



Final Project Data Analysis Hypothesis Testing

By : Dinda Raraswati

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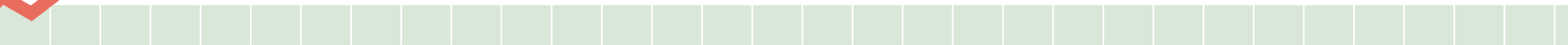
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ABOUT ME



SELF-OVERVIEW

A data enthusiast with a background in Agricultural Engineering who is currently transitioning from academia to industry

EDUCATION

- **Bachelor of Science in Agricultural Engineering (2016 - 2020)**
Bandung Institute of Technology (ITB)
- **Master of Agricultural Science (2021 - 2023)**
Kyoto University
- **Data Science Bootcamp (Apr 2025 - present)**
dibimbing.id

WORKING EXPERIENCE

- **Wageningen Food Safety Research (WFSR) (Nov 2023 - present)**
Researcher
- **Climate Change Center ITB (PPI-ITB) (Dec 2020 - Apr 2021)**
Project Assistant



PREVIOUS PROJECTS

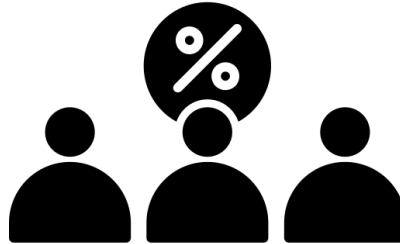


Customer Segmentation of Superstore Dataset

Segment superstore's customers using RFM (Recency, Frequency, Monetary) analysis



[Power BI](#)



Customer Churn Rate of Telco Dataset

Identify how demographic factors influence churn rate at Telco company



[Google Colab](#)



E-commerce Transaction Analytics

Analyze sales pattern at e-commerce



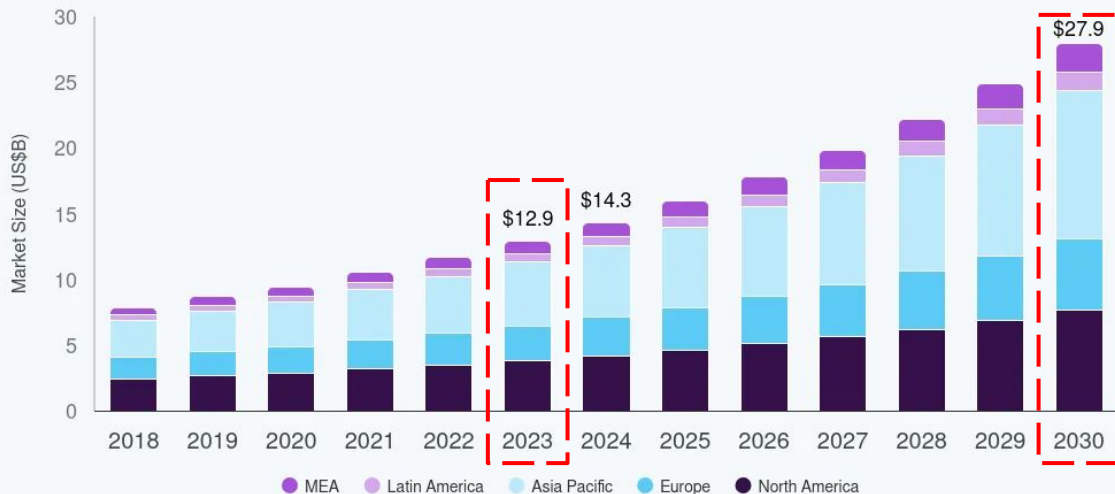
[Google Colab](#)

INTRODUCTION

Industry Overview

Portable Bluetooth Speaker Market

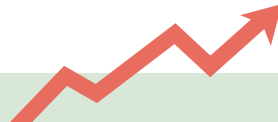
Size, by Region, 2018 - 2030



Demand for bluetooth speakers has increased which was driven by technological advancement and a global shift toward wireless speakers

(Grand View Research, 2023)

Source : Grand View Research, 2023

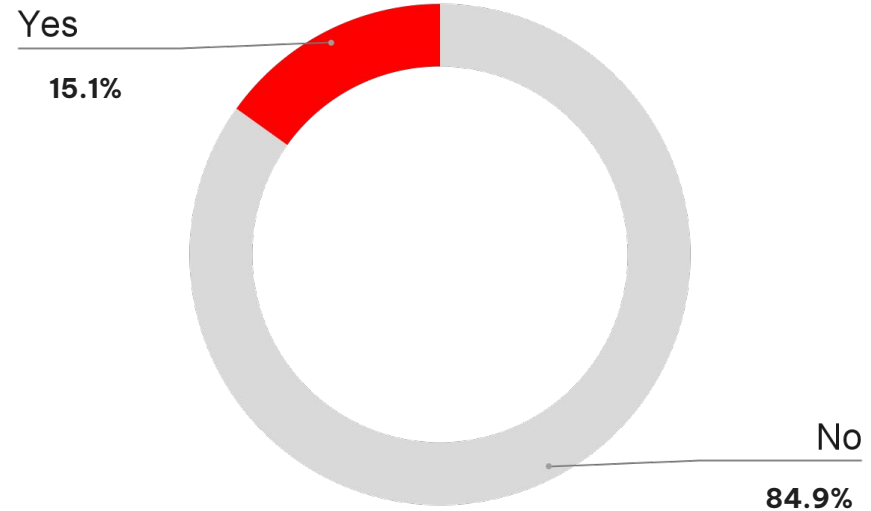


INTRODUCTION



Background and Problem Statement

- Although the global market of bluetooth speakers has been increasing, **the company/e-commerce is still struggling to increase the sales conversion rate**
- Out of 30,000 users, only **15.1%** customers who sign up or purchase products
- Low conversion rate can be influenced by **unoptimized landing page design or products sold do not match customer preferences**



INTRODUCTION

Business Objective & Questions

Main Objective : This project aims to evaluate the effectiveness of three landing page designs - Vibrant, Heat, Cold - on speaker sales conversion.

