1. Introduction

The purpose of this assessment is to examine the influence of currency-country mismatch on the success of subscription payments and offer valuable insights to XYZ' product strategy team.

Our research revolves around three key questions that shed light on the payment dynamics within XYZ' subscription model. Firstly, we explore the implications when a XYZ subscription customer chooses to make a payment in a currency that does not align with the country code associated with their card. Secondly, we investigate the probability of a failed transaction when a customer possesses a non-Nigerian country code card and opts to make payments in either Naira or USD. Lastly, we compare these findings with the experience of customers who pay in Naira but possess a Nigerian country code card.

2. Methodology

2.1. Methods

This study aims to investigate the effect of subscription customers' payment channels on checkout transaction status indicated in the dataset as failed or success. Our sample data represent de-identified customer checkout transaction records obtained from fintech - a Nigerian financial technology company that offers payment processing services. I propose the following methods to answer each question.

1. *What happens if a XYZ subscription customer makes a payment in a currency that doesn't match the card's country code?*
   - Analyze transaction data from XYZ subscription payments to identify instances where customers made payments in a currency that doesn't match their card's country code.
   - Examine the outcomes of these transactions, such as successful payments, failed payments, or other related issues.
   - Statistical analysis: Conduct statistical analysis to determine the frequency and distribution of payment failures and success or any other notable issues that occur when customers use a different currency than their card's country code.
2. *What is the likelihood of a failed transaction if a customer with a non-Nigerian country code card makes payment in Naira and in USD?*
   - Transaction analysis: Analyze the success rates and failure rates of these transactions to determine the likelihood of a failed transaction for each currency.
   - Compare the failure rates of transactions in Naira and USD to assess if there is any significant difference between the two currencies.

3. *How does it compare with customers paying in Naira with a Nigerian country code card?*
   - Gather transaction data specifically for customers with Nigerian country code cards who made payments in Naira.
   - Analyze the success rates and failure rates of these transactions.
   - Comparative analysis: Compare the failure rates of transactions made by customers with Nigerian country code cards in Naira with the failure rates observed in the previous question for customers with non-Nigerian country code cards making payments in Naira and USD.

2.2. Tools

Our data analysis will be performed using Python, leveraging libraries such as `pandas` for data manipulation and analysis, `numpy` for numerical computation and array manipulation, `matplotlib` for data visualization, and `scikit-learn` for logistic regression modeling. We will handle missing values `null` and irrelevant observations such as *abandoned* and *reversed*.

2.3. Assumption

1. The provided dataset captures first-time subscription payment attempts on the XYZ website.
2. The transaction status accurately represents the success or failure of the payment.
3. The currency and country code provided in the dataset accurately reflects the customer's intended payment method and card origin.
4. Successful transactions matched the holder's country card code to the currency. eg Nigerian cards paid in Naira and USD cards paid in USD succeeded.
5. A currency-country mismatch on subscription payment resulted in a failed transaction.
6. Each customer specifies only one payment option for their transactions, and the payment options (USD and Naira) are mutually exclusive, meaning there is no intersection between them.

3. Data Analysis & Results

3.1. Data Preprocessing and Cleaning
1. **Check data types**: The data types in this dataset make sense. All of the columns that I would expect to have categorical types seem to have them.
2. **Check missing data**: After a quick check for null values in the dataset, it seems that there are 1316 null values appearing in the categorical column `country_code`.
3. **Categorical variables**: There are no categories that obviously mean the same thing or have very small frequency counts. I take note of reversed transactions under the status column with frequency counts of 41.

4. **Duplicates**: There is no ID in this dataset so there is no way to know for sure whether records are duplicated.

