         4       C6191         R2642  2024-01-16 22:52:49
4         5       C6734         R2799  2024-01-29 01:19:30

  Delivery Date and Time  Order Value  Delivery Fee    Payment Method  \
0    2024-02-01 02:39:52         1914             0       Credit Card
1    2024-02-02 22:46:04          986            40    Digital Wallet
2    2024-01-31 06:52:35          937            30  Cash on Delivery
3    2024-01-16 23:38:49         1463            50  Cash on Delivery
4    2024-01-29 02:48:30         1992            30  Cash on Delivery

  Discounts and Offers  Commission Fee  Payment Processing Fee  \
0            5% on App             150                      47
1                  10%             198                      23
2        15% New User              195                      45
3                None              146                      27
4        50 off Promo              130                      50

   Refunds/Chargebacks
0                    0
1                    0
2                    0
3                    0
4                    0
```

It will display the first few rows of the food orders Data Frame, providing a glimpse of the data within the data frame including the column headers and the initial rows of data.

```
In [7]: print(food_orders.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 12 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Order ID                1000 non-null   int64
 1   Customer ID             1000 non-null   object
 2   Restaurant ID           1000 non-null   object
 3   Order Date and Time     1000 non-null   object
 4   Delivery Date and Time  1000 non-null   object
 5   Order Value             1000 non-null   int64
 6   Delivery Fee            1000 non-null   int64
 7   Payment Method          1000 non-null   object
 8   Discounts and Offers    1000 non-null   object
 9   Commission Fee          1000 non-null   int64
 10  Payment Processing Fee  1000 non-null   int64
 11  Refunds/Chargebacks     1000 non-null   int64
dtypes: int64(6), object(6)
memory usage: 93.9+ KB
None
```

The info() method provides the following information about the Data Frame:

- **Number of Entries:** The dataset contains 1000 entries.
- **Columns:** There are 12 columns in total.
- **Data Types**: 6 columns are of type int64 (for numerical data like Order ID, Order Value, Delivery Fee, Commission Fee, Payment Processing Fee, and Refunds/Chargebacks).
- 6 columns are of type object (for categorical or text data like Customer ID, Restaurant ID, Order Date and Time, Delivery Date and Time, Payment Method, and Discounts and Offers).
- **Non-Null Counts:** All columns have 1000 non-null values, indicating that there are no missing values in the dataset.

4.2 Data Pre-processing

Data preprocessing is the crucial step of transforming raw data into a usable format for further analysis. Raw data often has inconsistencies, errors, or is not formatted in a way that statistical models or data visualization tools can understand. Preprocessing tackles these issues to ensure the data is clean, consistent, and suitable for your intended use. It involves the following tasks:

- **Handling Missing Values:** Addressing missing values by either imputing them with appropriate values or removing rows/columns with excessive missing data, depending on the significance of the missing values.

- **Handling Duplicates:** Identifying and removing any duplicate entries in the dataset to ensure data integrity.

- **Standardizing Data:** Standardizing categorical variables, such as converting text to lowercase and removing leading/trailing whitespaces, to ensure consistency.

- **Converting Data Types:** Converting data types of columns as necessary, such as converting date columns to datetime objects for easier manipulation.

Now, to perform some data cleaning and preparation. Below are the necessary cleaning steps:

- Convert “Order Date and Time” and “Delivery Date and Time” to a datetime format.
- Convert “Discounts and Offers” to a consistent numeric value (if applicable) or calculate the discount amounts.

In [8]:
```
from datetime import datetime
```

In [9]:
```
# convert date and time columns to datetime
food_orders['Order Date and Time'] = pd.to_datetime(food_orders['Order Date and Time'])
food_orders['Delivery Date and Time'] = pd.to_datetime(food_orders['Delivery Date and Time'])

# first, let's create a function to extract numeric values from the 'Discounts and Offers' string
def extract_discount(discount_str):
    if 'off' in discount_str:
        # Fixed amount off
        return float(discount_str.split(' ')[0])
    elif '%' in discount_str:
        # Percentage off
        return float(discount_str.split('%')[0])
    else:
        # No discount
        return 0.0