Beyond that, the analysis will consider other factors such as demographic and user behaviours. The insight will **enhance marketing strategies, improve customer experience on the web/app, and boost speaker sales**

Business Questions :

1. Which design is more effective in converting into sign-up or purchase as well as improve customer engagement (duration and page views)?
2. Which channel contributes the most to the number of sessions and conversion?
3. When is the peak customer traffic on our website/app?
4. Which customer segments contribute the most to total sales and conversion rates?



INTRODUCTION

Check this out!

Data Preprocessing, Feature
Engineering, EDA



[Google Colab](#)

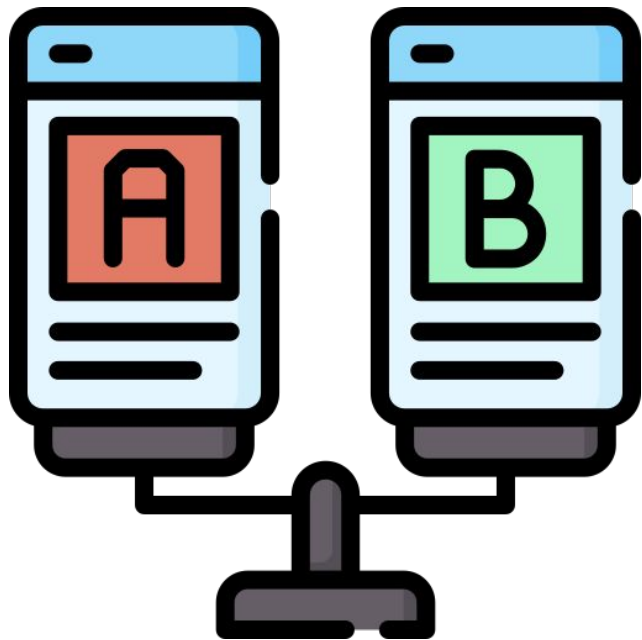
Full Dashboard

Power BI



[Power BI](#)

DATA UNDERSTANDING



- Dataset was downloaded from [Kaggle](#)
- **Dataset contains website conversion data for bluetooth speaker sales with a total of 30,000 user sessions.** The sessions are segmented by the landing page variant each user saw. The dataset also includes user-specific details, session engagement, product purchases, and payment methods
- Dataset contains **30,000 rows** with **24 features**
- Collected from 1st of January 2025 to 19th of February 2025

DATA PREPROCESSING



Convert Data Types

Convert column
timestamp
Object -> Date



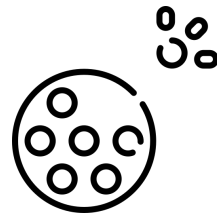
Check and Handle Missing Values

No missing values found



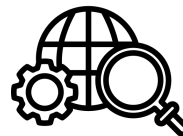
Check and Handle Duplicates

No duplicates found



Check and Handle Outliers

Outliers were maintained for
visualization purpose



Feature Engineering

Add some columns for further
analysis



Save File

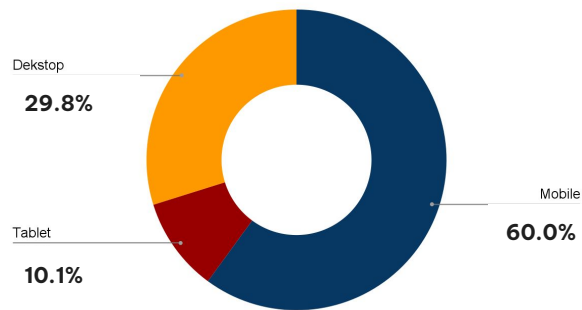
Save processed data into excel
for dashboard development in
Power BI



