



Data-Driven Insights: Funnel & Cohort Analysis for Business Growth

Using Python, SQL, and Tableau

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Business Intelligence
Dibimbing Batch 13

Github: <https://github.com/hijirdella/Funnel-Cohort-Analysis>

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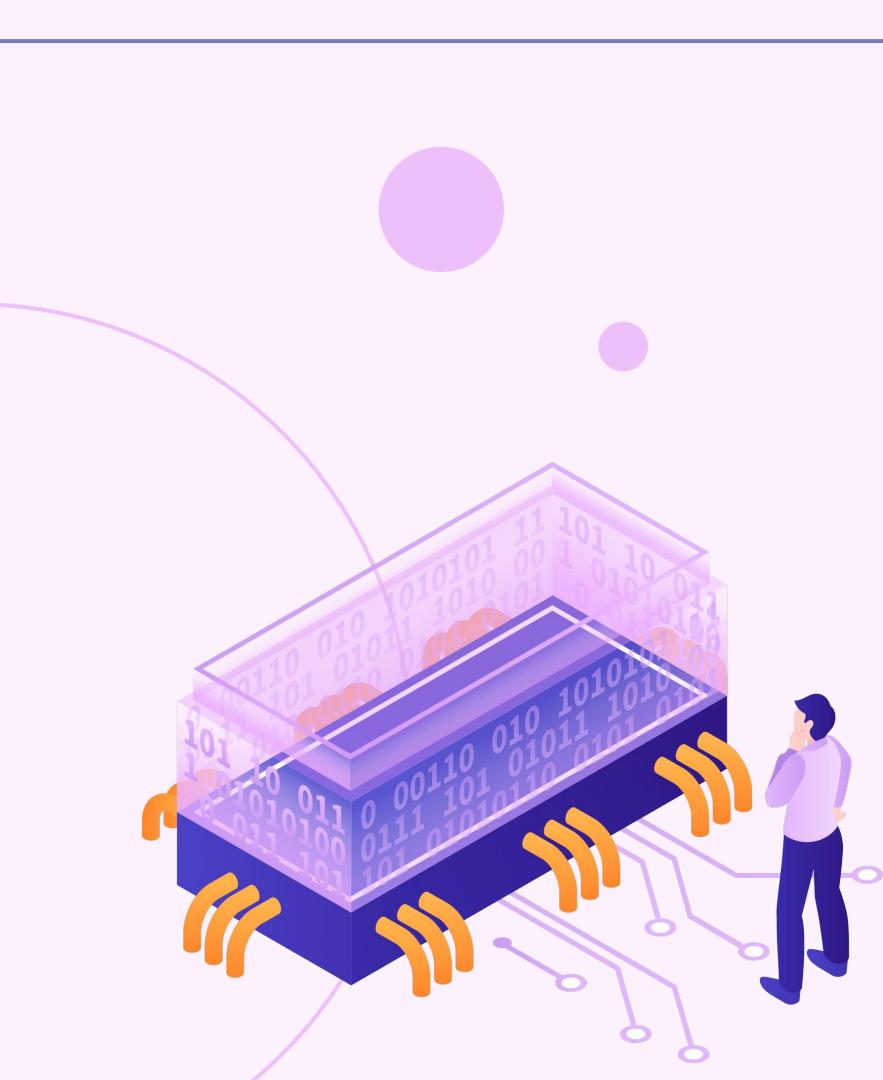
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Dataset	<u>Event & Sales</u>
Github	<u>https://github.com/hijirdella/Funnel-Cohort-Analysis</u>
Google Collab	<u>https://colab.research.google.com/drive/1Ixyv816RGTM3WRWGUBJzwVvnghiSqPQX?usp=sharing</u>
Tableau	<u>https://public.tableau.com/app/profile/hijir.della.wirasti5486/viz/FunnelCohort/FunnelCohortDashboard2</u>



01

Introduction

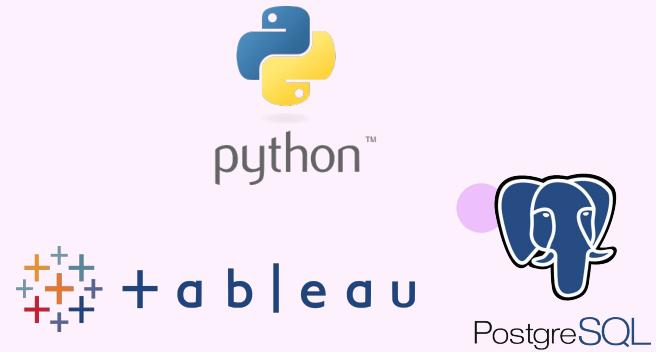
Introduction

Welcome to my presentation on **Funnel and Cohort Analysis for Business Intelligence**. This project is my individual effort, utilizing **Python**, **SQL**, and **Tableau** to analyze customer data, uncover patterns, and provide actionable insights.

The objectives of this project include:

1. Understanding customer behavior through Funnel Analysis.
2. Identifying retention patterns using Cohort Analysis.
3. Developing visualizations that support data-driven decision-making.

With interactive dashboards and a detailed analysis, this project showcases the power of combining data analytics and visualization for business growth. Let's explore the findings!



Hijir Della Wirasti

Business Intelligence

02

Data Pre-Processing





Funnel Data Pre-Processing

1

	event_id	user_id	age	gender	city	country	session_id	sequence_number	created_at	browser	traffic_source	event_type
0	555311	42922.0	46.0	M	Bogatynia	Poland	f65f7f31-1078-45da-a7af-2dd41a894e5d	3	2023-01-19 22:54:38 UTC	Other	Email	cart
1	714816	55343.0	16.0	M	Bogatynia	Poland	cc3509fc-641b-4632-ac47-4949209b9afb	4	2023-11-26 17:12:19 UTC	Safari	Email	cart
2	464405	35775.0	46.0	F	Bogatynia	Poland	16Bb065-9b2e-47bf-b8e7-793060cfbe04	9	2023-09-27 02:46:04 UTC	Firefox	Adwords	cart
3	649908	50243.0	47.0	M	Bogatynia	Poland	8b145bdf-4ddd-473a-8095-c35504afa112	3	2023-04-16 08:50:42 UTC	Chrome	Adwords	cart
4	874098	67437.0	30.0	M	Zgorzelec	Poland	4871ce1f-0b5c-446d-aa7c-016c959cbe56	3	2023-05-18 04:24:49 UTC	Firefox	Email	cart

2

```
> <class 'pandas.core.frame.DataFrame'>
RangeIndex: 418279 entries, 0 to 418278
Data columns (total 12 columns):
 #   Column          Non-Null Count  Dtype  
--- 
 0   event_id        418279 non-null   int64  
 1   user_id         265687 non-null   float64 
 2   age              265687 non-null   float64 
 3   gender            265687 non-null   object  
 4   city              262839 non-null   object  
 5   country            265687 non-null   object  
 6   session_id       418279 non-null   object  
 7   sequence_number    418279 non-null   int64  
 8   created_at        418279 non-null   object  
 9   browser             418279 non-null   object  
 10  traffic_source     418279 non-null   object  
 11  event_type         418279 non-null   object  
dtypes: float64(2), int64(2), object(8)
memory usage: 38.3+ MB
```

