

# Tech Saksham

## Case Study Report

### Data Analytics with Power BI

## “Real-Time Analysis of Bank Customers”

### “Madonna Arts and Science College For Women”

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# ABSTRACT

In the digital age, data has become an invaluable asset for businesses, particularly in the banking sector. The proposed project, “Real-Time Analysis of Bank Customers,” aims to leverage PowerBI, a leading business intelligence tool, to analyze and visualize real-time customer data. This project will enable banks to gain deep insights into customer behavior, preferences, and trends, thereby facilitating data-driven decision-making and enhancing customer satisfaction. The real-time analysis will allow banks to respond promptly to changes in customer behavior or preferences, identify opportunities for cross-selling and up-selling, and tailor their products and services to meet customer needs. The project will also contribute to the broader goal of digital transformation in the banking sector, promoting efficiency, innovation, and customer-centricity.

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# CHAPTER 1

## INTRODUCTION

### Problem Statement

In today's competitive banking landscape, understanding customer behavior and preferences is crucial for customer retention and revenue generation. However, banks often face challenges in analyzing customer data due to the sheer volume and velocity of data generated. Traditional data analysis methods are time-consuming and often fail to provide real-time insights. This lack of real-time analysis can lead to missed opportunities for customer engagement, cross-selling, and up-selling, impacting the bank's revenue generation and customer satisfaction. Furthermore, the complexity and diversity of customer data, which includes transaction history, customer feedback, and demographic data, pose additional challenges for data analysis.

### Proposed Solution

The proposed solution is to develop a PowerBI dashboard that can analyze and visualize real-time customer data. The dashboard will integrate data from various sources such as transaction history, customer feedback, and demographic data. It will provide a comprehensive view of customer behavior, preferences, and trends, enabling banks to make informed decisions. The dashboard will be interactive, user-friendly, and customizable, allowing banks to tailor it to their specific needs. The real-time analysis capability of the dashboard will enable banks to respond promptly to changes in customer behavior or preferences, identify opportunities for cross-selling and up-selling, and tailor their products and services to meet customer needs.

### Feature

- **Real-Time Analysis:** The dashboard will provide real-time analysis of customer data.
- **Customer Segmentation:** It will segment customers based on various parameters like age, income, transaction behavior, etc.
- **Trend Analysis:** The dashboard will identify and display trends in customer behavior.

- **Predictive Analysis:** It will use historical data to predict future customer behavior

## Advantages

- **Data-Driven Decisions:** Banks can make informed decisions based on real-time data analysis.
- **Improved Customer Engagement:** Understanding customer behavior and trends can help banks engage with their customers more effectively.
- **Increased Revenue:** By identifying opportunities for cross-selling and up-selling, banks can increase their revenue.

## Scope

The scope of this project extends to all banking institutions that aim to leverage data for decision-making and customer engagement. The project can be further extended to incorporate more data sources and advanced analytics techniques, such as machine learning and artificial intelligence, to provide more sophisticated insights into customer behavior. The project also has the potential to be adapted for other sectors, such as retail, healthcare, and telecommunications, where understanding customer behavior is crucial. Furthermore, the project contributes to the broader goal of digital transformation in the banking sector, promoting efficiency, innovation, and customer-centricity.

## CHAPTER 2

### SERVICES AND TOOLS REQUIRED

#### Services Used

- **Data Collection and Storage Services:** Banks need to collect and store customer data in real-time. This could be achieved through services like Azure Data Factory, Azure Event Hubs, or AWS Kinesis for real-time data collection, and Azure SQL Database or AWS RDS for data storage.
- **Data Processing Services:** Services like Azure Stream Analytics or AWS Kinesis Data Analytics can be used to process the real-time data.
- **Machine Learning Services:** Azure Machine Learning or AWS SageMaker can be used to build predictive models based on historical data.

#### Tools and Software used

##### Tools:

- **PowerBI:** The main tool for this project is PowerBI, which will be used to create interactive dashboards for real-time data visualization.
- **Power Query:** This is a data connection technology that enables you to discover, connect, combine, and refine data across a wide variety of sources.