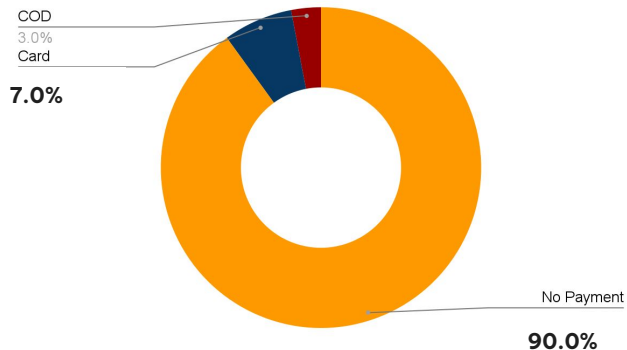
DATA ANALYSIS & INSIGHTS

EDA - Categorical Columns

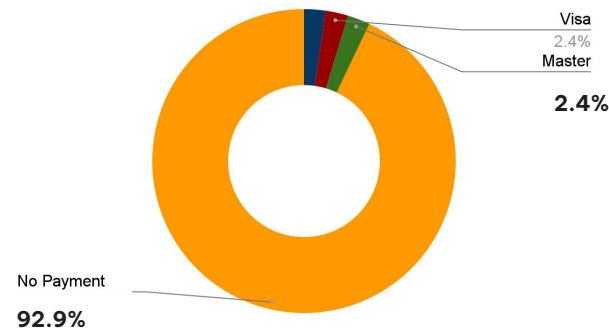
Distribution of Device Type



Distribution of Payment Type



Distribution of Card Type

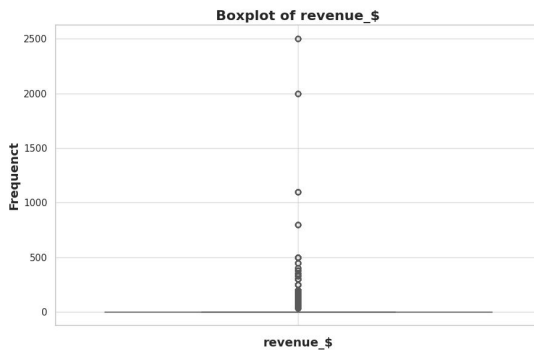
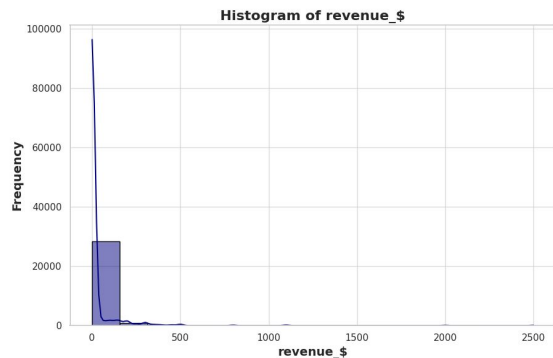
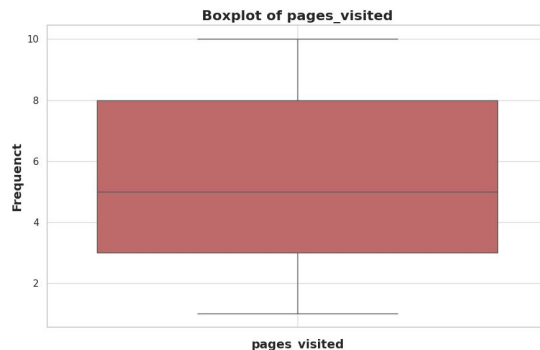
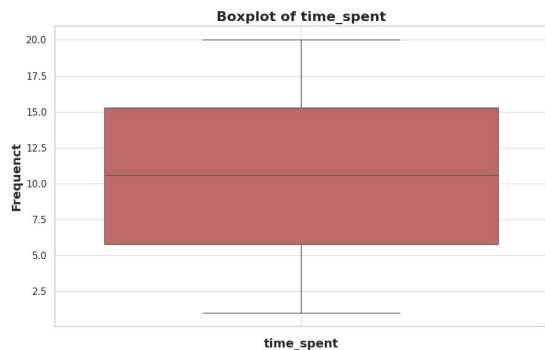


Insights:

- device_type : more than half of users visit the website through their mobiles
- payment_type and card_type : among users who made transactions, **most customers prefer card over COD** with the proportion of any card type used is the same

DATA ANALYSIS & INSIGHTS

EDA - Numerical Columns



- **revenue_\$**: Despite having maximum revenue of \$2499, **75% of total customers did not generate any revenue**. This indicates that only 25% who made purchase with the average revenue of \$26.21
- **Time_spent and pages_visited**: there are no outliers

DATA ANALYSIS & INSIGHTS

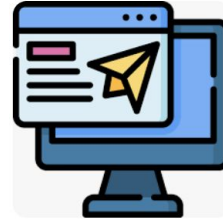
Hypothesis Testing - Landing Page Effects on Conversion Rate



VS



VS



Vibrant

Heat

Cold

12.13%

15.17%

18.08%

Conversion

Conversion

Conversion

WINNER

- Proportion one-tailed z-test was conducted in pairwise
- **Alpha = 5%**
- **Insights : Different color themes used in landing pages were proved to significantly increase conversion rate since $p \text{ value} < \alpha$ for all the pairs**

DATA ANALYSIS & INSIGHTS

Hypothesis Testing - Landing Page Effects on Session Duration & Page Views

Session Duration

12.50%

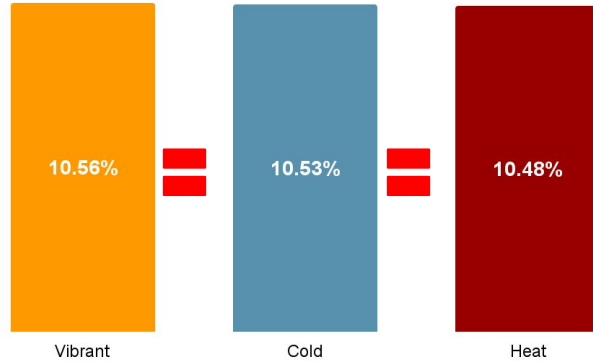
10.00%

7.50%

5.00%

2.50%

0.00%



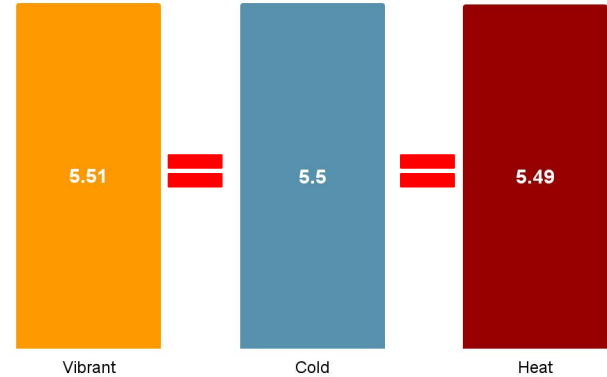
Pages Visited

6

4

2

0



- **Hypotheses :**

H0 : there is no difference in session duration/the number of pages visited among different landing page designs