3

	event_id	user_id	age	sequence_number
count	4.182790e+05	265687.000000	265687.000000	418279.000000
mean	1.088930e+06	49931.155348	41.025319	3.940023
std	6.835370e+05	29001.961975	17.092576	2.855708
min	1.600000e+01	2.000000	12.000000	1.000000
25%	5.066330e+01	24718.000000	26.000000	2.000000
50%	1.019051e+02	50062.000000	41.000000	3.000000
75%	1.651511e+02	75007.000000	56.000000	5.000000
max	2.420896e+02	99999.000000	70.000000	13.000000

4

	feature	missing_value
0	event_id	0
1	user_id	152592
2	age	152592
3	gender	152592
4	city	155440
5	country	152592
6	session_id	0
7	sequence_number	0
8	created_at	0
9	browser	0
10	traffic_source	0
11	event_type	0

5

	feature	missing_value	missing_percentage
0	event_id	0	0.00%
1	user_id	152592	36.48%
2	age	152592	36.48%
3	gender	152592	36.48%
4	city	155440	37.16%
5	country	152592	36.48%
6	session_id	0	0.00%
7	sequence_number	0	0.00%
8	created_at	0	0.00%
9	browser	0	0.00%
10	traffic_source	0	0.00%
11	event_type	0	0.00%

6

	event_id	user_id	age	gender	city	country	session_id	sequence_number	created_at	browser	traffic_source	event_type
0	0	0	0	0	0	0	0	0	0	0	0	0

Funnel Data Preprocessing

Missing Value Handling:

- Replaced missing `user_id` values with `0`.
- Filled missing values in `age` with the median and in `gender`, `city`, and `country` with the most common value (mode).

Duplicate Removal:

- Checked for duplicate rows using `df_funnel.duplicated().sum()` and removed any duplicates to ensure data integrity.

Exporting Data:

- The cleaned and processed data was exported as an Excel file (`funnel_analysis.xlsx`) for further analysis in Tableau.



Cohort Data Pre-Processing

1

	order_id	order_date	user_id	user_name	age	gender	product_id	product_name	category	quantity	sale_price	cost
0	102234	2024-10-22	81494	Sheri Ramos	31	F	8038	Embroidered Capri Set - Sizes: 1X2X3X4X	Clothing Sets	1	22.990000	13.862970
1	72773	2024-03-02	57833	Judy Beltran	56	F	8032	Aeropostale Womens Juniors Long Sleeve Logo G...	Clothing Sets	1	34.500000	21.010500
2	123719	2024-03-01	98736	Erin Mora	55	F	8030	Calvin Klein Women's MSY Velour Pant	Clothing Sets	1	50.000000	32.900000
3	14065	2024-05-22	11186	Shelly Hill	25	F	8027	Only Necessities Plus Size Peachskin 3 piece P...	Clothing Sets	1	54.990002	35.798491
4	37640	2024-10-07	29909	Tina Davis	26	F	8049	VIOLET BLOUSE GAUCHO PALAZZO SET ASYM - FITS (...	Clothing Sets	1	57.990002	34.098121

2

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19163 entries, 0 to 19162
Data columns (total 12 columns):
 #   Column          Non-Null Count  Dtype    
--- 
 0   order_id        19163 non-null   int64    
 1   order_date      19163 non-null   datetime64[ns]
 2   user_id         19163 non-null   int64    
 3   user_name       19163 non-null   object   
 4   age             19163 non-null   int64    
 5   gender          19163 non-null   object   
 6   product_id      19163 non-null   int64    
 7   product_name    19162 non-null   object   
 8   category        19163 non-null   object   
 9   quantity        19163 non-null   int64    
 10  sale_price      19163 non-null   float64  
 11  cost            19163 non-null   float64  
dtypes: datetime64[ns](1), float64(2), int64(5), object(4)
memory usage: 1.8+ MB
```

3

	order_id	order_date	user_id	age	product_id	quantity	sale_price	cost
count	19163 00000000	19163 00000000	19163 00000000	19163 00000000	19163 00000000			
mean	93119.000000	2024-07-20 17:22:41	9023.000000	3.000000	12.000000	1.000000	1.0	0.020000 0.000000
std	3.000000	2024-01-01 00:00:00	3.000000	3.000000	3.000000	1.000000	1.0	0.020000 0.000000
25%	35572.000000	2024-02-02 00:00:00	29123.000000	26.000000	8044.000000	24.339999	11.330000	
50%	65726.000000	2024-02-02 00:00:00	50598.000000	41.000000	16055.000000	30.380002	19.700001	
75%	94477.000000	2024-11-01 00:00:00	75259.000000	56.000000	23625.000000	46.690000	34.340000	
max	192320.000000	2024-12-31 00:00:00	99987.000000	70.000000	29120.000000	70.000000	557.150002	
std	36335.949328	NAN	29884.295583	17.112731	8425.186994	0.0	65.304460	30.209388

4

	feature	missing_value	missing_percentage
0	order_id	0	0.00%
1	order_date	0	0.00%
2	user_id	0	0.00%
3	user_name	0	0.00%
4	age	0	0.00%
5	gender	0	0.00%
6	product_id	0	0.00%
7	product_name	1	0.01%
8	category	0	0.00%
9	quantity	0	0.00%
10	sale_price	0	0.00%
11	cost	0	0.00%

5

	order_id	order_date
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0

Cohort Data Preprocessing

- Missing Value Handling:**
 - Identified 1 missing value in the `product_name` column (0.01%).
 - Removed the row with the missing value since it had minimal impact on the dataset.
- Duplicate Removal:**
 - Verified that no duplicate rows existed (`(df_coclean.duplicated().sum() == 0)`).
- Exporting Data:**
 - Saved the cleaned dataset in CSV (Cohort.csv) format for SQL processing.
 - Exported the cleaned dataset in Excel (Cohort.xlsx) format for Tableau visualization.

Cohort Data Pre-Processing

Query Query History

