AB Testing Analysis (Facebook vs Adwords)

March 30, 2025

1 A/B Testing Analysis - Facebook VS Adword

Business Problem

Our marketing agency is focused on maximizing ROI for our client's advertising campaigns. To evaluate platform effectiveness, we have conducted two ad campaigns one on Facebook and another on AdWords. Our goal is to analyze which platform performs better in terms of clicks, conversions, and overall cost-efficiency. By determining the most effective option, we can optimize resource allocation and enhance our advertising strategies to drive better outcomes for our clients.

1.1 Importing Libraries and Dataset

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```
!gdown 17Ux7Bj_nKYK0ac6DnruytjxPjzuEnKet
df = pd.read_csv('/content/A_B_testing_dataset.csv')
```

```
Downloading…
From: https://drive.google.com/uc?id=17Ux7Bj_nKYK0ac6DnruytjxPjzuEnKet
To: /content/A_B_testing_dataset.csv
   0% 0.00/93.2k [00:00<?, ?B/s] 100% 93.2k/93.2k [00:00<00:00, 64.1MB/s]
```

Dataset Description

- **date_of_campaign:** The date of each campaign, ranging from 2021 to 2024.
- **facebook_ad_campaign:** The name of the Facebook ad campaign.
- **facebook_ad_views:** The number of people who viewed the Facebook ad.
- **facebook_ad_clicks:** The number of people who clicked the Facebook ad after viewing it.
- **facebook_ad_conversions:** The number of people who became customers after clicking the Facebook ad.
- **facebook_cost_per_ad:** The cost (in USD $) of running a Facebook ad.

- **facebook_ctr:** Facebook Click-Through Rate in % => (facebook_ad_clicks / facebook_ad_views) × 100
- **facebook_conversion_rate:** Facebook conversion rate in % => (facebook_ad_conversions / facebook_ad_clicks) × 100
- **facebook_cost_per_click:** Cost per click for Facebook ads (in USD $) => (facebook_cost_per_ad / facebook_ad_clicks)
- **adword_ad_campaign:** The name of the AdWords campaign.
- **adword_ad_views:** The number of people who viewed the AdWords ad.
- **adword_ad_clicks:** The number of people who clicked the AdWords ad after viewing it.
- **adword_ad_conversions:** The number of people who became customers after clicking the AdWords ad.
- **adword_cost_per_ad:** The cost (in USD) of running an AdWords ad.
- **adword_ctr:** AdWords Click-Through Rate in % (CTR) => (adword_ad_clicks / adword_ad_views) × 100
- **adword_conversion_rate:** AdWords conversion rate in % =>(adword_ad_conversions / adword_ad_clicks) × 100
- **adword_cost_per_click:** Cost per click for AdWords ads (in USD $) =>(adword_cost_per_ad / adword_ad_clicks)

[3]:
```
df.head()
```

[3]:

	date_of_campaign	facebook_ad_campaign	facebook_ad_views	facebook_ad_clicks	facebook_ad_conversions	facebook_cost_per_ad	facebook_ctr	facebook_conversion_rate	facebook_cost_per_click
0	2021-12-22	FACEBOOK AD	3172	62	14	141	1.95	22.58	2.27
1	2021-12-24	FACEBOOK AD	3211	38	9	186	1.18	23.68	4.89
2	2021-12-25	FACEBOOK AD	1936	53	15	66	2.74	28.30	1.25
3	2021-12-25	FACEBOOK AD	1194	45	9	71	3.77	20.00	1.58
4	2021-12-26	FACEBOOK AD	2479	44	12	174	1.77	27.27	3.95

```
  adword_ad_campaign  adword_ad_views  adword_ad_clicks  \
0          ADWORD AD             5754                64
1          ADWORD AD             4954                73
2          ADWORD AD             4702                38
3          ADWORD AD             3718                58
4          ADWORD AD             5562                63

   adword_ad_conversions  adword_cost_per_ad  adword_ctr  \
0                      9                 177        1.11
1                      6                  54        1.47
2                      9                 187        0.81
3                      3                 161        1.56
4                      4                 162        1.13

   adword_conversion_rate  adword_cost_per_click
0                   14.06                   2.77
1                    8.22                   0.74
2                   23.68                   4.92
3                    5.17                   2.78
4                    6.35                   2.57
```

[4]:
```
df.shape
```

[4]:
```
(1000, 17)
```

[5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 17 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   date_of_campaign          1000 non-null   object
 1   facebook_ad_campaign      1000 non-null   object
 2   facebook_ad_views         1000 non-null   int64
 3   facebook_ad_clicks        1000 non-null   int64
 4   facebook_ad_conversions   1000 non-null   int64
 5   facebook_cost_per_ad      1000 non-null   int64
 6   facebook_ctr              1000 non-null   float64
 7   facebook_conversion_rate  1000 non-null   float64
 8   facebook_cost_per_click   1000 non-null   float64
 9   adword_ad_campaign        1000 non-null   object
 10  adword_ad_views           1000 non-null   int64
 11  adword_ad_clicks          1000 non-null   int64
 12  adword_ad_conversions     1000 non-null   int64
 13  adword_cost_per_ad        1000 non-null   int64
 14  adword_ctr                1000 non-null   float64
```

```
 15  adword_conversion_rate    1000 non-null   float64
 16  adword_cost_per_click     1000 non-null   float64
dtypes: float64(6), int64(8), object(3)
memory usage: 132.9+ KB
```

[6]:
```
# checking duplicates
df.duplicated().sum()
```

[6]:
```
0
```

[7]:
```
#changing datatype of date column
df['date_of_campaign'] = pd.to_datetime(df['date_of_campaign'])
```

[8]:
```
df.describe().T
```

[8]:

	count	mean	min	25%	\
date_of_campaign	1000	2023-07-04 07:13:26.399999744	2021-12-22 00:00:00	2022-10-07 18:00:00	
facebook_ad_views	1000.0	2152.031	1050.0	1600.25	
facebook_ad_clicks	1000.0	44.196	15.0	30.0	
facebook_ad_conversions	1000.0	11.975	5.0	8.0	
facebook_cost_per_ad	1000.0	156.61	60.0	110.0	
facebook_ctr	1000.0	2.28316	0.49	1.3675	
facebook_conversion_rate	1000.0	32.69608	6.85	18.0525	
facebook_cost_per_click	1000.0	4.3105	0.96	2.3375	
adword_ad_views	1000.0	4771.438	3715.0	4258.25	
adword_ad_clicks	1000.0	60.128	31.0	45.0	
adword_ad_conversions	1000.0	5.933	3.0	4.0	
adword_cost_per_ad	1000.0	124.741	50.0	86.0	
adword_ctr	1000.0	1.28095	0.54	0.94	
adword_conversion_rate	1000.0	10.80751	3.37	6.97	
adword_cost_per_click	1000.0	2.26554			

