BUDGET ALLOCATION FOR MARKETING CAMPAIGN

For the fourth quarter of 2024

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Project Link:

https://github.com/HienNau/Budget-Allocation/blob/main/Allocation.ipynb

Project Overview

In the dynamic landscape of modern business, effective budget allocation is a critical component of strategic planning and execution. It involves distributing financial resources across various segments, projects, or departments to maximize the organization's overall profitability and efficiency. This process is particularly vital in marketing, where budgets must be allocated to different campaigns and customer segments to achieve the highest return on investment (ROI).

- ○ **Targeted Investment**: By analyzing and allocating budgets based on metrics such as ROI, Conversion Rate (CVR), and Average Order Value (AOV), businesses can ensure that their financial resources are directed towards the most profitable segments.
- ○ **Data-Driven Approach**: Budget allocation decisions are often based on quantitative data and analytics. This data-driven approach ensures that decisions are objective and grounded in empirical evidence.

The company produces a new generation of electric men razor and registered an e-commerce site 1 month ago to sell its product online instead of the traditional supermarket channel. During the last month, it piloted advertising on 2 channels:

● Email Channel

● SMS Channel

Data are extracted from a centralized database and stored in the attached file called "mkt_data.csv".

Dataset

id	Format: Integer, representing each message
send_date	Format: data, date when sms/Email was sent
estimated_age	Format: Integer, ranging from 0 to 100
age_range	Format: string. Audience is divided into 4 age ranges
channel	Format: string, either SMS or Email
coupon	Format: float, the value of coupon expressed in each message, valid for up to 3 units for each order
clicked	Format: binary, either 0 (customer doesn't click on the link in SMS/Email) or 1 (they clicked)
last_step	Format: string. It can have one of the following values: "received", "bounced", "saw review", "added to cart", "payment page", "purchased"
nb_units	Format: integer, representing the number of units of customers' order.
order_value	Format: float, representing value of the order customer made. Already minus the coupon applied.

Financial Information

Together with the data above, I have additional information about the production cost and the marketing campaigns.

● Production cost for each razor is 18$.

● Cost per one SMS is $0.050, cost per one email sent is $0.075.

● Each email or SMS will be supplied a coupon which can have value of 2$, 4$ or 6$. Coupon is valid for up to 3 razors in each order. They have the option to wrap the items as gift. Ignore wrapping and shipping costs.

● The price without coupon is 40$ / razor.

● From experience (and some models), potential customers are divided into 4 age groups:

   O 18 - 30

○ 31 - 45

○ 46 - 60

○ 60 +

For the next quarter, the marketing department has a budget of $60,000 to spend on online campaigns. So how would I allocate it between SMS and Email?

Assume that the potential customer pool for each age group as below:

Age Group	Pool size
18 - 30	300,000
31 - 45	350,000
46 - 60	500,000
60+	200,000

In summary, a company is planning to allocate its marketing budget across different customer segments and channel for a targeted campaign. The budget needs to be distributed according to the priority of each segment and the cost associated with reaching each customer within those segments. The goal is to maximize the coverage of the marketing campaign without exceeding the total available budget.

Definations

ROI

- Return on investment (ROI) is a performance measure used to evaluate the efficiency or profitability of an investment or compare the efficiency of a number of different investments. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost.
- ROI can be used to make apples-to-apples comparisons and rank investments in different projects or assets.

$$ROI = \frac{Net\ Profit}{Cost\ of\ Investment}$$

CVR

- Conversion rate, or CVR, is a common metric used in digital marketing to denote the percentage of website visitors who 'convert' by taking a desired action, such as making a purchase, filling out an online form, or subscribing to a newsletter. CVR is a key indicator of how effectively a website is converting visitors into customers or leads.

