

Feynn Labs

Project-3

**SMART PRICING SUGGESTIONS
FOR
LOCAL RESTAURANTS AND CAFES
WITH
DYNAMIC PRICING**

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The report delves into the necessity for small and medium-sized restaurants and cafes to embrace dynamic pricing strategies, leveraging AI and machine learning for market adaptation. It underscores the potential benefits in revenue optimization, customer satisfaction, and operational efficiency. Through thorough market and business need assessments, the report highlights the competitive advantage dynamic pricing offers in the ever-changing food industry landscape. By providing insights into customer characteristics, pain points, and applicable patents, it presents a comprehensive view of the potential impact and feasibility of implementing dynamic pricing solutions. Overall, the report emphasizes the transformative potential of dynamic pricing in maximizing profitability and market competitiveness.

1. Problem Statement

Small and medium-sized restaurants and cafes often grapple with revenue optimization and competitiveness due to static pricing models. These models lack adaptability to real-time market shifts, resulting in missed revenue opportunities and inventory surplus. Implementing a dynamic pricing engine addresses this issue by suggesting timely price adjustments based on sales, market trends, and customer demand fluctuations. Offering flexibility in pricing adjustments on a monthly, quarterly, seasonal and customizable basis ensures enhanced profitability and customer satisfaction, fulfilling a vital need in the food and beverage sector.

“Pricing is the moment of truth – all of marketing comes to focus on the pricing decision” E. Raymond Corey, Harvard Business School.

2.1 Market Need Assessment

Utilizing AI and Machine Learning for Dynamic Pricing in Restaurants

1. Introduction to Dynamic Pricing:

- **Utilization of AI and Machine Learning:** The incorporation of AI and machine learning algorithms enables dynamic pricing strategies that adjust based on past sales and demands. This technology-driven approach ensures optimal revenue management and maintains a competitive edge in the rapidly changing restaurant landscape.

2. Market Demand and Trends:

- **Real-Time Demand Fluctuations:** Restaurants face varying demand patterns influenced by time of day, day of the week, and seasonal trends. AI and machine learning can analyse these patterns and suggest pricing dynamically, enhancing customer satisfaction and maximizing profits.
- **Consumer Behaviour Analysis:** Understanding consumer preferences and purchasing behaviours allows for more targeted pricing strategies, aligning menu prices with customer expectations and willingness to pay.

3. Competitive Advantage:

- **Optimizing Revenue Streams:** By leveraging dynamic pricing, restaurants can maximize their revenue potential during peak and off-peak times, filling seats that would otherwise remain empty.
- **Adapting to Market Changes:** Dynamic pricing models provide the flexibility to adapt to market changes, such as shifts in consumer spending habits or competitive pricing strategies.

4. Implementation and Feasibility:

- **Cost Structure and Pricing Models:** Successful implementation of dynamic pricing requires an acceptable cost structure and pricing model. This involves periodic reviews and adjustments to align with market modifications, shifting prices, and changing customer moods.
- **Frequency of Price Adjustments:** Our dynamic pricing engine suggests price adjustments on a weekly, monthly, and quarterly basis, providing flexibility for businesses to adapt to varying demand patterns and market trends.

- **Menu Pricing Strategy:** According to the conceptual framework from previous research, menu pricing involves setting prices in line with sales, costs, and profit goals, while also considering consumer perceptions and expectations.

Importance of Dynamic Pricing for Restaurants and Cafes

1. Revenue Optimization:

- Dynamic pricing helps restaurants optimize their revenue by suggesting prices based on sales, demand and customer behaviour, ensuring higher occupancy rates and better financial performance.

2. Customer Satisfaction:

- By offering prices that reflect demands, restaurants can attract more customers during off-peak hours and maintain customer satisfaction during peak times with fair pricing.

3. Competitive Edge:

- Restaurants that adopt dynamic pricing can stay ahead of competitors by being more responsive to market conditions and customer needs, thereby increasing their market share.

4. Technology Integration:

- Utilizing AI and machine learning for dynamic pricing demonstrates a forward-thinking approach, aligning with modern technological trends and consumer expectations for personalized experiences.

In conclusion, the provided information highlights the potential benefits and feasibility of implementing dynamic pricing strategies in the restaurant industry. This approach, supported by AI and machine learning, can significantly enhance revenue management, customer satisfaction, and competitive positioning in the market.

2.2 Business Need Assessment

The objective of implementing a dynamic pricing strategy is to maximize the revenue of local small and medium-sized restaurant and café businesses. This is achieved by providing demand-based and trend-based price adjustments on a monthly, quarterly, seasonal and customized frequency basis.

Market Context

Small and medium-sized restaurants and cafés often struggle to compete with larger establishments that have the resources to leverage advanced pricing strategies. Static pricing models prevent these smaller businesses from capitalizing on peak demand periods and adapting to market trends, thereby missing out on potential revenue streams. Implementing dynamic pricing can help these businesses adjust prices seamlessly according to demand and trends, maximizing revenue while maintaining customer satisfaction and achieving market differentiation.

Key Benefits

1. Revenue Optimization

- **Increased Revenue:** Dynamic pricing helps restaurants capture more revenue during peak times and fill seats during off-peak times by adjusting prices based on real-time demand.
- **Profit Margins:** Optimized pricing enhances profit margins, which are traditionally very thin in the restaurant industry.

2. Competitive Advantage

- **Market Differentiation:** Dynamic pricing differentiates smaller establishments from competitors using static pricing models, making them more attractive to price-sensitive customers.
- **Customer Loyalty:** Offering competitive and fair prices through dynamic adjustments can improve customer satisfaction and loyalty.

3. Operational Efficiency

- **Inventory Management:** Adjusting prices in response to demand helps manage inventory effectively, reducing overstock and preventing stockouts.
- **Labor Savings:** Automating the pricing process minimizes the need for manual price updates, allowing staff to focus on other critical operational tasks.

4. Scalability and Growth

- **Scalability:** The dynamic pricing solution can be scaled to accommodate multiple locations or expanded to other regions, enhancing its applicability.
- **Growth Potential:** As the system proves its effectiveness, it can be marketed to a broader audience, including franchise chains and larger establishments.

The estimated value of the small/medium restaurant and cafe business in India by 2029 is as follows:

Full-Service Restaurants: The market size for full-service restaurants in India is estimated to reach USD 59.09 billion by 2029, growing at a CAGR of 11.67% during the forecast period (2024-2029)¹.

Cafes & Bars: The market size for cafes and bars in India is estimated to reach USD 26.17 billion by 2029, growing at a CAGR of 8.33% during the forecast period (2024-2029)².