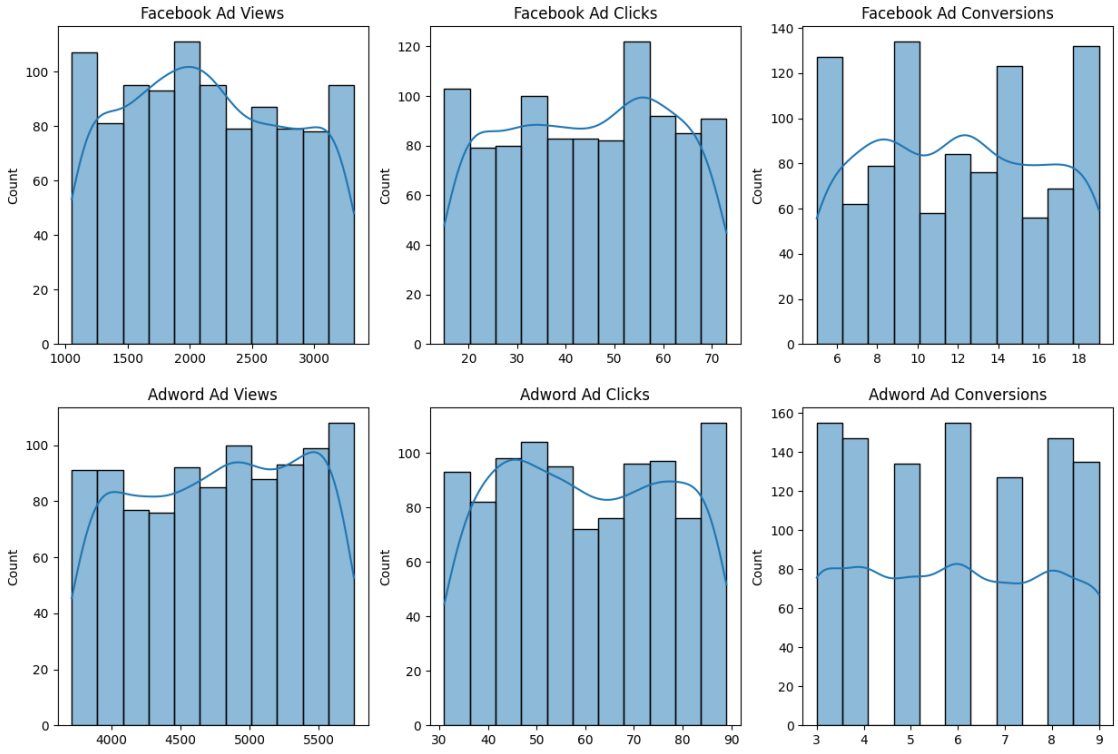
```
adword_cost_per_click                    0.58                 1.47

                                          50%                  75%  \
date_of_campaign          2023-07-20 12:00:00  2024-03-24 00:00:00
facebook_ad_views                      2123.5              2706.25
facebook_ad_clicks                       44.5                 58.0
facebook_ad_conversions                  12.0                 16.0
facebook_cost_per_ad                    156.0                205.0
facebook_ctr                             2.07               2.9225
facebook_conversion_rate                27.12                41.88
facebook_cost_per_click                   3.6                 5.61
adword_ad_views                        4808.5              5300.75
adword_ad_clicks                         60.0                 75.0
adword_ad_conversions                     6.0                  8.0
adword_cost_per_ad                      124.0                163.0
adword_ctr                               1.26                 1.57
adword_conversion_rate                   9.72                13.485
adword_cost_per_click                    2.03                2.8025

                                          max         std
date_of_campaign          2024-12-20 00:00:00         NaN
facebook_ad_views                      3320.0  661.982166
facebook_ad_clicks                       73.0   16.833328
facebook_ad_conversions                  19.0    4.298471
facebook_cost_per_ad                    250.0   54.918904
facebook_ctr                             6.86      1.2067
facebook_conversion_rate                118.75   20.570796
facebook_cost_per_click                  16.53    2.751582
adword_ad_views                        5754.0  598.647684
adword_ad_clicks                         89.0   17.047822
adword_ad_conversions                     9.0    2.011606
adword_cost_per_ad                      200.0   43.809053
adword_ctr                               2.37    0.402492
adword_conversion_rate                  29.03    5.205133
adword_cost_per_click                    6.19    1.101846
```

- Average Click through rate of Facebook is 2.28%
- Average Conversion rate of Facebook is 32.7%
- Average Click through rate of Adwords is 1.28%
- Average Conversion rate of Adwords is 10.8%