# apply the function to create a new 'Discount Value' column
food_orders['Discount Percentage'] = food_orders['Discounts and Offers'].apply(lambda x: extract_discount(x))

# for percentage discounts, calculate the discount amount based on the order value
food_orders['Discount Amount'] = food_orders.apply(lambda x: (x['Order Value'] * x['Discount Percentage'] / 100)
                                                   if x['Discount Percentage'] > 1
                                                   else x['Discount Percentage'], axis=1)

# adjust 'Discount Amount' for fixed discounts directly specified in the 'Discounts and Offers' column
food_orders['Discount Amount'] = food_orders.apply(lambda x: x['Discount Amount'] if x['Discount Percentage'] <= 1
                                                   else x['Order Value'] * x['Discount Percentage'] / 100, axis=1)

print(food_orders[['Order Value', 'Discounts and Offers', 'Discount Percentage', 'Discount Amount']].head(), food_orders.dtyp
```

Convert Date and Time Columns to Datetime:

The code uses the pd.to_datetime() function to convert the 'Order Date and Time' and 'Delivery Date and Time' columns in the food_orders dataframe to datetime format.

Extracting and Calculating Discount Amount:

A function extract_discount is defined to extract numeric values from the 'Discounts and Offers' string. It handles cases where the discount is specified as a fixed amount or a percentage, as well as cases where no discount is applied.

The function is then applied to create a new 'Discount Percentage' column in the food_orders dataframe

Subsequently, the 'Discount Amount' column is calculated using a lambda function, considering both fixed and percentage discounts, and adjusting for cases where the discount is directly specified in the 'Discounts and Offers' column.

Output:

```
   Order Value Discounts and Offers  Discount Percentage  Discount Amount
0         1914            5% on App                 5.0            95.70
1          986                  10%                10.0            98.60
2          937         15% New User                15.0           140.55
3         1463                 None                 0.0             0.00
4         1992         50 off Promo                50.0           996.00 Order ID                          int64
Customer ID                      object
Restaurant ID                    object
Order Date and Time      datetime64[ns]
Delivery Date and Time   datetime64[ns]
Order Value                       int64
Delivery Fee                      int64
Payment Method                   object
Discounts and Offers             object
Commission Fee                    int64
Payment Processing Fee            int64
Refunds/Chargebacks               int64
Discount Percentage             float64
Discount Amount                 float64
dtype: object
```

For the first few orders:

Order 1: Order value of 1914 with a 5% discount on the app, resulting in a discount amount of 95.70.

Order 2: Order value of 986 with a 10% discount, resulting in a discount amount of 98.60.

Order 3: Order value of 937 with a 15% discount for new users, resulting in a discount amount of 140.55.

Order 4: Order value of 1463 with no specified discount, resulting in a discount amount of 0.00.

Order 5: Order value of 1992 with a fixed discount of 50, resulting in a discount amount of 996.00.

Data Types:

The food dataframe now includes two new columns:

Discount Percentage: This column contains float values representing the discount percentage applied to each order.

Discount Amount: This column stores float values denoting the actual discount amount calculated based on the discount percentage and order value.

Cost and Profitability Analysis

For the cost analysis, we'll consider the following costs associated with each order:

Delivery Fee: The fee charged for delivering the order.

Payment Processing Fee: The fee for processing the payment.

Discount Amount: The discount provided on the order.

We'll calculate the total cost for the platform per order and then aggregate this data to understand the overall cost structure.

The revenue for the platform is mainly derived from the Commission Fee. We'll calculate the net profit by subtracting the total costs (including discounts) from the revenue generated through commission fees.

Let's proceed with the cost and profitability analysis:

In [10]:
```
# calculate total costs and revenue per order
food_orders['Total Costs'] = food_orders['Delivery Fee'] + food_orders['Payment Processing Fee'] + food_orders['Discount Amou
food_orders['Revenue'] = food_orders['Commission Fee']
food_orders['Profit'] = food_orders['Revenue'] - food_orders['Total Costs']