##### Software Requirements:

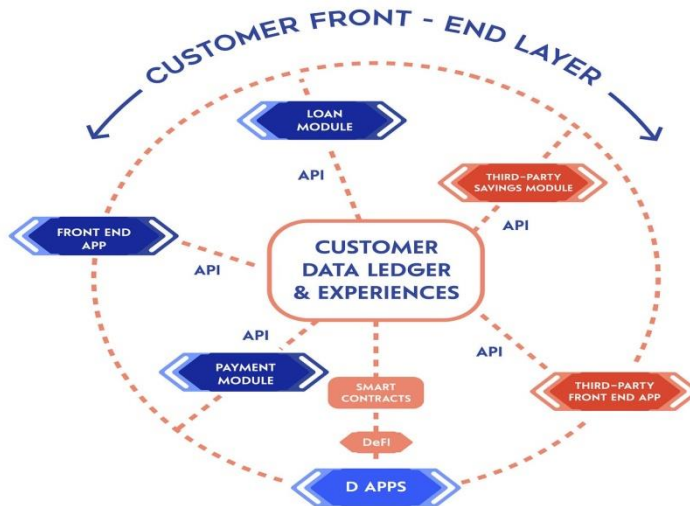
- **PowerBI Desktop:** This is a Windows application that you can use to create reports and publish them to PowerBI.

- **PowerBI Service:** This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.
- **PowerBI Mobile:** This is a mobile application that you can use to access your reports and dashboards on the go.

## CHAPTER 3

# PROJECT ARCHITECTURE

## Architecture



### Deposit-taking products (liabilities)

- Deposit-taking products include checking, savings and money market accounts, certificate of deposit (CDs), etc.
- Deposits are a liability to the bank as the bank must make deposited funds available to customers on demand
- Banks may offer modest interest rates on deposit products to encourage customers to maintain long-term funds in their accounts that the bank uses to extend loans

### Loan products (assets)

- Loan products include credit cards, mortgages, personal loans, student loans, auto loans, etc.
- Loans are an asset to the bank since the bank can borrow deposits to lend funds at higher interest rates than they are paying out on deposits
- Banks earn net interest income on loans. Net interest income is defined as interest earned on loans less interest paid on deposits

Retail banks have four primary revenue sources: interest, investment, interchange and fee revenue.

Interest revenue is earned through lending, as described above. Banks may also invest deposits in non-loan assets and earn investment income. Bank investments are highly regulated to ensure financial



stability and availability of deposits. Both interest and investment revenues are generated through balance sheet management activity.

Banks earn interchange and fee revenue through transaction activity. Many retail banks issue debit or credit cards that allow them to earn interchange revenue, an incentive payment facilitated by card networks such as Visa and Mastercard, whereby merchants pay the issuing banks a small fee for all purchases made using the banks' debit or credit card to cover card payment acceptance costs. Banks also charge fees on certain products and services. The list below outlines some of the common fees that retail banks may charge:

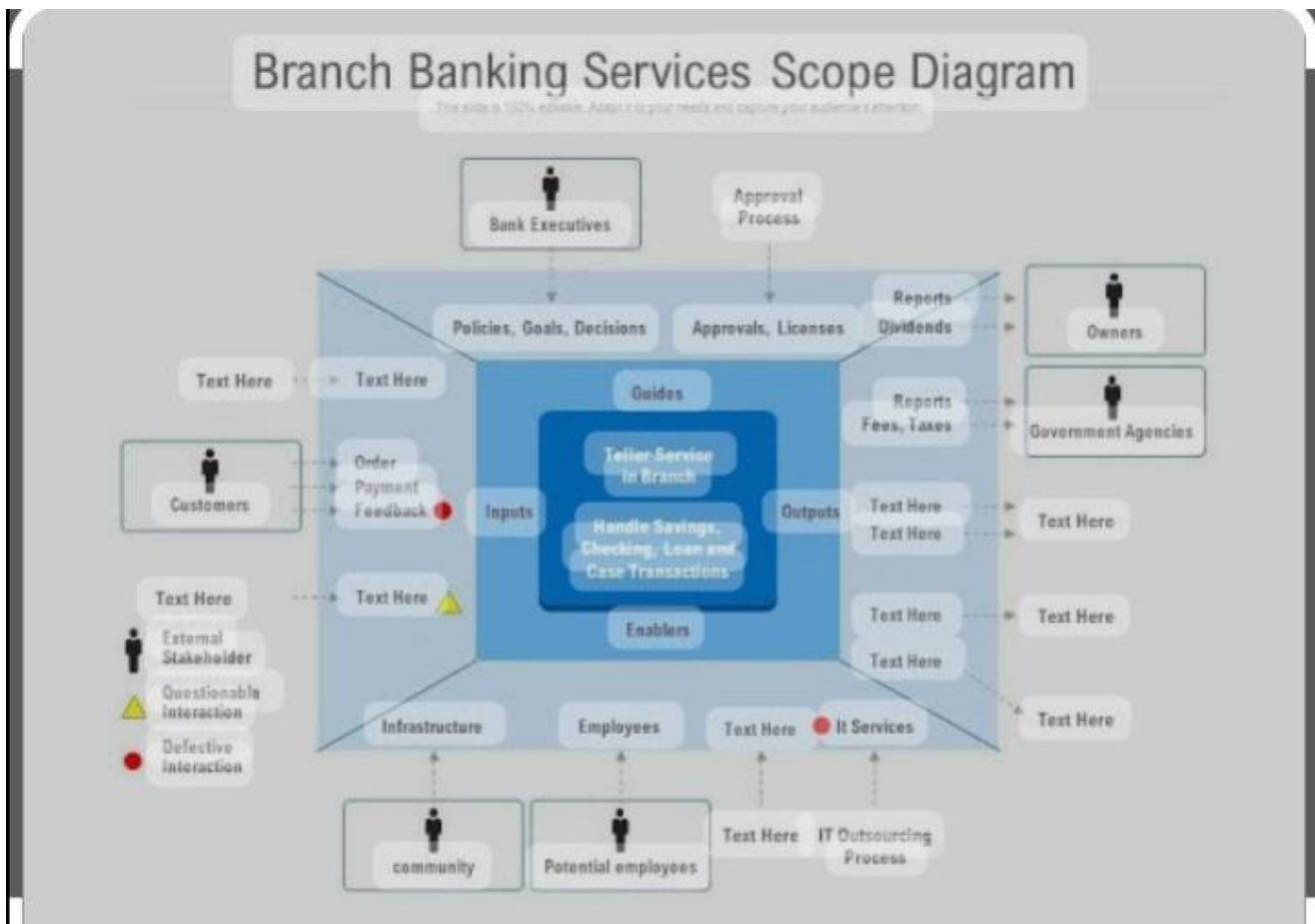
- Account maintenance or inactivity fees
- Overdraft fees
- ATM withdrawal fees
- Card order and card replacement fees
- Check issuance fees
- Safety deposit box fees
- Payment related fees (e.g., bounced checks, stop payments, late payments)
- Application fees (for mortgages and other products)