1.2 Ad campaign performance comparision

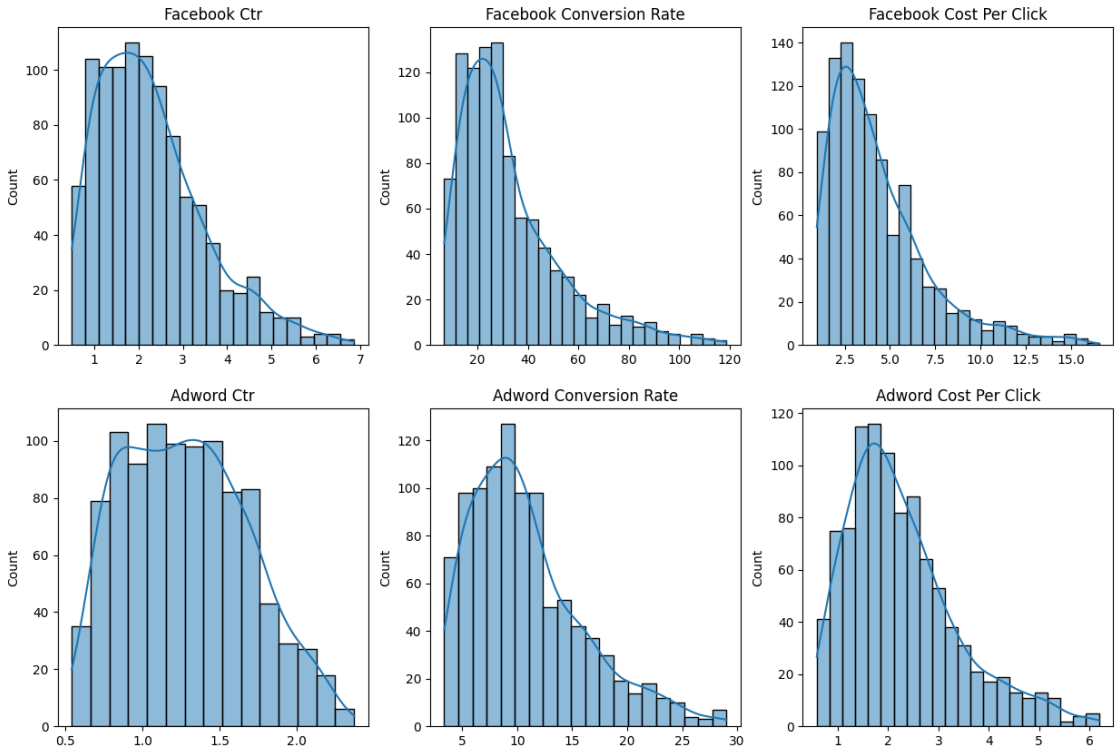
[9]:
```
cols = ['facebook_ad_views', 'facebook_ad_clicks', 'facebook_ad_conversions',␣
 ↪'adword_ad_views', 'adword_ad_clicks', 'adword_ad_conversions']
plt.figure(figsize=(15,10))
for i in cols:
```

```
  plt.subplot(2,3,cols.index(i)+1)
  plt.title(i.replace('_',' ').title())
  sns.histplot(df[i], kde=True)
  plt.xlabel('')
```



Seems like views, clicks and conversions of both the ad platforms are evenly distributed with no outliers but has variance.

[10]:
```
cols = ['facebook_ctr', 'facebook_conversion_rate', 'facebook_cost_per_click',␣
 ↪'adword_ctr', 'adword_conversion_rate', 'adword_cost_per_click']
plt.figure(figsize=(15,10))
for i in cols:
  plt.subplot(2,3,cols.index(i)+1)
  plt.title(i.replace('_',' ').title())
  sns.histplot(df[i], kde=True)
  plt.xlabel('')
```



We can see that CTR, Conversion rates and Cost per clicks of both platforms are right skewed having outliers.

1.2.1 Conversions comparision

[11]:
```
def conersion_category(x):
  if x < 6:
    return '0-5'
  elif x < 11:
    return '6-10'
  elif x < 16:
    return '11-15'
  elif x < 21:
    return '16-20'
  else:
    return '20+'
```

[12]:
```
df['facebook_ad_conversions'].apply(lambda x: conersion_category(x)).
↪value_counts().reset_index()
```

[12]:

	facebook_ad_conversions	count
0	11-15	341
1	6-10	337

```
2                    16-20    257
3                      0-5     65
```

[13]:
```
df['adword_ad_conversions'].apply(lambda x: conersion_category(x)).
 ↪value_counts().reset_index()
```

[13]:
```
  adword_ad_conversions  count
0                 6-10    564
1                  0-5    436
```

[14]:
```
fb_conversions = df['facebook_ad_conversions'].apply(lambda x:␣
 ↪conersion_category(x)).value_counts().reset_index()
fb_conversions = fb_conversions.rename(columns={'facebook_ad_conversions':
 ↪'category', 'count':'Facebook'})
adw_conversions = df['adword_ad_conversions'].apply(lambda x:␣
 ↪conersion_category(x)).value_counts().reset_index()
adw_conversions = adw_conversions.rename(columns={'adword_ad_conversions':
 ↪'category', 'count':'AdWords'})
ad_conversions_category = pd.merge(fb_conversions, adw_conversions,␣
 ↪how='outer', on='category')
ad_conversions_category
```

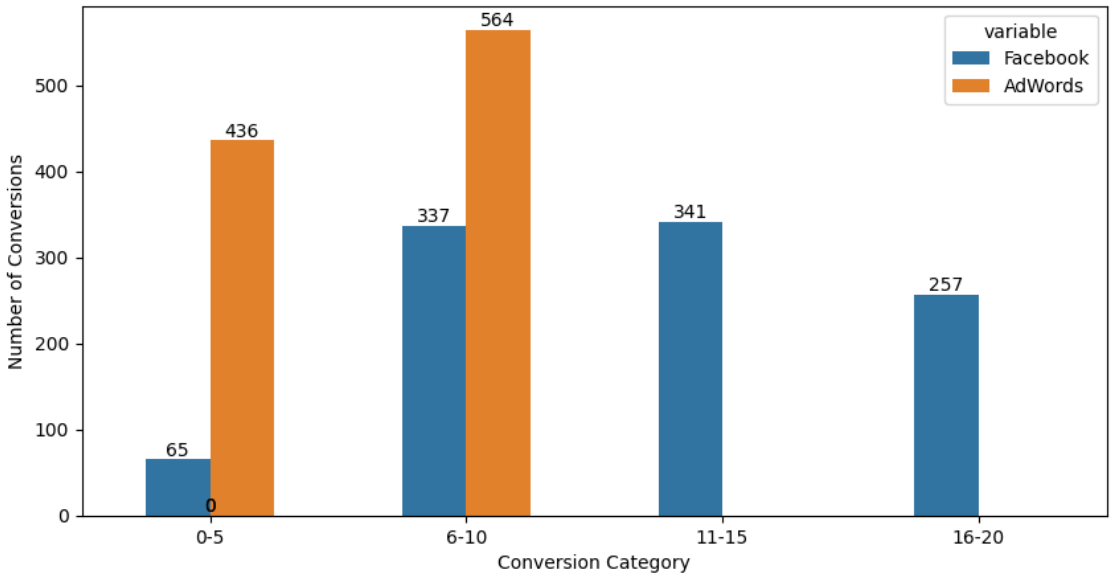
[14]:
```
  category  Facebook  AdWords
0      0-5        65    436.0
1    11-15       341      NaN
2    16-20       257      NaN
3     6-10       337    564.0
```

[15]:
```
ad_conversions_category = ad_conversions_category.reindex([0,3,1,2]).
 ↪reset_index(drop=True)
ad_conversions_category
```

[15]:
```
  category  Facebook  AdWords
0      0-5        65    436.0
1     6-10       337    564.0
2    11-15       341      NaN
3    16-20       257      NaN
```

[51]:
```
plt.figure(figsize=(10,5))
g = sns.barplot(data=ad_conversions_category.melt(id_vars=['category'],␣
 ↪value_vars=['Facebook', 'AdWords']),
            x='category', y='value', hue='variable', width=0.5)
plt.ylabel('Number of Conversions')
plt.xlabel('Conversion Category')
for p in g.patches:
  g.text(p.get_x() + p.get_width() / 2, p.get_height(),  f'{p.get_height():.
 ↪0f}', ha='center', va='bottom')
```

```
plt.show()
```



- This data shows that Facebook has high more high-conversion days than Adwords.
- There is a significant variance in the number of high-conversion days between two platforms.
- Adwords has conversions of 10 or below in each day where as Facebook has 20 or below.