- In this report, CVR represents the percentage of customers who, after receiving an email or SMS from the company, proceeded to make a purchase. This metric is crucial for understanding the effectiveness of the company's email and SMS marketing campaigns.

$$CVR = \left(\frac{\text{Number of Conversions}}{\text{Number of Visitors}} \right) \times 100$$

AOV

- Average order value (AOV) is a metric used in eCommerce to measure the average amount customers spend per order over a certain period of time. To calculate your company's average order value, simply divide total revenue by the number of orders.
- AOV is a key performance indicator that online businesses measure to understand their customers' purchasing habits.

$$AOV = \frac{\text{Total Revenue}}{\text{Number of Orders}}$$

Methodology

Objectives

1. **Allocate Budget by Priority**: Distribute the marketing budget to the customer segments based on their given priority.

2. **Maximize Coverage**: Ensure the highest possible number of customers are reached within the constraints of the available budget.

3. **Avoid Budget Overrun**: Ensure that the total allocated budget does not exceed the available budget.

Plan

1. **Compute Metrics**:
   - Calculate ROI, CVR, and AOV for each segment(and each channel)
2. **Rank Segments**:
   - Rank segments based on ROI, CVR, and AOV.
   - Determine the order of priority for budget allocation by computing and comparing ROI, CVR, and AOV.
3. **Allocate Budget**:
   - Allocate the budget to the highest-ranked segments based on the priority until the budget is exhausted.

Metrics Calculation

1.ROI:

$$ROI = \frac{(\text{Total Sales}-\text{COGS})-(\text{Cost of Sending SMS/Email}+\text{Cost of Coupons})}{\text{Cost of Sending SMS/Email}+\text{Cost of Coupons}}$$

Total Sales: The revenue generated from the sales. Take a note that in this dataset, the order_value representing value of the order customer made. Already minus the coupon applied.

Cost of Goods Sold (COGS): The direct costs attributable to the production of the goods sold.

Advertising Cost: This includes both:

- The cost of sending SMS/emails.
- The cost of coupons for purchased orders.

2.CVR

$$\text{CVR (Conversion Rate)} = \frac{\text{Number of Orders (or Number of Customers Who Purchased)}}{\text{Number of Emails/SMS Sent}} \times 100$$

This formula calculates the percentage of customers who made a purchase after receiving an email or SMS from the company.

3.AOV

$$AOV = \frac{\text{Sum of Order Values}}{\text{Sum of Orders (or Sum of Customers Who Purchased)}}$$

4.Sum of net profit:

$$\text{Net Profit} = (\text{Total Sales} - \text{COGS}) - (\text{Cost of Sending SMS/Email} + \text{Cost of Coupons})$$

After computing, I gain this data table:

| age_range	channel	sum_of_net_profit	ROI	CVR	AOV
18-30	Email	4408.5	90.421	0.006	56.791
18-30	SMS	11991.65	242.336	0.008	67.192
31-45	Email	12497	183.861	0.01	58.197
31-45	SMS	3507	80.676	0.003	71.805
46-60	Email	1418.925	61.132	0.005	53.948
46-60	SMS	8417.4	268.703	0.011	64.855
60+	Email	-751.1	-89.513	0	71
60+	SMS	-467.6	-68.005	0	61.667