Asset size can further classify retail banks. There are three types of retail banks in the United States based on asset size: community, regional and large/national. The table below outlines the characteristics of each type of retail bank.

Here's a high-level architecture for the project:

1. **Data Collection:** Real-time customer data is collected from various sources like bank transactions, customer interactions, etc. This could be achieved using services like Azure Event Hubs or AWS Kinesis.
2. **Data Storage:** The collected data is stored in a database for processing. Azure SQL Database or AWS RDS can be used for this purpose.
3. **Data Processing:** The stored data is processed in real-time using services like Azure Stream Analytics or AWS Kinesis Data Analytics.
4. **Machine Learning:** Predictive models are built based on processed data using Azure Machine Learning or AWS SageMaker. These models can help in predicting customer behavior, detecting fraud, etc.
5. **Data Visualization:** The processed data and the results from the predictive models are visualized in real-time using PowerBI. PowerBI allows you to create interactive dashboards that can provide valuable insights into the data.
6. **Data Access:** The dashboards created in PowerBI can be accessed through PowerBI Desktop, PowerBI Service (online), and PowerBI Mobile.

This architecture provides a comprehensive solution for real-time analysis of bank customers. However, it's important to note that the specific architecture may vary depending on the bank's existing infrastructure, specific requirements, and budget. It's also important to ensure that all tools and services comply with relevant data privacy and security regulations.

