Data Science & Analytics - Internship

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Introduction:

The task focuses on analyzing marketing campaign performance data to uncover actionable business insights. The primary aim is to explore customer engagement, revenue contribution, and response behavior across campaigns. By transforming raw campaign data into meaningful visual representations, the project emphasizes storytelling through data, helping identify high-performing customer segments, top-spending groups, and trends across products and demographics.

Objectives:

- Understand the structure and components of the marketing dataset.
- Perform data cleaning and transformation for accurate visualization.
- Identify top-performing campaigns, high-engagement segments, and revenue-driving products.
- Develop interactive dashboards using DAX-based KPIs and visuals.
- Derive insights to support strategic campaign optimization and decision-making.

Assigned Dataset:

Raw Dataset	Cleaned Dataset Exported as
"marketing_data.csv"	"Marketing_Campaign_Data.csv"

Tools Used:

Tool	Purpose
Power BI	To build professional, interactive dashboards for campaign performance analysis and visualization.
Visual Studio (Python - Jupyter Notebook)	For quick data cleaning, transformation, and exploratory analysis before dashboard creation.

Expected Outcome:

- ✓ A fully cleaned and transformed dataset ready for analysis.
- ✓ Development of key visuals: Donut, Pie, Line, Clustered Bar, Clustered Column, and Gauge charts.
- ✓ Identification of high-response customer segments (Education, Marital_Status, Income), top-spending groups (MntWines, MntFruits, MntMeatProducts, etc.), and campaign engagement trends (Total_Engagements, Response).

✓ Implementation of DAX measures for Total Engagements, Total Revenue, Cost per Engagement (CPE), Engagement Rate.

Creation of an interactive dashboard that enables dynamic filtering by Year (Dt_Customer), Marital_Status, Education, Country, Kidhome, Teenhome, and Response.

✓ Actionable insights for improving future marketing campaigns and optimizing ROI.

Dashboard Flow:

Trend → Segmentation → Efficiency → Revenue → Improvement

Explanation of the Flow:

- **Trend** – Analyze campaign performance over time (e.g., total engagements, revenue by month).
- **Segmentation** – Break down performance by customer demographics (Education, Marital Status, Income) or country.
- **Efficiency** – Evaluate cost-effectiveness using metrics like Cost per Engagement (CPE) and Engagement Rate.
- **Revenue** – Assess financial impact via Total Revenue, Total Spending, and Average Purchases per Customer.
- **Improvement** – Identify opportunities for optimization, such as underperforming segments or low-response campaigns, and suggest actionable recommendations.

My Github Link: https://github.com/sumaiya-tasnim-18

(All my projects are available on my Github Account)

Summarizing all the data cleaning steps:

Step	Column(s)	Issue / Observation	Action Taken	Result
1	Income	Some missing / non-numeric values	Converted to numeric; replaced invalid/missing with 0	All values numeric, no missing
2	Dt_Customer	Date format inconsistent; previous conversion failed	Converted to datetime; invalid entries replaced with current date	All values valid datetime
3	Marital_Status	Invalid/unrealistic entries (YOLO, Alone, Absurd)	Replaced invalid entries with "Other"	Only valid categories + "Other"
4	Education	Typo: "2n Cycle"	Corrected to "2nd Cycle"	All entries consistent
5	Country	Country codes (SP, US, etc.)	Replaced codes with full country names	All entries human-readable
6	All Columns	Missing values	Checked & handled (Income: 0, others no missing)	No missing values
7	All Columns	Duplicates	Checked & removed (none found)	No duplicates
8	All Columns	Data types	Corrected: numeric → numeric, dates → datetime, categorical kept as object	All columns have correct types

Data Structure:

