Buffet Optimization: High Steaks Forecasting

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Problem Statement

Singaporeans live for food. This fact is nowhere more evident than in our nation's vibrant buffet scene. Yet even our most celebrated hotel buffets struggle to turn that passion into optimal performance.

Key challenges faced in the F&B industry:

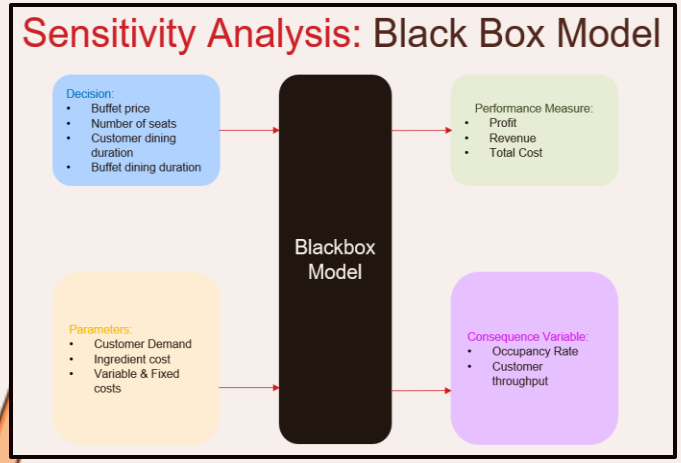
- Rising ingredient costs,
- Tight labor market,
- Declining consumer demands,
- Narrowing profit margins,
- More competitors

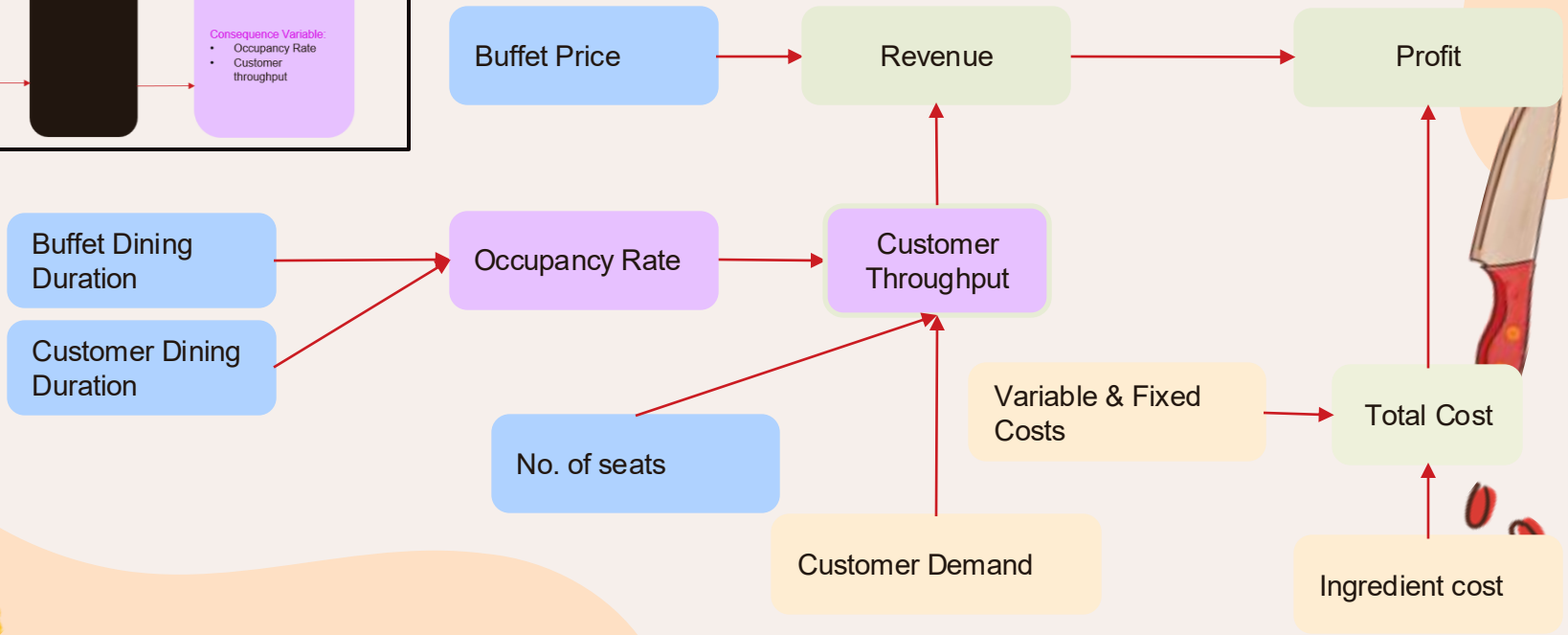
In this project, our team assumes the role of an operator for a buffet restaurant located in a 5-star hotel. As such, the goal is to develop a data-driven framework to tackle the challenges in the F&B industry and optimize our operations.

