# 📑 Project Report: Ad Campaign Performance Analysis

## 1. Project Overview

This project focuses on analyzing advertising campaign performance using **Facebook Ad Campaign Data**.
The goal is to calculate key digital marketing metrics (CTR, CPC, CPA, ROAS), identify top-performing campaigns, compare platforms, and provide actionable insights for **ad budget optimization**.

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## 2. Objectives

- Perform **data cleaning and preprocessing** on campaign data.
- Calculate key performance indicators (KPIs).
- Analyze campaign performance by **clicks, conversions, and spend**.
- Compare performance across platforms (Google, Facebook, LinkedIn).
- Identify correlations between **spend, clicks, and conversions**.
- Provide **data-driven recommendations** for better ROI.

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## 3. Dataset Description

The dataset contains records of multiple ad campaigns with columns such as:

- `Campaign_ID` – Unique campaign identifier
- `Platform` – Source (Google, Facebook, LinkedIn)

- `Impressions` – Number of times the ad was shown
- `Clicks` – Number of clicks received
- `Conversions` – Number of successful actions (leads/sales)
- `Spend` – Total money spent on the campaign
- `Revenue` – Earnings generated from the campaign

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## 4. Key Metrics

- **CTR (Click-Through Rate)** = (Clicks ÷ Impressions) × 100
- **CPC (Cost per Click)** = Spend ÷ Clicks
- **CPA (Cost per Acquisition)** = Spend ÷ Conversions
- **ROAS (Return on Ad Spend)** = Revenue ÷ Spend

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## 5. Analysis & Insights

- **Top 5 Campaigns** → Identified by clicks and conversions.
- **Platform Comparison** → Facebook generated higher conversions, while Google had better CTR.
- **Correlation Analysis** → Strong positive correlation between Spend, Clicks, and Conversions.
- **Funnel Analysis** → Conversion rates show drop-offs at each stage (Impressions → Clicks → Conversions).

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## 6. Visualizations

- Bar chart of **Top 5 campaigns by conversions**.
- Line chart of **Spend vs Revenue trend**.
- Heatmap showing **correlation matrix**.
- Platform-wise comparison (Google vs Facebook vs LinkedIn).

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## 7. Recommendations

- Increase budget allocation to campaigns with **high ROAS**.
- Optimize underperforming campaigns with **low CTR and high CPA**.
- Focus more spend on **Facebook campaigns**, which showed better conversion efficiency.
- Use forecasting models (Prophet/XGBoost) for predicting next quarter's performance.

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## 8. Tools & Technologies

- **Python**: Pandas, NumPy, Matplotlib, Seaborn
- **Jupyter Notebook** for analysis
- **Excel/Power BI** (optional dashboards)

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## 9. Conclusion

This project highlights how **data analytics can improve decision-making** in digital marketing. By calculating KPIs, comparing platforms, and performing correlation analysis, we provide **actionable insights** that can help companies like **DeltaX** optimize ad spend and maximize ROI.