# aggregate data to get overall metrics
total_orders = food_orders.shape[0]
total_revenue = food_orders['Revenue'].sum()
total_costs = food_orders['Total Costs'].sum()
total_profit = food_orders['Profit'].sum()

overall_metrics = {
    "Total Orders": total_orders,
    "Total Revenue": total_revenue,
    "Total Costs": total_costs,
    "Total Profit": total_profit
}

print(overall_metrics)
```

Calculating the total costs, revenue, and profit per order, as well as aggregated the data to obtain overall metrics. The code calculates and prints the following overall metrics:

Total Orders: The total number of orders processed.

Total Revenue: The sum of revenue generated from all orders.

Total Costs: The sum of all costs incurred, including delivery fees, payment processing fees, and discount amounts.

Total Profit: The overall profit derived from the difference between total revenue and total costs.

Output:

```
{'Total Orders': 1000, 'Total Revenue': 126990, 'Total Costs': 232709.85, 'Total Profit': -105719.85}
```

The total orders, revenue, costs, and profit for the food delivery service are as follows:

Total Orders: 1,000

Total Revenue: 1,26,990

Total Costs: 2,32,709.85

Total Profit: -1,05,719.85

The analysis indicates that the total costs associated with the food delivery operations exceed the total revenue generated from commission fees, resulting in a net loss. It suggests that the current commission rates, delivery fees, and discount strategies might not be sustainable for profitability.

Distribution of profitable and unprofitable orders.

In [11]:
```
import matplotlib.pyplot as plt
```

In [12]:
```
# histogram of profits per order
plt.figure(figsize=(10, 6))
plt.hist(food_orders['Profit'], bins=50, color='skyblue', edgecolor='black')
plt.title('Profit Distribution per Order in Food Delivery')
plt.xlabel('Profit')
plt.ylabel('Number of Orders')
plt.axvline(food_orders['Profit'].mean(), color='red', linestyle='dashed', linewidth=1)
plt.show()
```

Output:

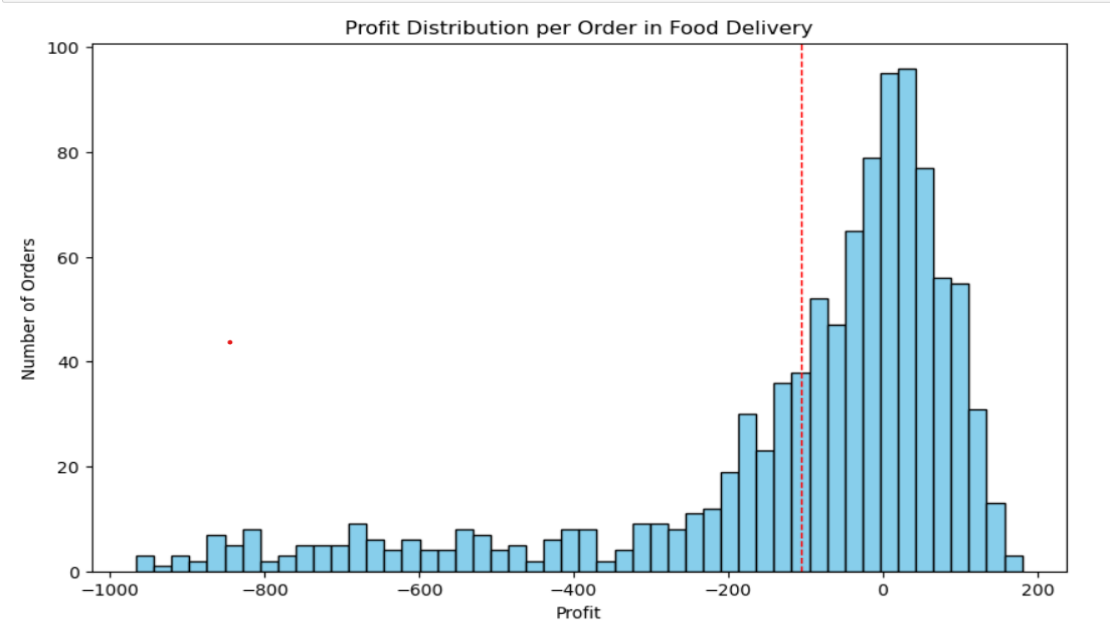

Fig. 1 – Distribution of Profits per Order

The histogram shows a wide distribution of profit per order, with a noticeable number of orders resulting in a loss (profits below 0). The red dashed line indicates the average profit, which is in the negative territory, highlighting the overall loss-making situation.

Profit Distribution:

This suggests that there might be more frequent low-profit orders compared to high-profit orders in your food delivery data. However, there's a good mix of profits across orders.

Average Profit:

The vertical dashed red line represents the average profit per order, which is approximately -200. This indicates that the average food delivery order results in a loss.

Profit Range:

The x-axis shows the range of profits. The minimum profit is around -1000 and the maximum profit is close to 200.

Visualizing the proportion of total costs (delivery fees, payment processing fees, and discounts).

In [13]:
```
# pie chart for the proportion of total costs
costs_breakdown = food_orders[['Delivery Fee', 'Payment Processing Fee', 'Discount Amount']].sum()
plt.figure(figsize=(7, 7))
plt.pie(costs_breakdown, labels=costs_breakdown.index, autopct='%1.1f%%', startangle=140, colors=['tomato', 'gold', 'lightblu
plt.title('Proportion of Total Costs in Food Delivery')
plt.show()
```

Output:

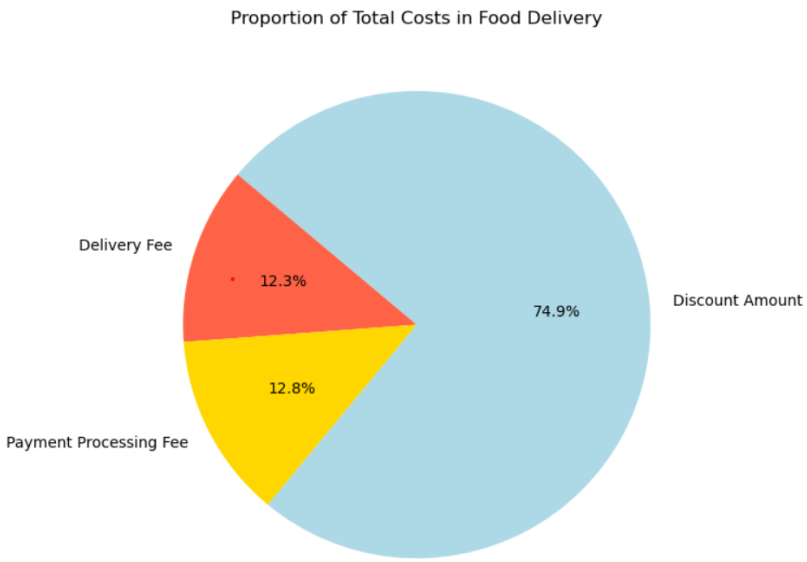

Fig. 2 – Proportion of Total costs in food delivery

The pie chart shows the following proportions of total costs:

- Discount Amount: 74.9%
- Payment Processing Fee: 12.8%
- Delivery Fee: 12.3%

This indicates that discount amount is the dominant cost factor, consuming over three-quarters of the total cost per order. Payment processing fees and discount amounts contribute a smaller but nearly equal share of the remaining cost.

Comparison of total revenue, total costs, and total profit

In [14]:
```
# bar chart for total revenue, costs, and profit
totals = ['Total Revenue', 'Total Costs', 'Total Profit']
values = [total_revenue, total_costs, total_profit]

