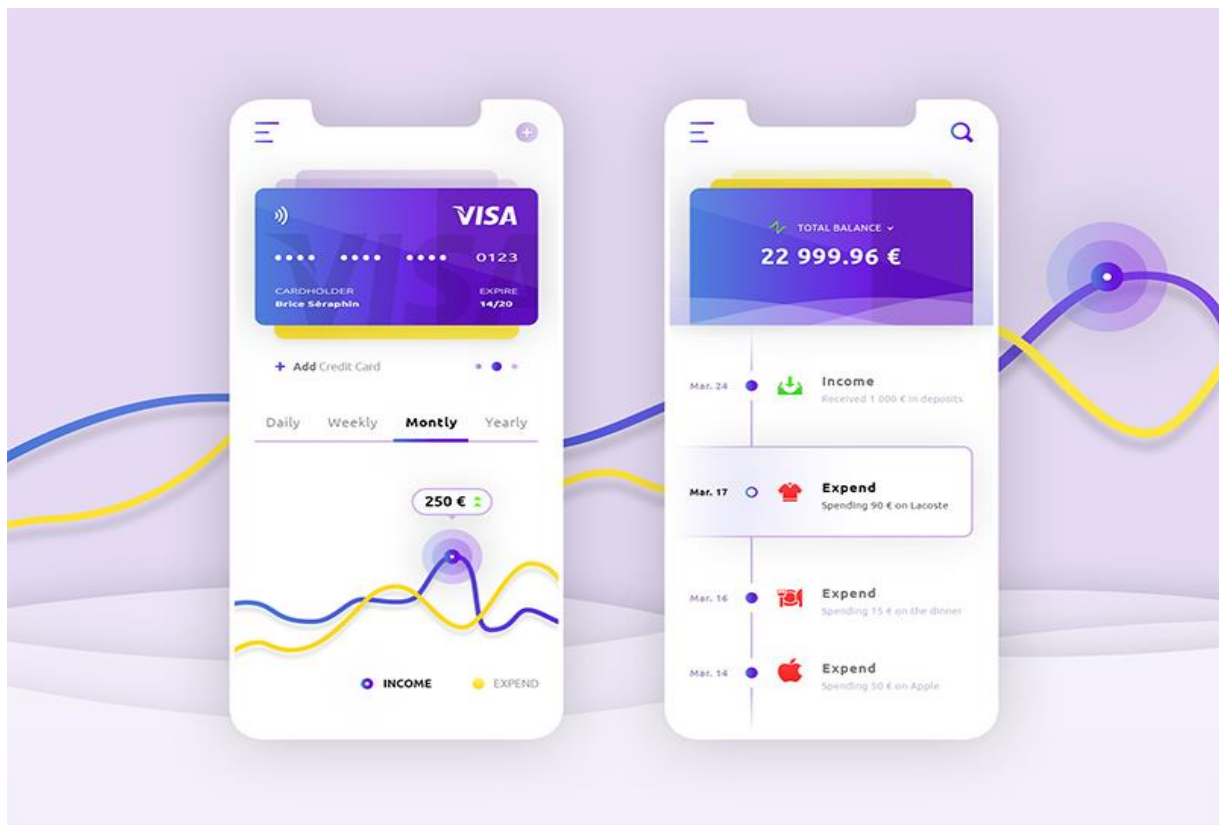# Enhancing User Experience:

Analysis & Recommendations for an Online Payment App

Report by: Khang Le

Table of Contents

I.   State the problem.

Problem: You are a data analyst working for an **online payment app** company. Your boss has requested you to analyze **user behavior and trends** in the online payment app to **provide recommendations** for improving the service and enhancing the user experience.

II.   Identify the data

- **Paying method**: Information about customer paying method.

There are five main payment methods, including: credit card, banking account, money in app, local card and debit card.

method_id	name
11	credit card
12	banking account
13	money in app
14	local card
15	debit card

- **table_message**: Information about the detailed error codes of the order.

There are a total of 14 main error code notifications and 1 successful transaction notification, listed in the image below.

message_id	description
-15	Your account is temporarily locked
-14	Transactions suspected to be fraudulent
-13	Unknown error from the bank
-12	The bank transaction processing time has expired
-11	Payment failed
-10	Transactions suspected to be fraudulent
-9	Payment failed
-8	Wrong OTP
-7	Wrong password to pay more than limit number of…
-6	Exceeded the allowed amount for the day
-5	Payment password is incorrect
-4	Transaction failed due to duplicate order ID
-3	The account does not have enough funds for paym…
-2	Payment expired transaction
1	Success

- **product:** Detailed information about product group of the app.

This table has 286 rows and 5 columns of data, including product_number, sub_category, category, product_group, and online_offline. The image below shows the first 5 rows of the table.

product_number	sub_category	category	product_group	online_offline
P1_10	Marketplace	Marketplace	Payment	Online
P1_100	Restaurant Chain	FnB	Payment	Offline
P1_101	Restaurant Chain	FnB	Payment	Offline
P1_102	Restaurant Chain	FnB	Payment	Offline
P1_103	Beverage Stores	FnB	Payment	Offline

This payment app offers 5 main product groups, including: Payment, Bank Transfer, Top – up account, Credit Card Billing and Withdraw.

product_group
Bank Transfer
Credit Card Billing
Payment
Top-up account
Withdraw

- **payment_history_18:** Information about all the transactions in 2018.

This table includes 247 509 rows of data and 12 columns. The image below shows the first 10 rows of this table.

order_id	customer_id	product_id	payment_id	promotion_id	bank_id	platform_id	app_version	message_id	discount_price	final_price	transaction_date
531469	28762	P2_1	14	0	B_9	P1	4.22.0	1	0	100000	2018-01-01 00:59:09.6510
531518	14964	P2_1	14	0	B_17	P1	4.22.0	1	0	100000	2018-01-01 01:42:22.7210
531561	26851	P1_13	12	P_332	B_6	P2	4.21.3	1	0	47750	2018-01-01 03:15:06.5600
531595	17983	P1_67	12	P_310	B_36	P2	4.21.3	-3	0	280000	2018-01-01 05:04:57.2500
531600	17983	P1_67	12	P_310	B_36	P2	4.21.3	1	50000	280000	2018-01-01 05:02:15.0820
531605	17983	P1_67	12	P_310	B_36	P2	4.21.3	-3	0	280000	2018-01-01 05:09:41.1600
531607	6477	P2_1		0	B_3	P2	4.21.3	-9	0	5000	2018-01-01 05:26:58.7980
531621	6477	P2_1	14	0	B_3	P2	4.21.3	1	0	5000	2018-01-01 05:48:41.4070
531622	6477	P2_1	14	0	B_3	P2	4.21.3	1	0	500000	2018-01-01 05:51:53.1790
531649	21916	P1_13	14	0	B_9	P2	4.21.3	1	0	95300	2018-01-01 06:34:14.3810

- **payment_history_17:** Information about all the transactions in 2017.

This table includes 115 035 rows of data and 12 columns. The image below shows the first 10 rows of this table.

order_id	customer_id	product_id	payment_id	promotion_id	bank_id	platform_id	app_version	message_id	discount…	final_price	transaction_date
101	10863	P2_1	12	0	B_36	P1	3.21.1	-9	0	100000	2017-01-01 00:06:30.4110000
102	10863	P2_1	12	0	B_36	P1	3.21.1	-9	0	100000	2017-01-01 00:06:44.6560000
111	4403	P1_10	11	0	B_8	P2	3.20.1	1	0	204445	2017-01-01 00:37:18.8710000
130	10863	P2_1	12	0	B_36	P1	3.21.1	1	0	100000	2017-01-01 01:06:55.7570000
135	4802	P1_3	14	0	B_31	P2	3.21.0	1	0	97000	2017-01-01 02:37:47.2230000
137	12430	P2_1	12	0	B_6	P2	3.21.0	1	0	500000	2017-01-01 06:09:49.0320000
142	7348	P2_1	15	0	B_8	P2	3.21.0	-9	0	500000	2017-01-01 06:18:04.9190000
143	6833	P2_1	12	0	B_6	P1	3.21.1	1	0	2000000	2017-01-01 07:03:36.5170000
146	7348	P2_1	15	0	B_8	P2	3.21.0	-9	0	500000	2017-01-01 06:27:47.3520000
148	13652	P2_1	12	0	B_36	P1	3.21.1	-3	0	100000	2017-01-01 06:39:11.9910000