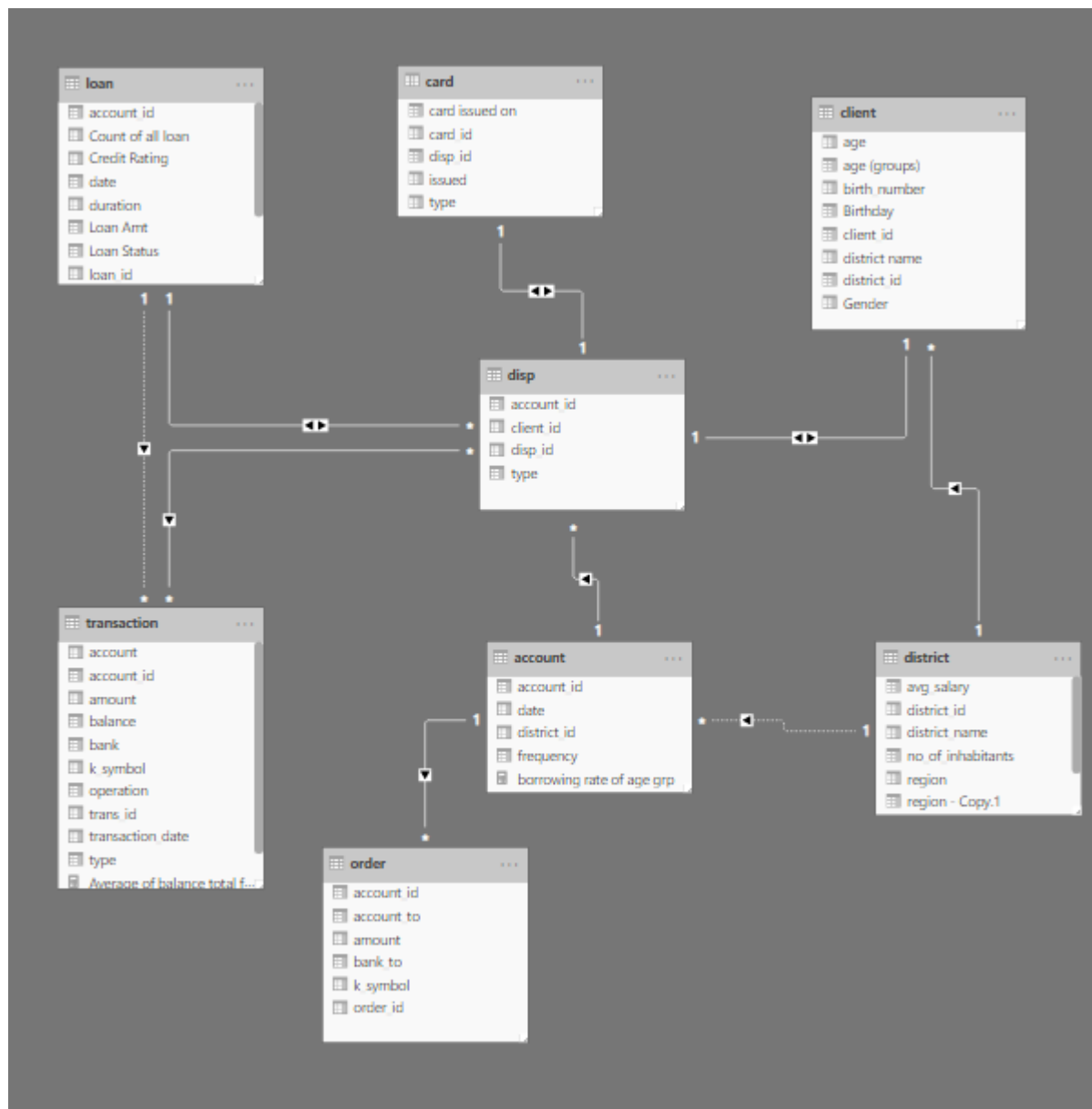


## CHAPTER 4

### MODELING AND RESULT

#### Manage relationship

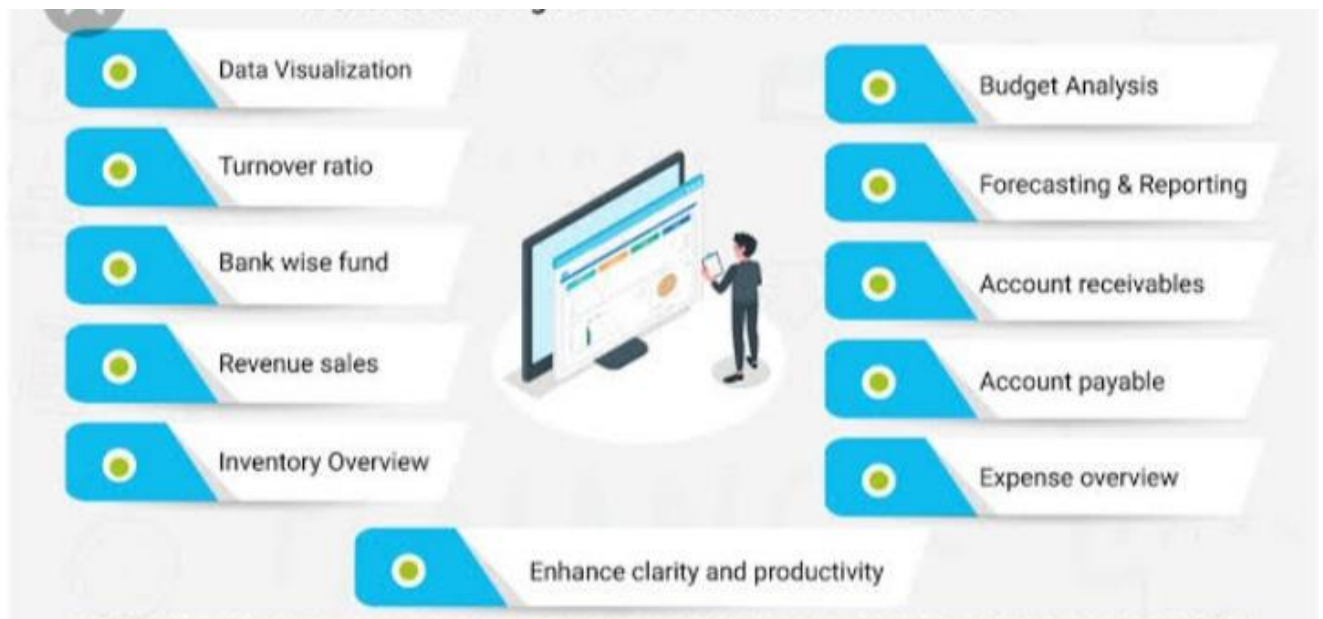
The “disp” file will be used as the main connector as it contains most key identifier (account id, client id and disp id) which can be use to relates the 8 data files together. The “district” file is use to link the client profile geographically with “district id”