Common Assumptions for Project

Opening Hours: Lunch **(12-2.30pm, 2.5hrs)** and Dinner **(6-10pm, 4hrs)**
Dining Time: 90 minutes
Max capacity: 260 seats

Module 1: Business Resilience and Pricing Optimization





Module 1: Business Resilience and Pricing Optimization

Objectives:

1) To analyze how changes in **uncontrollable** factors (Cost, Demand) affect the model's main output (Profit).
2) Evaluating and comparing **performance measures** (Revenue, Total Cost) when current controllable factors changes. Determine best price to set based on business pricing to obtain **optimal profit**.

Assumptions made for Models

Base price and Dining

- Lunch and Dinner pricing are obtained from industry 5* hotel prices and averaged to represent the model's weekday and weekend prices.
- 1.5hrs used for customer dining duration where customers will stay for the entire duration

Costs

- Fixed, variable and ingredient cost is obtained for average % from industry based on revenue.

Occupancy Rate

- Occupancy rate is based on how many customers will occupy each seat during the whole day.

Excel Workings

Demand Curve

- Graphs is based on weekday and weekend prices as a whole. (Lunch + Dinner averaged and combined)
- For every $10 price increase, weekday demand drops by 5% and weekend demand drops by 4%.
- Equation of curve will be linear.