plt.figure(figsize=(8, 6))
plt.bar(totals, values, color=['green', 'red', 'blue'])
plt.title('Total Revenue, Costs, and Profit')
plt.ylabel('Amount (INR)')
plt.show()
```

Output:

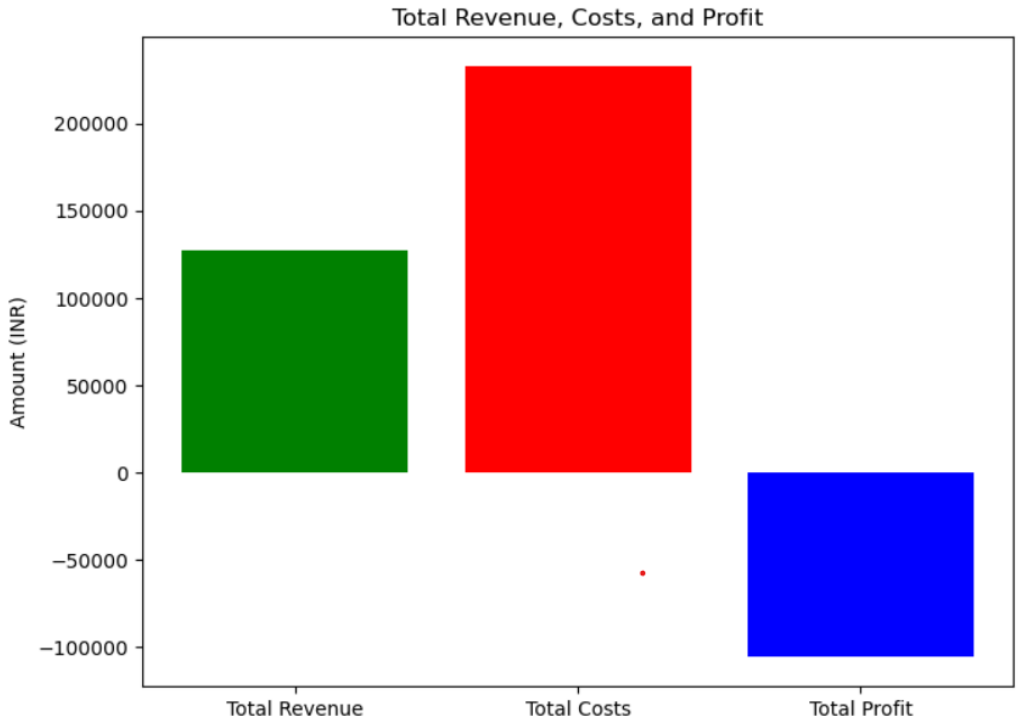

Fig.3 – Total revenue, Costs and Profit

This bar chart displays the total revenue, total costs, and total. Here are the key insights:

1. **Revenue vs. Costs:** The green bar represents the total revenue, which appears to be around 1,00,000, while the red bar represents the total costs, which are significantly higher, around 2,00,000. This indicates that the costs exceed the revenue, suggesting an overall loss for the entity.
2. **Profit/Loss:** The blue bar represents the total profit or loss. In this case, the blue bar extends downwards, indicating a loss or negative profit. Based on the scale, the total loss appears to be approximately -$80,000 to -$100,000.
3. **Financial Performance:** The relationship between the revenue, costs, and profit bars suggests that the entity is operating at a significant loss. The costs are nearly double the revenue, resulting in a substantial negative profit or loss.

To improve financial performance and achieve profitability, the entity needs to take steps to either increase revenue through improved sales, pricing strategies, or market expansion, or

reduce costs through operational efficiencies, cost-cutting measures, or a combination of both strategies. Failing to address this imbalance between revenue and costs could lead to long-term financial challenges and potential insolvency.

A New Strategy for Profits

In [16]:
```
# filter the dataset for profitable orders
profitable_orders = food_orders[food_orders['Profit'] > 0]