## DATABASE SCHEMA:
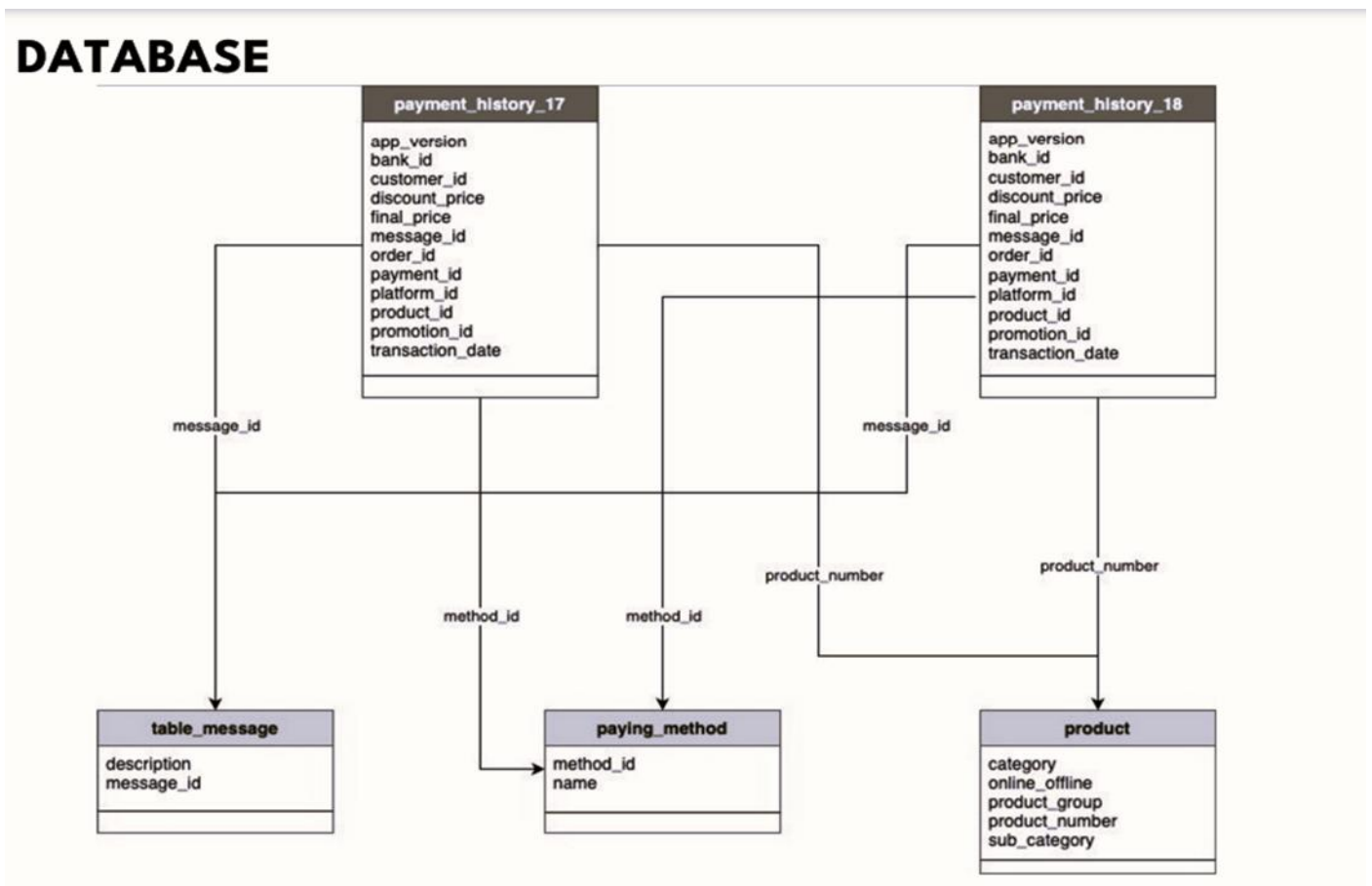
III. Online payment app analysis.

Since I want to analyze customer trends over both years, I will first merge the payment tables for 2017 and 2018 into one and save it into a local table.

```sql
-- Join table history 2017 and 2018

WITH table_union AS (
    SELECT * FROM payment_history_17
    UNION
    SELECT * FROM payment_history_18
)
SELECT *
INTO #payment_history
FROM table_union
```

1. Overview.

In the past 2 years, the total number of customers using the app was 15684, with 5252 customers using the app in 2017 and 10432 customers using the app in 2018.
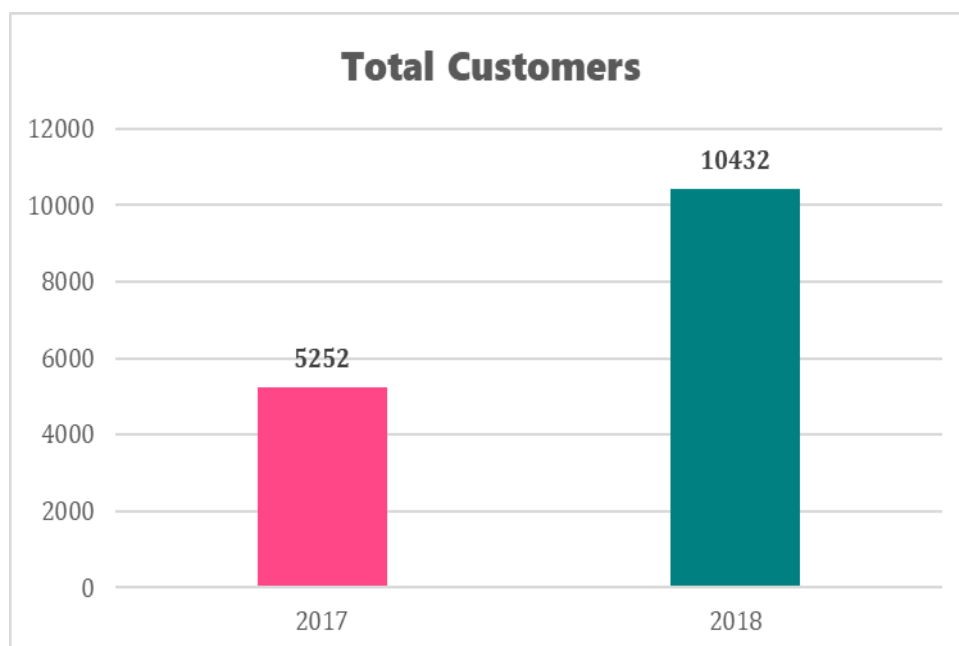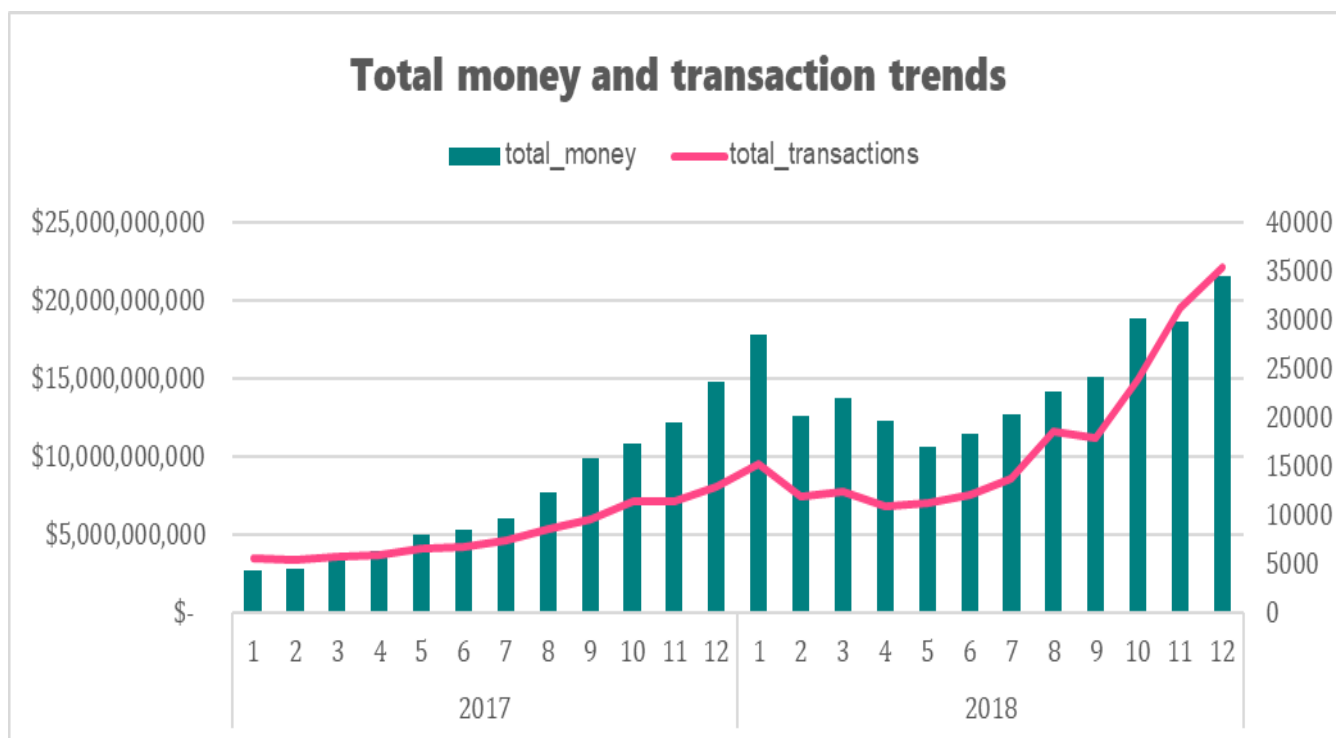
In addition, a total of 10,000 payment transactions were conducted over the past 2 years, with 1,000 transactions in 2017 and 9,000 transactions in 2018 (including both successful and unsuccessful transactions).
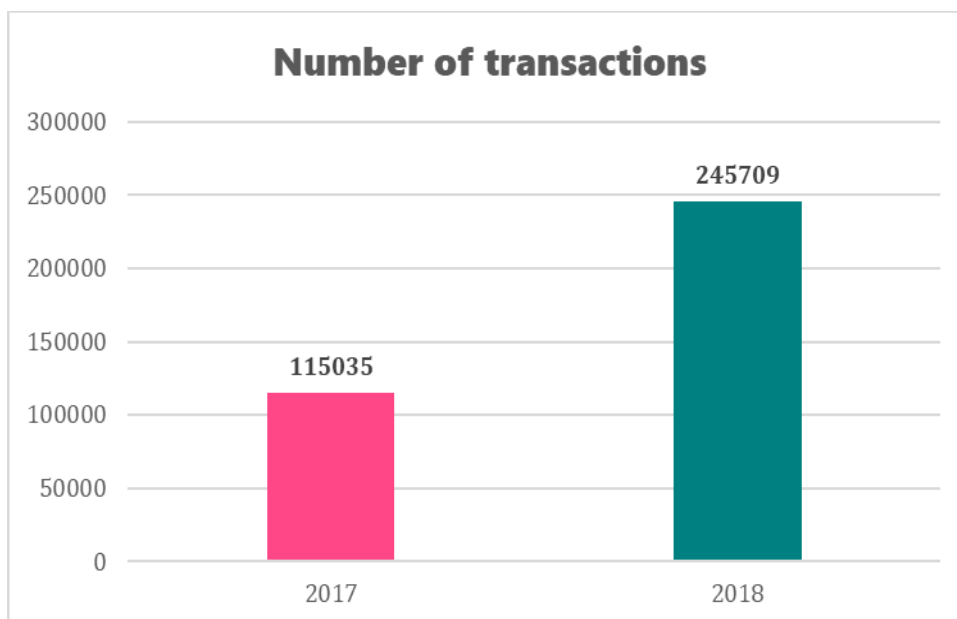
## 2. Transaction and amount trends.

a. By month and year.