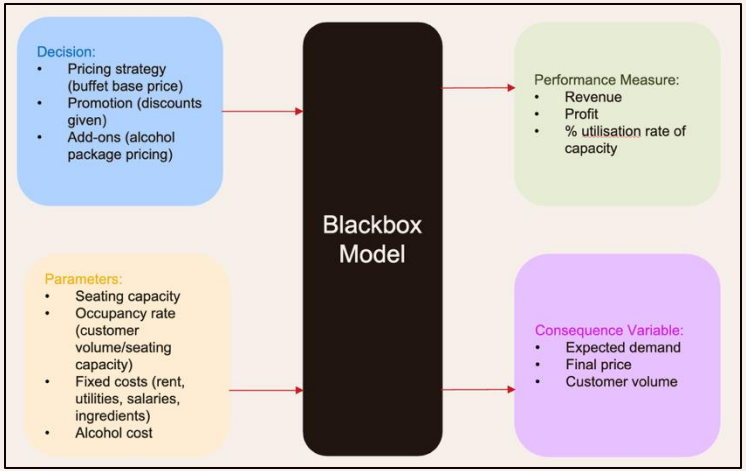
Sensitivity Analysis

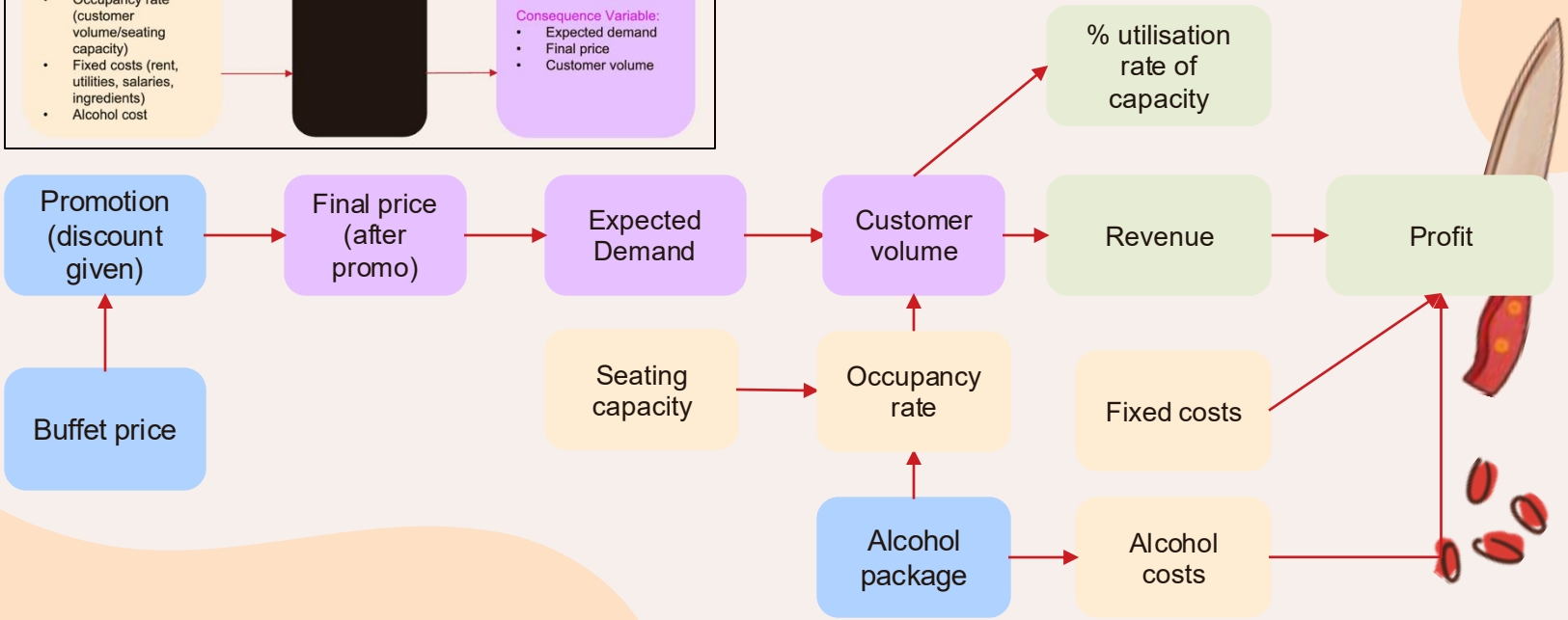
- Percentage change of each cost will be by increment/decrements of 1%.

Tradeoff Analysis

- Only best price for profit will be calculated instead of buffet/customer dining duration and no. of seats to lead of to next Module.

Module 2: Marketing Pricing Strategy





Module 2: Marketing Pricing Strategy

Assumptions made

Base price

- Fixed base price per category e.g. weekday vs weekend vs holiday (based on sensitivity analysis on best price)
- Weekends and holidays have the same base price

Costs (fixed)

- Fixed cost (as % of max revenue): 7.5% Full Timers, 17.5% rental
- Variable cost (as % of total revenue): 31.5% ingredient cost, 5.5% Part Timers, 5% utilities
- Alcohol cost fixed rate (as % of alcohol revenue): 30%

Operations

- Daily occupancy rate per seat consistent across weekday, weekend and holiday (based on same rates as sensitivity analysis), based on same operating hours

Demand (buffet)

- Holidays >= weekends > weekdays
- Dinner > lunch

Demand (alcohol)

- Differing alcohol uptake rate across each session, where:

i. Alcohol uptake rate: holiday > weekend > weekday
ii. Alcohol uptake rate: dinners > lunches

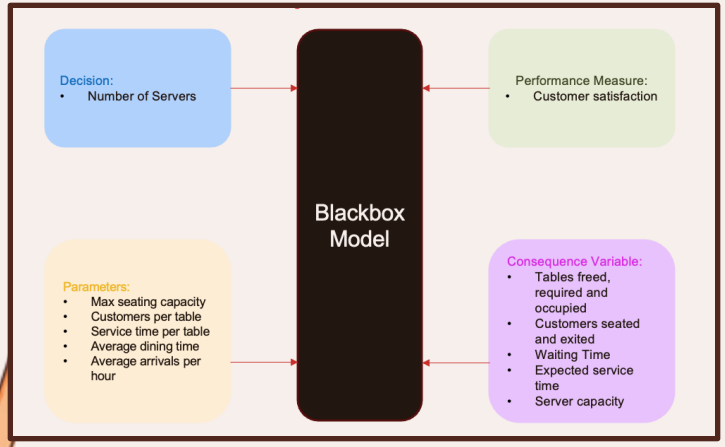
- Price elasticity of alcohol:

i. Relatively more elastic during weekdays and lunches i.e. customers more price sensitive
ii. Relatively less elastic during dinners, weekends and holidays dinners i.e. customers less price sensitive