H1 : at least one design differs from others

- **Alpha : 5%**
- **Normality Test : Kolmogorov-Smirnov Test**
- **Non-parametric Test : Kruskal-Wallis Test**

Insights : There is no significant difference in session duration and page views

RECOMMENDATIONS

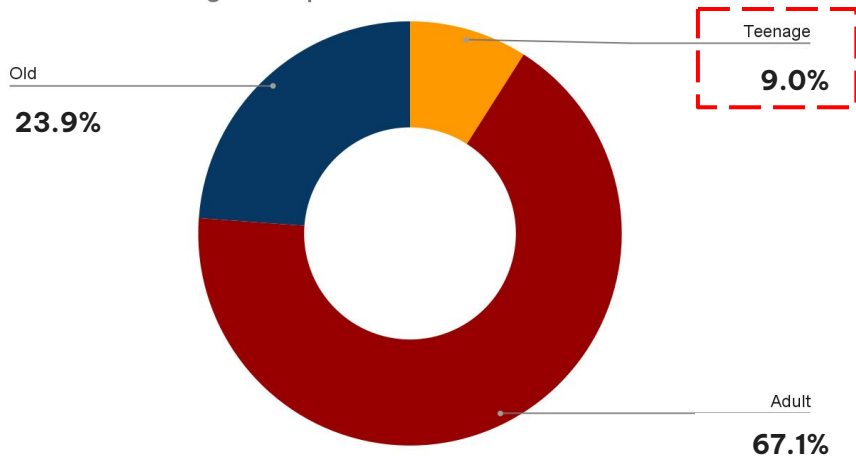
Landing Page Colors

- **Implement cold color theme on the landing page**
- Investigate other factors (button, layout, font color) that can significantly impact customer engagement (page views and session duration) and do another A/B testing

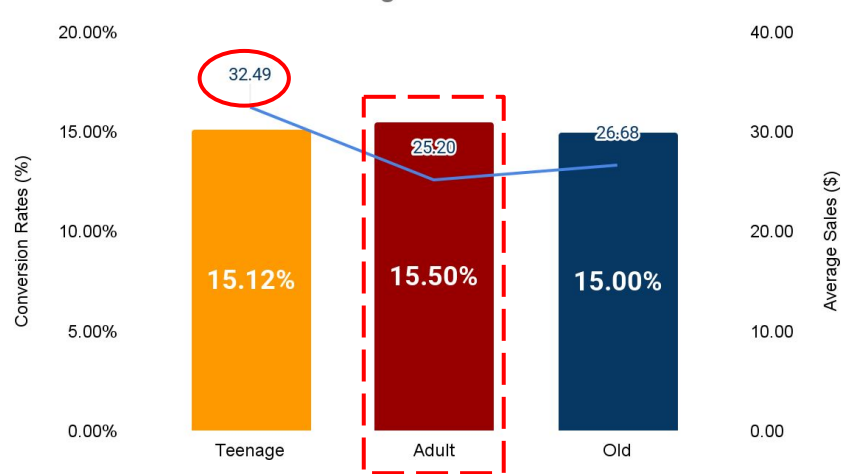
DATA ANALYSIS & INSIGHTS

Data Visualization - Age Group on Conversion Rate & Average Sales

Distribution of Age Group



Conversion Rates and Average Sales



Insights :

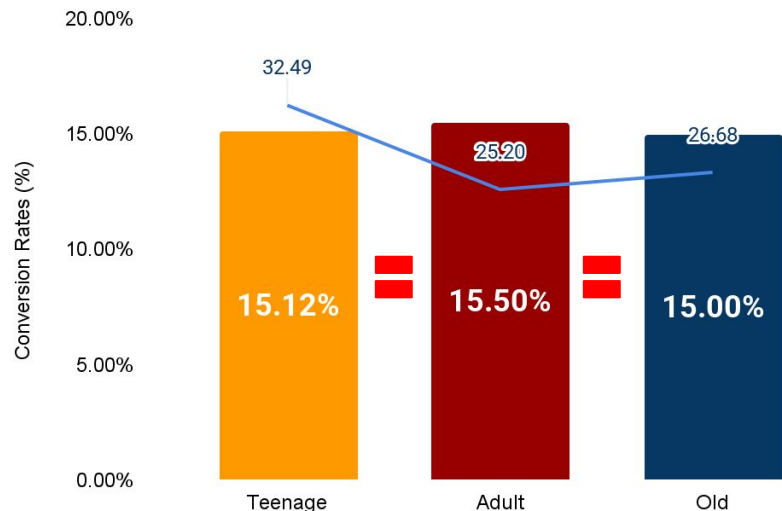
1. Although **teenage accounts only 9%** of total users, this age group contributed to **the highest average sales of \$32.49** compared to other groups -> **indicating higher Average Order Value (AOV)**
2. Adult has the highest conversion rate than other other groups, but they spend the least money than other age groups

DATA ANALYSIS & INSIGHTS

Hypothesis Testing- Age Group on Conversion Rate & Average Sales

Is the difference in conversion rate & sales among age group statistically significant?

