Stephen Dornu Dugbartey
Edmonton, Alberta – Canada | +1 (825) 777-0501 | ddstephen07@gmail.com

Electronic Banking Fraud Risk Analysis

1.0 Executive Summary

Background

Banks cannot survive competition and utmost value creation without relying on electronic banking services such as mobile applications, internet banking, debit/credit cards. The services have increased convenience for customers, but have also created vulnerabilities and cyber threats which can cause a weak basis for fraud to occur.

Project Objective:

The objective of this project is prioritizing, a standard-guided view of electronic banking fraud risks that will enable management to proactively strengthen controls while optimizing fraud detection efficiency. The objective is broken into three (3) activities:

- Identify and analyse risk areas of using electronic banking services with sample datasets generated
- Assess the likelihood and impact of each risk area to inform priority and resource allocation
- Recommend fraud risk prevention, detection, and correction techniques guided by the NIST SP-800 53r5

Project Scope:

- 2850 transactions of electronic banking nature were selected
- 50 customers were involved with the selected datasets
- 4 account types were involved: checking, savings, credit card and debit card
- 4 channels were deployed for customers: POS, ATM, mobile app and internet banking
- The transactions were performed between 1st January 2025 and 1st January 2026
- 6 merchant categories were the focus: food, service, electronic, entertainment, travel and retail
- 4 authentication types were the focus: biometric, OTP, password and PIN

Tools Deployed:

- Microsoft Excel
- Power Query
- Pivot Tables
- Excel charts
- Semi-quantitative risk metrics
- NIST SP 800-53r5

Summary of Project Findings:

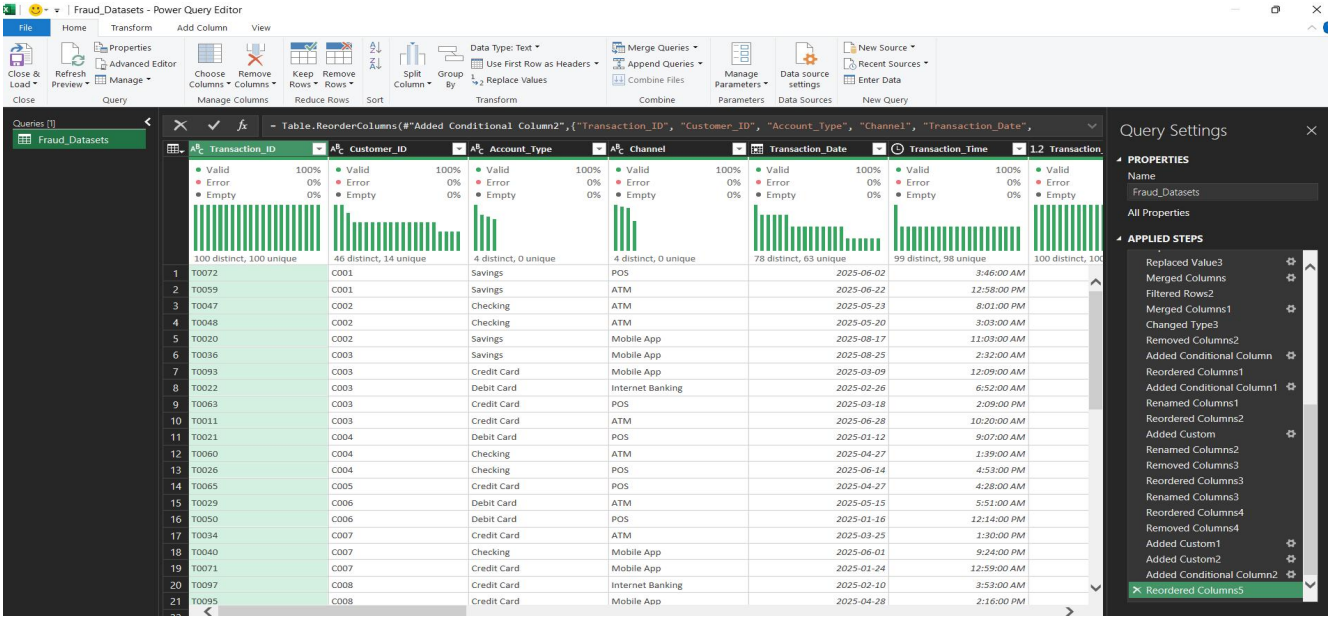
Generally, all the risk areas capture some form of irregularity that needs to be further investigated with strategies and additional controls put in place. There is 706 to 1505 transactions exposed and at transaction values at risk ranging from $2,763,645.81 to $10,701,598.31. Out of the 6 risk areas assessed, unusual transactions which defined by an actual transaction amount exceeding the average transaction amount of the same customer tops with transaction value while the transactions performed at risky locations defined as where the transaction country is different resident country of the custoemr and the authentication type is neither biometric or OTP. The risk level assessment is assigned to this areas based on their likelihood and impact. 5 high and 1 medium level risks were identified.