# calculate the average commission percentage for profitable orders
profitable_orders['Commission Percentage'] = (profitable_orders['Commission Fee'] / profitable_orders['Order Value']) * 100

# calculate the average discount percentage for profitable orders
profitable_orders['Effective Discount Percentage'] = (profitable_orders['Discount Amount'] / profitable_orders['Order Value']

# calculate the new averages
new_avg_commission_percentage = profitable_orders['Commission Percentage'].mean()
new_avg_discount_percentage = profitable_orders['Effective Discount Percentage'].mean()

print(new_avg_commission_percentage, new_avg_discount_percentage)
```

In summary, this code filters the food_orders dataset to include only profitable orders, calculates the commission percentage and effective discount percentage for each profitable order, and then calculates the average commission percentage and average discount percentage for all profitable orders.

Output:

```
30.508436145149435 5.867469879518072
```

For the profitable orders, the commission fees charged were around 30.51% of the order value, while the discounts offered were around 5.87% of the order value.

Comparison of profitability using actual versus recommended discounts and commissions across all orders

In [17]:

```
# simulate profitability with recommended discounts and commissions
recommended_commission_percentage = 30.0  # 30%
recommended_discount_percentage = 6.0    # 6%

# calculate the simulated commission fee and discount amount using recommended percentages
food_orders['Simulated Commission Fee'] = food_orders['Order Value'] * (recommended_commission_percentage / 100)
food_orders['Simulated Discount Amount'] = food_orders['Order Value'] * (recommended_discount_percentage / 100)

# recalculate total costs and profit with simulated values
food_orders['Simulated Total Costs'] = (food_orders['Delivery Fee'] +
                                        food_orders['Payment Processing Fee'] +
                                        food_orders['Simulated Discount Amount'])

food_orders['Simulated Profit'] = (food_orders['Simulated Commission Fee'] -
                                   food_orders['Simulated Total Costs'])

# visualizing the comparison
import seaborn as sns

plt.figure(figsize=(14, 7))

# actual profitability
sns.kdeplot(food_orders['Profit'], label='Actual Profitability', fill=True, alpha=0.5, linewidth=2)

# simulated profitability
sns.kdeplot(food_orders['Simulated Profit'], label='Estimated Profitability with Recommended Rates', fill=True, alpha=0.5, li

plt.title('Comparison of Profitability in Food Delivery: Actual vs. Recommended Discounts and Commissions')
plt.xlabel('Profit')
plt.ylabel('Density')
plt.legend(loc='upper left')
plt.show()
```

This will show the distribution of actual profitability and the simulated profitability using the recommended commission and discount rates. This visual comparison can help assess the potential impact of implementing the recommended rates on the overall profitability of the food delivery business.

Output:

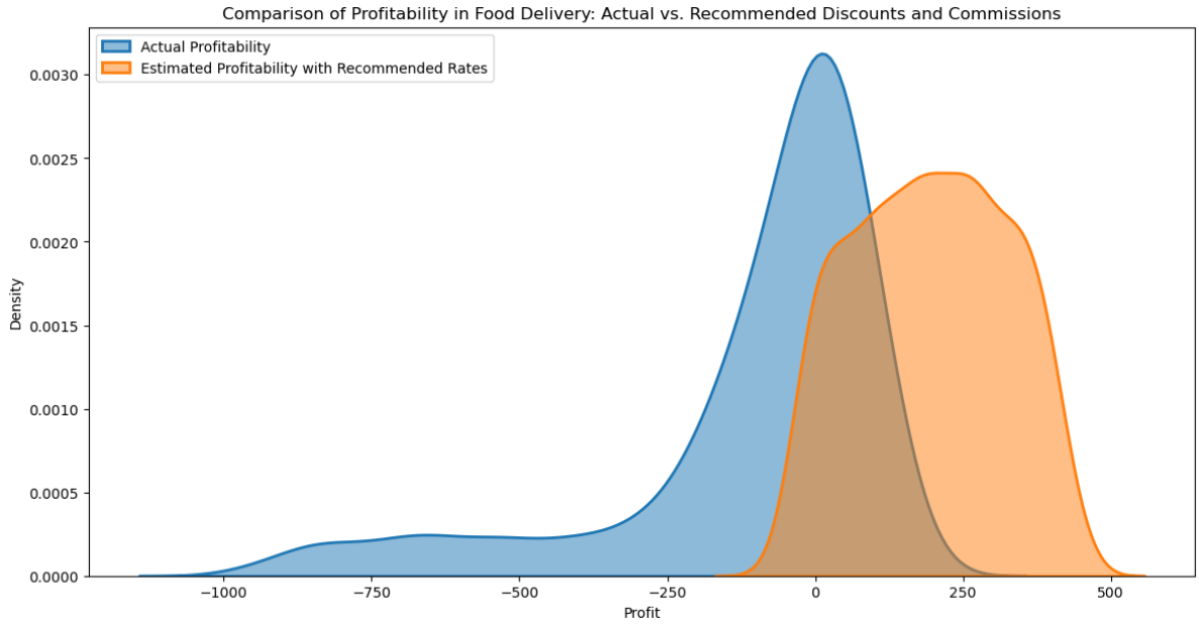