Summary:

The business need for a dynamic pricing is driven by the necessity to remain competitive, manage inventory effectively, and maximize revenue. By addressing these needs, a dynamic pricing engine can provide substantial value to small and medium-sized restaurants and cafes. This makes it a viable and sellable product in the market, capable of transforming how these businesses operate and compete. Implementing a dynamic pricing strategy can lead to increased revenue, improved profit margins, enhanced operational efficiency, and a strong competitive advantage for small and medium-sized restaurant and cafe businesses. This strategy will not only help in sustaining existing customers but also in differentiating the business in a competitive market.

2.3 Customer Need Assessment

1. Target Customer Characteristics:

- **Size:** Small to medium-sized restaurants and cafes.
- **Tech Savvy:** Moderate; familiar with using digital ordering systems and POS technology.
- **Budget-Conscious:** Limited budget for technology investments but willing to invest in solutions that demonstrate clear ROI.

2. Customer Pain Points:

- **Inflexible Pricing:** Difficulty in adjusting prices to reflect real-time demand and cost changes.
- **Competitive Pressure:** Need to stay competitive with larger chains and local competitors who might already use more advanced pricing strategies.
- **Profit Margins:** Thin profit margins necessitate more efficient and responsive pricing mechanisms to maximize revenue and minimize waste.

3. Benchmarking

Criteria	Juicer	Sauce	DynamEat	Priceff	Our Proposed Product
Dynamic Pricing	Yes, real-time, AI-driven	Yes, machine learning for delivery orders	Yes, AI algorithms	Yes, real-time demand and capacity	Yes, machine learning for periodic pricing suggestions
Menu Modification & Addition	No	No	No	No	Yes (for <u>high tier</u>), suggests menu modifications and new recipes
Customer Behavior Analysis	Yes, Sentiment Analysis	Yes, historical and real-time data	Yes, occupancy forecasts	Yes, detailed analytics	Yes, tailored for SMBs, market trends and behaviors, based on purchase trends

POS Integration	Micros Symphony, ItsaCheckmate, Qu Beyond, NCR	Toast, Revel, NCR Aloha, PAR Brink	Infrasys by Shiji, SAP, Oracle Symphony, Agora, Revo, Silverware	User-friendly dashboard, easy workflow integration	Yes (for high tier), Existing POS systems integration
Inventory Management	No	No	No	No	Yes (for high tier), integrates with inventory management
Customer Base Focus	Medium to large chains	Medium to large chains	Large Hotel groups	Various Industries	Small to Medium sized restaurants & cafes
Customization of Pricing Models	Moderate, focuses on static dynamic pricing	High, flexible for delivery	Moderate. Focused on high-margin and popular dishes	High, based on real-time demand	High, includes promotional, loyalty, timely and demand-based pricing models
User-Friendly Interface	Yes, but complexity depend on integrations	Yes, flexible and Ai-driven	Yes, with smart menu configurations	Yes, with user friendly dashboard	Yes, with user friendly dashboard & ML driven pricing suggestions
Revenue Impact	Optimizes profitability, enhances offers and promotions	Increases profitability during peak and slow periods	Maximizes profitability, customer satisfaction	Maximizes revenue and transaction volume	Optimizes revenue, reduces waste, and enhances customer satisfaction

4. External Search

4.1 Industry Trends & Consumer Behaviour

Digital and interactive menus: Restaurants are turning to digital menus to enhance customer engagement, provide detailed descriptions, and visualize dishes through augmented reality.

Social and environmental responsibility: Restaurants are becoming more socially and environmentally conscious, addressing broader impacts such as fair labor practices and sustainability.

Customization and personalization: Consumers expect the ability to customize their meals based on dietary restrictions and personal preferences, driving restaurants to offer personalized experiences at scale.

Experience-driven dining: Restaurants are incorporating themed experiences, pop-culture experiences.

4.2 Competitive Landscape

Market positioning: Restaurants position themselves based on factors such as pricing, convenience, ambiance, and culinary expertise.

Niche markets: Exploring niche markets offers opportunities to tailor specific aspects of the restaurant experience to meet unique customer needs and fill gaps in the market.

4.3 Operational Insights

Supply chain analysis: Effective supply chain management ensures the availability and quality of ingredients critical for menu offerings, with strategic partnerships improving pricing and delivery reliability.

Cost management: Meticulous monitoring of direct and indirect costs helps identify savings opportunities and maintain profitability.

4.4 Restaurant Loyalty Programs (Generic Case Study)

Many restaurants, both independent and chains, have adopted tiered loyalty programs to drive repeat business and increase customer lifetime value.

Tiers:

Bronze Tier: Basic membership with occasional discounts and a free item on the customer's birthday.

Silver Tier: Mid-level membership with more frequent discounts, priority reservations, and exclusive menu previews.

Gold Tier: Premium membership with the highest level of benefits, including significant discounts, personalized service, and access to special events.

Results:

Customer Engagement: Tiered loyalty programs incentivized customers to visit more often and spend more to reach higher tiers.

Increased Spend: Members in higher tiers typically spent more per visit, driven by exclusive offers and perceived VIP status.

Data Collection: Restaurants gained valuable insights into customer behavior, preferences, and spending patterns, enabling personalized marketing and improved service.

Key Takeaway:

Tiered loyalty programs in restaurants effectively drive customer engagement, increase average spend, and provide valuable customer data, demonstrating the benefits of tiered subscription models in the hospitality industry.

5. Applicable Patents

Dynamic pricing method of data set based on machine learning (CN112132639A)

A dynamic pricing method based on machine learning for a dataset, utilizing an LSTM model. Here's the key points:

1. **Acquisition of Historical Transaction Information:** The method starts by acquiring historical transaction information of a dataset provided by a seller.
2. **Extraction of Custom Configuration Parameters:** Custom configuration parameters of state data of the dataset during transactions are extracted from various value measurement dimensions based on the historical transaction information.
3. **Configuration of State Data into Training Data:** State data extracted from historical transaction information are configured into required training data according to the input requirements of a dynamic pricing model. Pricing, state data, and income in a set time zone in the training data are configured based on their corresponding relation.
4. **Training of Dynamic Pricing Model:** The dynamic pricing model is trained with the training data to learn the ability to predict revenue based on pricing and state data corresponding to multiple different value-measuring dimensions, providing suggested pricing.

Additionally, the method includes forecasting recommended pricing for the seller to maximize profit in a future time interval and updating parameters of the dynamic pricing model based on feedback from historical transaction information.