2.0 Methodology

The following method was deployed:

- Sample datasets was acquired relating to fraud transactions in the use of electronic banking services. 2500 transactions were generated to include the columns: ***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.***

- The datasets were cleaned with Microsoft Power Query.



- Some of the relationships that needed to exist to define some of the risk areas was calculated
  For example: the average transaction amount of each customer was calculated and compared to the transaction value of the same customer to determine unusual transactions of each customer. Where the transaction value is greater than the average transaction amount of the same customer, possible risk may exist for investigation

- Pivot tables were generated into possible fraud risk areas for focus and further assessment

Row Labels	Count of Transaction_ID
unusual transa	2836
usual transact	14
Grand Total	2850

Row Labels	Count of Transaction_ID
safe location transaction	1345
unsafe location transaction	1505
Grand Total	2850

Row Labels	Sum of Transaction_Amount
unusual transa	14292391.45
usual transact	82338.22
Grand Total	14374729.67

Row Labels	Sum of Transaction_Amount
safe location transaction	6717587.13
unsafe location transaction	7657142.54
Grand Total	14374729.67

Row Labels	Count of Transaction_ID
Biometric	733
OTP	760
Password	687
PIN	670
Grand Total	2850

Count of Transaction_ID	Column Labels				
Row Labels	Biometric	OTP	Password	PIN	Grand Total
Checking	361	367	354	336	1418
Credit Card	6	5	10	11	32
Debit Card	10	4	5	4	23
Savings	356	384	318	319	1377
Grand Total	733	760	687	670	2850

Row Labels	Sum of Transaction_Amount
Biometric	3619901.59
OTP	3830295.92
Password	3593655.98
PIN	3330876.18
Grand Total	14374729.67

Row Labels	Count of Transaction_ID
safe merchant transaction	2323
unsafe merchant transaction	527
Grand Total	2850

Row Labels	Count of Transaction_ID
0	465
1	468
2	496
3	449

Row Labels	Sum of Transaction_Amount
safe merchant transaction	11611083.86
unsafe merchant transaction	2763645.81
Grand Total	14374729.67

- Risk metrics (the likelihood and impact) was defined
- The risk metrics was used to assess the risk areas to ascertain their likelihood and impact
- Microsoft Excel was used to create a dashboard summary of the findings
- Strategies were recommended to prevent, detect, and correct identified risk areas based on NIST SP 800-53r5

Data Limitations

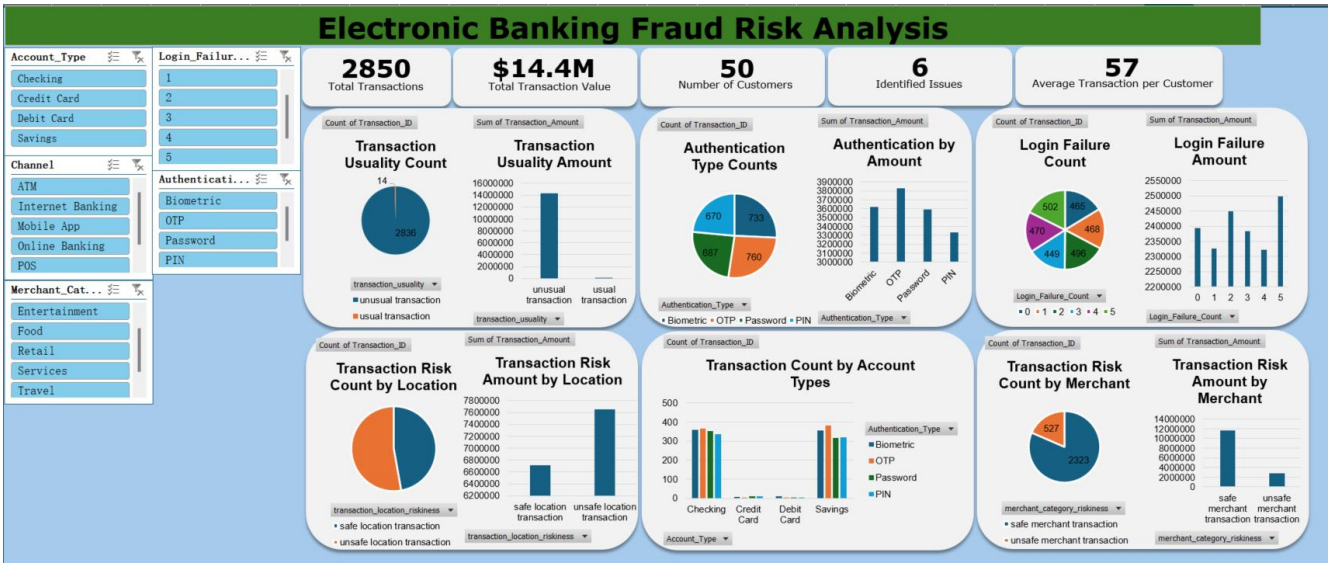
- Some fraud events may not be captured or incorrectly labeled in transaction logs. Some missing fields may include device ID, geographical location, and channels
- Fraudsters continuously change tactics to evade detection rules. Historical datasets may not reflect current or emerging fraud patterns.
- Strict privacy laws and internal policies limit access to sensitive data. Analysts may work with authorised datasets only.