3.2. Data Descriptions and Visualizations

The raw dataset consists of 3 columns: `status`, `currency`, and `country_code`, with a total of **3276** observations. Among these observations, we identified **1316** records with null values in the country_code column, which we have excluded from further analysis. The status column exhibits four distinct categories: success, failed, abandoned, and reversed. **Chart 1** visualizes the categorical columns, displaying only the non-null values.
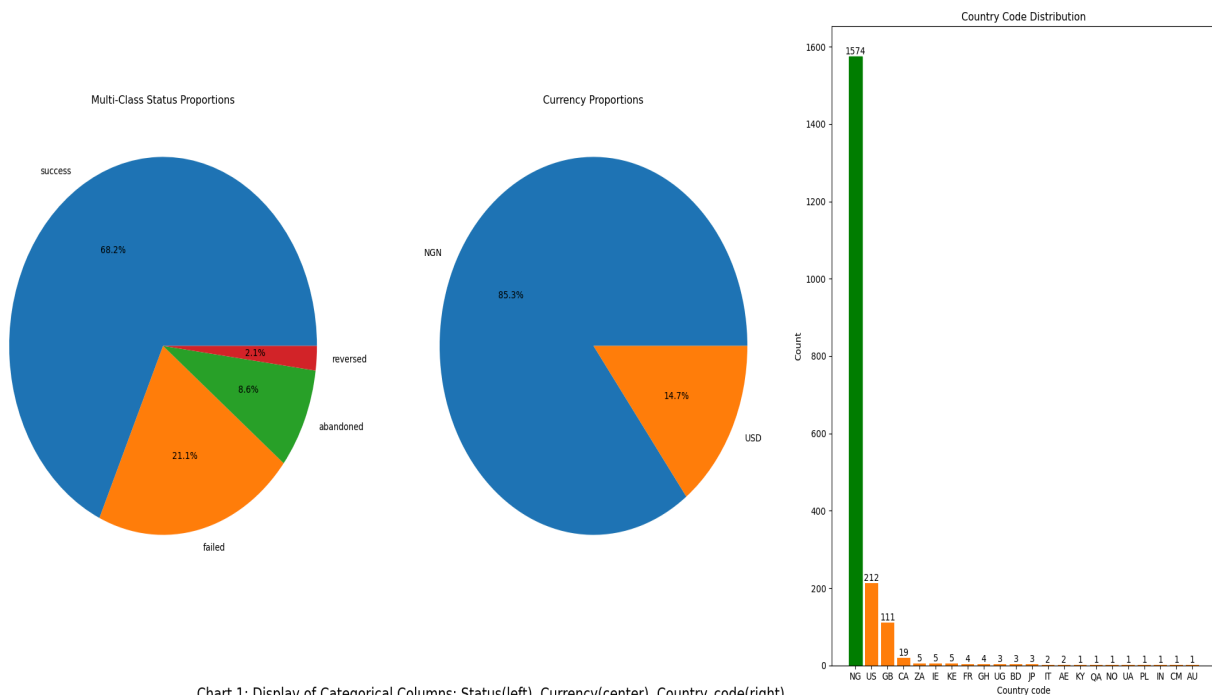

Chart 1: Display of Categorical Columns; Status(left), Currency(center), Country_code(right).

The chart above illustrates the distribution of categorical columns in the dataset. The left subplot represents the 'Status' column, the center subplot represents the 'Currency' column, and the right subplot represents the 'Country_code' column.

Research question 1:

What happens when a customer attempts to make a payment using a currency that does not align with the country code associated with their card?

In our dataset, we have identified 210 instances of both successful and failed transactions where customers made payments using a currency that does not match their card's country code. To further analyze this situation, we will calculate the raw value matrix and probability matrix to gain insights into the outcomes and probabilities associated with such transactions. These matrices will provide a comprehensive understanding of the implications of using mismatched currencies-country cards during payment transactions.

Raw value matrix

Status	Currency		
	NGN	USD	Total
failed	50	27	77
success	57	76	133
Total	107	103	210

Probability Matrix

Status	Currency		
	NGN	USD	Total
failed	0.238095238095238808	0.12857142857142856	0.36666666666666664
success	0.2714285714285714	0.3619047619047619	0.6333333333333333
Total	0.5095238095238095	0.49047619047619045	1.0

Table 1: Frequency and Distribution of Payment Failures and Success with Different Currency-Country Code Usage

Table 1 above provides information on the frequency and distribution of payment failures and successes that occur when there is a mismatch between the currency and country code used in a transaction. It examines the outcomes of payment transactions where the currency and country code do not align appropriately. The data highlights the prevalence and distribution of payment failures and successes in these mismatched scenarios, offering insights into the impact of such discrepancies on the overall payment process.

The findings reveal that individuals with a mismatched currency-country card are approximately twice as likely (46.73%) to encounter a failed transaction when making payments in Naira, compared to when they make payments in USD (26.21%). This indicates that utilizing Naira as the payment currency, when it does not align with the country code associated with the card, significantly amplifies the probability of payment failures for individuals with a mismatched country card.

Research question 2:

Is there a higher likelihood of a failed transaction for customers with a non-Nigerian card when attempting to make payments in Naira compared to payments in USD?

To investigate this research question, we have identified a sample of 314 customers who possess a non-Nigerian country code and have made payments in both Naira and USD. By analyzing their transaction data, we can assess whether there is a notable difference in the failure rates between payments made in Naira and USD for customers with non-Nigerian cards. This analysis will provide insights into the impact of currency choice on payment success and help determine whether customers with a non-Nigerian card encounter higher failure rates when paying in Naira compared to USD.