## Manage relationships

Active	From: Table (Column)	To: Table (Column)
<input checked="" type="checkbox"/>	card (disp_id)	disp (disp_id)
<input checked="" type="checkbox"/>	client (district_id)	district (district_id)
<input checked="" type="checkbox"/>	disp (account_id)	account (account_id)
<input checked="" type="checkbox"/>	disp (account_id)	loan (account_id)
<input checked="" type="checkbox"/>	disp (client_id)	client (client_id)
<input checked="" type="checkbox"/>	order (account_id)	account (account_id)
<input checked="" type="checkbox"/>	transaction (account_id)	disp (account_id)
<input type="checkbox"/>	account (district_id)	district (district_id)
<input type="checkbox"/>	transaction (account_id)	loan (account_id)



### Modelling for Gender and Age data

Notice that the Gender and age of the client are missing from the data. These can be formulated from the birth number YYMMDD where at months (the 3rd

and 4th digits) greater than 50 means that client is a Female. We can create a column for Gender.

✕
✓

```

1 Gender =
2 VAR stringDate = FORMAT(client[birth_number],"General Number")
3 VAR month = VALUE(MID(stringDate,3,2))
4 RETURN IF(month > 50,"F","M")
5

```

client_id	birth_number	district_id	Gender	Birthday	age
3428	875927	42	F	27/09/1987	13
4354	860813	28	M	13/08/1986	14
3417	855318	35	F	18/03/1985	15
10201	851019	13	M	19/10/1985	15

For birthday, we need to reduce the birth month of the female by 50 and then change the date format to DD/MM/YYYY adding 1900 to the year.

✕
✓

```

1 Birthday =
2 VAR stringDate = FORMAT(client[birth_number],"General Number")
3 VAR stringMonth = VALUE(MID(stringDate,3,2))
4 VAR mth = IF(stringMonth > 50, stringMonth - 50,stringMonth)
5 VAR year = VALUE(MID(stringDate,1,2))
6 VAR day = VALUE(MID(stringDate,5,2))
7 RETURN FORMAT(DATE(year+1900,mth,day),"DD/MM/YYYY")

```

client_id	birth_number	district_id	Gender	Birthday	age
3428	875927	42	F	27/09/1987	13
4354	860813	28	M	13/08/1986	14
3417	855318	35	F	18/03/1985	15
10201	851019	13	M	19/10/1985	15

For Age, we shall assume it is year 1999 as explain previously and use it to minus from the birth year.

✕
✓

```

1 age = 1999 -RIGHT(client[Birthday],4)

```

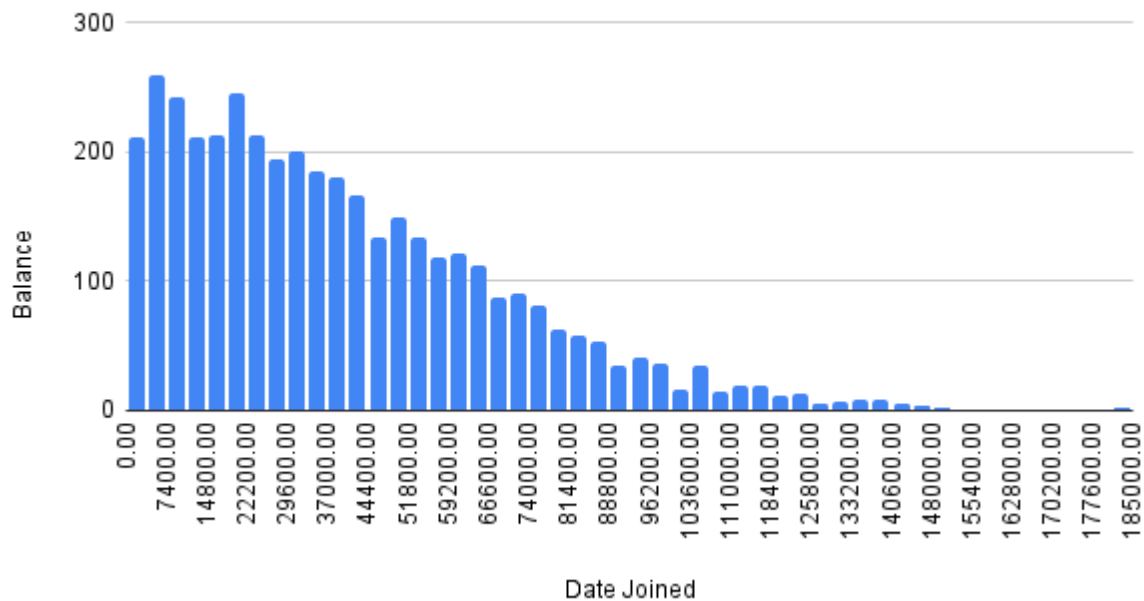
client_id	birth_number	district_id	Gender	Birthday	age	age (groups)
2	450204	1	M	04/02/1945	54	36 -54 Baby Boomers