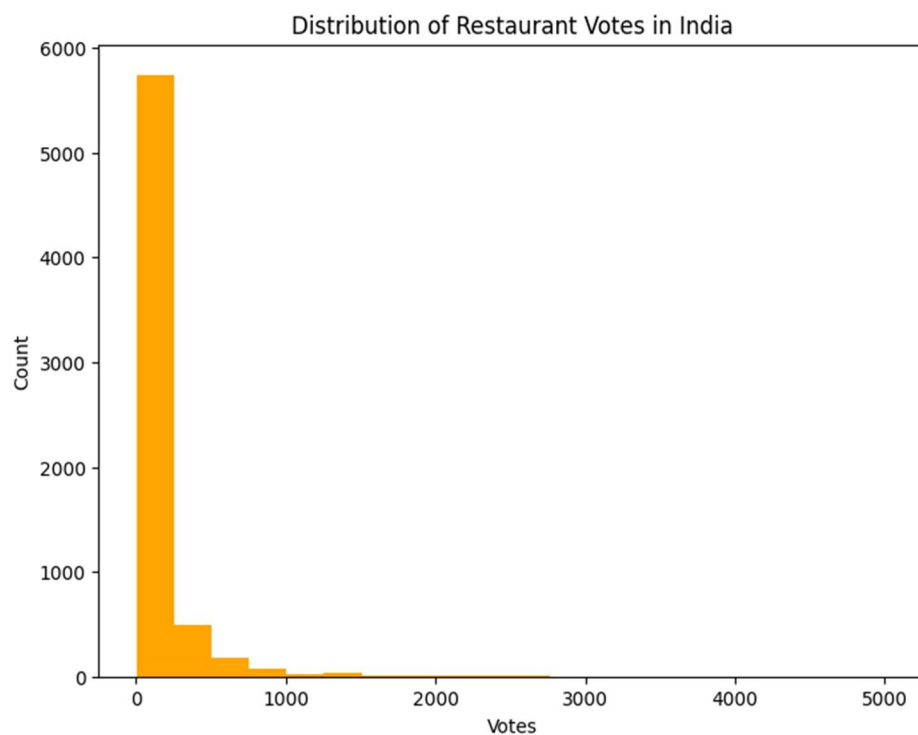
6. Data Analysis

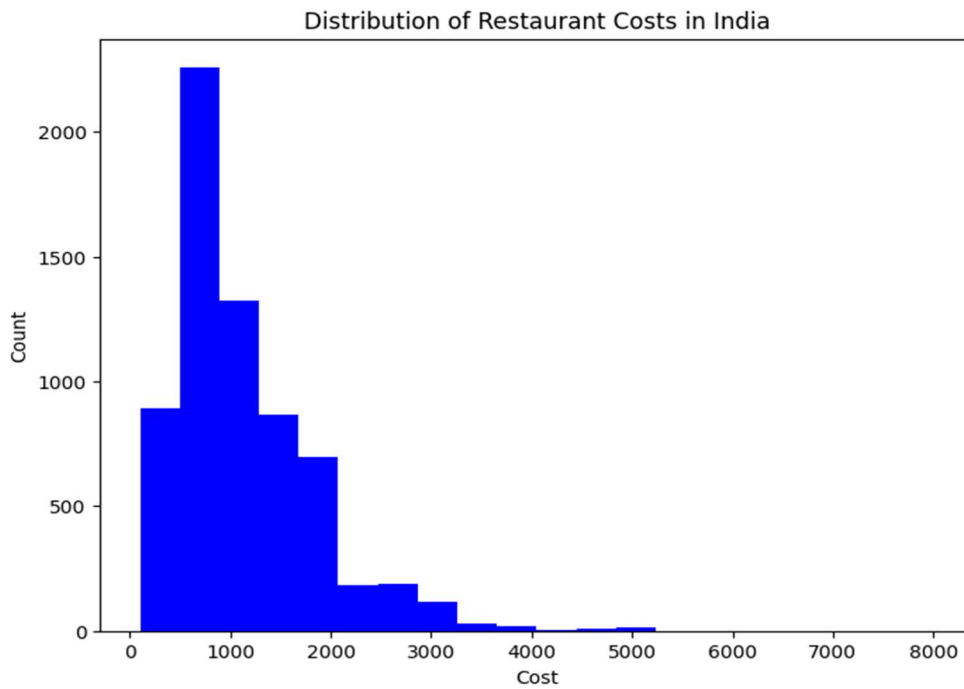
```
[ ] import pandas as pd
    import numpy as np
```

```
[ ] data = pd.read_csv('/content/restaurants.csv')
```

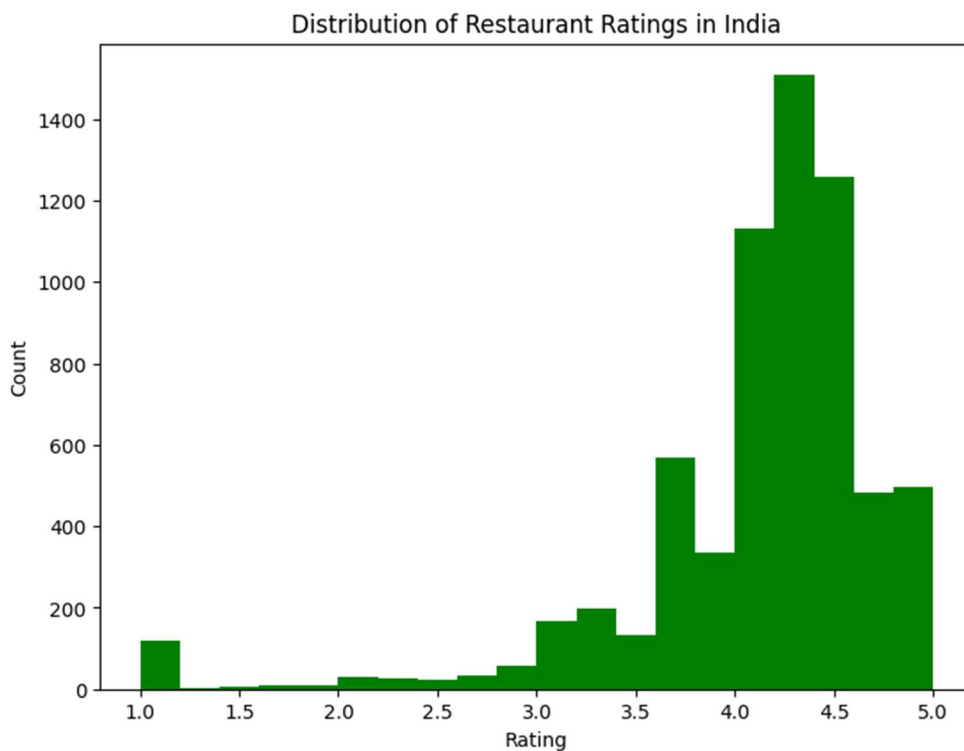
```
[ ] data.head()
```

	Name	Location	Locality	City	Cuisine	Rating	Votes	Cost
0	Local	Scindia House,Connaught Place, Central Delhi	Central Delhi	Delhi	North Indian, Finger Food, Continental	4.1	2415	2000
1	The G.T. ROAD	M-Block,Connaught Place, Central Delhi	Central Delhi	Delhi	North Indian	4.3	2363	1500
2	Tamasha	Connaught Place, Central Delhi	Central Delhi	Delhi	Finger Food, North Indian, Italian, Contine...	4.2	5016	2000
3	The Junkyard Cafe	Connaught Place, Central Delhi	Central Delhi	Delhi	North Indian, Mediterranean, Asian, Italian...	4.2	2821	1800
4	Chili's American Grill and Bar	M-Block,Connaught Place, Central Delhi	Central Delhi	Delhi	Mexican, American, Italian	4.4	1094	2000