Conversion Rates and Average Sales

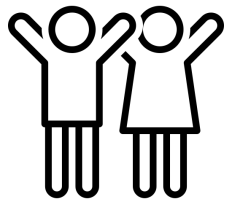


- Hypothesis testing :
 - **Conversion rate** : proportion one-tailed z-test in pairwise
 - **Average sales** : due to non-normal distribution, Kruskal-Wallis Test was chosen
- Alpha = 5%
- **Insights** : There is no significant difference in conversion rates and average sales across age group

RECOMMENDATIONS

Age Group on Conversion Rate & Average Sales

Although age group doesn't significantly conversion rate and average sales, we can still use these insights for business recommendations



Teenage (9% users)

- Metric Highlight : Highest average sales (**\$32.49**)
- Recommendation :
 - Analyze outlier purchases
 - Targeted campaign for teenagers



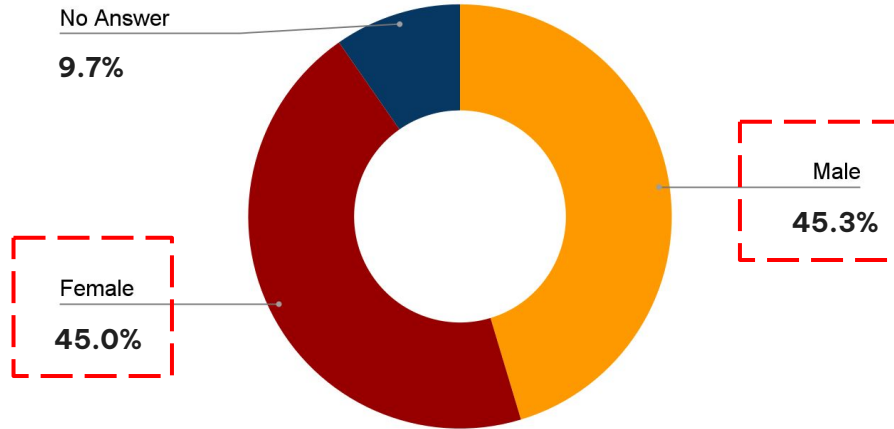
Adult (67.1% users)

-
- Metric Highlight : Largest proportion of users and highest conversion rates (**15.5%**)
 - Recommendation :
 - **Prioritize adult customers**
 - **Boost Average Order Value (AOV)** by offering product bundling or giving recommendations based on purchase history
 - **Encourage purchase frequency** by giving purchase points which can be redeemed for discounts

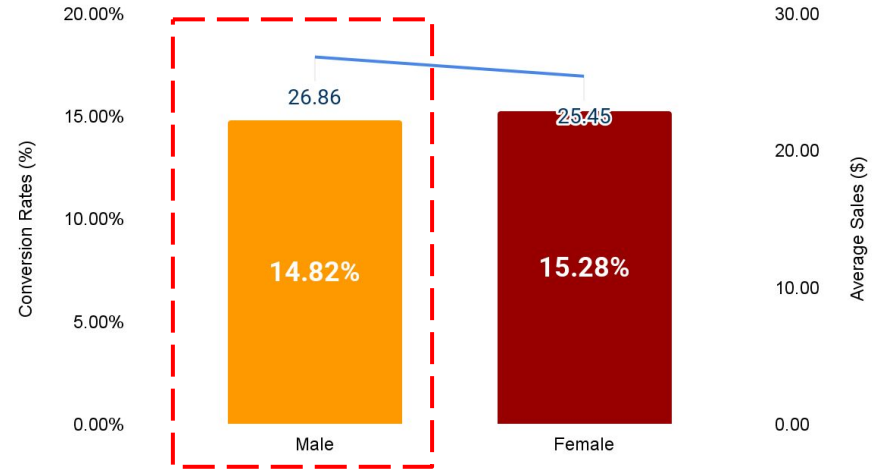
DATA ANALYSIS & INSIGHTS

Data Visualization - Gender on Conversion Rate & Average Sales

Distribution of Gender



Conversion Rates and Average Sales



Insights :

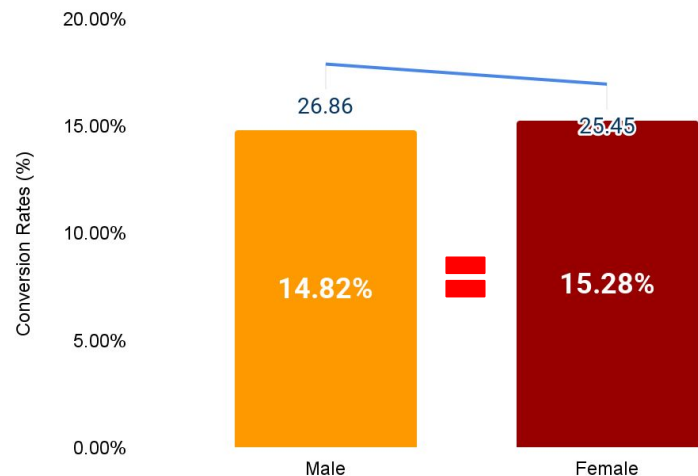
1. Proportions of male dan female are quite the same, both at 45%
2. Although male customers have lower conversion rate, this customer segment has higher sales -> indicating higher AOV

DATA ANALYSIS & INSIGHTS

Hypothesis Testing- Gender on Conversion Rate & Average Sales

Is the difference in conversion rate & sales among gender statistically significant?