```

24   GROUP BY cohort_month
25 )
26
27   SELECT
28     c.cohort_month,
29     DATE_PART('month', AGE(c.order_month, c.cohort_month)) AS month_offset, -- Selisih bulan
30     c.user_count,
31     (c.user_count::NUMERIC / b.initial_users) AS retention_rate -- Retention Rate skala 0-1
32   FROM cohort_data c
33   JOIN cohort_base b
34     ON c.cohort_month = b.cohort_month
35   ORDER BY c.cohort_month, month_offset;
  
```

Data Output Messages Notifications

	cohort_month	month_offset	user_count	retention_rate
1	2024-01-01	0	798	1.0000000000000000
2	2024-01-01	1	24	0.03007518796992481203
3	2024-01-01	2	12	0.01503759398496240602
4	2024-01-01	3	11	0.01378446115288220551
5	2024-01-01	4	8	0.01002506265664160401
6	2024-01-01	5	8	0.01002506265664160401
7	2024-01-01	6	11	0.01378446115288220551
...	2024-01-01	7	0	0.01378446115288220551

Total rows: 78 of 78 Query complete 00:00:00.399

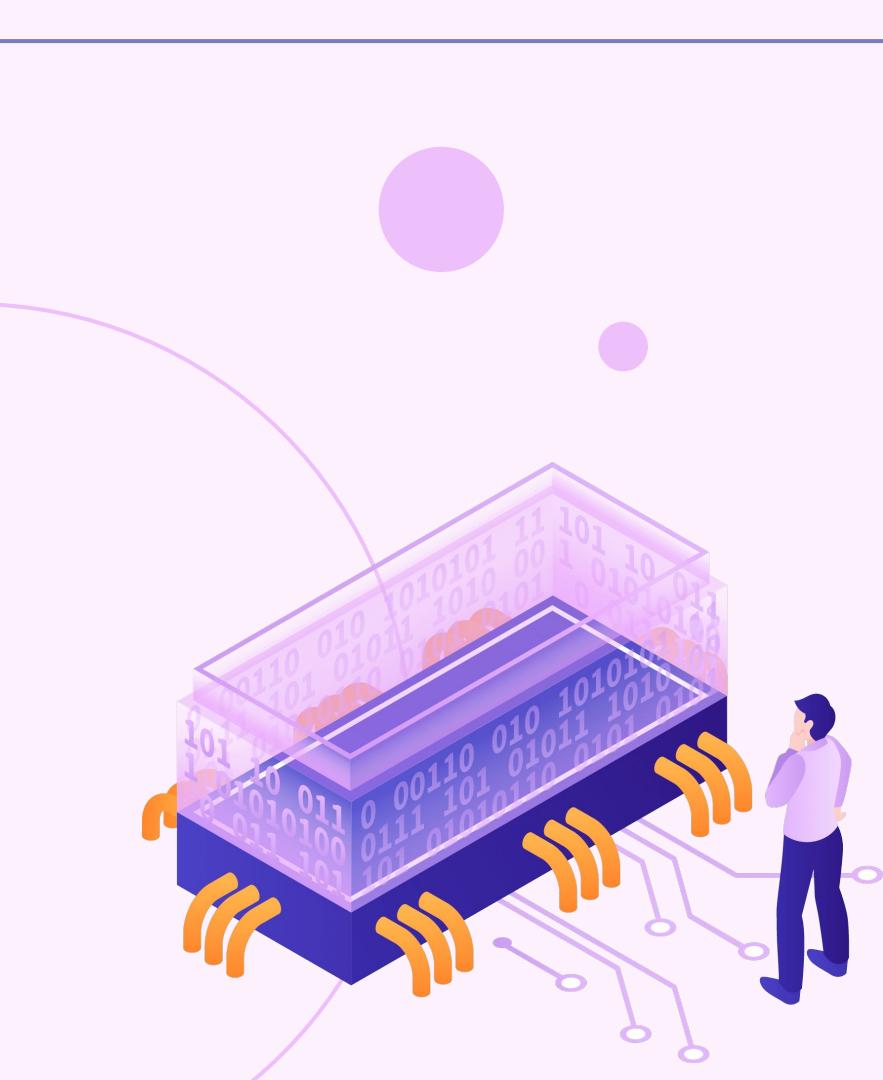
Ln 31, Col 19

SQL Cohort Analysis Explanation:

- Step 1: Define Cohort Month (`month_order`)**
 - Identifies the cohort month for each user based on their first transaction (`order_date`).
- Step 2: Calculate Cohort Data (`cohort_data`)**
 - Counts unique users (`user_count`) who made transactions in each month following their cohort month.
- Step 3: Determine Initial Users (`cohort_base`)**
 - Calculates the number of initial users (`initial_users`) in each cohort month (offset 0).
- Step 4: Compute Retention Rates**
 - For each cohort month, calculates the retention rate as the ratio of active users in subsequent months to the initial users.
- Export Data:**
 - The resulting data is saved as `cohort_analysis.xlsx` for visualization of the cohort retention chart in Tableau.