3.0 Project Findings

After analysing the generated datasets, six (6) fraud risk areas were identified as follows:

- 1,429 transactions were identified as unusual. The total value exposed with this risk is $10,701,598.31
- 1,357 transactions are identified at risk with the use of password or PIN only. $6,924,532.16 is value is at risk.
- 1,421 transactions with 3 or more failed login attempts are a risk with $7,204,121.31 worth of transactions
- 1,505 transactions were identified as risky locations with $7,657,142.54 exposed.
- 706 transactions and $3,544,286.50 have been identified to be at risk based on account type usage.
- 527 transactions and $2,763,645.81 are at risk based on merchant category.

A summary of the outcome is shown in the dash board below:



Root Causes of Vulnerabilities with Electronic Banking:

- ***Weak authentication and access controls***. The electronic products of the bank work on different platforms connected over the internet. A weak password policy, weak multi-factor authentication and inadequate session management can cause some of these fraud risks to occur.
- ***Inadequate transaction monitoring and fraud detection***. Fraud events are dynamic with time, hence static rules and poor alert escalation will not help the bank adapt to and detect new fraud patterns.
- ***Vulnerabilities in applications and infrastructure security***. Architectural weaknesses in applications and IT infrastructure security can occur with outdated software, unpatched systems, weak encryption implementation and insecure API connecting banking systems.
- ***Non-compliance with security standards.*** The bank may have improper network segregation, or weak logging and monitoring of card transactions as recommended by NIST SP-800r5, or inadequate protection of cardholder data as recommended by PCI-DSS.
- ***Limited user awareness and social engineering controls.*** The bank may not have created enough awareness for their customers about social engineering and security practices required to stay safe while using the bank's electronic platforms. The staff of the bank may also not have adequate training or education regarding security and privacy trends to protecting customers.

Risk Impact to the Bank

Related fraud with the use of electronic banking products could result in the following risks:

- ***Financial loss to the customers and bank***. Unauthorized withdrawals could cause loss of customers while reimbursement and charge back will cost the bank's in the fraud event.
- ***Regulatory and compliance risk***. The fraud event could trigger regulatory findings for breach with consumer protection laws which may result in fines or stricter supervision conditions.

- ***Customer experience and reputation risk***. Customers may lose trust in the bank with their fraud experiences particularly, if the same fraud trend continues
- ***Operational disruption***. To resolve fraud occurrences, emergency shutdowns and high volumes of customer complaints will increase workload for fraud and customer support teams taking up existing financial resources, IT resources, human resources and time.
- ***Control breakdown and inefficiencies***. The need to correct errors will result in increased human intervention which may result in more errors and dire impacts.
- ***Legal and liability risk***. Customers may embark on lawsuits. Unbearable numbers of such lawsuits could shut down the bank's operations.

4.0 Details of Risk Areas Identified

Unusual Transaction Amount

The average transaction of each customer is compared to individual transactions performed by that same customer. Risk is identified where the actual transaction is greater than the average transaction amount for the same customer. It shows an unusual pattern traceable to the customer. 2836 transactions were identified as unusual. The total value exposed with this risk is $14,292,391.45

Row Labels	Count of Transaction_ID	Sum of Transaction_Amount
unusual transaction	2836	14292391.45
usual transaction	14	82338.22
Grand Total	**2850**	**14374729.67**

Risky Authentication Type

Biometric and OTP are more secure authentications than passwords or PIN because they involve a direct involvement of the actual customer to validate. 1,357 transactions are identified at risk with the use of password or PIN only because they can easily be acquired by unauthorized users. $6,924,532.16 is value is at risk.