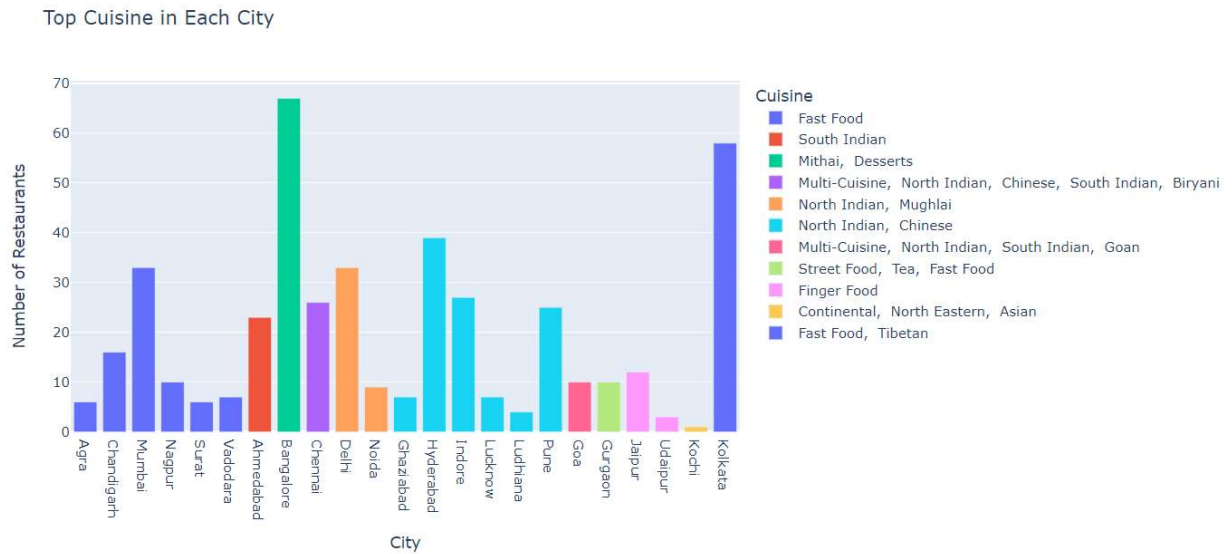




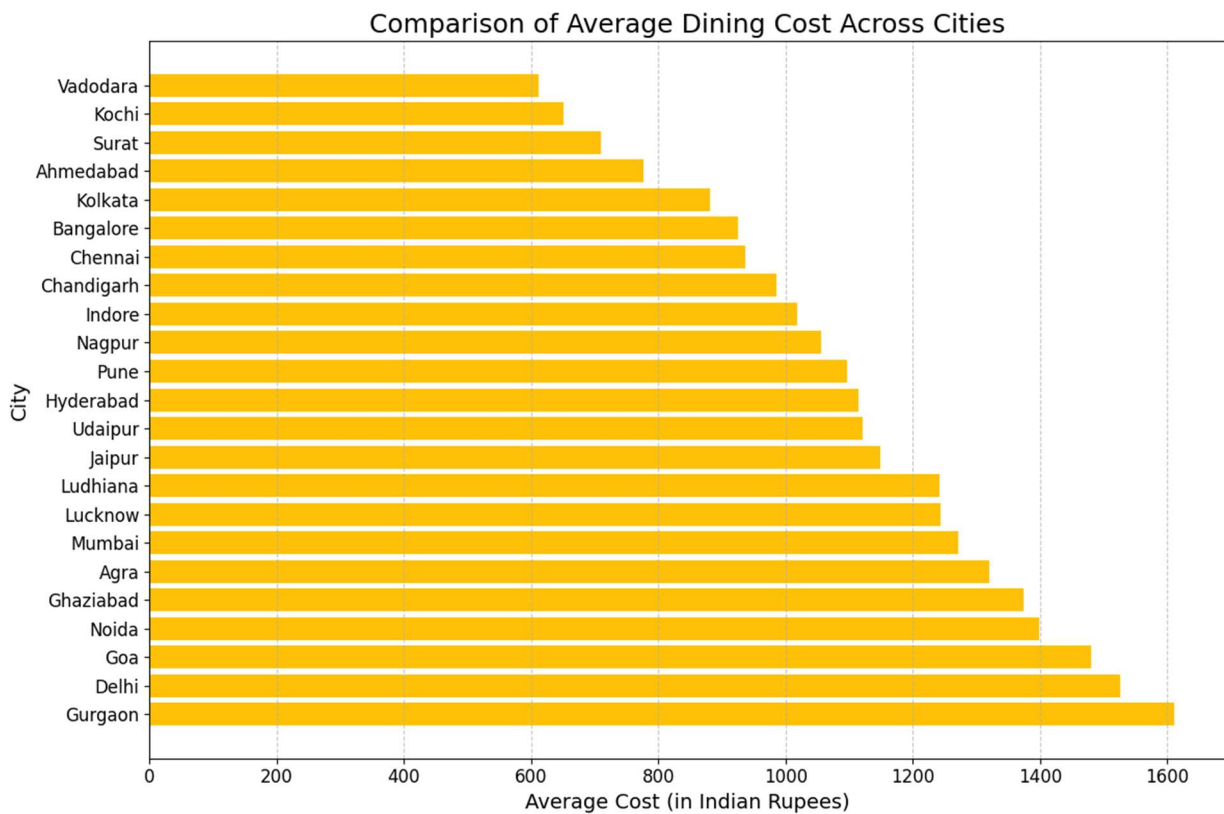
According to the dataset, more than 1400 restaurants in India have a rating of 4.5 or above, indicating a high level of customer satisfaction. This suggests that there are many good dining options available in the country.