Raw Value Matrix Table - Non-Nigerian Country Code/card

	Currency		
Status	NGN	USD	Total
failed	50	81	131
success	57	126	183
Total	107	207	314

Table 2: Frequency and distribution of payment failures and success that occur when customers pay in Naira and USD with Non-Nigerian country code card

Table 2 above presents the frequency and distribution of payment failures and successes that occur when customers use non-Nigerian country code cards to make payments in both Naira and USD. It provides insights into the outcomes of these payment transactions, shedding light on the patterns and proportions of failures and successes in relation to different currencies and country code card types.

The results indicate that the failure rate for customers with non-Nigerian cards is **46.73%** when they choose to pay in Naira. In contrast, the failure rate drops to **39.13%** when the same customers opt to pay in dollars (USD). This suggests that customers with non-Nigerian cards have a higher likelihood of experiencing failed transactions when paying in Naira compared to when they choose to pay in USD.

Research question 3:

How does the payment behavior of individuals using Naira with non-Nigerian cards compare to those using Naira with Nigerian cards?

To explore this research question, we have identified a total of **1417** customers who made payments in Naira using Nigerian cards. By examining the payment behavior of individuals using non-Nigerian cards in Naira and comparing it to the behavior of individuals using Nigerian cards in Naira, we can gain insights into any differences in payment outcomes and success rates. This analysis will provide valuable information on how the type of card (Nigerian vs. non-Nigerian) impacts payment transactions in Naira, enabling a better understanding of customer behavior and payment preferences.

Raw value matrix - Nigerian country code card

	Currency	
Status	NGN	Total
failed	270	270
success	1147	1147
Total	1417	1417

Probability Matrix - Nigerian country code card

	Currency	
Status	NGN	Total
failed	0.19054340155257588	0.19054340155257588
success	0.8094565984474241	0.8094565984474241
Total	1.0	1.0

Table 3: Frequency and Distribution of Payment Failures and Success When Customers Pay in Naira with Nigerian Country Code Card

The **table 3** above presents the frequency and distribution of payment failures and successes that occur when customers make payments in Naira using a Nigerian country code card. It provides insights into the occurrence and distribution of payment outcomes, including failures and successes, in these specific cases. This analysis allows for an examination of the payment behavior and outcomes associated with customers using the Naira as the payment currency with a Nigerian country code card.

The results indicate that individuals with a non-Nigerian card are more than **twice** as likely (46.73%) to experience a failed transaction when paying in Naira compared to individuals with a Nigerian card paying in Naira (19.05%). This highlights a significant difference in payment failure rates between these two groups, suggesting that using Naira as the payment currency with a non-Nigerian card increases the likelihood of payment failures compared to using Naira with a Nigerian card.

In contrast, the results reveal a significant disparity between the failure rates when a Nigerian card pays in Naira and when it pays in dollars. Specifically, the failure rate drops significantly from **65%** when paying in dollars to **19.05%** when paying in Naira. This highlights the importance of utilizing the Naira as the payment currency with a Nigerian card, as it significantly improves the likelihood of successful transactions and reduces the occurrence of payment failures.

Assumption Evaluation

We will evaluate the assumptions by comparing the insights from data analysis with the assumption and assessing whether the evidence supports or contradicts the assumption.

1. The provided dataset captures first-time subscription payment attempts on the XYZ website.
   - This assumption is valid and holds true based on the information provided in the problem statement, which indicates that the dataset includes data related to initial payment transactions for new subscriptions.
2. The transaction status accurately represents the success or failure of the payment.
   - This assumption holds true unless there is evidence provided to suggest otherwise.
3. The currency and country code provided in the dataset accurately reflects the customer's intended payment method and card origin.
   - This assumption may be partially valid and requires further investigation to assess both failed and successful transactions.
4. Successful transactions matched the holder's country card code to the currency. eg Nigerian cards paid in Naira and USD cards paid in USD succeeded.
   - There is sufficient evidence to suggest that this assumption does not hold true. For example, in the dataset, all five transactions from Kenya (country code KE) were successful, while transactions with a US country code paying in USD currency experienced both failures and successes, including instances where they failed when paying in USD but succeeded when paying in Naira.

Therefore, further analysis is required to understand the relationship between country codes, currencies, and transaction success accurately.

5. A currency-country code mismatch on subscription payment always resulted in a failed transaction.

   - Evidence indicates that this assumption is invalid, as there are instances where a currency-country code mismatch has resulted in successful transactions. Therefore, it is clear that the relationship between currency-country code mismatch and transaction outcome is more complex and requires further investigation to understand the factors influencing payment success or failure accurately.

6. Each customer specifies only one payment option for their transactions, and the payment options (USD and Naira) are mutually exclusive, meaning there is no intersection between them.

   - This assumption holds true because a customer cannot choose two payment options at the same time.