Row Labels	Count of Transaction_ID	Sum of Transaction_Amount
Biometric	733	3619901.59
OTP	760	3830295.92
Password	687	3593655.98
PIN	670	3330876.18
Grand Total	**2850**	**14374729.67**

Failed Login Attempts

1,421 transactions with 3 or more failed login attempts are a risk because the actual customer is likely to recall their login credentials by the second attempt. $7,204,121.31 worth of transactions is at risk

Row Labels	Count of Transaction_ID	Sum of Transaction_Amount
0	465	2394557.5
1	468	2326748.99
2	496	2449301.87
3	449	2384244.24
4	470	2321440.11
5	502	2498436.96
Grand Total	**2850**	**14374729.67**

Risky Location Transaction

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 with the transaction performed. Biometric and OTP give reasonable assurance that the customer is performing the transactions themselves away from where the bank knows them on record to reside. 1,505 transactions were identified as risky locations with $7,657,142.54 exposed.

Row Labels	Count of Transaction_ID	Sum of Transaction_Amount
safe location transaction	1345	6717587.13
unsafe location transaction	1505	7657142.54
Grand Total	**2850**	**14374729.67**

Account Type Usage Risk

Checking accounts, credit cards and debit cards are usually transactional in nature but an ATM or POS usage on savings accounts exposes risk with the inappropriate account usage which defeats the savings purpose of that account. 706 transactions and $3,544,286.50 have been identified to be at risk based on account type usage.

Count of Transaction_ID	Column Labels					
Row Labels	ATM	Internet Banking	Mobile App	Online Banking	POS	Grand Total
Checking	373	1	376	338	330	1418
Credit Card	8	8	7		9	32
Debit Card	10	4	4		5	23
Savings	364	5	355	311	342	1377
Grand Total	**755**	**18**	**742**	**649**	**686**	**2850**

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. A customer will highly plan purchases of an electronic or travel nature and will usually perform such transactions from their country of residence. When electronic or travel expenses are paid from outside the country of residence, there is some level of risk that it may not be the actual customer of the bank performing that transaction. $2,763,645.81 and 527 transactions are at risk based on merchant category.

Row Labels	Count of Transaction_ID	Sum of Transaction_Amount
safe merchant transaction	2323	11611083.86
unsafe merchant transaction	527	2763645.81
Grand Total	**2850**	**14374729.67**

5.0 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 area.

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

Likelihood

Defined as the possibility of the risk area occurring. The number of the affected transaction expressed as a percentage of the total number of transactions observed defines the possibility.

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 amount value that can be affected in relation to the expressed likelihood.

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

Fraud Risk Area Risk Assessment Summary

Risk Category	Likelihood		Impact Severity		Risk Rating	Risk Level
	Percentage	Rating	Amount	Rating		
Unusual Transaction Amount	50%	3	$1,0701,598.31	2	5	High
Risky Authentication Type	48%	3	$6,924,532.16	3	6	High
Failed Login Attempts	50%	3	$7,204,121.31	3	6	High
Risky Location	53%	3	$7,657,142.54	3	6	High
Account Usage Risk	25%	2	$3,544,286.50	3	5	High
Merchant Category Risk	18%	2	$2,763,645.81	2	4	Medium

6.0 Risk Areas and Required Strategies

Due to scarce resources and budget constraints, the assessed risk areas must be prioritized 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 Category	Recommended Controls based on NIST SP 800-53r5	Implementation Timelines	Responsibility
1. Risky Locations Transactions 2. Risky Merchant Category Transaction 3. Failed login Attempts Risk 4. Risky Authentication Type 5. Unusual Transaction Amount 6. Account Usage Risk	AC-18: Wireless Access AC-19: Access Control for Mobile Devices AU-6: Audit Record Review, Analysis and Reporting AU-8: Time Stamps CA-3: Information Exchange CA-7: Continuous Monitoring CP-9: System Backup IA-3: Device Identification and Authentication IA-8: User Identification and Authentication RA-5: Vulnerability Monitoring and Scanning	Within 1 month And Up to a week regular review and reporting	**IT and IS Steering Committee** • Chief Risk Officer • Chief Information Officer • Chief Financial Officer • Chief Compliance Officer • Head, Legal • Head of Internal Audit • Head, Human Resources • Various Departmental Heads
	RA-7: Risk Response	Within 1 week And Monthly review and reporting	
	AT-2: Literacy Training and Awareness CA-2: Control Assessments SC-12: Cryptographic Key Establishment and Management	Within 1 month And Monthly review and reporting	
	CM-4: Impact Analyses RA-3: Risk Assessment	Within the next quarter And Quarterly review and reporting	
	CP-2: Contingency Plan IR-8: Incident Response Plan	Within the next quarter And Annual review and reporting	