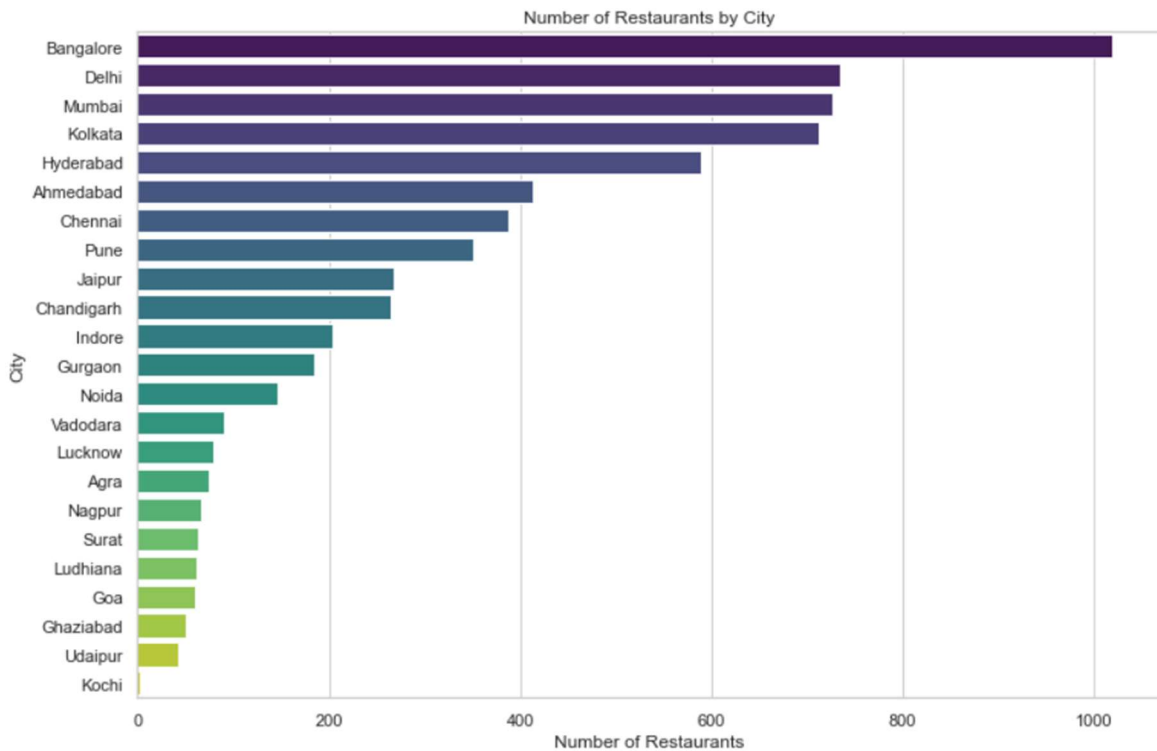


According to the dataset, there are over 2000 restaurants in India that charge around 1000, while the maximum restaurant charges are around 5000. This information can be useful for those who are looking to dine out and want to have an idea of the price range.



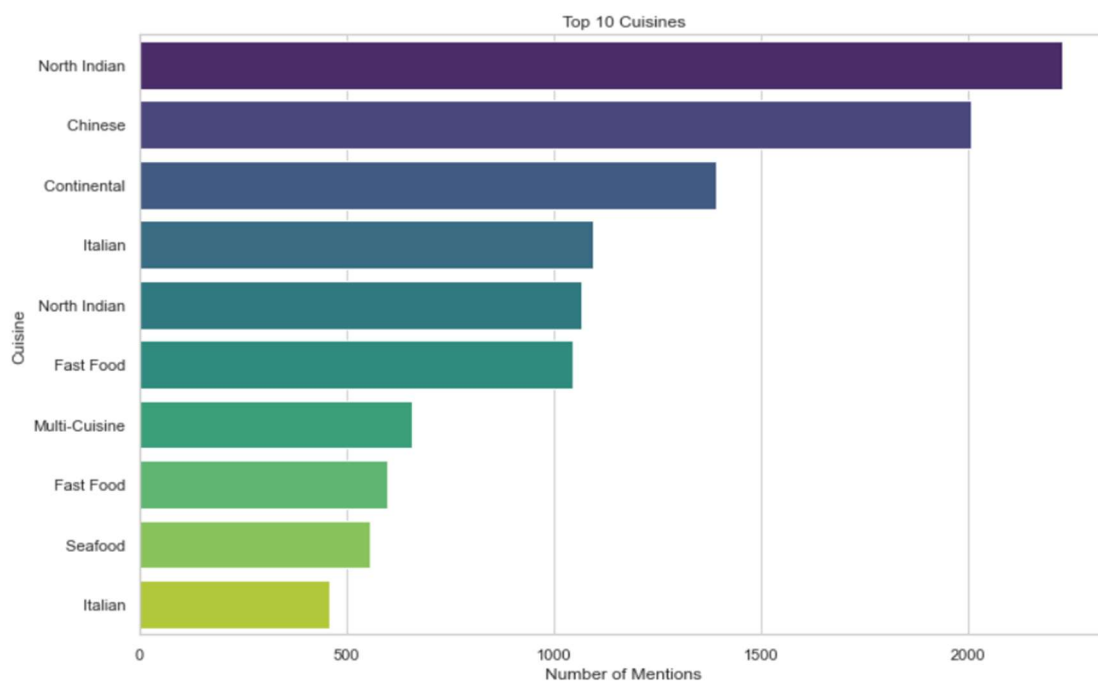
We can see that Mithai and Desserts are among the top cuisines in India based on the number of restaurants offering them.





Bangalore, Delhi, and Mumbai have the highest concentration of restaurants, indicating significant market opportunities in these cities.