The transaction amount tends to be low at the beginning of the year and gradually increases towards the end of the year. This phenomenon can be due to several factors:

- **Seasonal trends:** Consumer spending typically increases during many holiday seasons, such as Christmas and New Year, thus increasing the total transaction amount.
- **Promotions and Sales Events**: End-of-year promotions, sales events, and marketing campaigns can drive higher transaction amounts as consumers take advantage of discounts and special offers.
- **Annual Bonuses and Incentives**: Many employees receive annual bonuses or incentives towards the end of the year, which can lead to higher spending and transaction amounts during this period.

Meanwhile, the number of transactions tends to increase steadily from the beginning of 2017 to the end of 2018. This may be due to the company's promotion campaigns attracting many more customers. We will continue to analyze this to gain a better understanding.

b. By hour.
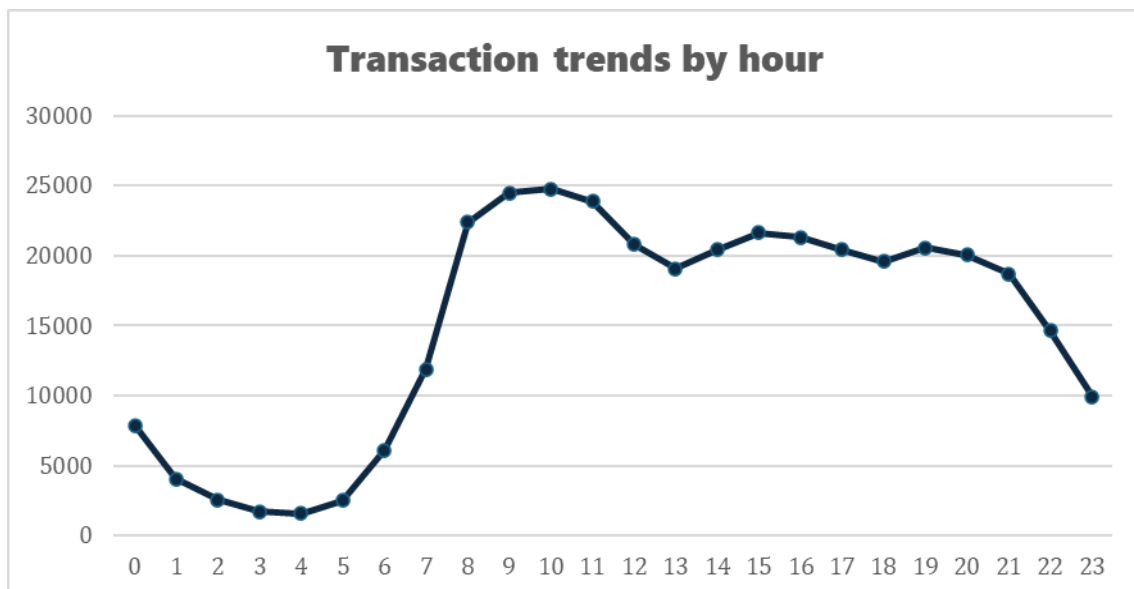
The number of transactions in a day peaks from around 6 AM to 9 PM, which coincides with people's working and daily activity hours, then begins to decrease gradually from 10 PM to 4 AM.

→ **To reduce the rate of failed payment transactions for customers, it's necessary to analyze and optimize the payment process, improve user experience during this time frame.**

3. Success rate.

a. Successful & Failed Transactions analysis.

Successful vs Failed Transactions 2017-2018
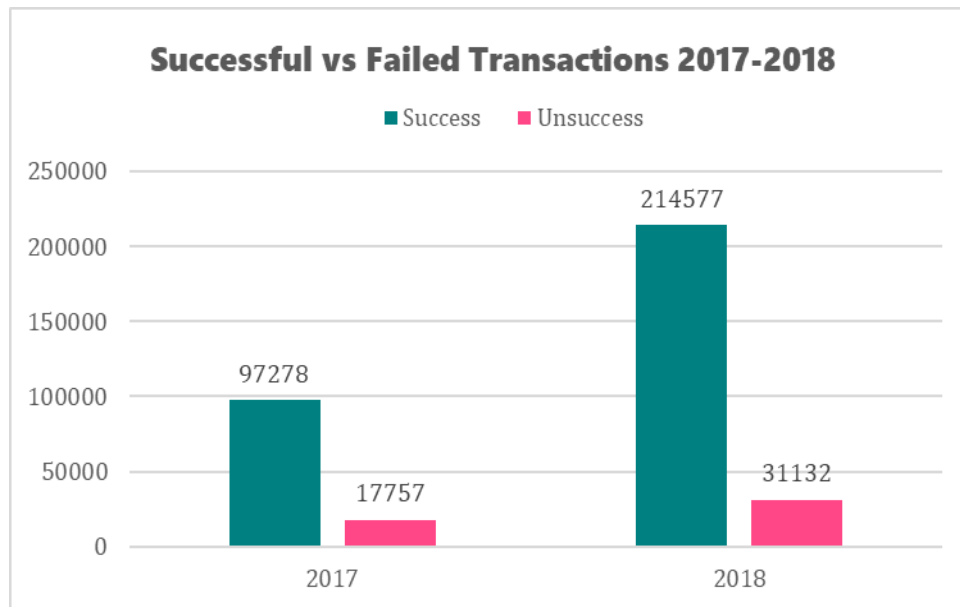
The total number of transactions in 2018 increased significantly compared to 2017, leading to a rise in both successful and failed payment transactions. However, we can observe that the failure rate in 2017 was $\frac{17757}{115035} = 15.4\%$, whereas in 2018 it decreased to 12.7%. This indicates that despite an increase in the number of failed transactions, the company has effectively reduced the failure rate by 2.7% and significantly increased the success rate by 2.77%.

Unsuccess orders by Month
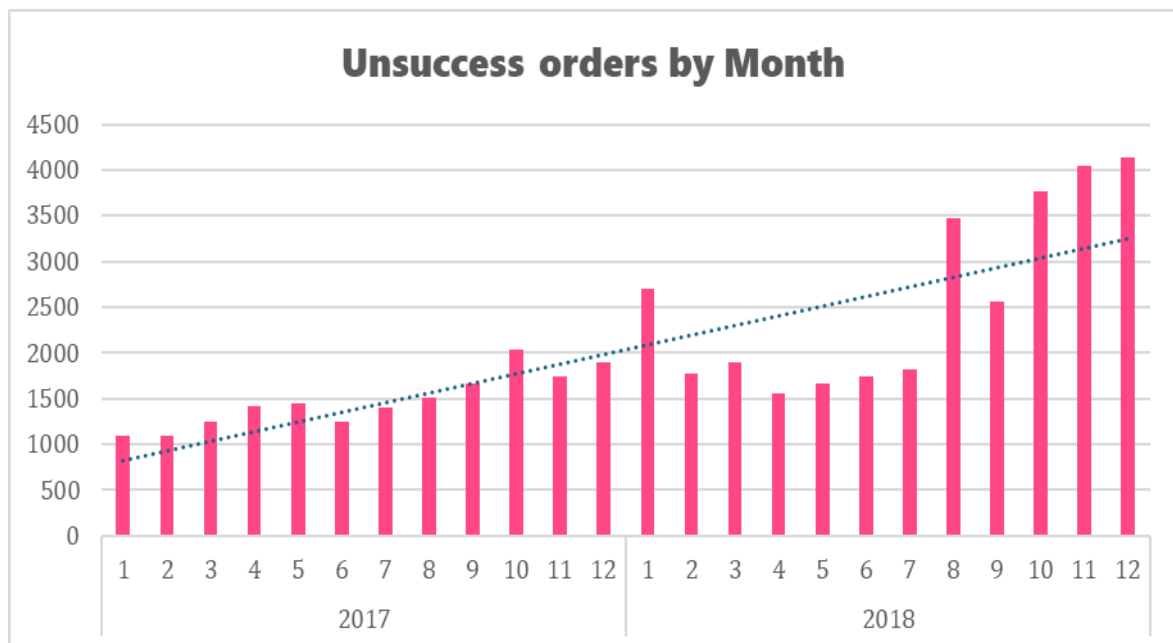
During the peak months at the end of the year, the number of failed transactions rises due to increased payment demands. Therefore, the company needs to focus on improving the app and user experience during these months.