Excel workings

1. Calculator for each scenario (lunch and dinner across weekday, weekend and holiday), calculating the demand, revenues, costs and profit
2. Data table for each scenario to show the profit margin across different buffet discounts and alcohol pricing

Module 3: Customer Satisfaction



Number of servers

Service time per table

Server capacity

Average dining time

Pax exited

Tables freed

Customers per table

Tables Required

Pax Seated

Waiting time

Customer satisfaction

Base Average Arrivals

Arriving Customers

Scenario Factor

Max seating capacity

Module 3: Customer Satisfaction

Assumptions:

Seating and Capacity

- One table only can fit a maximum of 4.
- Every party, even if less than 4 is treated as requiring/freeing 1 table to account for no one seated with strangers from another group.
- Seats are immediately available upon clearing

Dining & Services Time

- Each server is available in the defined 10 minutes time bucket and works continuously at full capacity.
- Service time is calculated for each table, not per customer with a duration of 5 minutes.
- Based on research, less than 5 minutes of waiting time is considered good customer satisfaction.

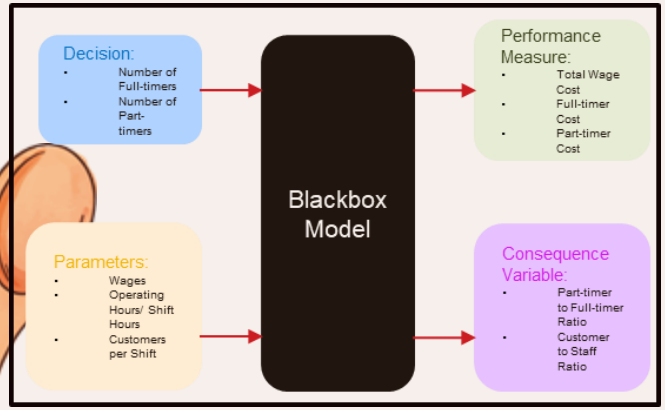
Arrivals & Queue

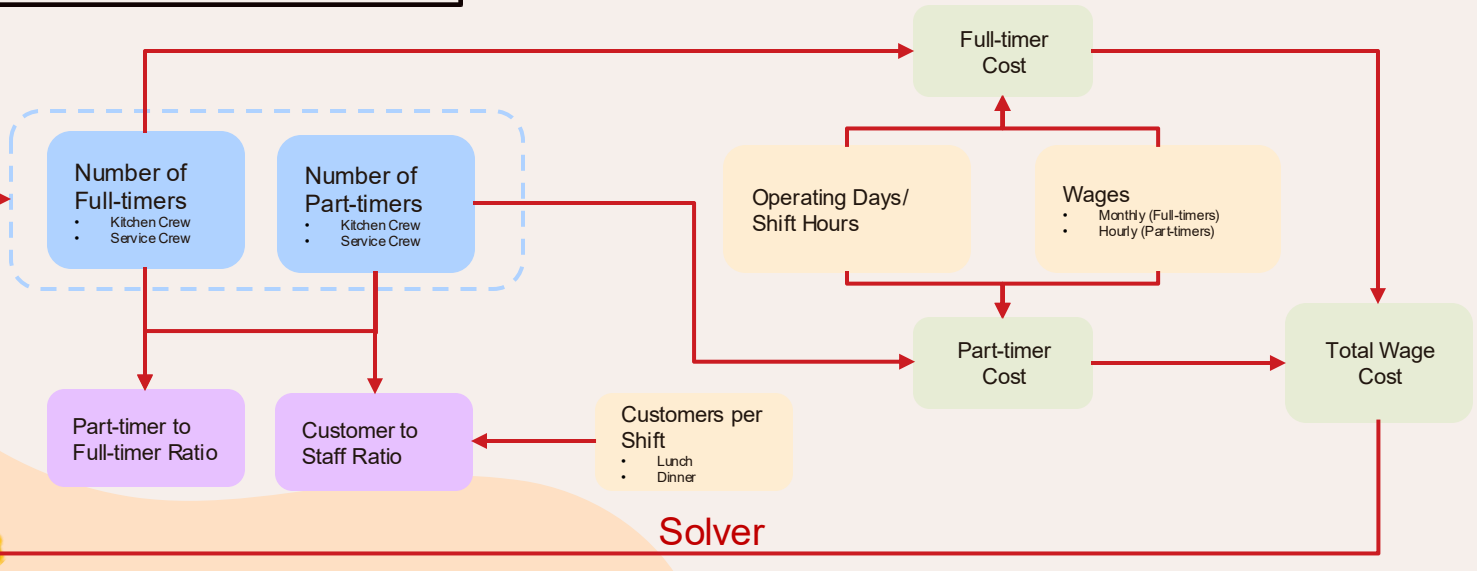
- All waiting customers stay in queue until seated, no one leaves the queue.
- Arrivals follow an exponential distribution with a factor included depending on scenario.
- Only dinner is modelled as it assumes that lunch would have lower occupancy, so number of servers during dinner would naturally be more.