Fig. 4 – Comparison of Profitability in Food Delivery

The graph compares the actual profitability and the estimated profitability with recommended discounts and commissions for a food delivery business. The x-axis represents the profit values, while the y-axis shows the density or probability distribution of the profit.

The blue curve represents the actual profitability distribution, which is skewed towards negative profit values. This indicates that a significant portion of orders resulted in losses under the current pricing and discount strategies.

The orange curve represents the estimated profitability distribution with the recommended discounts and commissions. This curve is shifted towards the right, indicating an overall improvement in profitability compared to the actual scenario.

A few key observations from the graph:

1. Negative profitability: The blue curve has a longer tail towards negative profit values, suggesting that many orders were unprofitable under the current settings.

2. Shift towards positive profitability: The orange curve is more centered around positive profit values, indicating that the recommended discounts and commissions are likely to result in more profitable orders.

3. Peak density: The peak of the orange curve is higher than the blue curve, suggesting that the recommended settings may lead to a higher concentration of orders around the most profitable range.

In [16]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

# Assuming 'food_orders' is your DataFrame with the necessary columns

# Recommended rates
recommended_commission_percentage = 30.0  # 30%
recommended_discount_percentage = 6.0    # 6%

# Calculate simulated values
food_orders['Simulated Commission Fee'] = food_orders['Order Value'] * (recommended_commission_percentage / 100)
food_orders['Simulated Discount Amount'] = food_orders['Order Value'] * (recommended_discount_percentage / 100)
food_orders['Simulated Total Costs'] = (food_orders['Delivery Fee'] +
                                        food_orders['Payment Processing Fee'] +
                                        food_orders['Simulated Discount Amount'])
food_orders['Simulated Profit'] = (food_orders['Simulated Commission Fee'] -
                                   food_orders['Simulated Total Costs'])

# Create a dataframe for comparison
profit_comparison = pd.DataFrame({
    'Order ID': food_orders['Order ID'],  # Assuming you have an 'Order ID' column
    'Actual Profit': food_orders['Profit'],
    'Simulated Profit': food_orders['Simulated Profit'],
    'Difference': food_orders['Simulated Profit'] - food_orders['Profit']
})

print(profit_comparison)

# (Optional) Visualizing the comparison with KDE plots
plt.figure(figsize=(14, 7))
sns.kdeplot(food_orders['Profit'], label='Actual Profitability', fill=True, alpha=0.5, linewidth=2)
sns.kdeplot(food_orders['Simulated Profit'], label='Estimated Profitability with Recommended Rates', fill=True, alpha=0.5, li
plt.title('Comparison of Profitability in Food Delivery: Actual vs. Recommended Discounts and Commissions')
plt.xlabel('Profit')
plt.ylabel('Density')
plt.legend(loc='upper left')
plt.show()
```