Transaction trends by Hour
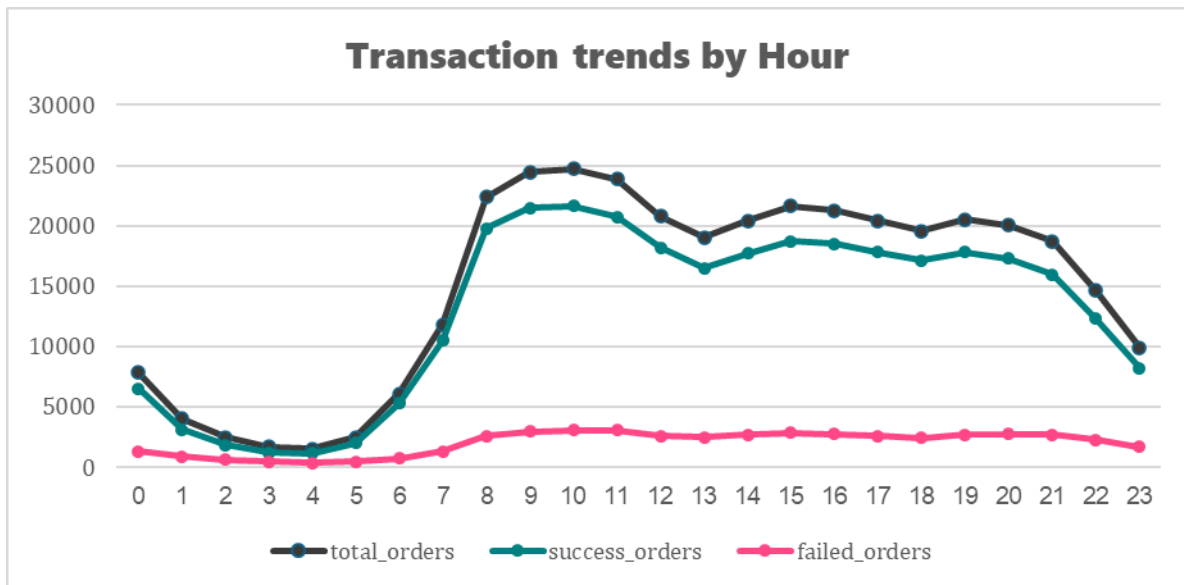
The total number of transactions increases significantly from 7:00 to 21:00, which leads to a slight increase in the number of failed transactions. However, this number gradually decreases after approximately 22:00.

b. Error types.

Failed Transactions by Error Code
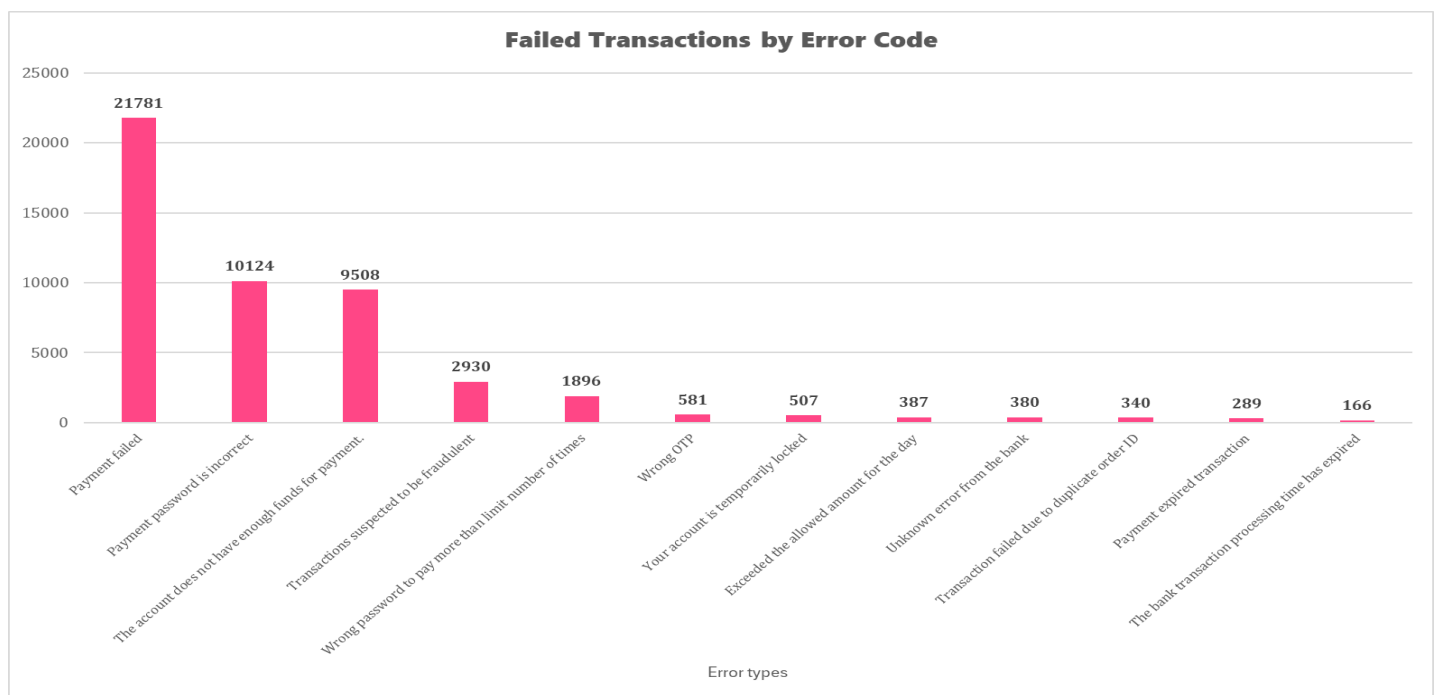
The **payment failed** error accounts for the largest portion - 44.5% of total failed transactions over the past 2 years. This needs to be reported to the boss and the IT department for them to investigate whether the issue originates from the system.

The other two major causes of failed transactions are **incorrect passwords** and **insufficient funds** in accounts. The remaining errors account for a very small portion of failed transactions, but we should also pay attention to them and find ways to resolve them.
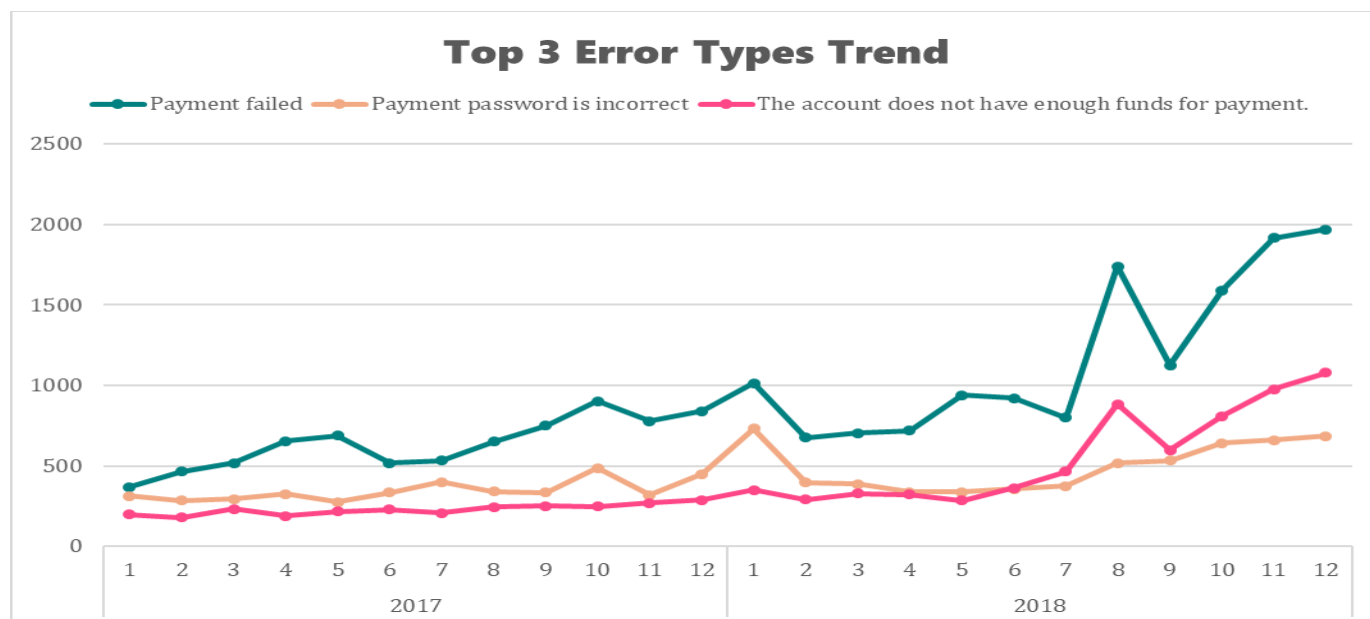
The number of transactions with the 'payment failed' error continued to rise sharply at the end of 2018. Therefore, we need to check whether these transaction errors are coming from the customers or the system to provide timely solutions. The other two errors, 'wrong password' and 'insufficient funds,' are also increasing, but these are typically customer errors. Thus, we can send notifications to remind them about these issues to reduce the number of failed transactions.

4. Paying method.

a. Paying method overview.