Evaluate Segments
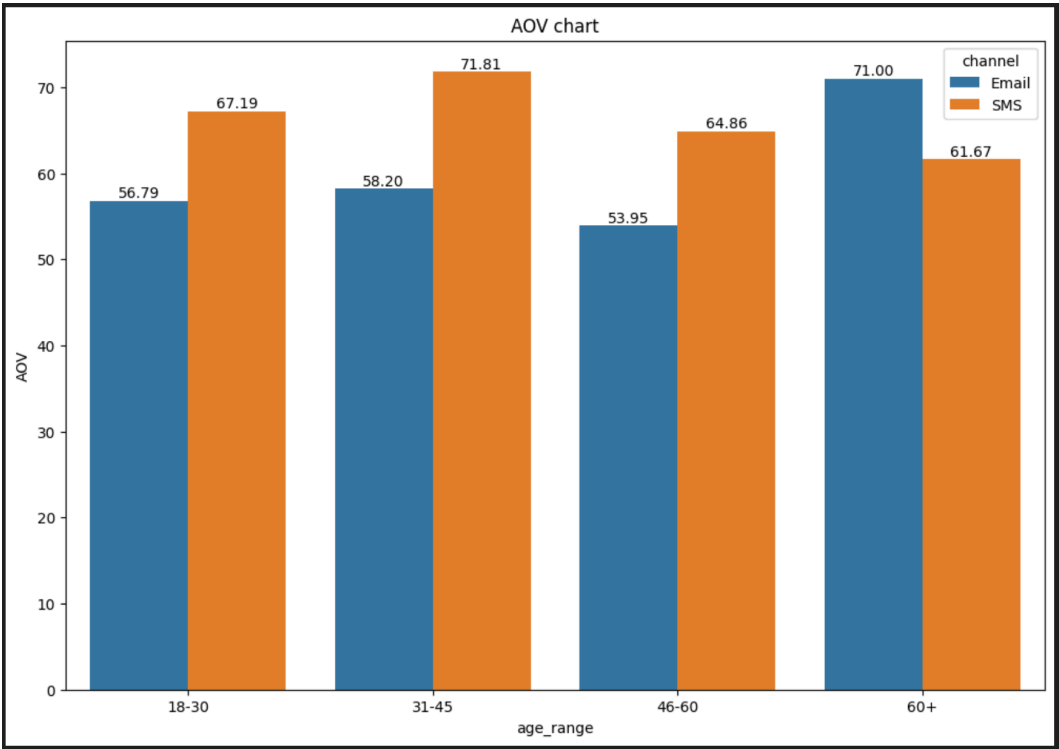
The AOV chart compares the Average Order Value (AOV) across different age ranges and

channels (Email and SMS).

- **Overall Trend**: For the age ranges 18-30, 31-45, and 46-60, SMS has a consistently higher AOV compared to Email.
- **Exception**: For the age range 60+, Email has a higher AOV than SMS.

Because the AOV is pretty common in each customer segment and each channel, excluding Customer group 60+ (but difference is little), we can ignore this element.
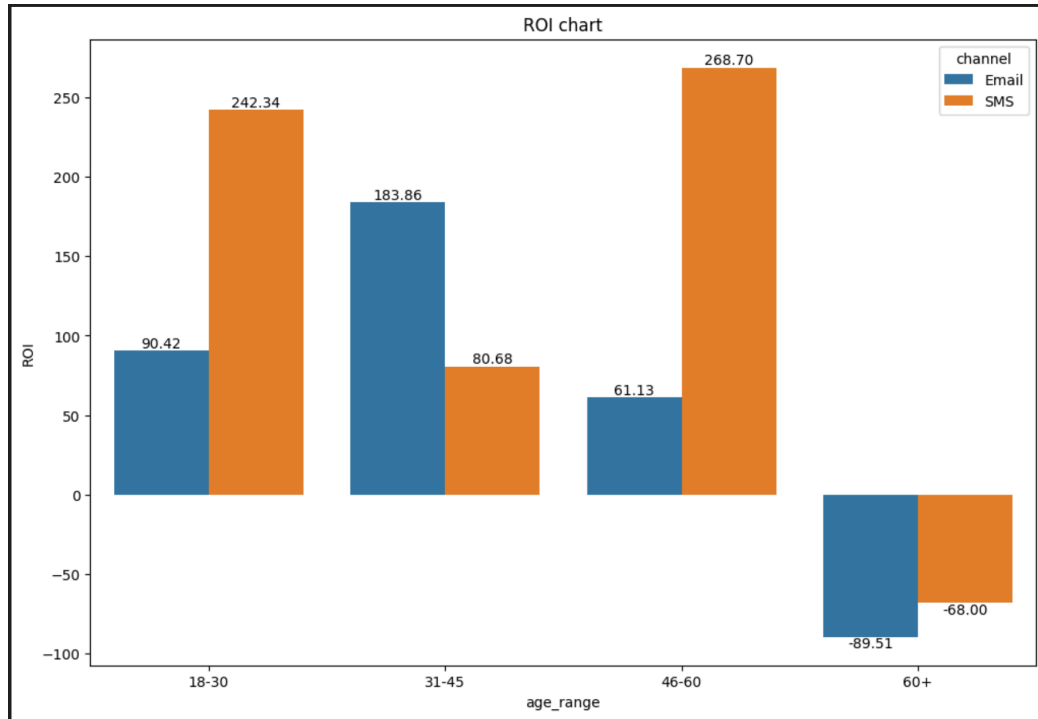
The ROI chart compares the Return on Investment (ROI) across different age ranges and channels (Email and SMS)