```

WITH month_order AS (
  SELECT
    DISTINCT
    user_id
    DATE_TRUNC('month', order_date)::date AS cohort_month -- Bulan cohort
  FROM sales
)
,
cohort_data AS (
  SELECT
    m0.cohort_month, -- Bulan cohort
    DATE_TRUNC('month', m1.order_date)::date AS order_month, -- Bulan transaksi
    COUNT(DISTINCT m1.user_id) AS user_count -- Jumlah pengguna unik
  FROM month_order AS m0
  JOIN sales AS m1
    ON m0.user_id = m1.user_id
  WHERE m1.order_date >= m0.cohort_month -- Transaksi setelah cohort
  GROUP BY m0.cohort_month, DATE_TRUNC('month', m1.order_date)
),
cohort_base AS (
  SELECT
    cohort_month
    MAX(CASE WHEN order_month = cohort_month THEN user_count ELSE 0 END) AS
  initial_users -- Pengguna awal (Offset 0)
  FROM cohort_data
  GROUP BY cohort_month
)
,
SELECT
  c.cohort_month
  , DATE_PART('month', AGE(c.order_month, c.cohort_month)) AS month_offset, -- Selisih bulan
  c.user_count,
  (c.user_count::NUMERIC / b.initial_users) AS retention_rate -- Retention Rate skala 0-1
FROM cohort_data c
JOIN cohort_base b
  ON c.cohort_month = b.cohort_month
ORDER BY c.cohort_month, month_offset;
  
```



03

Dashboard





Funnel & Cohort Analysis

Welcome Hijir Della Wirasti !

Created At 1/1/2023 12:01:41 AM

12/31/2023 11:59:53 PM Month

(All)

Quarter (All)

Country

(All)

City

(All)

Traffic Source

(All)

Event Type

(All)

Age Range

(All)

Gender

F

M



Top City

City F

Shanghai

Beijing

Seoul

Shenzhen

Chengdu

New York

London

Singapore

Tokyo

Bangkok

Paris

Mumbai

Los Angeles

San Francisco

Hong Kong

Sydney

Kuala Lumpur

Qatar

Doha

Abu Dhabi

Malaysia

Indonesia

Thailand

Vietnam

Philippines

Myanmar

Laos

Cambodia

Brunei

Maldives

Sri Lanka

Nepal

Bhutan

Yemen

Saudi Arabia

Lebanon

Jordan

Event Type

product

182,825

100.0%

cart

139,267

75.0%

purchase

50,185

50.0%

home

24,234

25.0%

cancel

21,768

0.0%

0K 50K 100K

Number of Event

Traffic Source

Email

Adwords

EXPORT



January February March April May June July August September October November December

Month of Created At [2023]

Number of Event

150K

100K

50K

0K

Traffic Source

Email

Adwords

YouTube

Facebook

Organic

Age Range / Gender

0-19

20-39

40-59

60+

F

M

F

M

F

M

F

M

Number of Event

200K

150K

100K

50K

0K

Funnel Dashboard



Funnel & Cohort Analysis

Welcome Hijir Della Wirasti !



RETENTION

Month of Cohort Month	Month Offset											