1.2.2 Which platform has higher conversion rates?

[17]:
```
df[['facebook_conversion_rate', 'adword_conversion_rate']].mean()
```

[17]:
```
facebook_conversion_rate    32.69608
adword_conversion_rate      10.80751
dtype: float64
```

- **Null Hypothesis**: Both Facebook and AdWords have same average conversion rates
- **Alternate Hypotheis:** Facebook has higher average conversion rates than AdWords

[18]:
```
H0 = 'Both Facebook and AdWords have same average conversion rates'
Ha = 'Facebook has higher average conversion rates than AdWords'
alpha = 0.05

t_stat, p_val = stats.ttest_ind(df['facebook_conversion_rate'],␣
 ↪df['adword_conversion_rate'], equal_var=False, alternative='greater')

print(f't-statistic: {t_stat}')
print(f'p-value: {p_val}\n')

if p_val < alpha:
```

```
  print('Result: Reject Null Hypothesis')
  print(Ha)
else:
  print('Result: Failed to reject Null Hypothesis')
  print(H0)
```

```
t-statistic: 32.62045547744514
p-value: 3.5580132532960424e-165

Result: Reject Null Hypothesis
Facebook has higher average conversion rates than AdWords
```

1.2.3 Which platform has lesser cost per click?

[19]:
```
df[['facebook_cost_per_click', 'adword_cost_per_click']].mean()
```

[19]:
```
facebook_cost_per_click    4.31050
adword_cost_per_click      2.26554
dtype: float64
```

- **Null Hypothesis**: Both Facebook and AdWords have same average Cost per click
- **Alternate Hypotheis:** Adword has lesser average Cost per click than Facebook

[20]:
```
H0 = 'Both Facebook and AdWords have same average Cost per click'
Ha = 'Adword has lesser average Cost per click than Facebook'
alpha = 0.05

t_stat, p_val = stats.ttest_ind(df['adword_cost_per_click'],␣
 ↪df['facebook_cost_per_click'], equal_var=False, alternative='less')

print(f't-statistic: {t_stat}')
print(f'p-value: {p_val}\n')

if p_val < alpha:
  print('Result: Reject Null Hypothesis')
  print(Ha)
else:
  print('Result: Failed to reject Null Hypothesis')
  print(H0)
```

```
t-statistic: -21.81761965852683
p-value: 1.3950540029254255e-90

Result: Reject Null Hypothesis
Adword has lesser average Cost per click than Facebook
```

1.2.4 Which platform has higher views?

[21]:
```
df[['facebook_ad_views', 'adword_ad_views']].mean()
```

[21]:
```
facebook_ad_views    2152.031
adword_ad_views      4771.438
dtype: float64
```

- **Null Hypothesis**: Both Facebook and AdWords have same average views
- **Alternate Hypotheis:** Adword has more average views than Facebook

[22]:
```
H0 = 'Both Facebook and AdWords have same average views'
Ha = 'Adword has more average views than Facebook'
alpha = 0.05

t_stat, p_val = stats.ttest_ind(df['adword_ad_views'], df['facebook_ad_views'],␣
 ↪equal_var=False, alternative='greater')

print(f't-statistic: {t_stat}')
print(f'p-value: {p_val}\n')

if p_val < alpha:
  print('Result: Reject Null Hypothesis')
  print(Ha)
else:
  print('Result: Failed to reject Null Hypothesis')
  print(H0)
```

```
t-statistic: 92.80748119475
p-value: 0.0

Result: Reject Null Hypothesis
Adword has more average views than Facebook
```

1.2.5 Which platform has higher ctr (user engagement)?

[23]:
```
df[['facebook_ctr', 'adword_ctr']].mean()
```

[23]:
```
facebook_ctr    2.28316
adword_ctr      1.28095
dtype: float64
```

- **Null Hypothesis**: Both Facebook and AdWords have same average CTRs
- **Alternate Hypotheis:** Facebook has higher average CTR than AdWords

[24]:
```
H0 = 'Both Facebook and AdWords have same average CTRs'
Ha = 'Facebook has higher average CTR than AdWords'
alpha = 0.05
```

```
t_stat, p_val = stats.ttest_ind(df['facebook_ctr'], df['adword_ctr'],␣
 ↪equal_var=False, alternative='greater')

print(f't-statistic: {t_stat}')
print(f'p-value: {p_val}\n')

if p_val < alpha:
  print('Result: Reject Null Hypothesis')
  print(Ha)
else:
  print('Result: Failed to reject Null Hypothesis')
  print(H0)
```

```
t-statistic: 24.914527350282636
p-value: 2.244609815844214e-111

Result: Reject Null Hypothesis
Facebook has higher average CTR than AdWords
```

1.2.6 Which platform has high Return on Ad Spend?

[25]:
```
df['facebook_total_spend'] = df['facebook_cost_per_click'] *␣
 ↪df['facebook_ad_clicks']
df['adword_total_spend'] = df['adword_cost_per_click'] * df['adword_ad_clicks']

# Assume average revenue per conversion
avg_revenue_per_conversion = 50

df['facebook_revenue'] = df['facebook_ad_conversions'] *␣
 ↪avg_revenue_per_conversion
df['adword_revenue'] = df['adword_ad_conversions'] * avg_revenue_per_conversion

fb_roas = df['facebook_revenue'].sum() / df['facebook_total_spend'].sum()
adw_roas = df['adword_revenue'].sum() / df['adword_total_spend'].sum()

print(f"Facebook ROAS: {fb_roas:.2f}")
print(f"AdWords ROAS: {adw_roas:.2f}\n")

if fb_roas > adw_roas:
  print('Facebook has higher ROAS than Adwords')
else:
  print('Adwords has higher ROAS than Facebook')
```

```
Facebook ROAS: 3.82
AdWords ROAS: 2.38
```

```
Facebook has higher ROAS than Adwords
```