Column Name	Data Type	Column Name	Data Type	Column Name	Data Type
ID	int64	Year_Birth	int64	Education	object
Marital_Status	object	Income	float64	Kidhome	int64
Teenhome	int64	Dt_Customer	datetime64[ns]	Recency	int64
MntWines	int64	MntFruits	int64	MntMeatProducts	int64
MntFishProducts	int64	MntSweetProducts	int64	MntGoldProds	int64
NumDealsPurchases	int64	NumWebPurchases	int64	NumCatalogPurchases	int64
NumStorePurchases	int64	NumWebVisitsMonth	int64	AcceptedCmp3	int64
AcceptedCmp4	int64	AcceptedCmp5	int64	AcceptedCmp1	int64
AcceptedCmp2	int64	Response	int64	Complain	int64
Country	object				

Overall Review:

Dataset Version	Dataset Name	Total Rows	Total Columns	Notes / Status
Raw Dataset	marketing_data.csv	2240	28	Original dataset; Income had 24 missing values, Dt_Customer inconsistent, Marital_Status and Education had invalid/typo entries, Country in codes, mixed data types
Exported Cleaned Dataset	Marketing_Campaign_Data.csv	2240	28	Missing values handled (Income filled with 0), Dt_Customer converted to datetime, invalid Marital_Status replaced with "Other", "2n Cycle" corrected to "2nd Cycle", country codes replaced with full names, all data types corrected, dataset ready for analysis

Marketing Campaign Performance Dashboard KPI Summary:

Column Name	DAX Formula	Business Question Addressed	Why It's Important / Insight
Total Engagements	SUM('Marketing_Campaign_Data'[AcceptedCmp1]) + SUM('Marketing_Campaign_Data'[AcceptedCmp2]) + SUM('Marketing_Campaign_Data'[AcceptedCmp3]) + SUM('Marketing_Campaign_Data'[AcceptedCmp4]) + SUM('Marketing_Campaign_Data'[AcceptedCmp5]) + SUM('Marketing_Campaign_Data'[Response])	How many customers engaged with the campaigns?	Measures overall campaign engagement; helps understand campaign reach and effectiveness.

Column Name	DAX Formula	Business Question Addressed	Why It's Important / Insight
Total Revenue	SUM('Marketing_Campaign_Data'[MntWines]) + SUM('Marketing_Campaign_Data'[MntFruits]) + SUM('Marketing_Campaign_Data'[MntMeatProducts]) + SUM('Marketing_Campaign_Data'[MntFishProducts]) + SUM('Marketing_Campaign_Data'[MntSweetProducts]) + SUM('Marketing_Campaign_Data'[MntGoldProds])	How much revenue did the campaigns generate?	Shows financial impact of campaigns; identifies which campaigns/products drive sales.
Cost per Engagement (CPE)	DIVIDE([Total_Revenue], [Total_Engagements], 0)	How cost-efficient was each engagement?	Evaluates cost-effectiveness; lower CPE means better ROI per engagement.
Engagement Rate	DIVIDE([Total_Engagements], COUNT('Marketing_Campaign_Data'[ID]), 0)	What portion of customers engaged with campaigns?	Acts as a proxy for campaign CTR; shows overall effectiveness at reaching the audience.
Total Spending	SUM('Marketing_Campaign_Data'[MntWines]) + SUM('Marketing_Campaign_Data'[MntFruits]) + SUM('Marketing_Campaign_Data'[MntMeatProducts]) + SUM('Marketing_Campaign_Data'[MntFishProducts]) + SUM('Marketing_Campaign_Data'[MntSweetProducts]) + SUM('Marketing_Campaign_Data'[MntGoldProds])	How much did customers spend in total?	Shows overall monetary contribution; useful for revenue comparison across campaigns or segments.
Total Purchases	SUM('Marketing_Campaign_Data'[NumDealsPurchases]) + SUM('Marketing_Campaign_Data'[NumWebPurchases]) + SUM('Marketing_Campaign_Data'[NumCatalogPurchases]) + SUM('Marketing_Campaign_Data'[NumStorePurchases])	How many purchases were made by customers across channels?	Helps track customer activity; indicates cross-channel engagement and sales volume.