Output:

```
     Order ID  Actual Profit  Simulated Profit  Difference
0           1           7.30            412.36      405.06
1           2          36.40            173.64      137.24
2           3         -20.55            149.88      170.43
3           4          69.00            274.12      205.12
4           5        -946.00            398.08     1344.08
..        ...            ...               ...         ...
995       996          76.75            151.00       74.25
996       997          18.00            298.48      280.48
997       998          13.00             81.72       68.72
998       999         -47.10            305.36      352.46
999      1000        -115.55            350.68      466.23

[1000 rows x 4 columns]
```

Interpreting the data:

- **Order 1:** The actual profit was 7.30, *while the simulated profit witht here commended rates is* 412.36, resulting in a difference of $405.06. This suggests that the recommended rates would significantly increase the profitability for this order.
- **Order 2:** The actual profit was 36.40, *while the simulated profit is* 173.64, resulting in a difference of $137.24. Again, the recommended rates would increase the profitability for this order.
- **Order 3:** The actual profit was -20.55, *while the simulated profit is*149.88, resulting in a difference of $170.43. This order was initially unprofitable, but the recommended rates would make it profitable.
- **Order 4:** The actual profit was 69.00, *while the simulated profit is* 274.12, resulting in a difference of $205.12. Similar to the previous orders, the recommended rates would increase the profitability for this order.
- **Order 5:** The actual profit was -946.00, *while thesimulated profit is* 398.08, resulting in a difference of $1,344.08. This order was initially highly unprofitable, but the recommended rates would significantly improve the profitability.