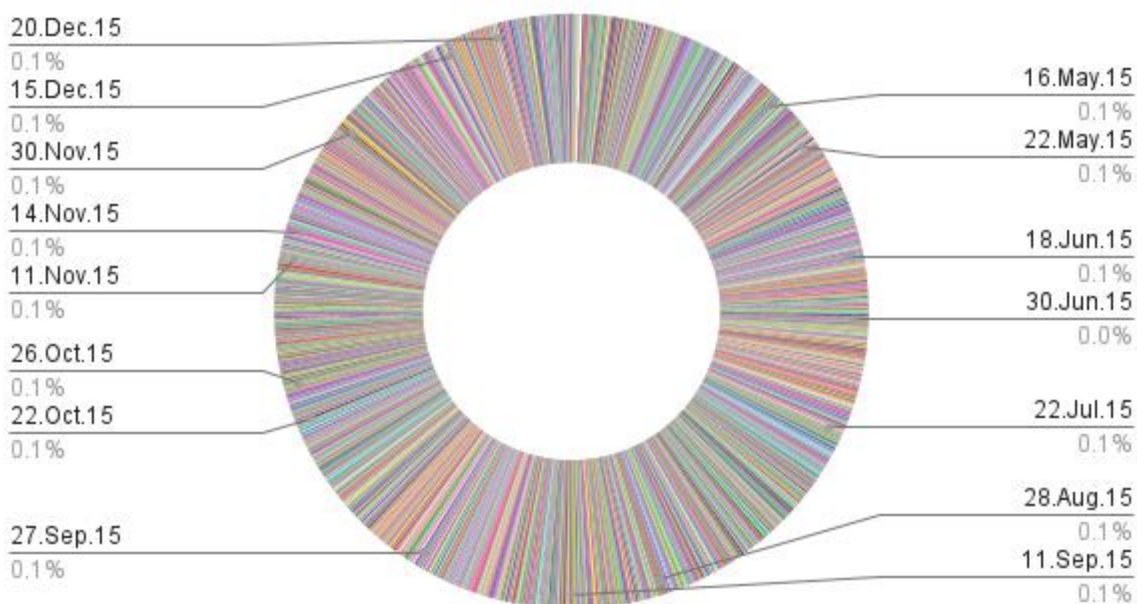
## Replacing values

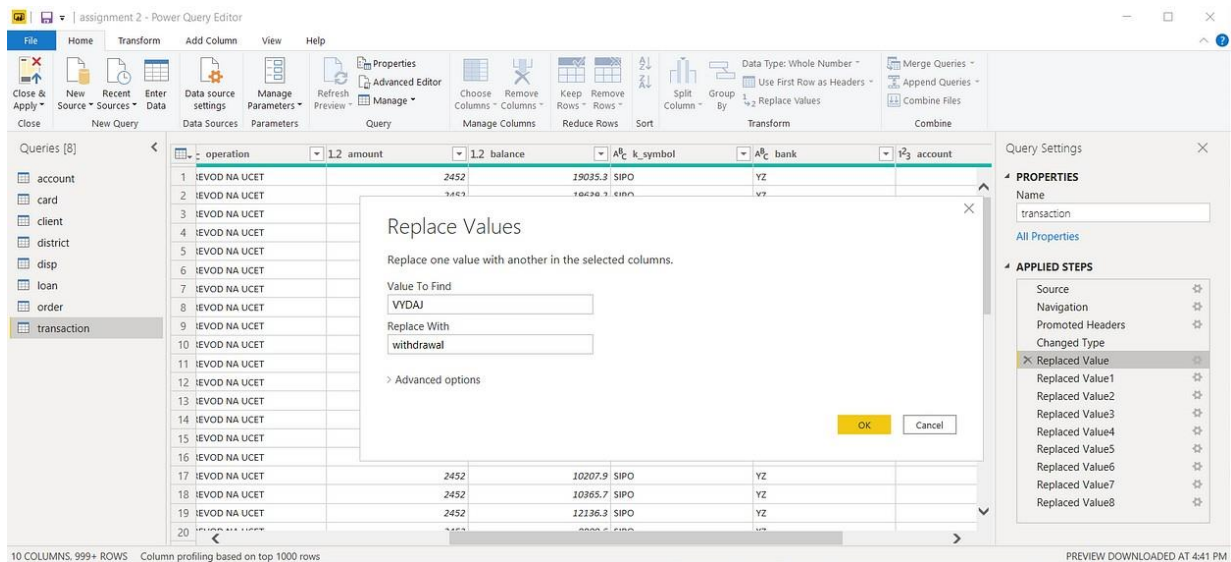
Set some fields to English for easy understanding, we replace values to English with the Power Query Editor.