1.2.7 Which platform has lower Cost Per Acquisation?

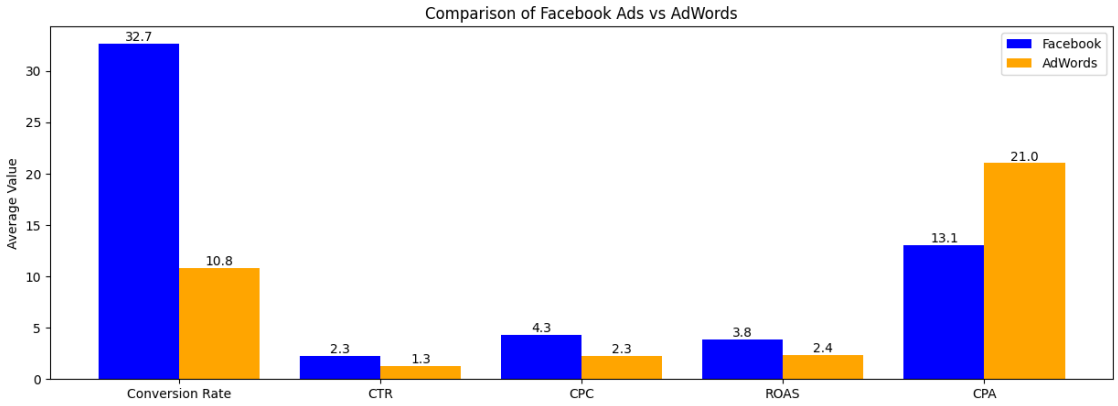
[26]:
```
fb_cpa = df['facebook_total_spend'].sum() / df['facebook_ad_conversions'].sum()
adw_cpa = df['adword_total_spend'].sum() / df['adword_ad_conversions'].sum()

print(f"Facebook CPA: {fb_cpa:.2f}")
print(f"AdWords CPA: {adw_cpa:.2f}\n")

if fb_cpa < adw_cpa:
  print('Facebook has lower CPA than Adwords')
else:
  print('Adwords has lower CPA than Facebook')
```

```
Facebook CPA: 13.08
AdWords CPA: 21.03

Facebook has lower CPA than Adwords
```

1.2.8 Comparison of Facebook vs AdWords

[27]:
```
metrics = ['Conversion Rate', 'CTR', 'CPC','ROAS', 'CPA']
facebook_values = [df['facebook_conversion_rate'].mean(), df['facebook_ctr'].
 ↪mean(),
                   df['facebook_cost_per_click'].mean(), fb_roas, fb_cpa]

adword_values = [df['adword_conversion_rate'].mean(), df['adword_ctr'].mean(),
                 df['adword_cost_per_click'].mean(), adw_roas, adw_cpa]

x = range(len(metrics))

plt.figure(figsize=(15, 5))
p1 = plt.bar(x, facebook_values, width=0.4, label='Facebook', align='center',␣
 ↪color='blue')
for p in p1:
  plt.text(p.get_x() + p.get_width() / 2, p.get_height(),  f'{p.get_height():.
 ↪1f}', ha='center', va='bottom')
p2 = plt.bar([i + 0.4 for i in x], adword_values, width=0.4, label='AdWords',␣
 ↪align='center', color='orange')
for p in p2:
  plt.text(p.get_x() + p.get_width() / 2, p.get_height(),  f'{p.get_height():.
 ↪1f}', ha='center', va='bottom')

plt.xticks([i + 0.2 for i in x], metrics)
plt.ylabel('Average Value')
plt.title('Comparison of Facebook Ads vs AdWords')
```

```
plt.legend()
plt.show()
```

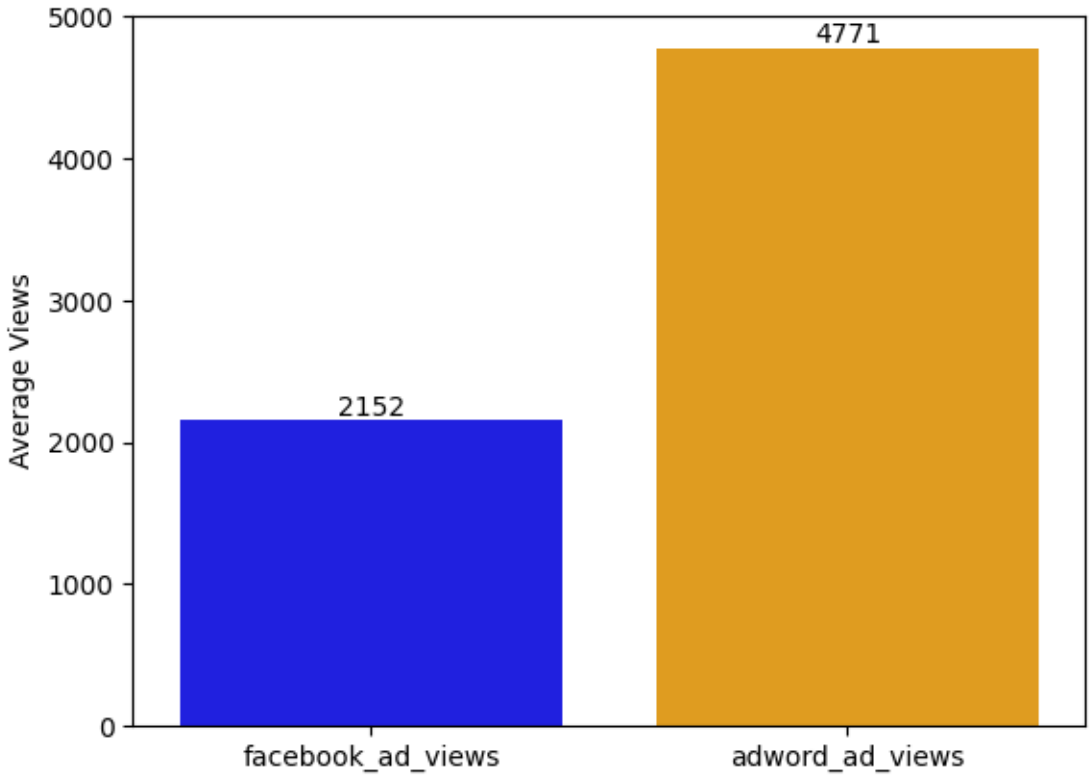


[28]:
```
views = df[['facebook_ad_views', 'adword_ad_views']].mean().
 ↪reset_index(name='avg_value')
views = views.rename(columns={'index':'platform'})
views
```

