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Project #1: Risk Management
Fraud Detection and Analysis with Using Electronic Banking Services by Customers

1.0 Project Background

The growth of electronic banking services such as mobile applications, internet banking, debit/credit cards have increased convenience for customers, but it has also created opportunities for bad actors and cyber threats. Cybercriminals, insiders, third-party providers, and customers exploit weaknesses in banking systems for fraud to occur.

Project Objective:

The objective of this project analyzes various risks capable of causing fraud associated with the use of electronic banking products by customers. The objective is broken into four (4) areas:

- Identify and analyze risk areas of using electronic banking services with sample datasets generated
- The risk matrix is applied to each risk area is assessed to determine its likelihood and impact to inform priority and resource allocation
- Recommend risk prevention, detection, and correction techniques guided by the NIST SP-800 53r5

Methodology:

The following methods were deployed in

- Acquired sample datasets relating to fraud transactions in the use of electronics banking services. 100 transactions were generated which includes information relating to: ***Transaction ID, Customer ID, Account type, Channel of transactions, Transaction date, Transaction Amount, Device ID, Merchant Category, Authentication type, Login failure counts, Country of residence, and Country of transaction,***

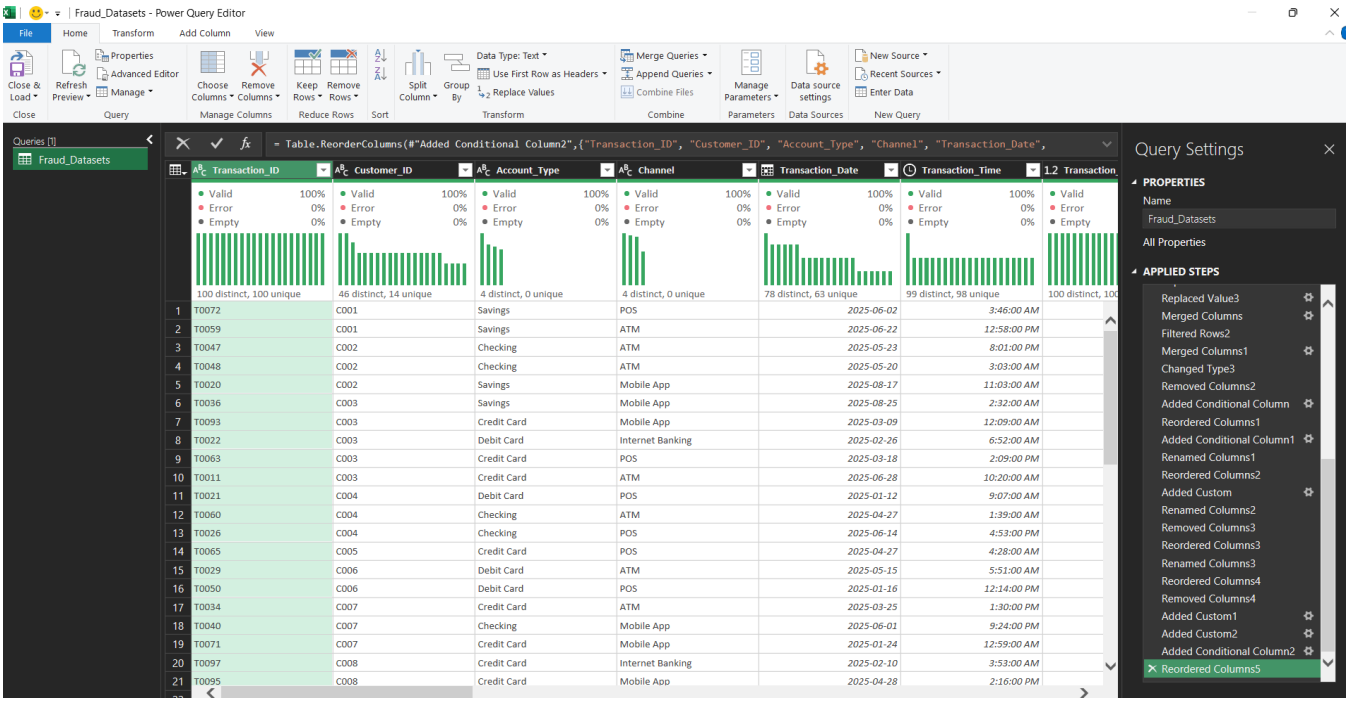
- SQL was used to customize the generated datasets. For example, the average transaction amount partitioned by customers ID was added.

```
Limit to 1000 rows

select * from fraud_dataset_amended_consistent;

select Customer_ID, Transaction_Amount, avg(Transaction_Amount) over (partition by customer_ID) as avg_tran_amount
from fraud_dataset_amended_consistent;

select Transaction_ID, Customer_ID, count(transaction_ID) over(partition by Transaction_Date) as transaction_count, Account_Type, Channel, Transaction_Date, Transaction_Amount, avg(Transaction_Amount) over (
Authentication_Type, Login_Failure_Count, Prev_Transaction_Time, Country_of_Residence, Country_of_Transaction, Mode_of_Card_Delivery
from fraud_dataset_amended_consistent;
```