Excel Workings:

1. Monte Carlo simulation of exponential distribution to randomize the arrivals
2. What-if Analysis' Data Table to generate the average wait time at different number of servers (1 – 30)
3. Run 1000 simulations to stabilize the results under different scenarios
4. Find the first quantity of number of servers that reaches < 5 minutes to keep manpower cost low, maximizing profit.
5. Average out the number of servers across all scenarios to find a baseline number of servers to achieve customer satisfaction.

Module 4: Manpower Optimization





Module 4: Manpower Optimization

Assumptions Made for the Model:

Staffing/ Operations :

- Set a Customer to Staff Ratio for customer satisfaction - Customer to Service Crew/ Kitchen Crew
- For Service Crew – More Part-timers than Full-timers for staff flexibility (set a min-max PT:FT ratio)
- Same no. of Full-timers work for both shifts, no. of Part-timers can vary for both shifts
- For Full-timer staff: **6 day work week** – Approximate no. of off days using a Utilisation Rate
- Min. no of Full-timers crew to support operations
- Assume no OT for Staff
- Part-timer Wages – **Per Hour,** 1.5x for Weekend, 2x for PH
- Full-timer Wages – **Per Month**

Excel Working:

- Calculator for Total Wage Cost in a selected month
- Solver to set the **Total Wage Cost to minimum** by adjusting **no. of staff as input**
- Data Table to show Total Wage Cost for each month in 2025

No.	Requirements	Solver Constraints Set
1	• No. of staff need to be a positive integer value	Set integer constraint for input cells for staff numbers • Min. no. of Full-timers – prevent -ve values
2	• Target Customer to Staff Ratio (For service and kitchen crew respectively)	• Customer to Service Crew Ratio (per lunch and dinner) • Customer to Kitchen Crew Ratio (combine both shifts)
3	• Part-timer to Full-timer Ratio • Full-timer's 6 day work week	• Min. no of Effective Full-timer (using utilization rate) for each role • Set Min and Max PT to FT Ratio

Insights and recommendations

Customer Satisfaction:
To maintain average wait times below five minutes, we recommend staffing a baseline of **17 servers** for regular dinner service. During peak-demand scenarios such as promotional events on public holidays, the server count should increase to **at least 21**. Conversely, to optimize labour costs during off-peak periods (for example, weekday services with lower patronage), the hotel can reduce its servers accordingly.

Optimizing Manpower:
To optimise the number of staff by minimizing wage cost while maintaining specified requirements to maintain customer satisfaction and service crew flexibility – we recommend to have a service crew of **4 full-timers** and **13 part-timers** together with a **kitchen crew** of **8 full-timers**

Business Resilience and Pricing Optimization:
For changes in demand and total cost, weekday profit is more sensitive to price-demand change while weekend profit is more sensitive to each individual changes to cost. Thus, based overall business challenges these models aims to provide an estimate on how much profit is gained/loss.

At the same time, based on the evaluating different buffet prices for Weekday and Weekend. The most optimal buffet pricing based on business conditions would be $115 and $164.50 respectively. (Old price: $85, $94.50)

Marketing Pricing Strategy:
To achieve a good profit margin while maintaining a minimum of 70% utilisation rate of capacity, these are the optimal discounts + alcohol pricing:

	Weekday - Lunch	Weekday - Dinner	Weekend - Lunch	Weekend - Dinner	Holiday - Lunch	Holiday - Dinner
Discount (%)	40	20	20	10	10	0
Alcohol price ($)	35	45	40	50	50	60
Profit Margin	6.73%	16.65%	30.95%	37.59%	33.81%	39.15%
% utilisation rate of capacity	73.4%		78.6%		71.9%	

Thank you!