Based on the ROI chart, we can evaluate effectiveness of each chanel in each Customer segment:

- Customer group 60+ have negative ROI in both Email and SMS channel, then I definitely exclude this group from our advertising campaigns due to financial losses.
- SMS Channel in Customer group 46-60 is the the best chanel
- The second-best, third-best, forth-best channel is SMS channel in Customer group 18-30, Email channel in Customer group 31 - 45, Email channel in Customer group 18-30, respectively.
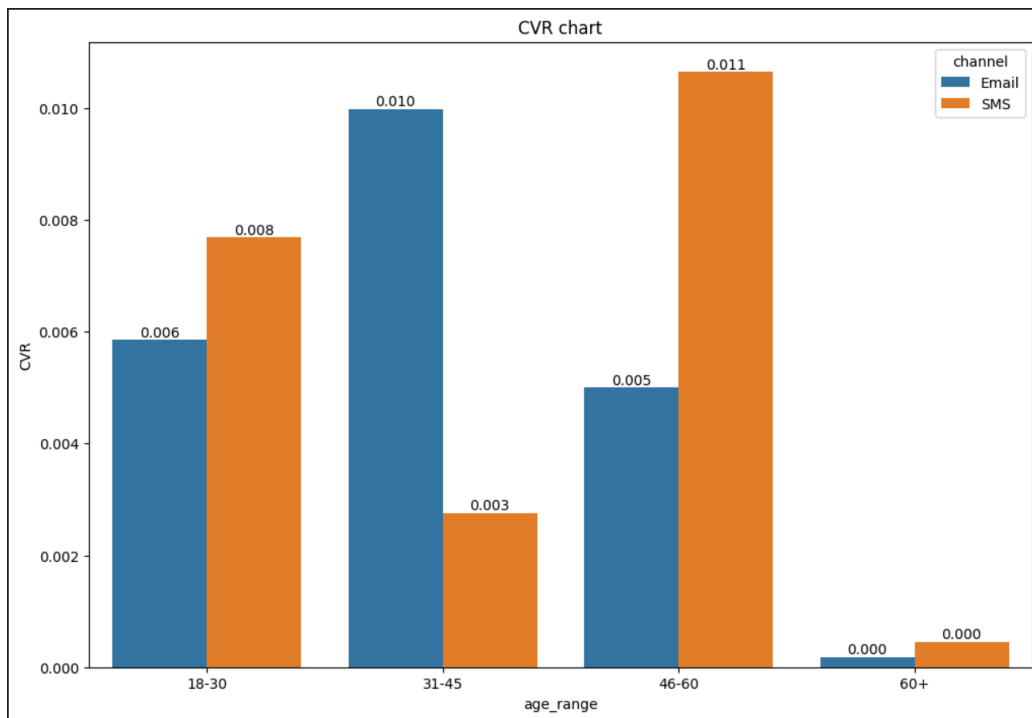
This chart compares the Conversion Rate (CVR) across different age ranges and channels (Email and SMS).

Base on the chart, we can also evaluate effectiveness of each chanel in each Customer segment

- Customer group 60+ have the very small CVR, then we exclude this group from advertising campaign.
- SMS Channel in Customer group 46-60 is still the the best chanel
- The second-best, third-best, forth-best channel is SMS channel in Customer group 31 - 45, SMS channel in Customer group 18 - 30, Email channel in Customer group 18-30, respectively

Take a note that there is a slight difference in ROI chart and CVR chart about rank number 2 and number 3. Although CRV of Email channel in Customer group 31 - 45 is higher than SMS channel in Customer group 18 - 30's, ROI is lower than the other's.

The focus will be on ROI for prioritizing channels and age groups. We are interested in the ROI more so that SMS channel in Customer group 18 - 30 takes the second priority after SMS Channel in Customer group 46-60.