	0	1	2	3	4	5	6	7	8	9	10	11
January 2024	100.00%	3.01%	1.50%	1.38%	1.00%	1.00%	1.38%	1.13%	1.13%	0.88%	1.13%	1.00%
	796	24	12	11	8	8	11	9	9	7	9	8
February 2024	100.00%	3.97%	1.85%	1.19%	1.59%	0.93%	0.83%	0.53%	1.19%	0.66%	0.79%	
	756	30	14	9	12	7	4	4	9	5	6	
March 2024	100.00%	2.82%	1.35%	1.47%	1.01%	1.24%	1.35%	1.69%	0.79%	0.79%		
	887	25	12	13	9	11	12	15	7	7		
April 2024	100.00%	2.82%	1.41%	1.52%	1.64%	1.43%	0.94%	0.47%	1.87%			
	864	24	12	13	14	12	8	4	16			
May 2024	100.00%	2.89%	2.22%	1.11%	1.67%	1.78%	0.44%	1.00%				
	900	26	20	10	15	16	4	9				
June 2024	100.00%	4.00%	1.03%	1.23%	1.03%	1.33%	2.08%					
	974	39	10	12	10	13	20					
July 2024	100.00%	3.87%	1.92%	1.56%	1.37%	1.28%						
	1,091	39	21	17	18	14						
August 2024	100.00%	3.88%	1.60%	2.20%	1.76%							
	1,135	44	17	25	20							
September 2024	100.00%	4.19%	2.14%	2.63%								
	1,237	51	26	32								
October 2024	100.00%	4.09%	2.73%									
	1,384	57	38									
November 2024	100.00%	5.87%										
	1,481	87										
December 2024	100.00%											
	1,876											

Sales Trends Over Time





Funnel & Cohort Analysis

Welcome Hijir Della Wirasti !

Order Date 1/1/2024

12/31/2024 Quarter

(All) ▾

Month

January 2024

▼

Category

Product Name

Gender

Age (Range)

(All) ▾

(All) ▾

(All) ▾

(All) ▾

SALES

PROFIT

COST

CUSTOMERS

1,138,015

590,634

547,381

12,293

Sales Distribution by Category

Total Sales by Product

Total Sales by Customer

Category ▾

Product Name ▾

User Name ▾

Outerwear & Coats
Jeans
Sweaters
Swim
Suits & Sport Coats
Sleep & Lounge

NIKE WOMEN'S PRO CO...
Canada Goose Men's Th...
Canada Goose Women's ...
Jones New York Women'...
Diesel Men's Lophophor...
True Religion Men's Ric...

Michael Winters
Timothy Romero
Jennifer Martinez
Robin Williams
Paul Miller
Brett Simon

0K 5K 10K
Total Sales ₦

0K 1K 2K 3K
Total Sales ₦

0 500 1000
Total Sales ₦

EXPORT



Sales Performance by Gender

Sales Contribution by Age

Profit Analysis by Product

Sales Price vs Cost Comparison

Gender

Age (Range)

Product Name ▾

Comparison

Total Sales

Total Sales

Product Name

Cost

F

M

0K

0-19

0K

20-39

0K

40-59

0K

60+

0K

0 1000 2000 Profit ₦

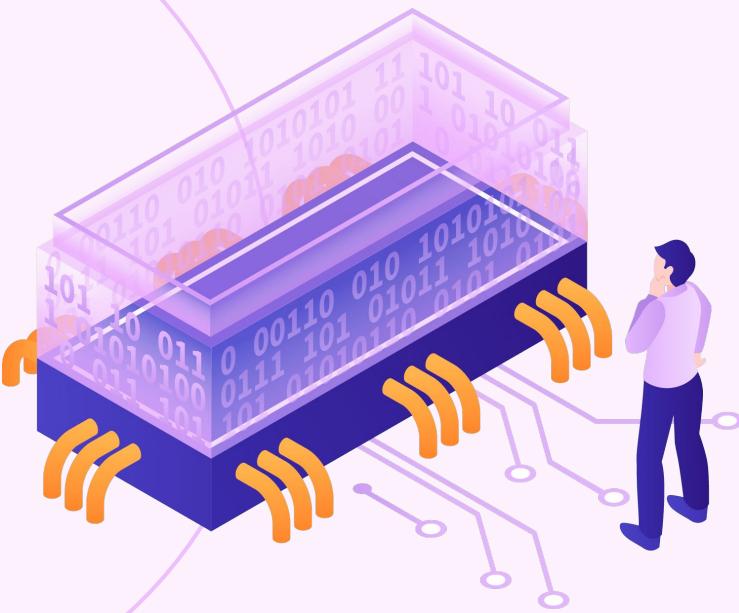
0K 2K Sale Price



Sales Dashboard

04

Insights & Recommendations

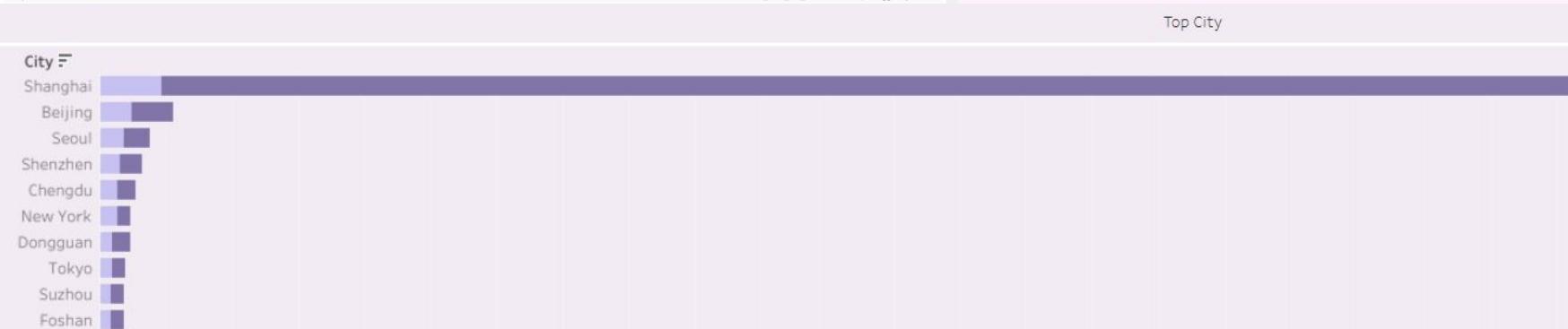


1. Top City Distribution

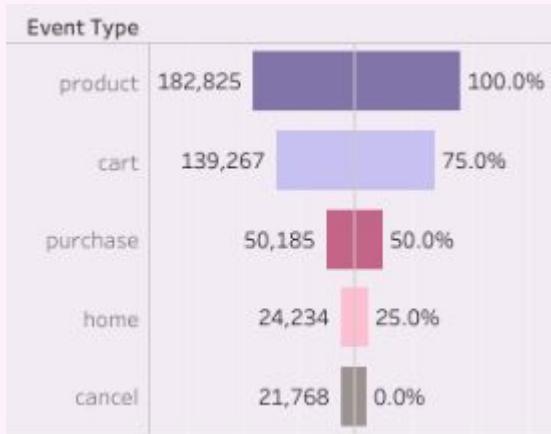