Total money by Methods (billions)
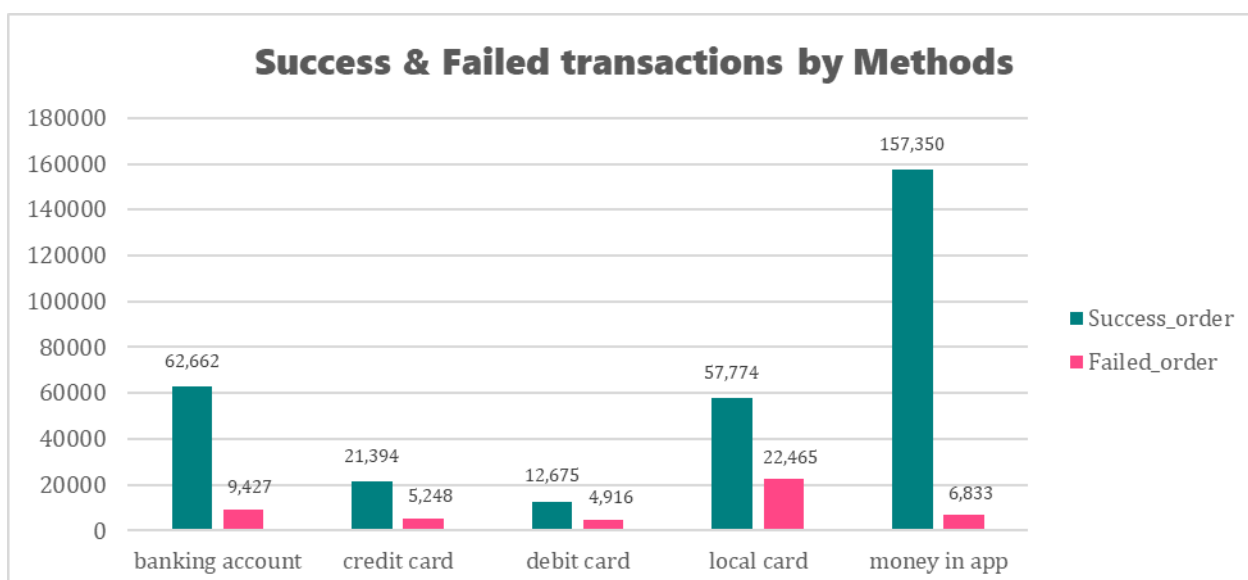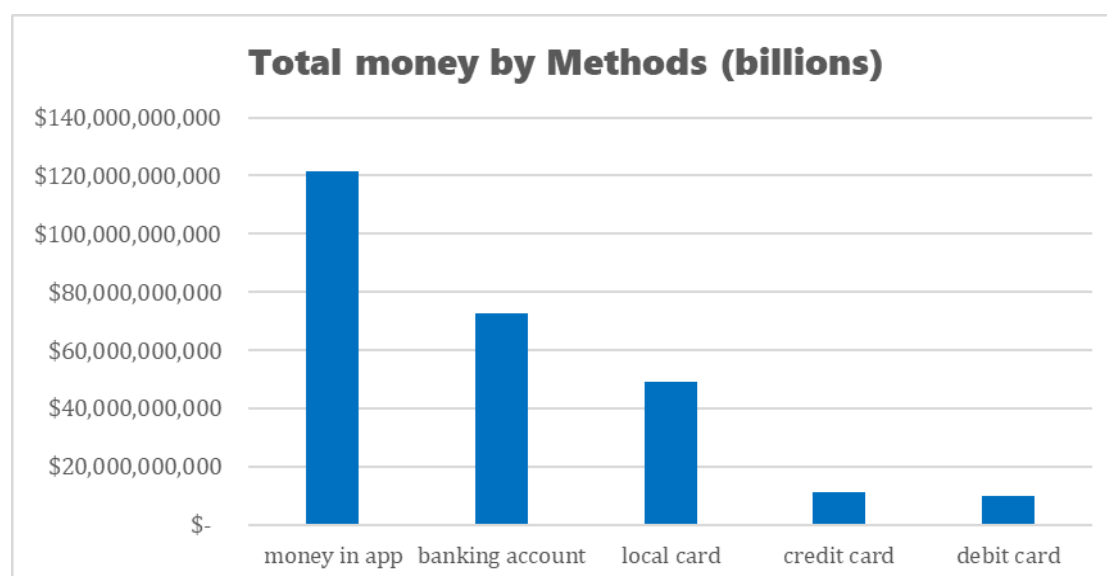
We can see that **money in app** is the most popular payment method, with nearly 160K successful transactions and a total transaction amount of over 120 billion, and Customers likely prefer this payment method due to its convenience and speed. Conversely, the debit card method is the least popular, possibly because fewer people own debit cards. In addition, the debit card, along with the local card, has the highest transaction failure rate, reaching up to 28%.

b. Method trends

Method trends
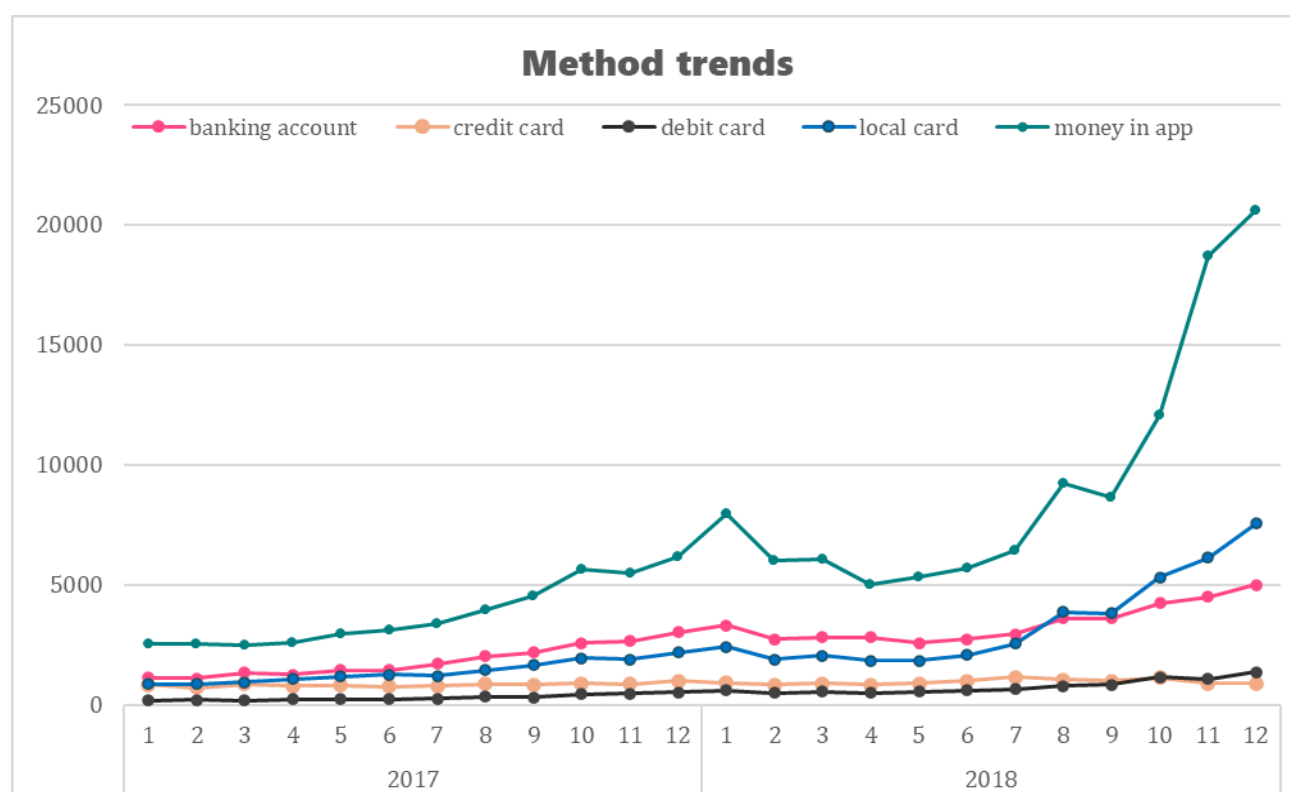
Over the past 2 years, the number of transactions made using money in app has increased rapidly, especially towards the end of 2018.

The number of transactions made using banking accounts has always been slightly higher than those using local cards. However, since August 2018, the local card method has experienced significant growth and surpassed the banking account method.

The other two methods, credit card and debit card, have remained virtually unchanged over the past 2 years.

→ **Money in app remains the most popular** payment method, growing strongly over the past 2 years. **Banking account** and **local card** methods have seen **slight growth**, while **credit card** and **debit card** methods have **remained stable**.

c. **Error Types by Methods.**

Error types by Methods	Failed transactions
⊖ **banking account**	**9427**
The account does not have enough funds for payment.	3696
Payment password is incorrect	2636
Payment failed	1936
Wrong password to pay more than limit number of times	438
Transactions suspected to be fraudulent	143
The bank transaction processing time has expired	142
Your account is temporarily locked	129
Wrong OTP	106
Unknown error from the bank	77
Transaction failed due to duplicate order ID	63
Payment expired transaction	61
⊖ **credit card**	**5248**
Payment failed	3508
Payment password is incorrect	813
The account does not have enough funds for payment.	394
Transactions suspected to be fraudulent	260
Wrong password to pay more than limit number of times	117
Transaction failed due to duplicate order ID	68
Your account is temporarily locked	46
Payment expired transaction	41
Unknown error from the bank	1

Top 3 error types most commonly encountered in each transaction are incorrect password, insufficient funds in the account, and payment failed. For the local card method, payment failed has recorded nearly 13,000 error transactions, so we need to pay special attention to this type of error.

debit card	4916
Payment failed	3425
Payment password is incorrect	716
The account does not have enough funds for payment.	518
Wrong password to pay more than limit number of time	107
Transactions suspected to be fraudulent	56
Your account is temporarily locked	35
Transaction failed due to duplicate order ID	24
Payment expired transaction	22
Unknown error from the bank	13
local card	22465
Payment failed	12909
The account does not have enough funds for payment.	4636
Payment password is incorrect	3030
Wrong OTP	475
Wrong password to pay more than limit number of time	451
Unknown error from the bank	282
Transactions suspected to be fraudulent	253
Your account is temporarily locked	199
Transaction failed due to duplicate order ID	136
Payment expired transaction	79
The bank transaction processing time has expired	15
money in app	6833
Payment password is incorrect	2929
Transactions suspected to be fraudulent	2218
Wrong password to pay more than limit number of time	783
Exceeded the allowed amount for the day	387
The account does not have enough funds for payment.	264
Your account is temporarily locked	98
Payment expired transaction	86
Transaction failed due to duplicate order ID	49
The bank transaction processing time has expired	9
Unknown error from the bank	7
Payment failed	3

For the money in app method, the two errors "transaction suspected to be fraudulent" and "wrong password to pay more than limit number of times" are more common.