[28]:

	platform	avg_value
0	facebook_ad_views	2152.031
1	adword_ad_views	4771.438

[50]:
```
p = sns.barplot(data=views, x='platform', y='avg_value', palette =['blue',␣
 ↪'orange'])
for i in p.patches:
  p.text(i.get_x() + i.get_width() / 2, i.get_height(),  f'{i.get_height():.
 ↪0f}', ha='center', va='bottom')
plt.xlabel('')
plt.ylabel('Average Views')
plt.show()
```



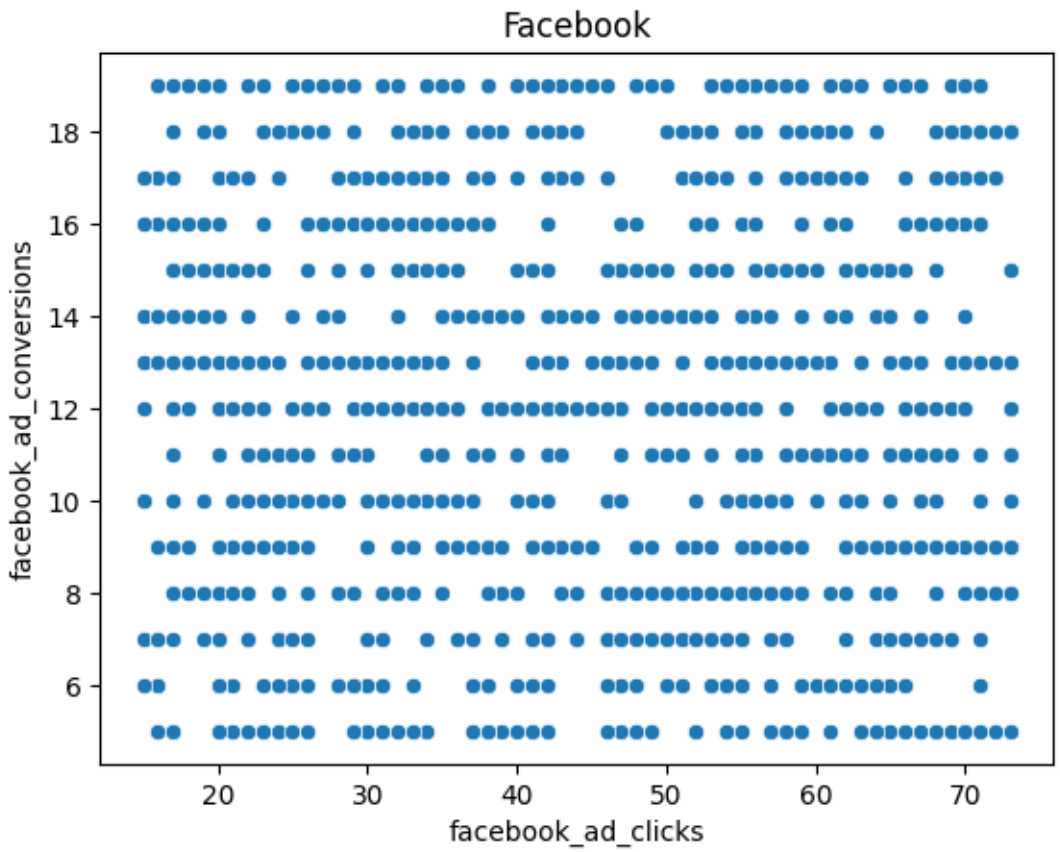
We found that - Facebook has higher average Conversion Rates than AdWords - Facebook has higher average Click Through Rates (CTR) than AdWords - Adword has lesser average Cost per Click than Facebook - Adword has more average Views than Facebook - Facebook has higher Return on Ad Spend (ROAS) than Adwords - Facebook has lower Cost Per Acquisation (CPA) than Adwords

So we can say that - `Facebook` is more efficient in terms of `Conversion Rate, CTR, ROAS, and CPA`. - `AdWords` is more `cost-effective per click and gets more views`, but conversions are lower.

If our goal is to increase brand awareness then we can invest in AdWords, but here we are looking for a platform which is better in terms of clicks, conversions, and overall cost-efficiency. So we are choosing `Facebook`.

1.3 Facebook platform Clicks to Conversion analysis

[30]:
```
sns.scatterplot(data=df, x='facebook_ad_clicks', y='facebook_ad_conversions')
plt.title('Facebook')
plt.show()
```



Seems like there is no correlation between number of clicks and number of conversions.

[31]:
```
df[['facebook_ad_clicks','facebook_ad_conversions']].corr()
```

[31]:

	facebook_ad_clicks	facebook_ad_conversions
facebook_ad_clicks	1.000000	-0.005009
facebook_ad_conversions	-0.005009	1.000000

Facebook has a very weak negative correlation of -0.005 which states that `number of clicks are not impacting the conversions`.

1.4 Facebook campaign metrics analysis over time

[60]:
```
fb_df = df[['date_of_campaign', 'facebook_ad_views', 'facebook_ad_clicks',␣
 ↪'facebook_ad_conversions', 'facebook_ctr', 'facebook_conversion_rate',␣
 ↪'facebook_cost_per_ad', 'facebook_total_spend']]
fb_df['month'] = fb_df['date_of_campaign'].dt.month_name()
fb_df['day'] = fb_df['date_of_campaign'].dt.day_name()
fb_df.head()
```

[60]:

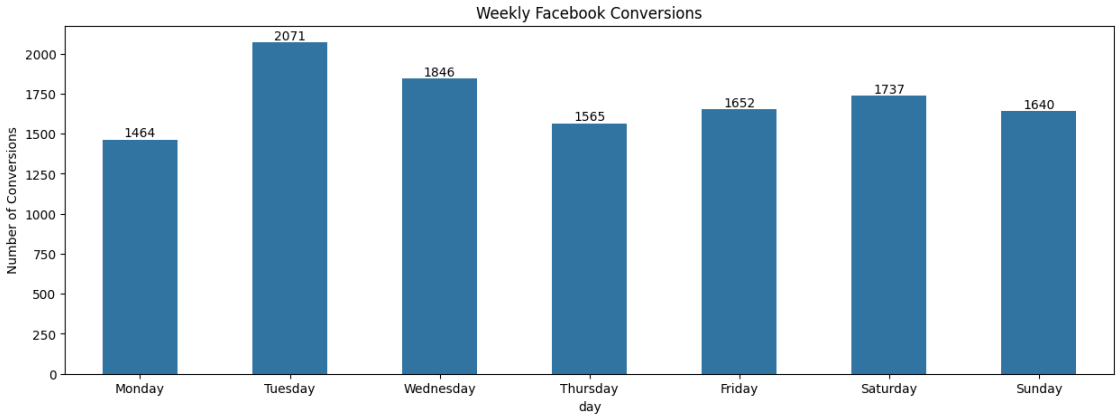
	date_of_campaign	facebook_ad_views	facebook_ad_clicks	\
0	2021-12-22	3172	62	
1	2021-12-24	3211	38	
2	2021-12-25	1936	53	
3	2021-12-25	1194	45	
4	2021-12-26	2479	44	