Conversion Rates and Average Sales



- Hypothesis testing :
 - Conversion rate : proportion one-tailed z-test
 - Average sales : due to non-normal distribution, Mann-Whitney U Test was chosen
- Alpha = 5%
- **Insights : There is no significant difference in conversion rates and average sales across gender**

RECOMMENDATIONS

Gender on Conversion Rate & Average Sales

Although gender isn't key driver for conversion rate and average sales, we can still use these insights for business recommendations



Male (45.3% users)

- Metric Highlight : Highest average sales (**\$26.86**)
- Recommendation :
 - Recommending high-margin products



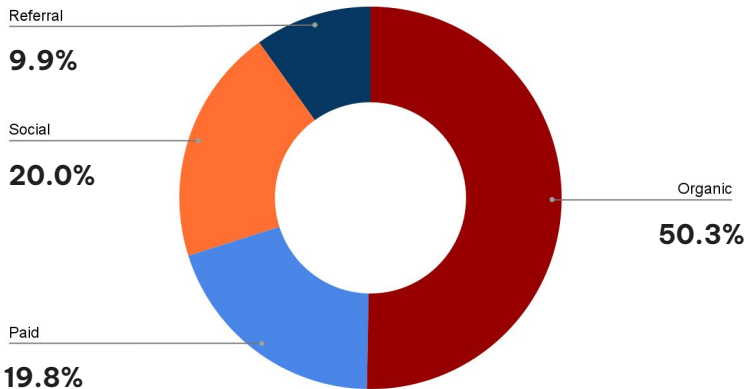
Female (45%)

- Metric Highlight : Highest conversion rates (**15.28%**)
- Recommendation :
 - **Boost Average Order Value (AOV)** by offering product bundling or giving recommendations based on purchase history

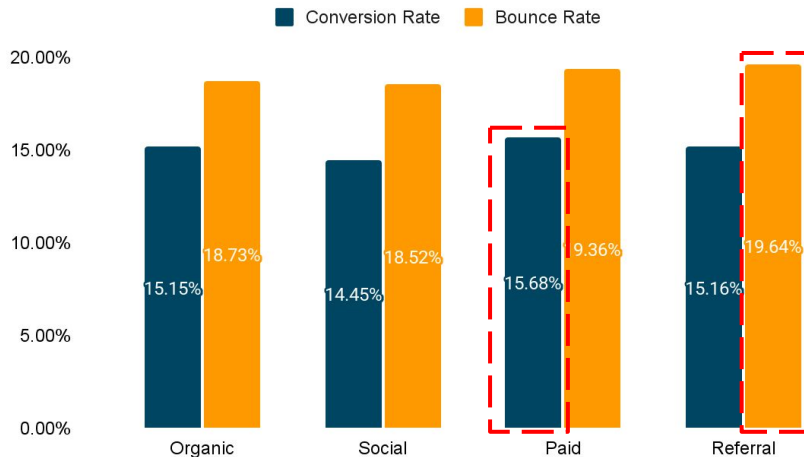
DATA ANALYSIS & INSIGHTS

Data Visualization - Marketing Channel on Conversion Rate & Bounce Rate

Distribution of Channel



Conversion Rate & Bounce Rate



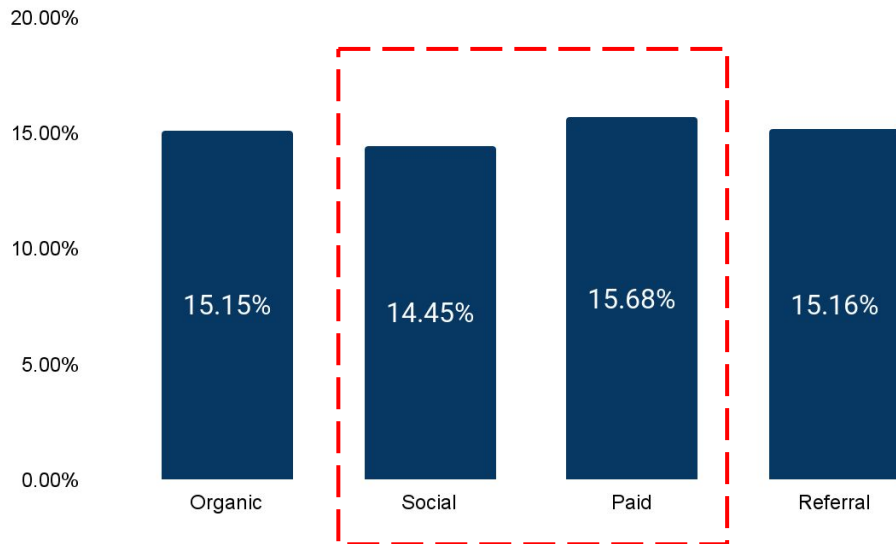
Insights :