Recommendations:

For "wrong password to pay more than number limits of time":

- Improve user interface: Ensure a clear and user-friendly payment interface to minimize errors when entering passwords.
- Notifications and support: Provide clear notifications to users when they approach the password attempt limit and offer guidance for password recovery.

For "transaction suspected to be fraudulent":

- Enhance fraud detection system: Strengthen algorithms and procedures for detecting fraudulent transactions early and preventing suspicious transactions.

- Two-factor authentication: Implement two-factor authentication to verify user identities and enhance transaction security.

- User education: Provide guidance and advisories to users on security measures, such as avoiding sharing personal information and refraining from clicking on suspicious links.

5. Products & Promotion.

a. Products.

Transaction by Product Groups

Product Group	Transactions
Top-up account	100,186
Bank Transfer	46,114
Payment	153,455
Withdraw	10,707
Credit Card Billing	1,393

Transaction Trends by Product Group

Legend: Bank Transfer, Credit Card Billing, Payment, Top-up account, Withdraw
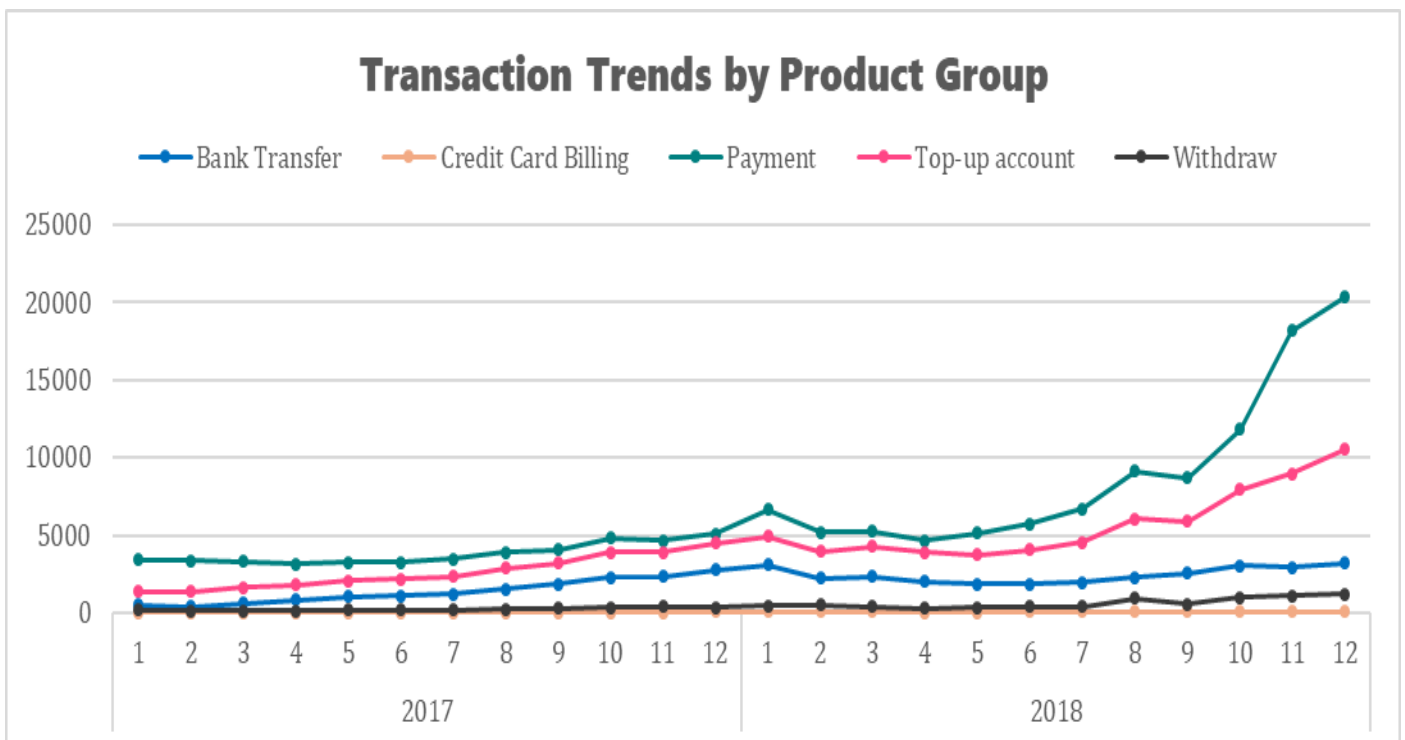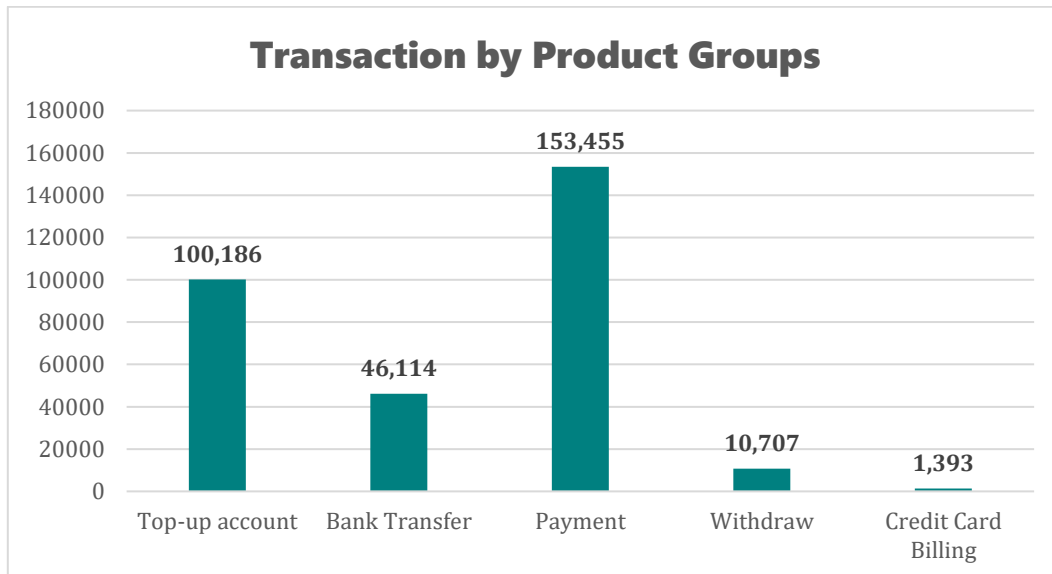
The payment product group is the most commonly used, with over 150K transactions, followed by the top-up account product. The credit card billing product group performs the worst, with only 1,300 transactions. Looking at the chart, we can conclude that the continuous growth in

the number of transactions from 2017 to 2018 is largely due to the increase in transactions in the payment product group.

Total money by Product Groups

Bar chart showing total money by product groups: Top-up account approximately $120,000,000,000; Bank Transfer approximately $92,000,000,000; Payment approximately $30,000,000,000; Withdraw approximately $18,000,000,000; Credit Card Billing approximately $5,000,000,000.

Money transaction trends by Products

Line chart showing monthly money transaction trends for 2017 and 2018 across five products: Bank Transfer, Credit Card Billing, Payment, Top-up account, and Withdraw.

In terms of transaction amount, the top-up account product group ranks first with a total transaction value exceeding 120 billion. Following that is the bank transfer product group. The credit card billing product group remains the lowest.

We can see that during the late months of 2017 and 2018, the total transaction amounts for the top-up account and bank transfer product groups increased rapidly, significantly contributing to the growth in total transaction amounts during the year-end periods.

Methods by Products	total_transactions	total_money
⊟ **Bank Transfer**	**46,114**	**$ 92,347,140,115**
money in app	46,114	$ 92,347,140,115
⊟ **Credit Card Billing**	**1,393**	**$ 4,333,271,278**
money in app	1,038	$ 3,131,820,678
banking account	249	$ 906,432,030
local card	100	$ 285,745,734
debit card	6	$ 9,272,836
⊟ **Payment**	**153,455**	**$ 29,800,272,458**
money in app	99,491	$ 8,495,829,832
credit card	21,394	$ 11,489,303,458
local card	14,949	$ 3,311,259,285
banking account	12,033	$ 4,535,070,015
debit card	5,588	$ 1,968,809,868
⊟ **Top-up account**	**100,186**	**$ 120,812,497,665**
banking account	50,380	$ 67,284,721,850
local card	42,725	$ 45,570,445,078
debit card	7,081	$ 7,957,330,737
⊟ **Withdraw**	**10,707**	**$ 17,378,188,369**
money in app	10,707	$ 17,378,188,369

In most product groups, customers prefer using the money in app method for transactions. In the payment product group, transactions using money in app reach nearly 100k. However, in the top-up account product group, the banking account method leads in the number of transactions.

b. Promotion orders.