## Histogram of Balance



## Balance vs Date Joined



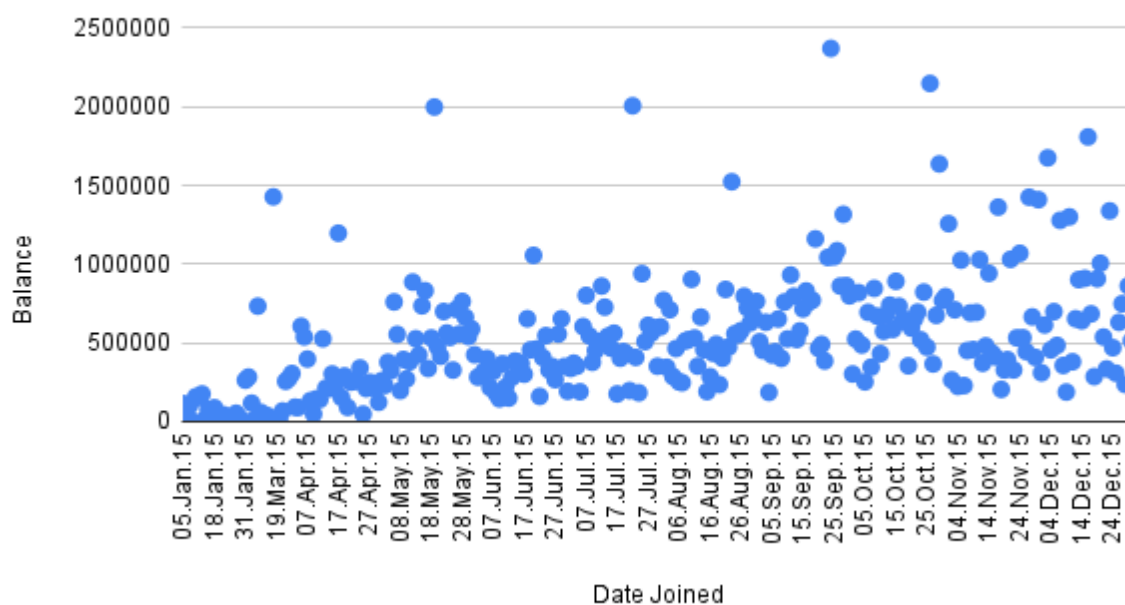


Changing the order of Region name at Power Query

Duplicate the “district /region” then split column using space as delimiter.

Then merge column by Region and direction. Refer to applied steps for details.

## Histogram of Balance





A <sup>B</sup> <sub>C</sub> region - Copy.2	A <sup>B</sup> <sub>C</sub> region - Copy.1	A <sup>B</sup> <sub>C</sub> REGION dir
	null	Prague
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	central	Bohemia central
Bohemia	south	Bohemia south

Query Settings

- PROPERTIES
- APPLIED STEPS
  - Source
  - Navigation
  - Promoted Headers
  - Changed Type
  - Duplicated Column
  - Split Column by Delimiter
  - Changed Type1
  - Reordered Columns
  - Inserted Merged Column
  - Inserted Merged Column1
  - Renamed Columns
  - Removed Columns

### Grouping of age by ranges

As the customers' age ranges from 12 to 88, we shall group them into different generation age range for easier profiling, we will group the ages into 5 groups.

The Gen Y are youths,

Gen X are young working adults, some starting their families

Baby Boomer are working adults with families.

The silent Generations some are working and retired, living on pensions.

The greatest Generation, retired elderly living on pensions.