1. **Organic dominates user acquisition (50.3%)**
2. There is only a slight difference in conversion rate among all the channels with **paid channel achieved the highest conversion rate (15.68%)**
3. **Referral achieved the highest bounce rate (19.64%)**

DATA ANALYSIS & INSIGHTS

Hypothesis Testing - Marketing Channel on Conversion Rate

Conversion Rate



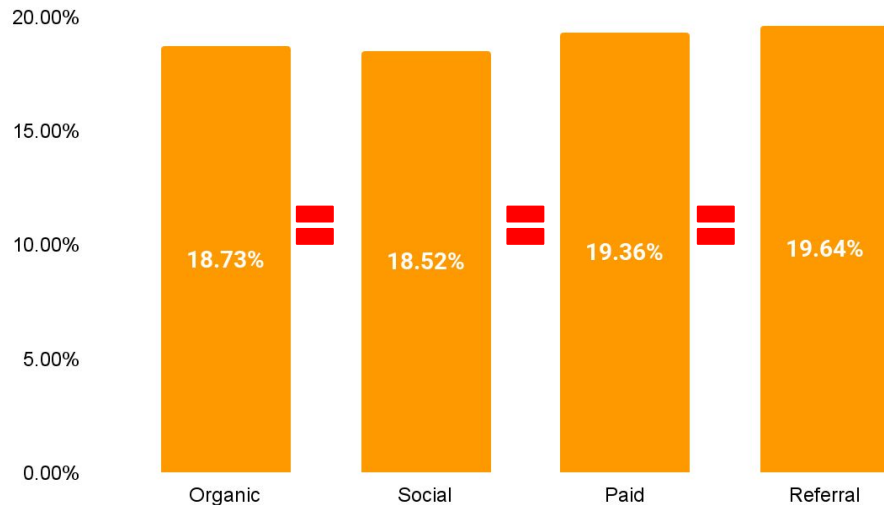
- Proportion one-tailed z-test was conducted in pairwise
- **Alpha** = 5%

Pairs	Results
Organic vs Paid	p_value > alpha
Organic vs Social	p_value > alpha
Organic vs Referral	p_value > alpha
Social vs Paid	p_value < alpha
Social vs Referral	p_value > alpha
Paid vs Referral	p_value > alpha

DATA ANALYSIS & INSIGHTS

Hypothesis Testing - Marketing Channel on Bounce Rate

Bounce Rate

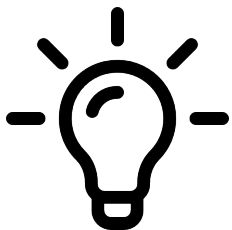


- Proportion one-tailed z-test was conducted in pairwise
- **Alpha** = 5%

Pairs	Results
Organic vs Paid	p_value > alpha
Organic vs Social	p_value > alpha
Organic vs Referral	p_value > alpha
Social vs Paid	p_value > alpha
Social vs Referral	p_value > alpha
Paid vs Referral	p_value > alpha

KEY INSIGHTS & RECOMMENDATIONS

Marketing Channel on Conversion Rate & Bounce Rate



KEY INSIGHTS

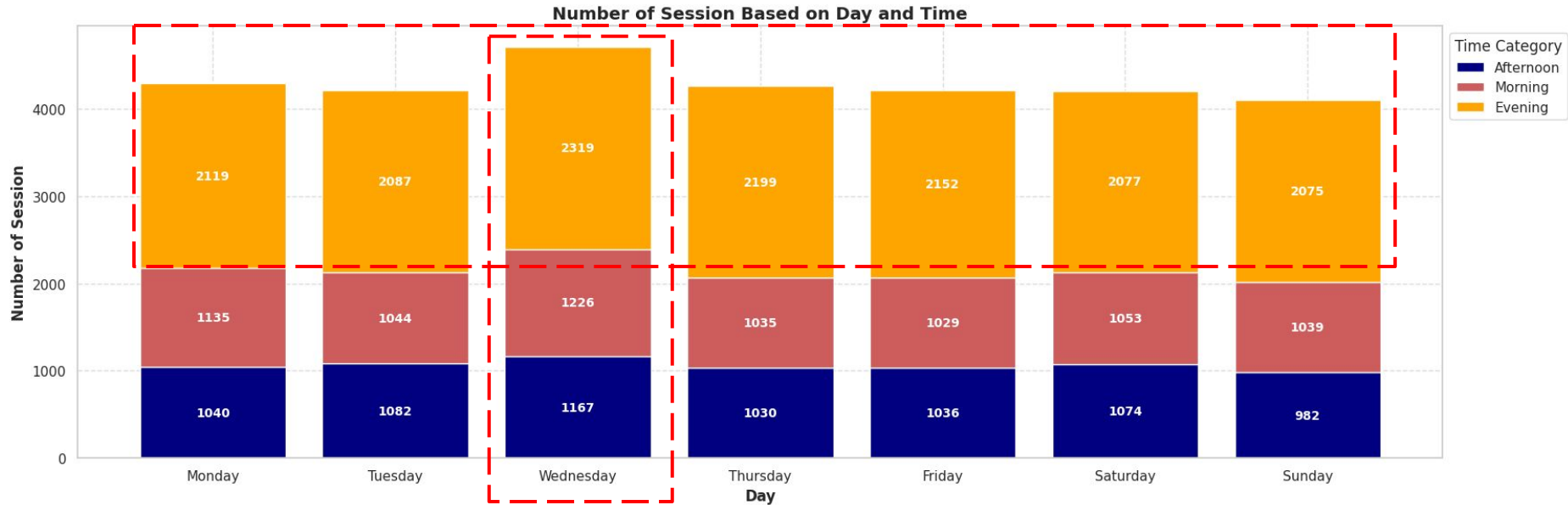
- **Social media has the lowest conversion rate** than other channels even though it is not statistically different when comparing to referral and organic. However, it is proved that **social media has a significantly lower conversion rate (14.45%) vs. Paid (15.68%) ($p < 0.05$)**
- Organic, paid, and referral channels have similar conversion rates, so the conversion rates among these channels are not significant different