6.1 Behavioral Analysis

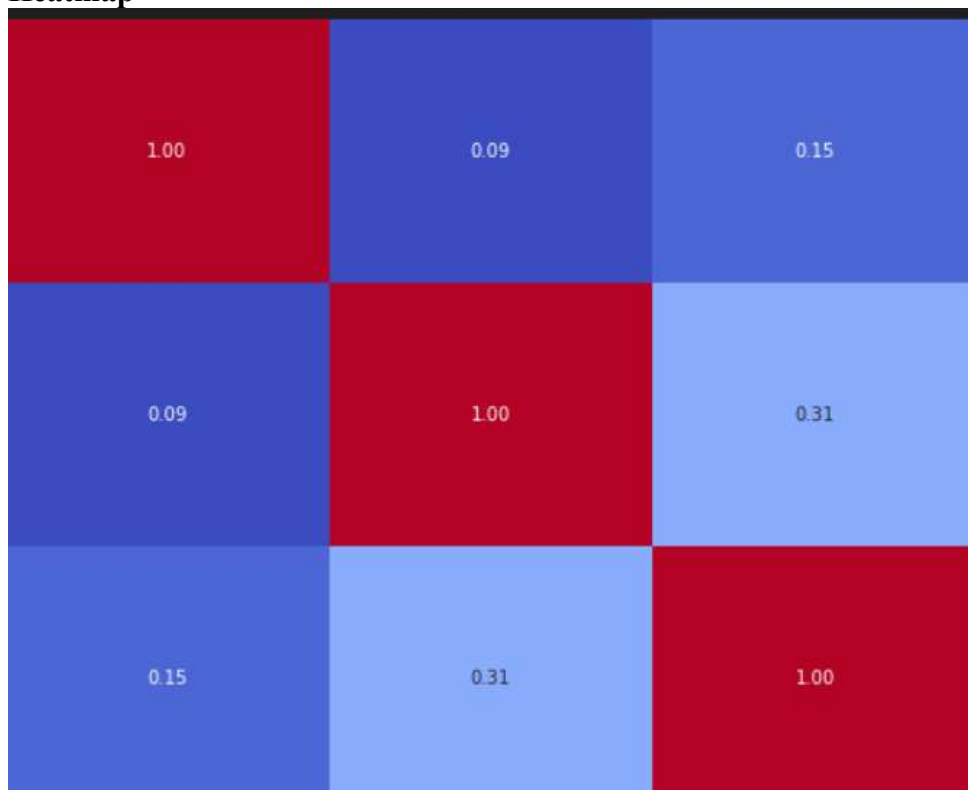


Market Demand: With the highest number of mentions, North Indian (3,296) and Chinese (2,007) cuisines are the most popular among consumers. This high demand indicates a strong preference for these cuisines.

Expansion Opportunities: Restaurants specializing in these cuisines can consider expanding their presence in cities and localities where these cuisines are less represented. For example, a North Indian restaurant could open new branches in localities with fewer North Indian options to capture unmet demand.

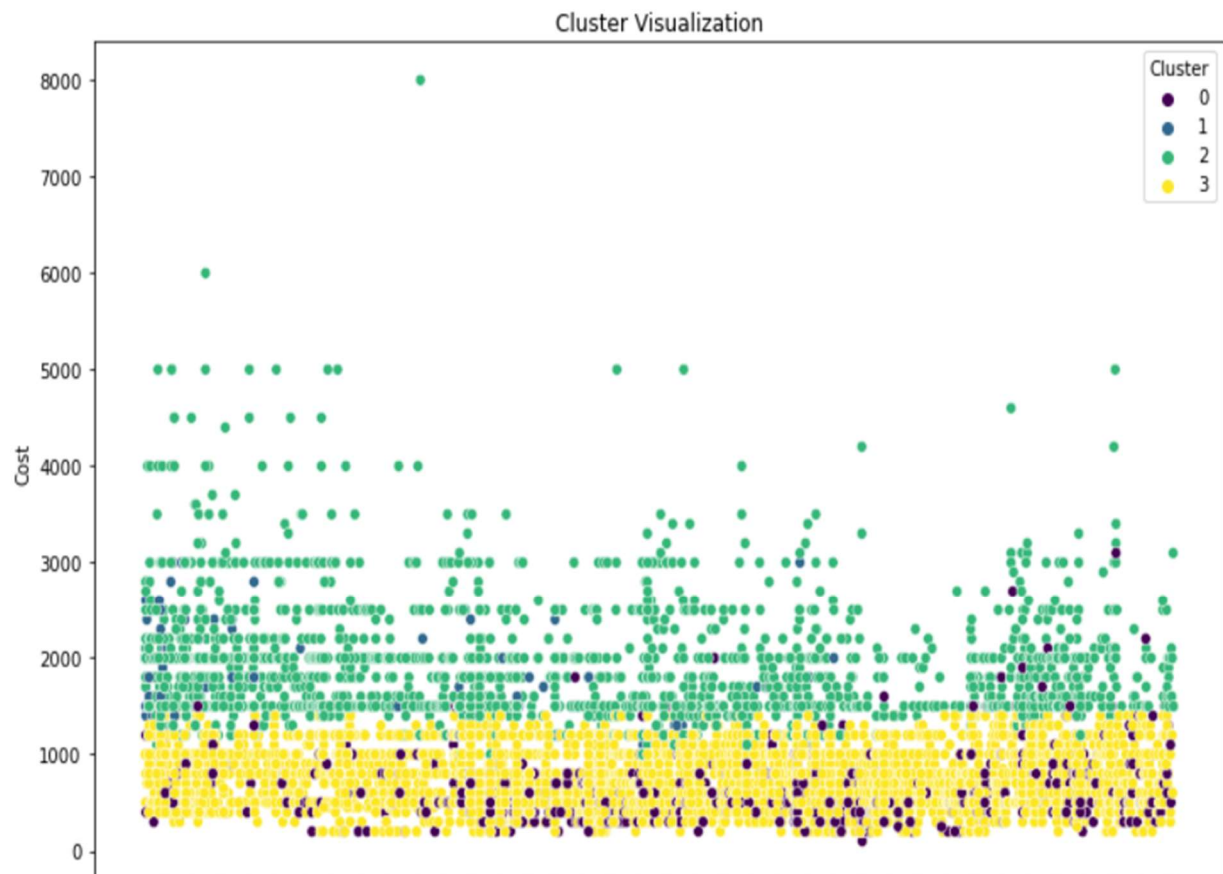
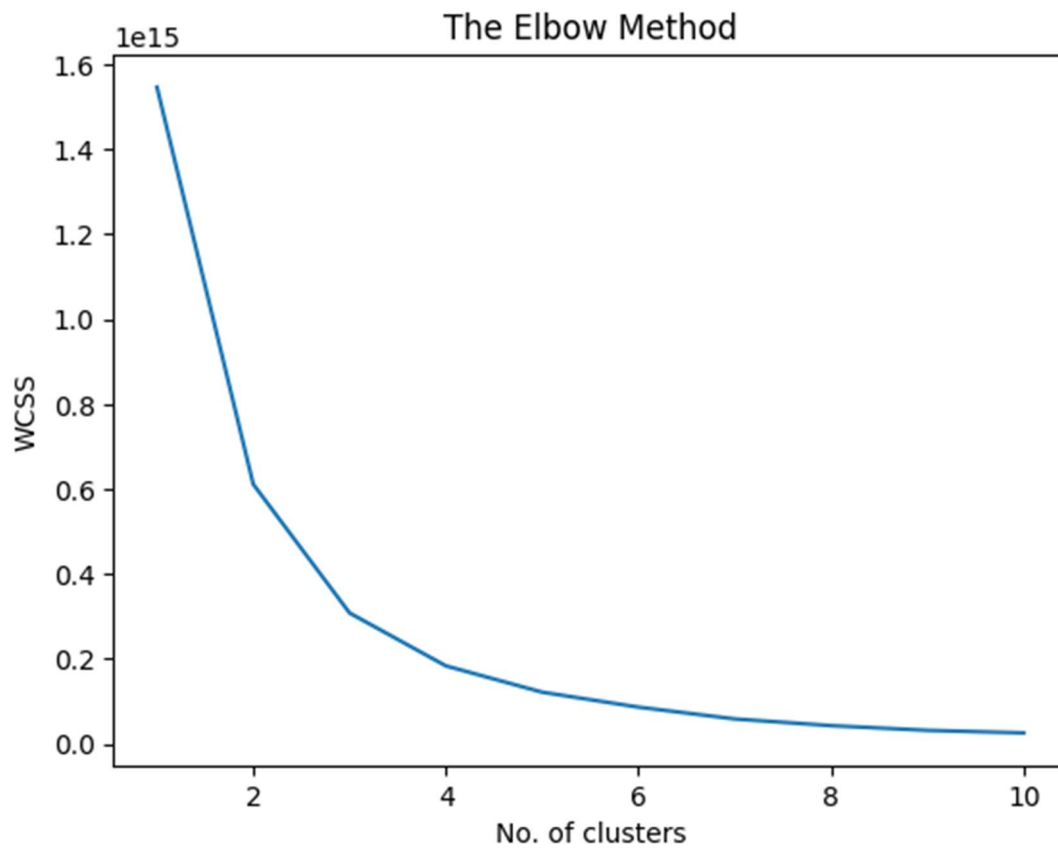
Menu Diversification: Existing restaurants could diversify their menu by incorporating popular North Indian and Chinese dishes to attract a wider customer base.