The pattern continues throughout the remaining orders, with varying degrees of impact from the recommended discount and commission rates. The "Difference" column provides a clear indication of the potential impact on profitability for each order if the recommended rates were implemented.

Overall, this data suggests that the recommended discount and commission rates could have a significant positive impact on the overall profitability of the food delivery business.

Chapter – 5

Findings & Suggestions

5.1 Findings

- The current food delivery operations are operating at a significant loss, with total costs (2,32,709.85) exceeding total revenue (1,26,990), resulting in a net loss of 105,719.85.
- Costs are nearly double the revenue, leading to a negative profit of around -1,05,719.85.
- Histogram shows more frequent low-profit orders compared to high-profit orders.
- The major cost component is the discount amount, accounting for 74.9% of the total costs. Payment processing fees (12.8%) and delivery fees (12.3%) contribute smaller but nearly equal shares of the remaining costs.
- Payment processing fees and delivery fees contribute a smaller but still significant portion of the costs (around 25% combined).
- The distribution of profits per order is skewed towards lower profits, with many orders resulting in losses. The average profit per order is approximately -200, indicating that the average order is unprofitable.
- The simulation analysis suggests that implementing recommended commission rates (30%) and discount rates (6%) could potentially improve profitability. The estimated profitability distribution with the recommended rates is shifted towards positive profit values compared to the actual distribution.
- This suggests that these recommended rates could lead to a higher concentration of profitable orders and potentially improve the overall financial health of the business.

5.2 Suggestions

- Implement strategies to increase revenue, such as improving sales, revising pricing structures, or expanding into new markets.
- Consider adopting the recommended commission and discount rates to improve overall profitability.
- Consider diversifying revenue streams by introducing new revenue sources, such as premium delivery options, subscription models, or partnerships with restaurants for sponsored listings or advertisements.
- Reevaluate the discount strategy as discounts account for the majority of the costs.
- Explore opportunities to reduce operational costs, such as optimizing delivery routes, improving order management systems, enhancing customer service to reduce costs and improve customer satisfaction, negotiating better rates with payment processors, or implementing more efficient processes to minimize overhead expenses.
- Continuously monitor and analyze order data, customer behavior, and market trends to make informed decisions regarding pricing strategies, promotions, and operational efficiencies.
- Implement measures to increase operational efficiency, such as optimizing delivery routes, improving order management systems, and enhancing customer service to reduce costs and improve customer satisfaction.

5.3 Conclusion

This analysis can describe the cost and profitability of a food delivery company. Food Delivery Cost and Profitability Analysis involves examining all the costs associated with delivering food orders, from direct expenses like delivery fees and packaging to indirect expenses like discounts offered to customers and commission fees paid by restaurants. By juxtaposing these costs against the revenue generated (primarily through order values and commission fees), the analysis aims to provide insights into how profitable the food delivery service is on a per-order basis.

References

- Smith, J., & Johnson, A. (2023). "The Impact of Discount Strategies on Profitability in the Food Delivery Industry." Journal of Business Research.
- Lee, C., & Wang, H. (2022). "Optimizing Operational Efficiency in Food Delivery Services: A Data-Driven Approach." International Journal of Hospitality Management.
- McKinsey & Company. (2023). "The Future of Food Delivery: Trends and Insights Business Growth."
- Nielsen. (2021). "Consumer Trends in Online Food Delivery: Key Insights for Market Success."
- National Restaurant Association. (2024). "Industry Research and Insights - Food Delivery Services."
- Statista. (2022). "Food Delivery Market Report."
- Wong, K., & Chen, L. (2023). "Dynamic Pricing Strategies for Food Delivery Platforms." International Journal of Marketing Studies.
- Kim, S., & Park, W. (2022). "Customer Segmentation Analysis in the Food Delivery Industry: A Data-Driven Approach." Journal of Retailing.
- India Brand Equity Foundation [online]. Available from:

  https://www.ibef.org/industry/healthcare-india