Percentage of Promotion vs. Non-Promotion Orders
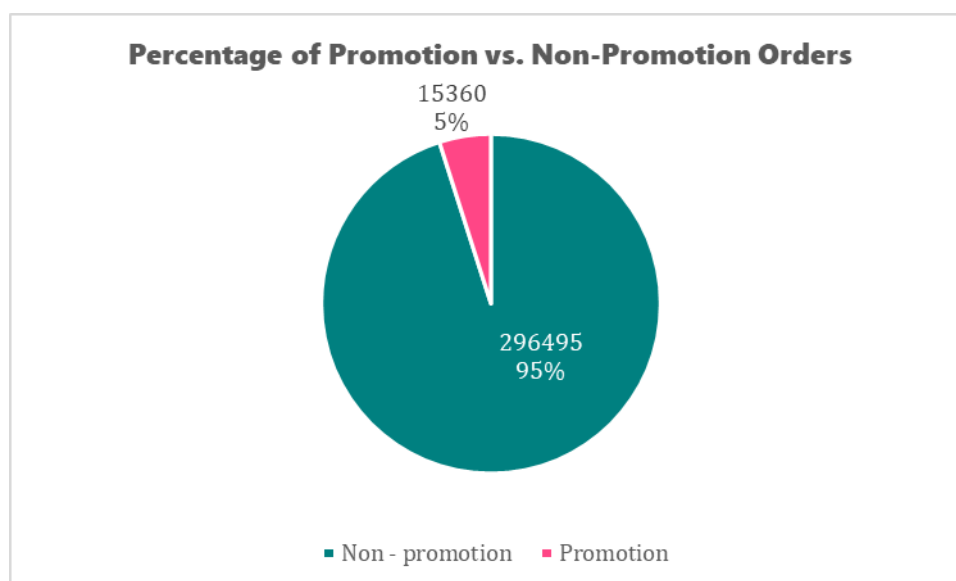
There are over 296K transactions without promotions and only over 15K transactions with promotions, accounting for 5% of the total transactions.
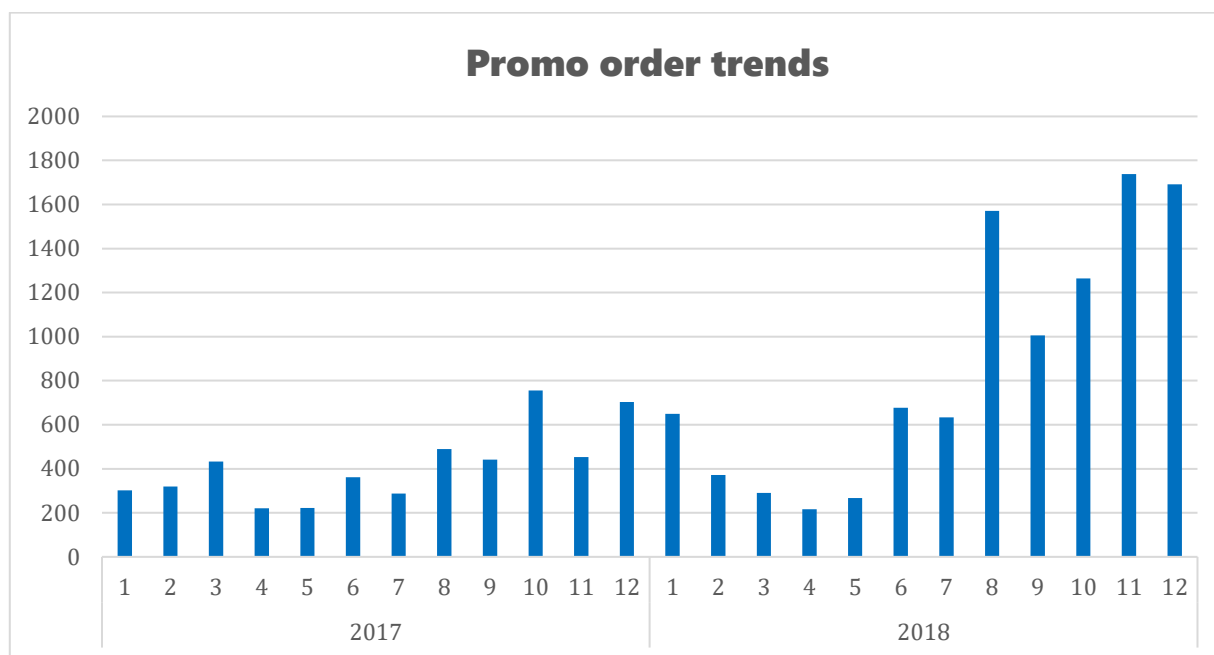
The number of promotional orders tends to increase at the end of the year, especially surging at the end of 2018.
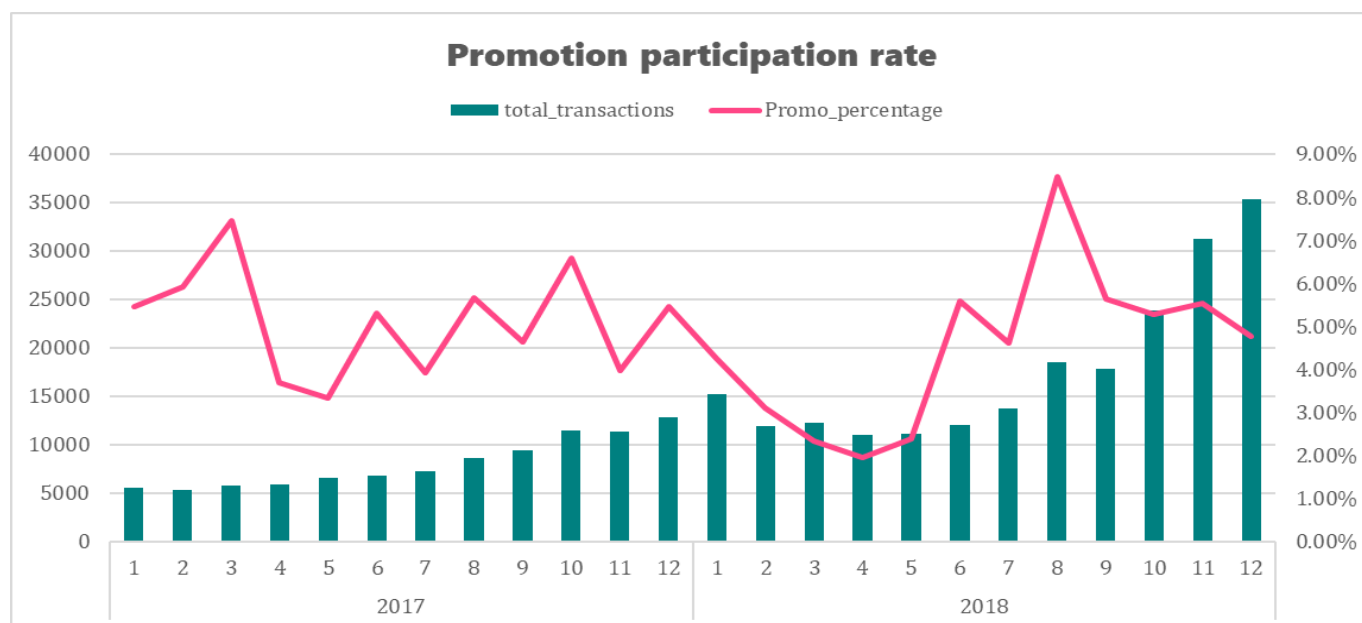
However, when analyzing the percentage of promotional orders out of the total orders by year, we can see that this percentage tended to decrease in 2017. Meanwhile, in 2018, the percentage showed a slight upward trend. This phenomenon indicates that the number of promotional transactions in 2017 did not increase at the same rate as the total number of transactions. This could be due to changes in customer behavior or the company's promotional strategies.

product_group	promo_status	total_transactions
Bank Transfer	Non - promotion	46114
Credit Card Billing	Non - promotion	1393
Payment	Non - promotion	138095
Payment	Promotion	15360
Top-up account	Non - promotion	100186
Withdraw	Non - promotion	10707

The payment product group is the only one that benefited from promotions.

Promotional orders by Category

Telco 8569, Billing 2278, Movies 1610, Shopping 986, FnB 890, Marketplace 614, Traveling 396, Transportation 17
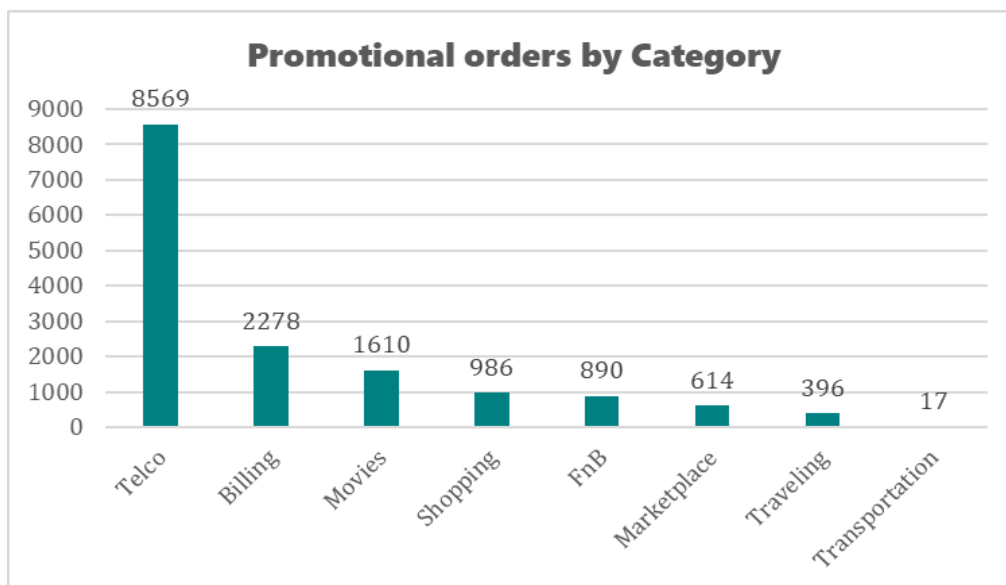
Diving deeper into the promotional transactions within the payment product group, we see that the telco category has the most promotional transactions, followed by the billing category. The transportation category has the fewest promotional transactions, with only 17.