Insight: Shanghai leads in the number of events, indicating a high level of customer engagement compared to other cities.

Recommendation: Focus marketing efforts on cities with high activity, like Shanghai, while exploring strategies to boost engagement in underperforming regions.



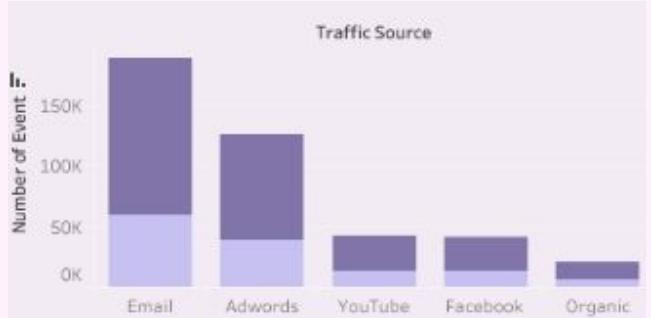
2. Event Type Analysis



Insight: Most interactions occur at the **product** stage (100%), but there's a sharp drop-off in **cart** (75%) and **purchase** (50%) stages.

Recommendation: Implement cart abandonment campaigns, offer discounts, or simplify the checkout process to increase conversions from cart to purchase.

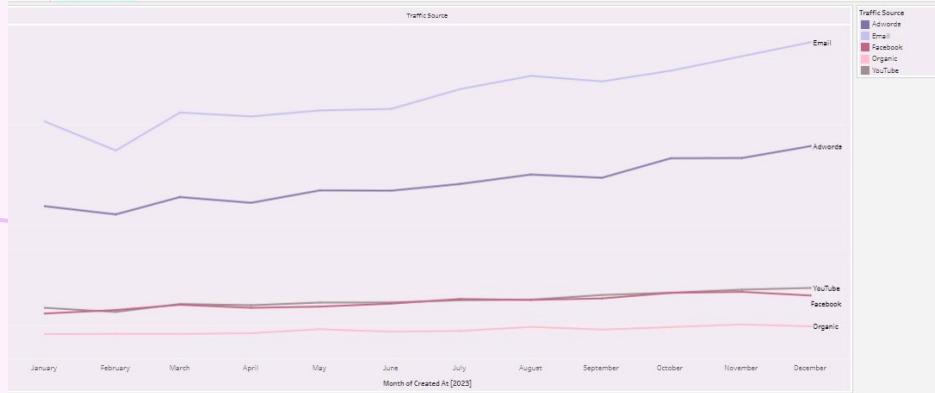
3. Traffic Source & Monthly Trends



Traffic Source

Insight: **Email** is the dominant traffic source, followed by **Adwords**, while platforms like **YouTube** and **Facebook** have lower engagement.

Recommendation: Continue leveraging email campaigns for high ROI but increase investments in YouTube and Facebook to diversify traffic sources and reach untapped audiences.

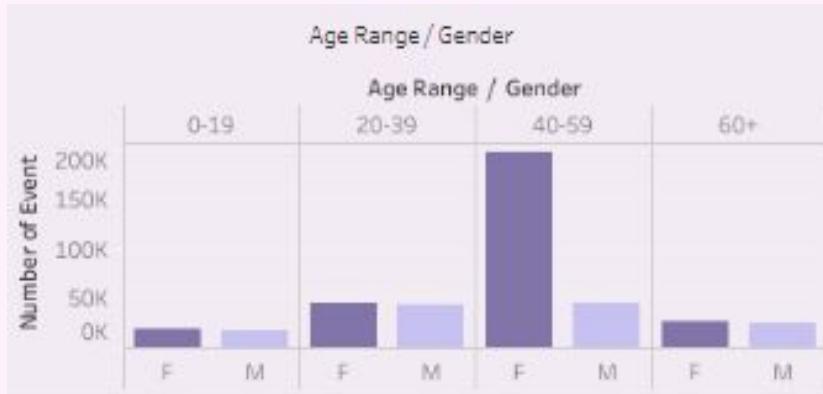


Monthly Traffic Trends

Insight: Traffic is consistent over the months, with no significant peaks or troughs.

Recommendation: Introduce seasonal campaigns or promotions to create traffic spikes during key months like holidays or special events.

4. Age Range and Gender Performance



Insight: Women aged **40-59** have the highest number of events, significantly outperforming all other age and gender groups. Male engagement is consistently lower across all age ranges.

Recommendation:

- Focus marketing campaigns on women aged 40-59 as they are the most active demographic.
- Explore strategies to increase male engagement, such as gender-specific promotions or products that appeal to men across all age ranges.
- Create targeted campaigns for younger demographics (20-39) to nurture their engagement further.

5. Cohort Retention Table

Month of Cohort	Month	Retention										
		0	1	2	3	4	5	6	7	8	9	10
January 2024	100.00%	3.01%	1.50%	1.38%	1.00%	1.00%	1.38%	1.13%	1.13%	0.88%	1.13%	1.00%
	798	24	12	11	8	8	11	9	9	7	9	8
February 2024	100.00%	3.87%	1.85%	1.19%	1.59%	0.93%	0.53%	0.53%	1.19%	0.66%	0.79%	
	786	30	14	9	12	7	4	4	9	5	6	
March 2024	100.00%	2.82%	1.35%	1.47%	1.01%	1.24%	1.35%	1.69%	0.79%	0.79%		
	887	25	12	13	9	11	12	15	7	7		
April 2024	100.00%	2.81%	1.41%	1.52%	1.64%	1.41%	0.94%	0.47%	1.87%			
	864	24	12	13	14	12	8	4	16			