Heatmap

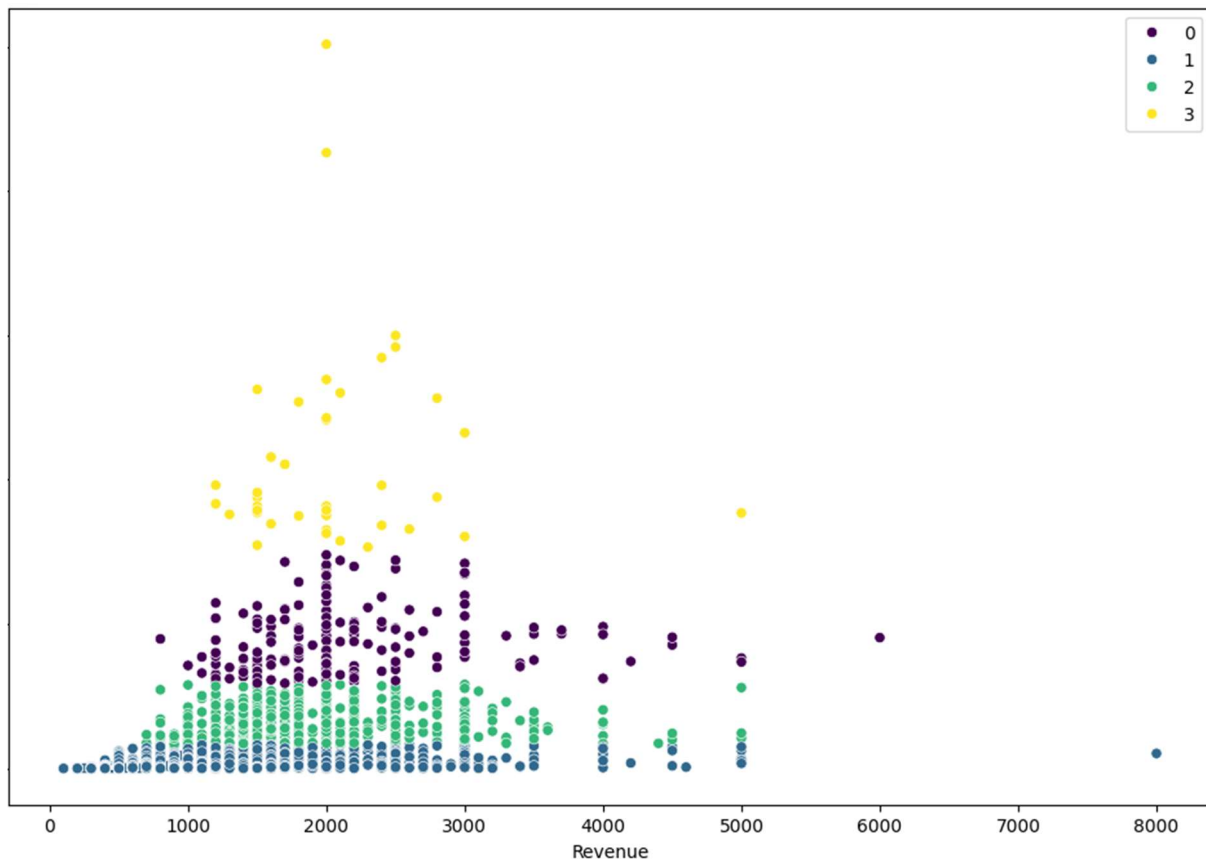


6.2 Market Segmentation Using k-means Clustering

To identify the optimal number of clusters (k) by plotting the total within-cluster sum of squares (inertia) against the number of clusters. In this analysis, the Elbow Method plot suggested $k=4$ as the optimal number of clusters.



This visualization provided a clear view of how restaurants are grouped based on location and cost facilitating the identification of patterns and anomalies. The mean values of numerical features (e.g., cost, rating, votes) for each cluster were calculated. These mean values highlighted the unique attributes of each cluster, revealing differences in pricing, customer preferences, and other key metrics.



This visualization provides clustering based on revenue and cost. For calculating revenue, the formula is “Number of customers (Sales) * Average Cost”. But here we have number of votes. Even though votes may not always sync with number of customers, we used votes to calculate revenue to get a rough description about this. So, we can conclude that we should target those restaurants that has larger number of votes since their revenues are much better.