Marketing Campaign Performance Dashboard Visualization Summary:

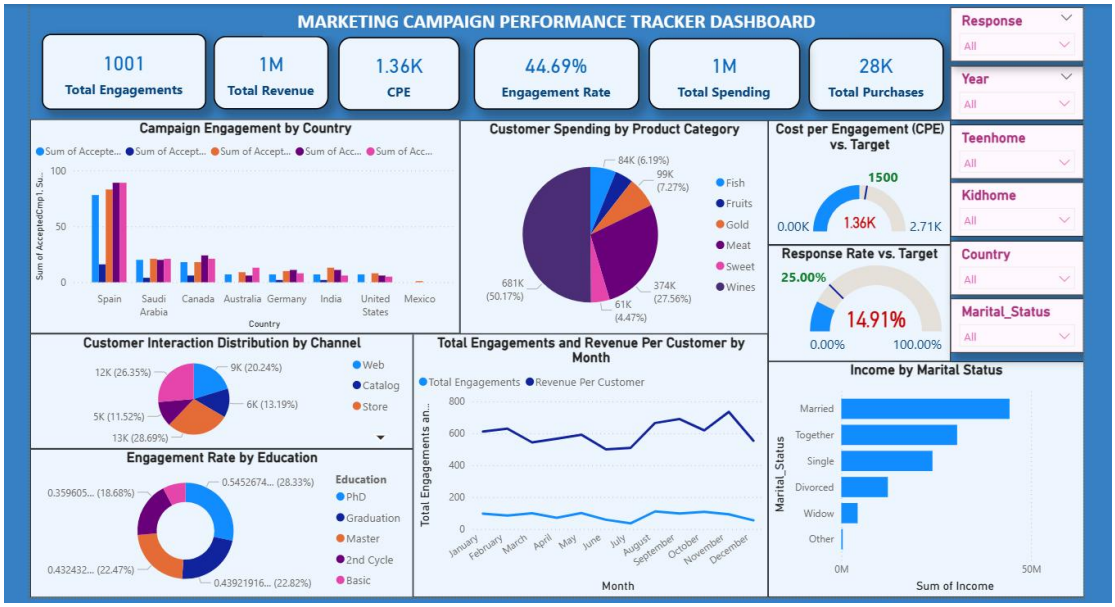
Visualization Title	Chart Type	DAX / Measure Used	Business Questions Addressed	Why It's Important / Insight
Engagement Rate by Education	Donut Chart	Engagement Rate = DIVIDE([Total_Engagements], COUNT('Marketing_Campaign_Data'[ID]), 0)	Which customer segments engage the most based on education level?	Identifies high-response education segments; helps target campaigns more effectively.
Total Engagement by Month	Line Chart	Total Engagements = SUM('Marketing_Campaign_Data'[AcceptedCmp1]) + SUM([AcceptedCmp2]) + … + SUM([Response])	How well did the ad campaign perform over time?	Shows engagement trends and campaign effectiveness month-to-month; highlights peaks and dips.
Total Engagement and Revenue per Customer by Month	Line & Column Combo Chart	Total Engagements = SUM('Marketing_Campaign_Data'[AcceptedCmp1]) + … + SUM([Response]); Revenue per Customer = DIVIDE([Total_Revenue], COUNT('Marketing_Campaign_Data'[ID]), 0)	How do customer engagement and revenue vary monthly?	Shows the relationship between engagement and revenue trends; helps align campaign timing with peak performance.
Customer Spending by Product	Pie Chart	Total Spending = SUM([MntWines]) + SUM([MntFruits]) + SUM([MntMeatProducts]) + SUM([MntFishProducts]) + SUM([MntSweetProducts]) + SUM([MntGoldProds])	Which products generated the most revenue from customers?	Identifies top-selling product categories; helps optimize product-focused campaigns.
Customer Interaction Distribution by Channel	Pie Chart	SUM([NumWebPurchases]) + SUM([NumCatalogPurchases]) + SUM([NumStorePurchases]) + SUM([NumDealsPurchases]) + SUM([NumWebVisitsMonth])	How do customers interact across different purchase and visit channels?	Provides visibility into preferred interaction channels; supports multichannel strategy and marketing