4. Conclusions and Recommendations

Conclusions

In summary, the analysis reveals interesting trends in payment success rates based on currency and card type. Customers with Nigerian cards who make payments in Naira have a significantly higher likelihood of success, with an 80.95% success rate compared to a 65% failure rate when paying in dollars. On the other hand, customers with non-Nigerian cards making payments in USD have a 60.87% success rate, surpassing the 53.27% success rate for those paying in Naira.

Moreover, the failure rate for non-Nigerian cardholders paying in Naira is 7.6% higher than if they choose to pay in dollars. This highlights the impact of currency selection on transaction outcomes. Additionally, individuals with non-Nigerian cards are more than twice as likely to experience failed transactions when paying in Naira compared to individuals with Nigerian cards paying in Naira. Similarly, individuals with a mismatched country card face double the likelihood of failed transactions when paying in Naira compared to those with a mismatched country card paying in USD.

These findings underscore the importance of currency-country card alignment and currency selection during the payment process to mitigate potential issues. It provides valuable insights for optimizing payment processes and enhancing transaction success rates for XYZ's local and international clients.

Recommendation

1. Enhance visibility and accessibility of the USD payment option on the website: Given the expanding international customer base, it is crucial to ensure that the USD payment option is prominently displayed and easily accessible. This will cater to the preferences of customers who prefer paying in dollars.

2. Implement an automated currency recommendation system: Develop a system that automatically suggests the appropriate payment currency based on the customer's card country. This will streamline the payment process and reduce the likelihood of customers selecting an unsuitable currency, leading to failed transactions.

3. Conduct targeted communication campaigns: Launch targeted communication campaigns to educate customers about the benefits of using the appropriate currency during payment. Emphasize how selecting the correct currency can minimize failed transactions and enhance user satisfaction. This can be done through email newsletters, website banners, or targeted advertisements.

4. Regularly monitor and analyze payment success rates: Continuously monitor and analyze payment success rates to identify any emerging patterns or issues. This proactive approach will enable the implementation of measures to address and resolve any potential problems promptly.

5. Educate customers on the importance of selecting the country code: As 44% of the total transactions were abandoned, with 80% of those abandoned observations having a null country code, it is recommended to educate clients about the implications of not selecting the country code during the payment process. Highlight the significance of providing accurate information to ensure successful transactions.

6. Investigate the root cause of abandoned transactions: Given a large number of abandoned transactions, further investigations are necessary to determine the root causes. Identify any underlying issues in the payment process or user experience that may contribute to the high abandonment rate.

7. Verify international payment compatibility with banks: Recommend that customers liaise with their banks to ensure their bank or bank cards can facilitate international payments. This step will help customers avoid any potential limitations or restrictions that may lead to failed transactions.

8. Collect additional data on customer location, card type, and transaction amount: Gather more comprehensive data that incorporates variables such as customer location, card type, and transaction amount. Analyzing these factors alongside payment success rates can provide deeper insights into the specific factors contributing to failed transactions in each currency.

By implementing these recommendations, the product strategy team can improve the payment experience, reduce failed transactions, and enhance customer satisfaction, ultimately maximizing the success and effectiveness of the payment platform

Further research

To gain a deeper understanding of the factors influencing payment success or failure rates and address the challenges related to currency mismatch, I recommend conducting further research in the following areas:

1. Payment processing systems and gateway restrictions: Investigate the payment processing systems and gateways utilized by XYZ to identify any specific restrictions or limitations that may impact transactions involving non-matching currencies. Explore the technical aspects and protocols involved in currency conversion and the associated regulations.

2. User surveys and interviews: Conduct surveys or interviews with XYZ subscription customers who have experienced making payments in a different currency. Gather their feedback, experiences, and any issues encountered during the payment process. This qualitative research approach will provide valuable insights into user experiences, pain points, and suggestions for improvement.

3. Payment gateway analysis: Collaborate with the payment gateway provider used by XYZ to understand their policies and mechanisms for handling transactions involving mismatched currencies and country codes. Review their documentation, engage with their support team, and examine their APIs to gain insights into how they handle these scenarios and identify any potential areas for improvement.

4. Regulatory compliance: Investigate the relevant currency conversion regulations and compliance requirements for international transactions. Ensure that XYZ is adhering to the necessary regulations and explore any potential impact on payment success rates.

5. Methods and analysis: Perform a logistic regression analysis to gain statistical evidence and quantifiable insights into the relationship between the customer's country code, chosen currency, and the likelihood of failed transactions. This analysis can help identify any significant predictors and inform decision-making processes to improve payment success rates. Additionally, conduct hypothesis testing to determine the significance of the observed differences in the likelihood of a failed transaction between payments made in Naira and USD by customers with a non-Nigerian country code card. This will provide valuable insights into the impact of payment currency on transaction success rates and inform decision-making processes to improve the payment system.