	facebook_ad_conversions	facebook_ctr	facebook_conversion_rate	\
0	14	1.95	22.58	
1	9	1.18	23.68	
2	15	2.74	28.30	
3	9	3.77	20.00	
4	12	1.77	27.27	

	facebook_cost_per_ad	facebook_total_spend	month	day
0	141	140.74	December	Wednesday
1	186	185.82	December	Friday
2	66	66.25	December	Saturday
3	71	71.10	December	Saturday
4	174	173.80	December	Sunday

1.4.1 Weekly Conversions

[61]:
```
days = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday',␣
 ↪'Sunday']
weekly_fb_conversions = fb_df.groupby('day')[['facebook_ad_conversions']].sum()
weekly_fb_conversions = weekly_fb_conversions.reindex(days).reset_index()
plt.figure(figsize=(15,5))
p = sns.barplot(data=weekly_fb_conversions, x='day',␣
 ↪y='facebook_ad_conversions', width=0.5)
for i in p.patches:
  p.text(i.get_x() + i.get_width() / 2, i.get_height(),  f'{i.get_height():.
 ↪0f}', ha='center', va='bottom')
plt.title('Weekly Facebook Conversions')
plt.ylabel('Number of Conversions')
plt.show()
```



Tuesdays exhibit high conversion compared to others.

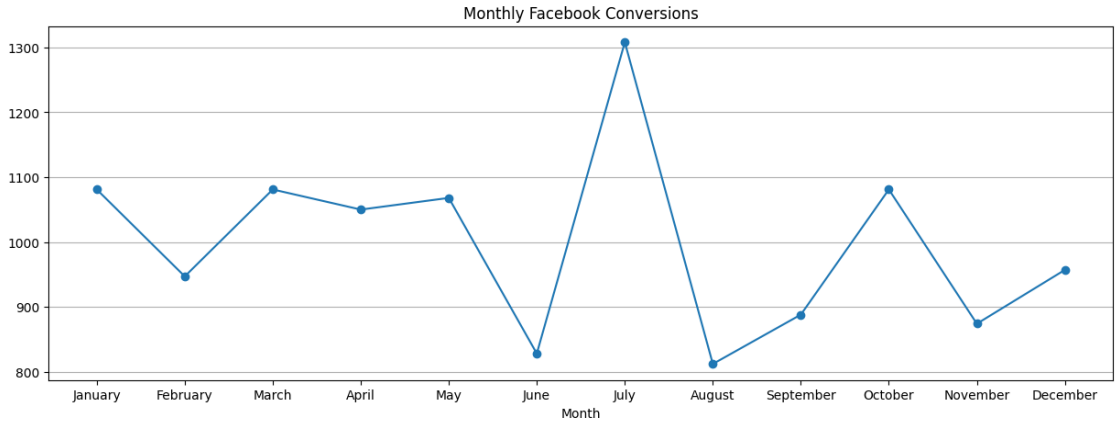
1.4.2 Monthly Conversion

[62]:
```
months = ['January', 'February', 'March', 'April', 'May', 'June', 'July',␣
 ↪'August', 'September', 'October', 'November', 'December']
monthly_fb_conversions = fb_df.groupby('month')[['facebook_ad_conversions']].
 ↪sum()
monthly_fb_conversions = monthly_fb_conversions.reindex(months).reset_index()
monthly_fb_conversions
```

[62]:

	month	facebook_ad_conversions
0	January	1081
1	February	947
2	March	1081
3	April	1050
4	May	1068
5	June	828
6	July	1308
7	August	812
8	September	888
9	October	1081
10	November	874
11	December	957

[63]:
```
plt.figure(figsize=(15,5))
plt.plot(monthly_fb_conversions['month'],␣
 ↪monthly_fb_conversions['facebook_ad_conversions'], marker='o')
plt.title('Monthly Facebook Conversions')
plt.xlabel('Month')
plt.grid(axis='y')
plt.show()
```



There are noticable variations in Facebook ad conversions, with a peak in July (~1300 conversions) and dips in June, August, and November, indicating possible seasonal trends, campaign effectiveness, or external factors impacting engagement.

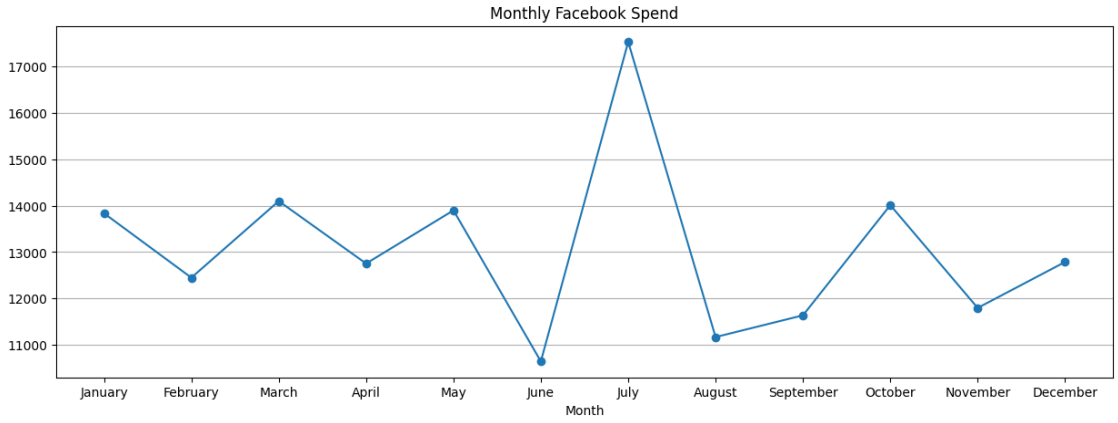
1.4.3 Monthly Facebook Ad Spend

[65]:
```
monthly_fb_spend = fb_df.groupby('month')[['facebook_total_spend']].sum()
monthly_fb_spend = monthly_fb_spend.reindex(months).reset_index()
monthly_fb_spend
```