Priority Ranking:

Based on the combined analysis of ROI, net profit, and other relevant metrics, the prioritized order of channel effectiveness for budget allocation is as follows:

1. **SMS Channel for Age Group 46-60**
2. **SMS Channel for Age Group 18-30**
3. **Email Channel for Age Group 31-45**
4. **Email Channel for Age Group 18-30**

Allocate Budget:

Now, allocate the budget to the highest-ranked segments based on the priority until the budget is exhausted.

Age Group 46-60: Total of SMS 500000, Allocated budget for this group is 25000.0

Age Group 18-30: Total of SMS 300000, Allocated budget for this group is 15000.0

Age Group 31-45: Total of Email 266666, Allocated budget for this group is 19999.95

Segment	Quantity	Segment_budget
46-60 SMS	500000	25000
18-30 SMS	300000	15000
31-45 Email	266666	19999.95

Budget Allocation Pie Chart:
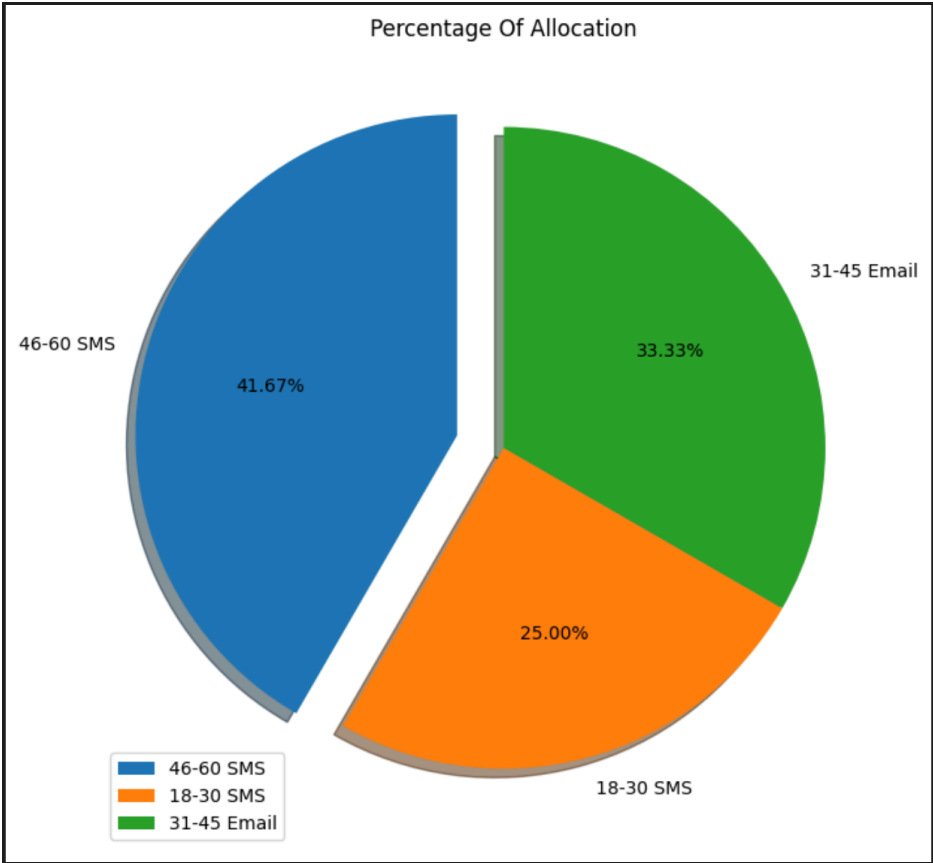
- **41.67%**: SMS Channel for Age Group 46-60
- **33.33%**: Email Channel for Age Group 31-45
- **25.00%**: SMS Channel for Age Group 18-30

Summary

In summary, this Data-driven approach ensures that the advertising budget is optimized by focusing on the highest-performing segments and channels, thereby maximizing returns and overall campaign effectiveness. The emphasis on ROI aligns with the objective of achieving the best financial outcomes from the advertising spend.