6. Retention Rates.

In 2017:

first_month	original_customer	month_0	month_1	month_2	month_3	month_4	month_5	month_6	month_7	month_8	month_9	month_10	month_11
1	1140	100%	58%	55%	50%	45%	45%	44%	44%	43%	41%	41%	40%
2	613	100%	29%	24%	26%	24%	23%	23%	20%	21%	20%	21%	
3	404	100%	40%	30%	31%	28%	31%	27%	26%	27%	30%		
4	252	100%	51%	42%	34%	35%	34%	36%	35%	34%			
5	223	100%	43%	44%	40%	38%	37%	32%	33%				
6	183	100%	45%	43%	38%	42%	36%	38%					
7	196	100%	52%	43%	41%	40%	35%						
8	294	100%	44%	36%	32%	30%							
9	219	100%	52%	43%	39%								
10	348	100%	38%	30%									
11	205	100%	55%										
12	305	100%											
Total		100%	46%	39%	37%	35%	34%	33%	32%	31%	30%	31%	40%

Overall, the number of new customers decreases month by month, and the retention rate of each customer cohort also tends to decline over time. The January cohort is the best for us, with the highest retention rate, meaning they return to use our app the most. In contrast, the February and March cohorts have low retention rates, indicating these customers are less interested and do not use our product much.

In 2018:

first_month	original_customer	month_0	month_1	month_2	month_3	month_4	month_5	month_6	month_7	month_8	month_9	month_10	month_11
1	2326	100%	56%	51%	45%	45%	47%	46%	50%	46%	50%	50%	52%
2	528	100%	41%	34%	33%	34%	33%	38%	35%	38%	39%	39%	
3	286	100%	42%	39%	36%	31%	40%	34%	31%	38%	35%		
4	258	100%	48%	38%	36%	41%	37%	38%	36%	38%			
5	274	100%	41%	35%	37%	40%	38%	43%	41%				
6	269	100%	49%	48%	42%	51%	47%	46%					
7	309	100%	53%	48%	47%	46%	49%						
8	1032	100%	38%	39%	38%	36%							
9	525	100%	50%	47%	45%								
10	893	100%	53%	47%									
11	1093	100%	56%										
12	1087	100%											
Total		100%	48%	43%	40%	41%	42%	41%	39%	40%	41%	45%	52%

The number of new customers in 2018 also showed a sharp decline month by month, but there were signs of an increase towards the end of the year. Looking at the retention rate of each customer cohort, we can see that this year's retention rate is significantly higher than last year's, indicating that the company is doing a very good job in retaining its customers.

A notable difference compared to last year is that the retention rate showed a decline in the early months of the year, but increased towards the end of the year.

Could it be that customers returning at the end of the year are due to the company's successful promotion programs during this period?

Let's examine the retention rates of two groups of customers: those who received promotions and those who did not, month by month.

Retention rate by Non – promotion Status

first_month	original_customer	0	1	2	3	4	5	6	7	8	9	10	11
1	2234	100%	57%	51%	45%	45%	46%	46%	49%	46%	49%	50%	51%
2	501	100%	41%	33%	32%	32%	33%	37%	31%	35%	37%	38%	
3	287	100%	45%	38%	32%	32%	38%	33%	30%	38%	34%		
4	266	100%	47%	36%	35%	38%	35%	35%	35%	39%			
5	272	100%	42%	35%	34%	36%	35%	41%	40%				
6	247	100%	48%	45%	43%	49%	45%	47%					
7	302	100%	52%	46%	45%	44%	47%						
8	948	100%	36%	38%	38%	36%							
9	487	100%	52%	51%	48%								
10	889	100%	52%	45%									
11	1081	100%	54%										
12	1082	100%											
Total		100%	48%	42%	39%	39%	40%	40%	37%	40%	40%	44%	51%

Retention Rate by Promotion Status

first_month	original_customer	0	1	2	3	4	5	6	7	8	9	10	11
1	403	100%	11%	10%	6%	7%	18%	12%	13%	12%	19%	16%	16%
2	257	100%	7%	7%	10%	21%	15%	16%	13%	17%	18%	15%	
3	190	100%	3%	6%	25%	16%	16%	12%	19%	16%	13%		
4	153	100%	8%	20%	15%	24%	12%	20%	21%	14%			
5	172	100%	16%	10%	20%	17%	17%	22%	15%				
6	267	100%	13%	21%	12%	18%	23%	20%					
7	252	100%	23%	16%	17%	26%	19%						
8	565	100%	21%	15%	19%	13%							
9	366	100%	17%	16%	14%								
10	439	100%	22%	23%									
11	489	100%	22%										
12	523	100%											
Total		100%	15%	14%	15%	18%	17%	17%	16%	15%	17%	16%	16%

We can see that the retention rate of the group of customers who did not receive promotions tends to increase in parallel with the overall customer retention rate each month in 2018. Therefore, we can conclude that the promotional programs did not influence customer retention.

The retention rate in 2018 shows an upward trend, which could be due to various factors. These factors might include increased demand for shopping and transactions towards the end of the year, attracting customers to return, or the marketing team sending emails to invite old customers to return and use the product.

IV. Summary & Recommendations.

1. Summary.

After analyzing the data from the online payment app, I can draw some conclusions as follows:

1. Transaction Growth and Seasonal Trends: Transactions in 2018 surged significantly compared to 2017, peaking towards the end of each year during festive seasons like Christmas and Tet Holiday.

2. Peak Hours: High transaction volumes occur typically from 7 AM to 9 PM, aligning with people's daily activities and work hours.

3. Transaction Failures: The correlation between increasing transaction volumes and rising failure rates underscores the challenges faced, despite overall improvements in error management. However, the failure rates in 2018 reduced significantly compared to 2017, indicating major system updates.

4. Common Errors: The most common errors were **'payment failed'**, **'incorrect password',** and **'insufficient funds'**, which increased notably towards the end of 2018. Addressing these issues is crucial for improving customer experience.

5. Preferred Payment Method: Users favored 'Money in app' the most, with over 160,000 successful transactions, showing a strong upward trend by late 2018.

6. Product Analysis: Payment and top-up account were the most used product categories over both years, with top-up accounts showing the highest transaction amounts. Money in app was preferred except in the top-up account category, where banking accounts were favored.

7. Promotion Analysis: Promotion-related orders constituted only 5% of total orders, with a declining trend in 2017 and a slight increase in 2018. Only payment products received promotions, with telco transactions having the highest promotion volume, nearly 9k orders.

8. Retention Rates: Retention rates in 2017 were stable, while 2018 saw a mid-year decline followed by a slight recovery towards year-end. The decline was not attributable to promotion programs, suggesting other factors at play that require further investigation.

2. Recommendations.

1. Reducing Failed Transactions:

- **Payment Failed Errors:**

  - **Enhance Payment Gateway Stability:** Regularly update and maintain the payment gateway to handle high transaction volumes, especially during peak hours and end-of-year periods.

  - **Load Balancing:** Implement load balancing techniques to distribute transaction loads evenly across servers to prevent overloading and ensure smooth processing.

  - **Transaction Retry Mechanism:** Implement a retry mechanism for failed transactions to automatically re-attempt the transaction after a brief delay.

- **Incorrect Password Errors:**

  - **Improve User Interface:** Simplify and clarify the payment interface to minimize errors during password entry. Use larger, more readable fonts and clear instructions.

  - **Multi-factor Authentication:** Implement multi-factor authentication to reduce reliance on passwords alone and enhance security.

- **Insufficient Funds Errors:**

- o **Real-time Balance Updates:** Ensure users have access to real-time balance updates before initiating transactions to prevent insufficient funds errors.

- o **Notification Alerts:** Send alerts to users when their account balance is low, encouraging them to top up their accounts before making transactions.

2. Enhancing Customer Experience:

- **User Education and Support:**

  - o **Educational Campaigns:** Launch campaigns to educate users about common transaction errors and how to avoid them.

  - o **24/7 Customer Support:** Provide round-the-clock customer support to assist users with transaction issues and improve their overall experience.

- **Promotion and Loyalty Programs:**

  - o **Targeted Promotions:** Offer targeted promotions to users who frequently experience transaction failures, encouraging them to continue using the platform.

  - o **Loyalty Rewards:** Implement a loyalty program to reward users for consistent usage and positive behavior, such as successful transactions without errors.

- **User Interface Improvements:**

  - o **Streamlined Navigation:** Simplify the navigation and transaction process within the app to reduce the likelihood of user errors.

  - o **Personalized Experience:** Personalize the user experience based on transaction history and preferences to make the process smoother and more intuitive.