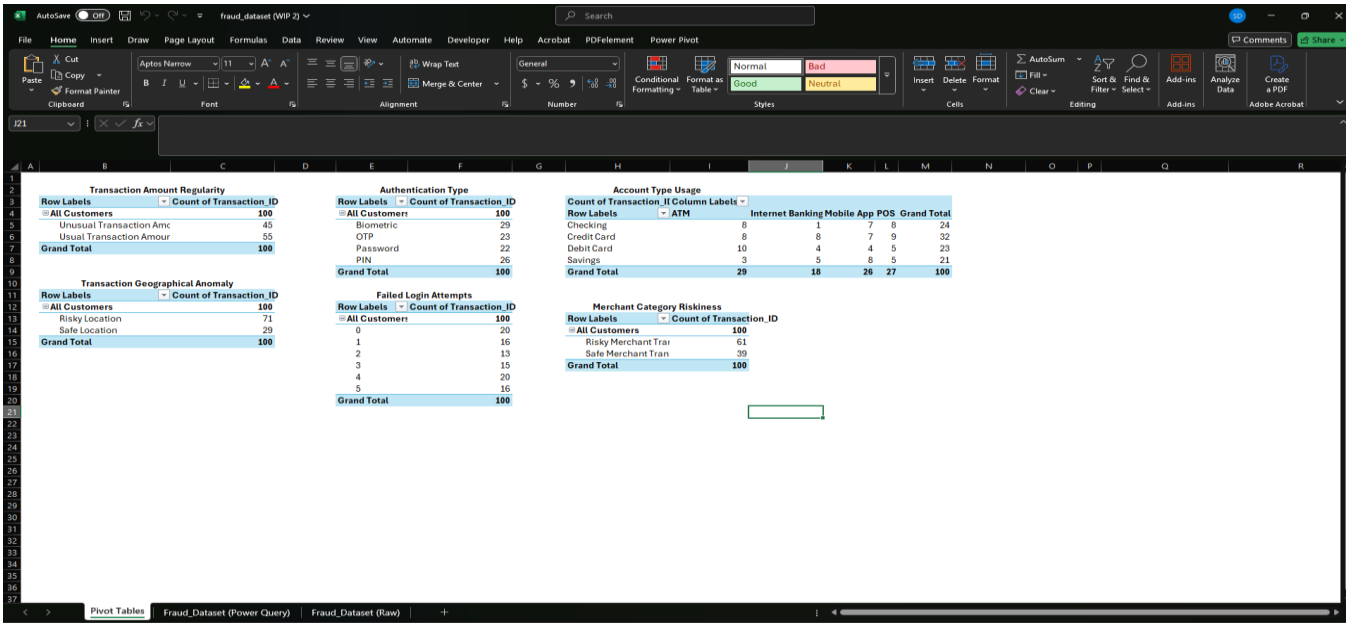
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Transaction_ID	Customer_ID	transaction_count	Account_Type	Channel	Transaction_Date	Transaction_Amount	avg_transaction_amount	location	Device_ID	Merchant_Category	Authentication_Type	Login_Failure_Count	Prev_Transaction_Time	C
T0072	C001	1	Savings	POS	2025-06-02 03:46:13	4743.46	3669.65	Lake Timothy	DEV2014	Food	Biometric	2	565	Zi
T0059	C001	1	Savings	ATM	2025-06-22 12:58:31	2595.84	3669.65	Jamesfort	DEV1807	Services	OTP	1	3756	Zi
T0047	C002	1	Checking	ATM	2025-05-23 20:01:28	9963.75	8637.28	Nixonside	DEV3332	Entertainment	OTP	4	1769	Ni
T0048	C002	1	Checking	ATM	2025-05-20 03:03:54	9557.91	8637.28	Morganland	DEV2966	Retail	Password	2	1725	Ni
T0020	C002	1	Savings	Mobile App	2025-08-17 11:03:57	6390.18	8637.28	Wigginsmouth	DEV6506	Travel	OTP	0	2095	Ni
T0036	C003	1	Savings	Mobile App	2025-08-25 02:32:39	3697.5	6551.482000000001	Bakerbury	DEV6305	Services	PIN	1	2175	Ri
T0093	C003	1	Credit Card	Mobile App	2025-03-09 00:09:15	4513.29	6551.482000000001	West Mark	DEV7980	Electronics	Password	5	3225	Ri
T0022	C003	1	Debit Card	Internet Banking	2025-02-26 06:52:52	8731.28	6551.482000000001	New Danaburgh	DEV1585	Entertainment	Biometric	0	2057	Ri

- The datasets were cleaned with Power Query



- Pivot tables were generated for possible fraud risk areas for focus



- Recommendations to prevent, detect, and correct identified risk areas using the NIST SP 800-53r5.

2.0 Project Outcomes

After analyzing the generated datasets, six (6) fraud risk areas were identified:

- Transaction amount regularity
- Transaction geographical anomaly
- Authentication type
- Failed login attempts
- Account type usage
- Merchant category riskiness

Transaction Amount Regularity

The average transaction of each customer is compared to each of the transactions performed by that same customer. Risk is identified where the actual transaction is greater than the average transaction amount for the customer. 45 transactions were identified as unusual.