Visualization Title	Chart Type	DAX / Measure Used	Business Questions Addressed	Why It's Important / Insight
				optimization.
Income by Marital Status	Clustered Bar Chart	Sum of Income	How does income vary across different marital status groups?	Reveals which marital segments have higher spending potential; helps target campaigns based on income.
Campaign Engagement by Country	Clustered Column Chart	Total Engagements = SUM([AcceptedCmp1]) + SUM([AcceptedCmp2]) + … + SUM([Response])	Which regions showed the highest campaign engagement?	Highlights high-performing countries; guides regional marketing strategy and resource allocation.
Response Rate vs. Target	Gauge	Response Rate = DIVIDE([Total_Engagements], COUNT([ID]), 0); Target = 20%	Is the campaign meeting the response target?	Provides a quick visual check if campaigns are performing against set benchmarks.
Cost per Engagement (CPE) vs. Target	Gauge	CPE = DIVIDE([Total_Revenue], [Total_Engagements], 0); Target = 1,500	Is the campaign cost-efficient per engagement?	Helps monitor cost-effectiveness; lower CPE means better ROI per engagement.

Marketing Campaign Performance Dashboard Filter (Slicers) Summary:

Filter Name	Field Type	Purpose / What It Controls	Why It's Important / Insight
Year	Date / Numeric	Filter data by campaign year or month	Helps analyze trends over time; identify seasonal effects and campaign performance per period.
Response	Numeric / Binary	Filter customers who responded or did not respond	Allows focus on engaged vs. non-engaged customers; helps evaluate effectiveness of campaigns.
Teenhome	Numeric / Binary	Filter customers with or without teenagers at home	Understand engagement/purchase patterns of families with teens; aids demographic segmentation.
Kidhome	Numeric / Binary	Filter customers with or without children at home	Helps identify engagement/purchase patterns of families with kids; supports targeted campaigns.
Country	Categorical	Filter campaign results based on customer location	Reveals regional trends and helps assess country-wise campaign success.
Marital_Status	Categorical	Filter customers by marital group (Single, Married, etc.)	Useful for analyzing behavioral differences and engagement based on relationship status.

Final Interactive Dashboard of Marketing Campaign Performance Tracker:



Conclusion:

The project successfully analyzed marketing campaign performance using customer demographics, engagement data, and spending metrics. The cleaned dataset and interactive Power BI dashboard provide insights into campaign trends, high-performing segments, revenue-generating products, and efficiency metrics like Cost per Engagement (CPE) and Engagement Rate. These insights can help businesses optimize future campaigns, target the right customer groups, and improve overall Revenue.

Learning Outcomes:

- Developed the ability to clean, transform, and standardize marketing datasets for accurate analysis.
- Learned to calculate and interpret key KPIs such as Total Engagements, Total Revenue, Engagement Rate, and CPE using DAX.
- Gained experience in visualizing data with Power BI using various chart types: Donut, Pie, Line, Clustered Bar, Clustered Column, and Gauge.
- Understood how to segment customers and evaluate campaign performance by demographics, income, and product categories.
- Applied insights from data to support strategic decision-making and campaign optimization.

Skill Gained:

- ✓ Marketing Analytics
- ✓ Campaign Optimization
- ✓ Dashboard Storytelling
- ✓ Data Cleaning & Transformation
- ✓ DAX Calculations & KPI Development
- ✓ Time Series & Trend Analysis
- ✓ Customer Segmentation & Performance Evaluation
- ✓ Interactive Filtering & Insights Generation