Dataset:

<https://www.kaggle.com/datasets/arnabchaki/indian-restaurants-2023>

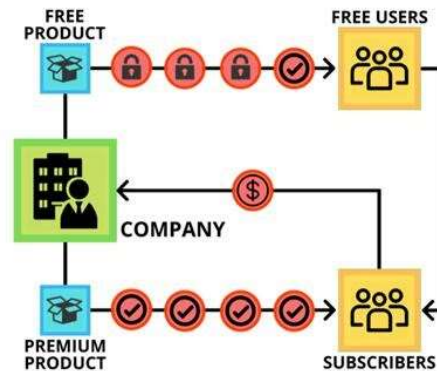
Complete Code:

<https://colab.research.google.com/drive/10NQWFYtW19AF6TyR7R2dxonyPm9c2dwT?usp=sharing>

7. Business Model

Our Business Model is Subscription Based Model

SUBSCRIPTION BUSINESS MODEL



A subscription-based model is a business model where customers pay a recurring fee at regular intervals (such as monthly or annually) in exchange for access to a product or service. This model contrasts with traditional one-time purchases, as it creates an ongoing relationship between the customer and the provider. Here's an explanation of key aspects of a subscription-based model:

Recurring Revenue: Instead of relying on one-time sales, subscriptions generate regular, predictable revenue streams for businesses. This stability can improve financial planning and forecasting.

Customer Relationship: Subscriptions foster long-term relationships with customers. Providers continuously engage with subscribers, often providing updates, improvements, and customer support throughout the subscription period.

Value Proposition: Subscriptions offer ongoing value to customers. They typically include access to updates, new features, support services, or exclusive content, ensuring that customers perceive ongoing benefits that justify the recurring cost.

Variants of Subscription Models: There are different types of subscription models:

Fixed Fee: Customers pay a set amount for access to a defined set of features or services.

Tiered: Offers multiple subscription levels (e.g., basic, standard, premium) with varying features and prices to cater to different customer needs.

Usage-Based: Charges are based on actual usage or consumption of the service (e.g., data usage, number of transactions).

Freemium: Offers a basic service for free with the option to upgrade to a paid subscription for additional features or enhanced functionality.

Our Tier based subscription plans include:

- **Tiered Plans:** Offer different subscription levels (e.g., basic, mid-range, premium) based on the need of the restaurant and the features they need. Higher tiers can include more advanced features like inventory management and menu modification suggestions.
- **Frequency-Based Pricing:** Offer pricing options based on the frequency of price adjustments (weekly, monthly, quarterly). Customers can choose plans that align with their business needs.

- **Revenue Sharing:** Charge a small percentage of the additional revenue generated through dynamic pricing adjustments & potential loyalty programs. This aligns our interests with the customers, as our success is directly tied to their increased profitability. (all types of clients will be charged based on revenue)
- **Advanced Analytics:** Offer advanced analytics and reporting tools as an add-on service, providing deeper insights into customer behavior, market trends, and performance metrics. (Note: for premium clients this is included by default)

Subscription Plan Details

Our subscription plan mainly categorized as:

1. **Basic plan:** Our basic plan includes the primary functionalities of dynamic pricing i.e dynamically suggesting the optimal prices for menu items w.r.t tailored market trend and consumer preferences.
2. **Plus Plan:** Our plus plan includes menu modification suggestion feature along with all the features of basic plan.
3. **Premium Plan:** Our Premium plan includes inventory management suggestions along with all the features of both basic plan as well as plus plan.

If Basic plan clients and Plus plan clients want to access any other add on features such as menu modification suggestion feature (for Basic plan clients), inventory management suggestion feature (for both Basic & Plus plan clients) they could avail with 'pay-as-you-go' basis.

Our services could be accessed as a freemium one, it includes dynamic pricing suggestion feature, where the prices of the food menu items are suggested based on generic market trends. To encourage free users to upgrade to paid plans by demonstrating the value and effectiveness of the dynamic pricing suggestions.

8. Financial Equation

To develop a financial equation for the "Smart Pricing Suggestions for Local Restaurants and Cafes with Dynamic Pricing" project, we can use the linear model $y = mx(t) + cy = mx(t) + c$, where:

- y = total profit
- m = pricing of your product
- $x(t)$ = total sales (market as a function of time)
- c = production, maintenance, and other fixed costs

Components Breakdown:

1. **Total Profit (y):**
 - Total profit over a given period, accounting for both revenue and costs.
2. **Pricing of Your Product (m):**
 - This represents the revenue per unit sold or service provided. In this context, it can include:

- Subscription fee per customer
- Transaction fee per processed transaction
- Consulting fee per session

3. **Total Sales (Market as a Function of Time) (x(t)):**

- The total number of units sold or services used over time. This includes:
 - Number of subscriptions over time
 - Number of transactions over time
 - Number of consulting sessions over time

4. **Production, Maintenance, and Other Fixed Costs (c):**

- This includes:
 - Development costs
 - Operational costs
 - Marketing costs
 - Customer support costs
 - Variable transaction costs

Financial Equation Development:

Linear Model: $y = mx(t) + c$

Total Revenue (TR):

$$TR = (P_{\text{sub}} \cdot N(t)) + (P_{\text{trans}} \cdot T(t)) + (P_{\text{consult}} \cdot K(t))$$

- P_{sub} : Subscription fee
- $N(t)$: Number of subscriptions over time
- P_{trans} : Transaction fee
- $T(t)$: Number of transactions over time
- P_{consult} : Consulting fee
- $K(t)$: Number of consulting sessions over time

Total Costs (TC):

$$TC = C_{\text{dev}} + C_{\text{oper}} + C_{\text{mkt}} + C_{\text{supp}} + (P_{\text{cost_trans}} \cdot T(t))$$

- C_{dev} : Development costs
- C_{oper} : Operational costs
- C_{mkt} : Marketing costs
- C_{supp} : Customer support costs
- $P_{\text{cost_trans}}$: Variable cost per transaction

Putting It All Together

Total Profit (y):

$$y = TR - TC$$

Given the linear model $y = mx(t) + c$

- **m**: Combined pricing per unit/service: $m = P_{\text{sub}} + P_{\text{trans}} + P_{\text{consult}}$
- **x(t)**: Combined sales over time: $x(t) = N(t) + T(t) + K(t)$
- **c**: Total fixed and variable costs: $c = C_{\text{dev}} + C_{\text{oper}} + C_{\text{mkt}} + C_{\text{supp}} + (P_{\text{cost_trans}} \cdot T(t))$

Conclusion

The adoption of dynamic pricing strategies, powered by AI and machine learning, holds transformative potential for small and medium-sized restaurants and cafes. Recognizing the importance of hotel owners' decision-making, our services are designed to offer dynamic pricing suggestions rather than automating price changes. This approach underscores the necessity of such strategies in today's rapidly evolving food industry.

Our dynamic pricing solutions can drive revenue optimization, enhance customer satisfaction, and improve operational efficiency. Through a comprehensive assessment of market needs, business demands, and customer characteristics, the feasibility and benefits of dynamic pricing are thoroughly analysed. This positions our solution as a viable option for maximizing profitability and enhancing market competitiveness.

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