RECOMMENDATIONS

- **Focused on using organic, paid, and referral channels instead of social media**
- **Scale up successful campaign on paid channel**
- **Optimize SEO on organic channel**
- **Analyze customer behavior on social media and improve ads on social media**

DATA ANALYSIS & INSIGHTS

Data Visualization - Number of Sessions



Insights

- Most of customers scrolled the website/app on evenings
- Wednesday is the peak day with the highest number of sessions (4712 sessions)
- Afternoon has the least sessions -> it could be happened because of office hours

Recommendation : Make a campaign/offer discount during the evening when majority of users are engaged

FULL DASHBOARD

SPEAKER SALES CONVERSION DASHBOARD

Landing Page & Marketing Channel Analysis

Customer Segmentation Analysis

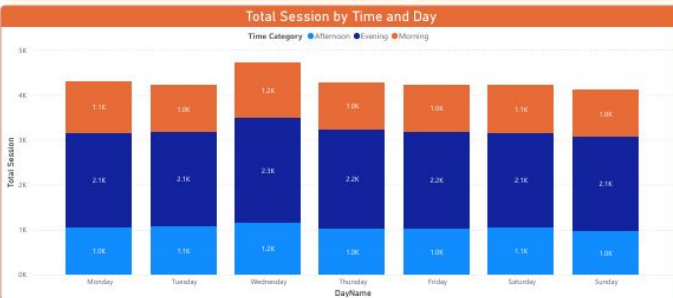
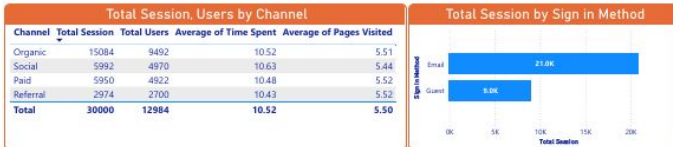
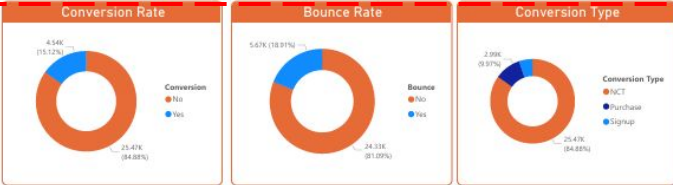
Landing Page Designs

Cold

Heat

Vibrant

Slicer

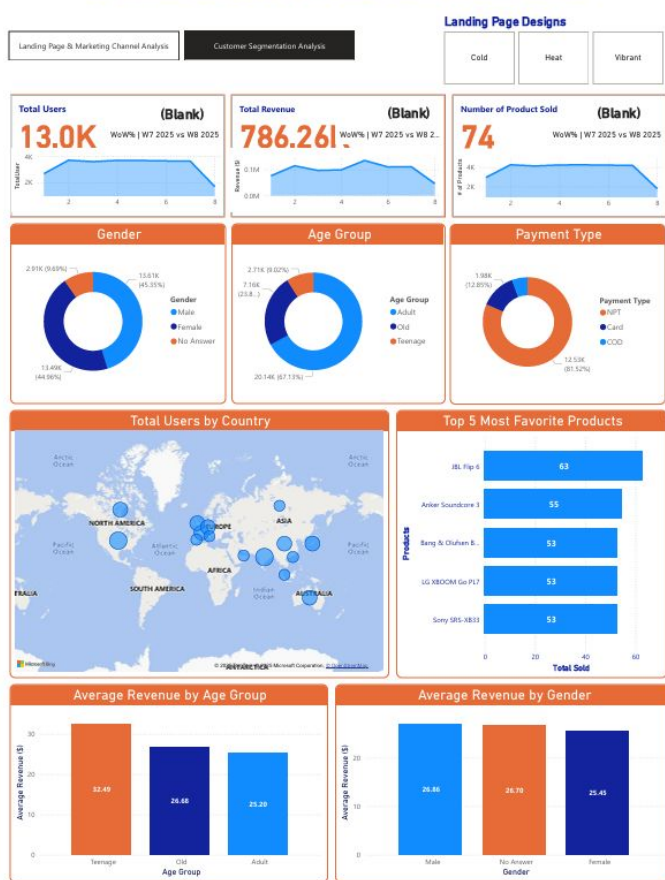


Landing Page & Marketing Channel Dashboard

This dashboard displays customers' online activities, **coupled with slicer and dynamic KPI cards that show WoW% change** for some metrics : total sessions, total time spent, dan total pages visited

FULL DASHBOARD

SPEAKER SALES CONVERSION DASHBOARD



Customer Segmentation Analysis Dashboard

This dashboard displays customer demography, **coupled with slicer and dynamic KPI cards that show WoW% change** for some metrics : total users, total revenue, number of products sold

Thank you!



[dindararas](#)



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