Transaction Amount Regularity

Row Labels	Count of Transaction_ID
All Customers	**100**
Unusual Transaction Amount	45
Usual Transaction Amount	55
Grand Total	**100**

Transaction Geographical Anomaly

The country of residence was compared to the country of transaction and the authentication type. Where the country of residence differs from the country of transaction and the authentication type is neither biometric nor OTP, the geographical location is risky. 71 transactions were identified as risky locations.

Transaction Geographical Anomaly

Row Labels	Count of Transaction_ID
All Customers	**100**
Risky Location	71
Safe Location	29
Grand Total	**100**

Authentication Type

Biometric and OTP are more secure authentication type than password or PIN. 48 transactions are identified at risk based on authentication type.

Authentication Type

Row Labels	Count of Transaction_ID
All Customers	**100**
Biometric	29
OTP	23
Password	22
PIN	26
Grand Total	**100**

Failed Login Attempts

51 transactions with more than 2 failed login attempts are a risk.

Failed Login Attempts

Row Labels	Count of Transaction_ID
All Customers	**100**
0	20
1	16
2	13
3	15
4	20
5	16
Grand Total	**100**

Account Type Usage

Checking accounts, credit cards and debit cards are usually transactional in nature but an ATM or POS transaction on savings accounts are risks which defeats the purpose of savings. 8 transactions have been identified to be at risk based on account type usage

Account Type Usage

Count of Transaction_ID Row Labels	ATM	Internet Banking	Mobile App	POS	Grand Total
Checking	8	1	7	8	24
Credit Card	8	8	7	9	32
Debit Card	10	4	4	5	23
Savings	3	5	8	5	21
Grand Total	**29**	**18**	**26**	**27**	**100**

Merchant Category Riskiness

If the country of residence differs from the country of transaction and the merchant category is either electronics or travel, risk is higher than retail, services, entertainment or food. A customer will highly plan purchase of an electronic or travel expense and will usually perform such transactions from their country of residence. 61 transactions are at risk based on merchant category.

Merchant Category Riskiness

Row Labels	Count of Transaction_ID
All Customers	**100**
Risky Merchant Transaction	61
Safe Merchant Transaction	39
Grand Total	**100**

3.0 Risk Metrics

The risk metrics is defined by the risk level rating, likelihood rating and impact rating.

Risk Level

Risk level rating is defined by the likelihood rating and impact rating of each risk category.

Risk Level	Rating
Low Risk	2 and below
Medium Risk	3 - 4
High Risk	5 and above

Likelihood

Defined as the number of the affected transaction expressed as a percentage to the total number of transactions observed.

Likelihood	Percentage Referred	Rating
Unlikely	Less than 5%	1
Likely	Between 6% and 40%	2
Very Likely	Higher than 40%	3

Impact

Defined as the total amount value of the affected transactions.

Impact Severity	Percentage Referred	Rating	Investigation and Resolution Timeline
Minor	Less than $100,000	1	Up to 2 months
Serious	Between $100,001 and $300,000	2	Up to 1 month
Major	Higher than $300,000	3	Up to 1 week

Fraud Risk Area Risk Assessment

Risk Category	Likelihood		Impact Severity		Risk Rating	Risk Level
	Percentage	Rating	Amount	Rating		
Unusual Transaction Amount	45%	3	$237,360.61	2	5	High
Risky Location	71%	3	$368,462.63	3	6	High
Risky Authentication Type	48%	3	$259,189.51	2	5	High
Failed Login Attempts	51%	3	$262,576.6	2	5	High

Account Usage Risk	8%	2	$30,813.08	1	3	Medium
Merchant Category Risk	61%	3	$328,984.62	3	6	High

Risk Areas Priority and Required Controls

Due to scarce resource and budget constraints, the assessed risk areas must be prioritised as follows considering the overall risk rating and the impact severity amounts. Controls to assist prevent, detect and correct the identified risk areas using the NIST SP 800-53r5 have been recommended.

Risk Priority	Risk Category	Recommended Controls based on NIST SP 800-53r5
1	Risky Locations Transactions	AC-18: Wireless Access AC-19: Access Control for Mobile Devices AT-2: Literacy Training and Awareness AU-6: Audit Record Review, Analysis and Reporting AU-8: Time Stamps CA-2: Control Assessments CA-3: Information Exchange CA-7: Continuous Monitoring CM-4: Impact Analyses CP-2: Contingency Plan CP-9: System Backup IA-3: Device Identification and Authentication IA-8: User Identification and Authentication IR-8: Incident Response Plan RA-3: Risk Assessment RA-5: Vulnerability Monitoring and Scanning RA-7: Risk Response SC-12: Cryptographic Key Establishment and Management
2	Risky Merchant Category Transaction	
3	Failed login Attempts Risk	
4	Risky Authentication Type	
5	Unusual Transaction Amount	
6	Account Usage Risk	