May 2024	100.00%	2.89%	2.22%	1.11%	1.67%	1.78%	0.44%	1.00%				
	900	26	20	10	15	16	4	9				
June 2024	100.00%	4.00%	1.03%	1.23%	1.03%	1.33%	2.05%					
	974	19	10	12	10	13	20					
July 2024	100.00%	3.87%	1.92%	1.86%	1.37%	1.28%						
	1,091	39	21	17	18	14						
August 2024	100.00%	3.88%	1.50%	2.20%	1.76%							
	1,135	44	17	25	20							
September 2024	100.00%	4.19%	2.14%	2.63%								
	1,217	51	26	32								
October 2024	100.00%	4.09%	2.72%									
	1,394	57	38									
November 2024	100.00%	5.87%										
	1,481	87										
December 2024	100.00%											
	1,876											

Cohort Retention

Insight: Retention drops sharply after the first month for all cohorts, stabilizing below 1% in later months. Recent cohorts (Sep–Dec 2024) show slightly better early retention.

Recommendation: Improve early retention with personalized onboarding and exclusive offers. Analyze recent cohorts to replicate successful strategies.

6. Sales Trends Over Time



Insight:

- Sales increase consistently throughout the year, with a noticeable spike during November and December, likely due to holiday shopping.

Recommendation:

- Plan cohort-focused re-engagement campaigns targeting dormant or less active users from earlier cohorts during peak sales periods.
- Offer tailored promotions to older cohorts to reactivate them while maximizing sales during high-demand months.

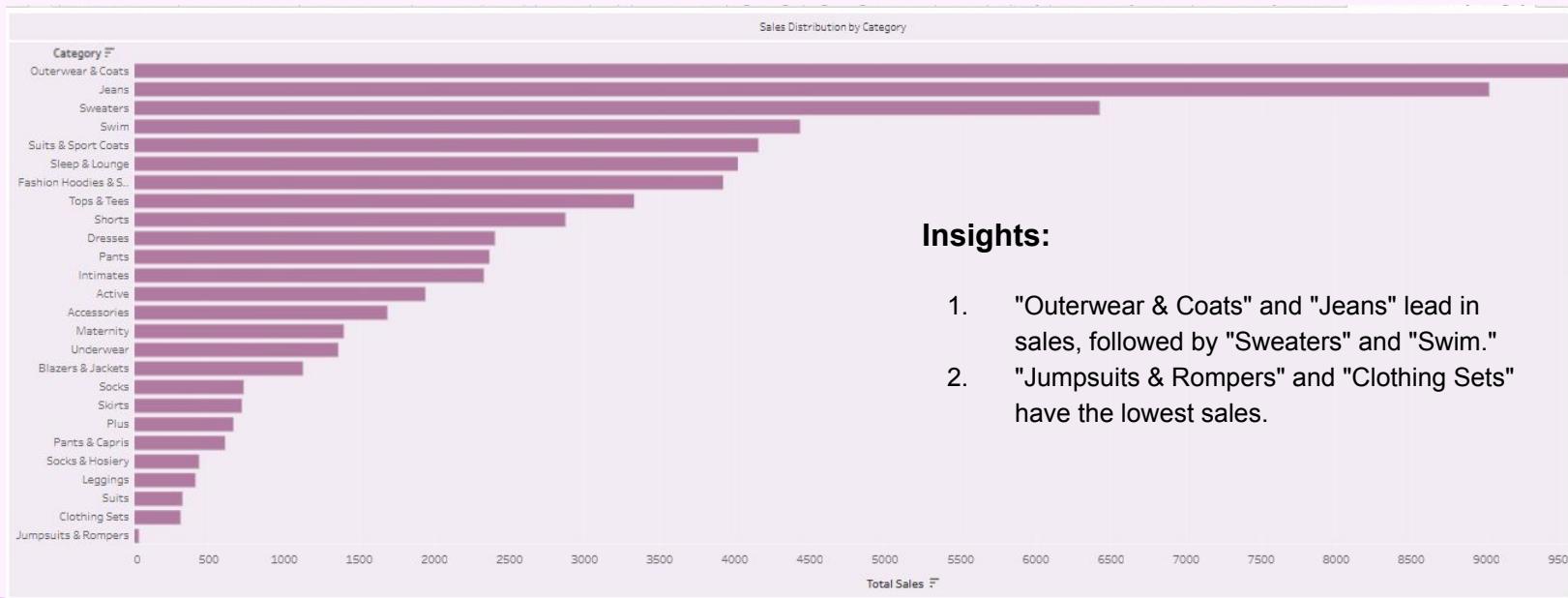
7. Overall Sales and Profit

Order Date	1/1/2024	12/31/2024	Quarter	(All)	Month	January 2024
Category	Product Name		Gender	Age (Range)		
(All)	(All)		(All)	(All)		
SALES		PROFIT	COST	CUSTOMERS		
1,138,015		590,634	547,381	12,293		

Insight: Total sales are \$1,138,015, with a profit of \$590,634, indicating a healthy profit margin.

Recommendation: Focus on high-performing products and categories to sustain profitability while exploring cost optimization for low-margin items.

8. Sales Distribution by Category



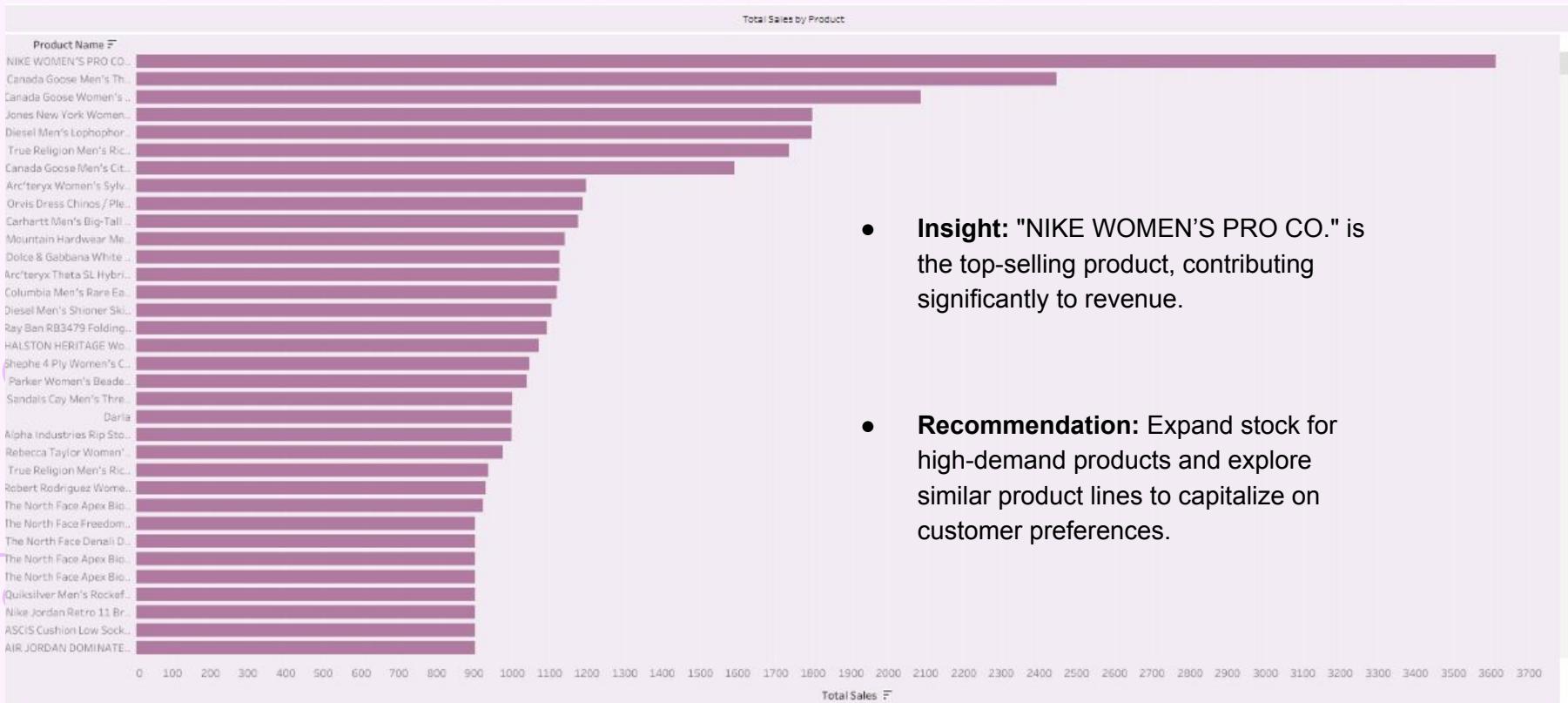
Insights:

- "Outerwear & Coats" and "Jeans" lead in sales, followed by "Sweaters" and "Swim."
- "Jumpsuits & Rompers" and "Clothing Sets" have the lowest sales.

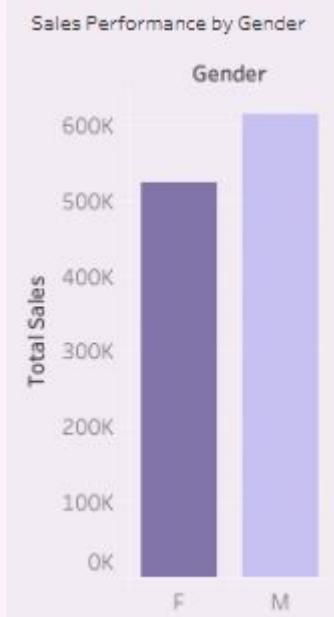
Recommendations:

- Focus promotions on top categories and maintain inventory.
- Boost underperforming categories with discounts and visibility campaigns.
- Use cross-selling (e.g., "Jeans" with "Tops & Tees") to improve sales.

9. Top Products by Sales