[65]:

	month	facebook_total_spend
0	January	13836.17
1	February	12449.20
2	March	14098.77
3	April	12753.89
4	May	13899.43
5	June	10645.88
6	July	17527.35
7	August	11170.16
8	September	11637.98
9	October	14012.03
10	November	11797.56
11	December	12787.44

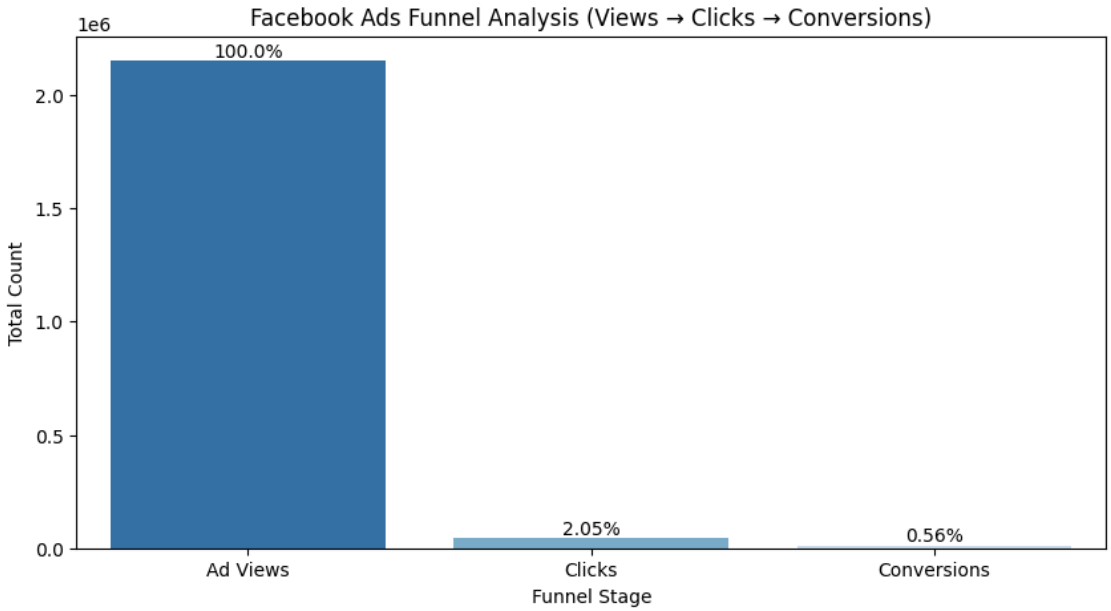
[67]:
```
plt.figure(figsize=(15,5))
plt.plot(monthly_fb_spend['month'], monthly_fb_spend['facebook_total_spend'],␣
↪marker='o')
plt.title('Monthly Facebook Spend')
plt.xlabel('Month')
plt.grid(axis='y')
plt.show()
```



Seems like ad spend has similar trend like that of conversions.

1.4.4 Facebook ad funnel analysis

[55]:
```
funnel = pd.DataFrame({
    'Stage': ['Ad Views', 'Clicks', 'Conversions'],
    'Value': [df['facebook_ad_views'].sum(), df['facebook_ad_clicks'].sum(),␣
 ↪df['facebook_ad_conversions'].sum()]
})

plt.figure(figsize=(10,5))
p = sns.barplot(x='Stage', y='Value', data=funnel, palette="Blues_r")
for i in p.patches:
  p.text(i.get_x() + i.get_width() / 2, i.get_height(),
         s = str(round((i.get_height()/df['facebook_ad_views'].
 ↪sum())*100,2))+'%',
         ha='center', va='bottom')

plt.xlabel("Funnel Stage")
plt.ylabel("Total Count")
plt.title("Facebook Ads Funnel Analysis (Views → Clicks → Conversions)")
plt.show()
```



2% of the total ad views are getting clicks whereas 0.5% of the total ad views are getting converted.

2 Insights and Recommendations

2.1 Insights

- Average Click through rate of Facebook is 2.28% and average Conversion rate is 32.7%
- Average Click through rate of Adwords is 1.28% and average Conversion rate is 10.8%
- Facebook has high more high-conversion days than Adwords.
- There is a significant variance in the number of high-conversion days between two platforms.
- Adwords has conversions of 10 or below in each day where as Facebook has 20 or below.
- Facebook has higher average Conversion Rates than AdWords
- Facebook has higher average Click Through Rates (CTR) than AdWords
- Adword has lesser average Cost per Click than Facebook
- Adword has more average Views than Facebook
- Facebook has higher Return on Ad Spend (ROAS) than Adwords
- Facebook has lower Cost Per Acquisation (CPA) than Adwords
- `Facebook` is more efficient in terms of `Conversion Rate, CTR, ROAS, and CPA`.
- `AdWords` is more `cost-effective per click and gets more views`, but conversions are lower.
- We are choosing `Facebook` as we are looking for a platform which is better in terms of clicks, conversions, and overall cost-efficiency.
- There is no correlation between number of clicks and number of conversions which states that number of clicks are not impacting the conversions.
- Tuesdays exhibit high conversion compared to others.
- There are noticable variations in Facebook ad conversions, with a peak in July (~1300 conversions) and dips in June, August, and November, indicating possible seasonal trends, campaign

effectiveness, or external factors impacting engagement.
- Facebook's total ad spend and conversions show a similar trend over time, but this does not imply a direct causal relationship.
- `2% of the total ad views are getting clicks` whereas `0.5% of the total ad views are getting converted`.

2.2 Recommendations

2.2.1 Recommendations for Stakeholders

1. **Focus More on Facebook Ads**
   - Facebook has **higher conversion rates and better returns on ad spend** than AdWords.
   - Shift more budget towards Facebook to get better results.
2. **Run Ads on the Best Days**
   - **Tuesdays** have the highest conversions, so increase spending on this day.
   - Reduce spending in **June, August, and November**, as conversions are lower.
3. **Improve Click-to-Conversion Rate**
   - Since more clicks don't always mean more conversions, focus on **better ad content, landing pages, and call-to-actions**.
   - Test different ad creatives and messages to find what works best.
4. **Use Better Targeting on Facebook**
   - Retarget people who clicked but didn't convert.
   - Use Facebook's **Lookalike Audiences** to find similar potential customers.
5. **Use Both Platforms Smartly**
   - **AdWords is cheaper per click and good for brand awareness**, so use it for visibility.
   - **Facebook is better for conversions**, so use it for sales and customer engagement.