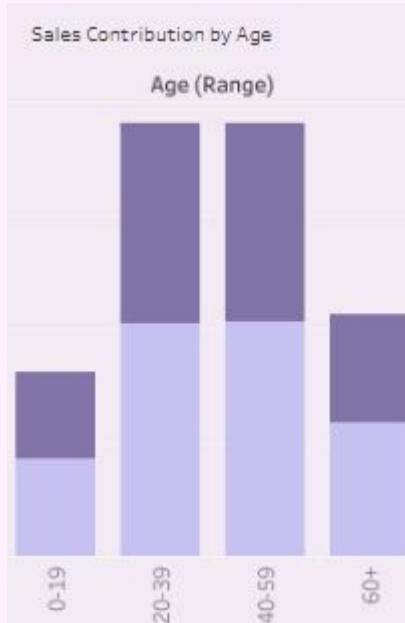


10. Sales by Gender



- **Insight:** Female customers drive the majority of sales.
- **Recommendation:** Tailor campaigns and products to meet the preferences of female customers while designing strategies to engage more male customers.

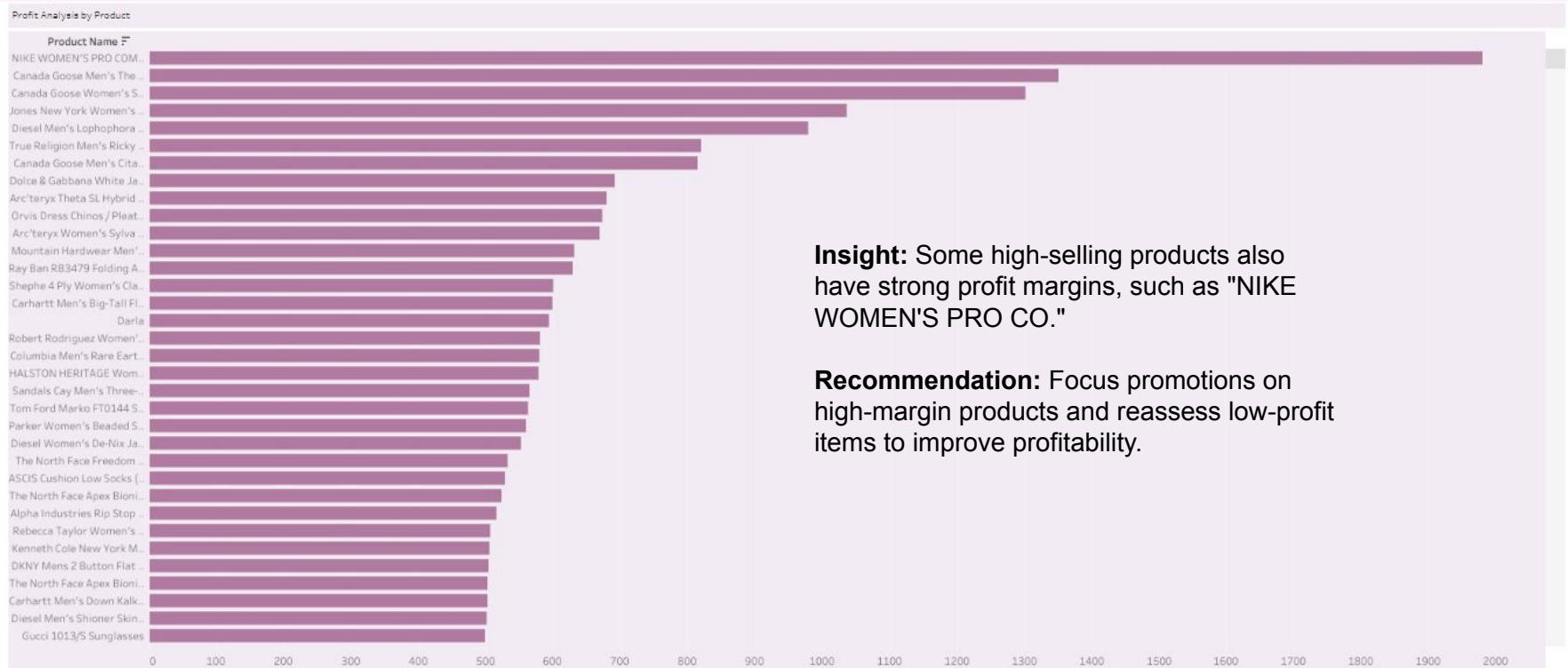
11. Sales Contribution by Age



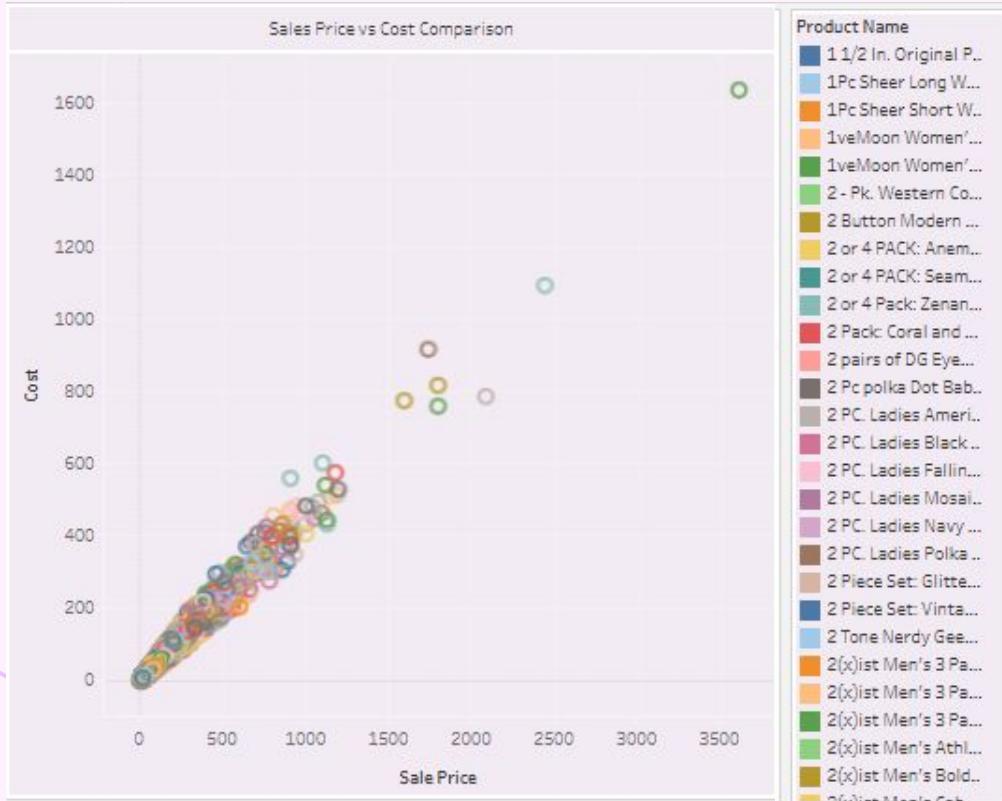
Insight: Customers aged 20–39 contribute the most to sales, while other age groups have lower engagement.

Recommendation: Target younger age groups (20–39) with personalized offers and explore strategies to boost engagement among older demographics.

12. Profit Analysis by Product

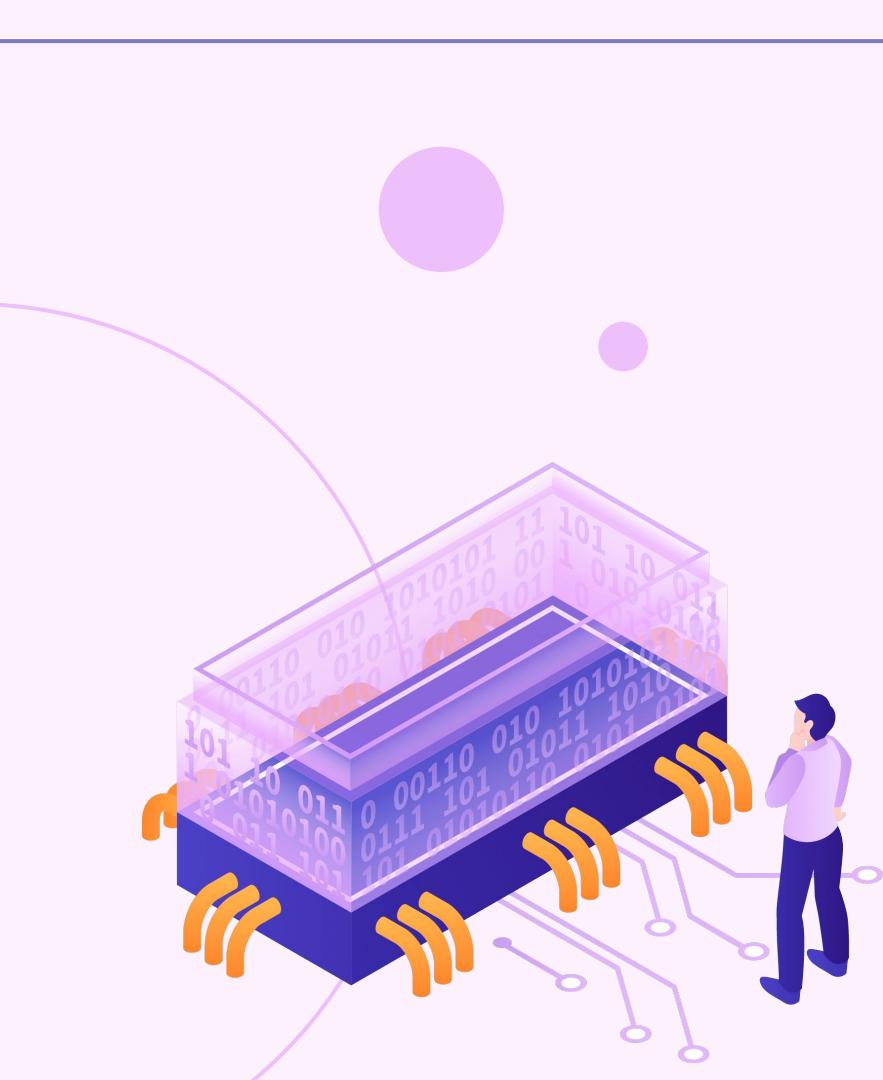


13. Sale Price vs. Cost Comparison



Insight: Products with a higher sale price relative to cost have better profitability.

Recommendation: Monitor pricing strategies to ensure a competitive yet profitable balance for all products.



05

Conclusion

Conclusion

The Funnel and Cohort Analysis highlights key areas of performance and opportunities for growth:

1. Funnel Analysis:

- Most users drop off between the cart and purchase stages. Strategies like cart abandonment emails, discounts, and a smoother checkout process can help increase conversion rates.
- Female customers aged 40–59 dominate sales, particularly in categories like "Outerwear & Coats" and "Jeans." Targeted campaigns for this demographic, along with efforts to engage other groups, can drive more sales.

2. Cohort Analysis:

- Retention rates drop significantly after the first month for all cohorts, stabilizing below 1% over time. Improving early engagement through personalized onboarding and loyalty programs is crucial.
- Recent cohorts show slightly better retention, indicating the potential of improved onboarding and marketing strategies.

3. Overall Trends:

- Sales consistently grow throughout the year, with a peak in November and December, driven by holiday shopping. Seasonal campaigns and reactivation strategies for past customers can maximize revenue.

"Understanding your customer journey and retention patterns is the key to turning insights into action. A well-optimized funnel and strong cohort retention aren't just metrics—they're the foundation of sustainable growth."



Thanks!

Do you have any questions?

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Business Intelligence