## Groups

Name	<input type="text" value="age (groups)"/>	Field	<input type="text" value="age"/>
Group type	<input type="text" value="List"/>		

Ungrouped values

## Groups and members

- ▶ 0 - 20 Gen Y
- ▶ 20 - 35 Gen X
- ▶ 36 -54 Baby Boomers
- ▶ 55- 73 THE SILENT GENERATION
- ▶ 74 and above - THE GREATEST GENERATION

### Credit Rating and Loan Status

As the Loan status uses A, B, C, D which are not reader friendly. We can add a column to represent what it stands for, we also simplify the classification of those with late or default on payment as bad credit, refer to the table below for details on the new columns added.

Status in "loan" data	New column "loan status"	New column "credit rating"
'A' stands for contract finished no problems	Fully Repaid	Good
'B' stands for contract finished loan not paid	Default	Bad
'C' stands for running contract OK so far	Timely Payment	Good
'D' stands for running contract client in debt	Late payment	Bad

X
✓

1 Loan Status =  
2 IF(loan[status]="A", "Repaid Full",  
3 IF(loan[status]="B", "Default", IF (loan[status]="c", "Timely payment", "Late payment" )))

loan_id	account_id	date	Loan Amt	duration	payments	status	Credit Rating	Loan Status
6059	5196	971228	79,824 Kč	12	6652	A	GOOD	Repaid Full
6727	8505	971210	42,840 Kč	12	3570	A	GOOD	Repaid Full

X
✓

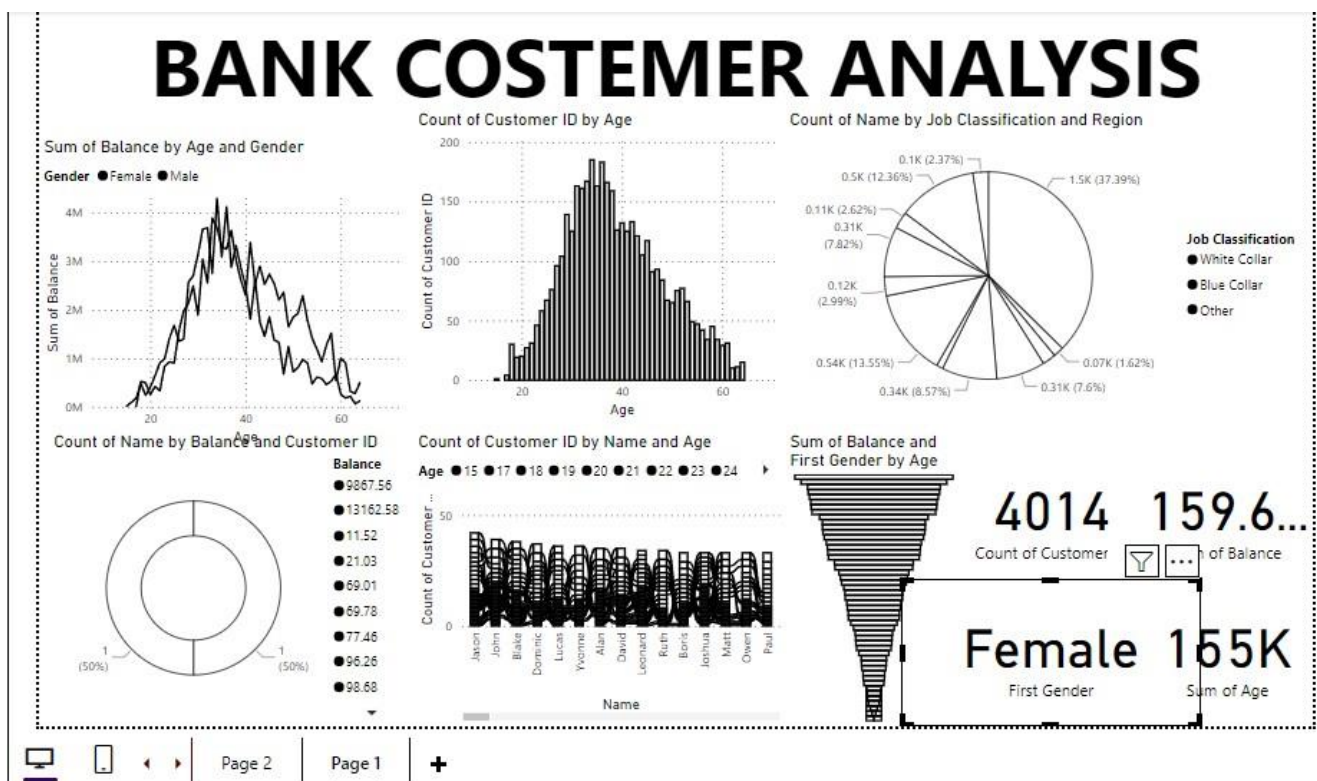
1 Credit Rating =  
2 IF(loan[status]="A", "GOOD",  
3 IF(loan[status]="B", "BAD", IF (loan[status]="c", "GOOD", "BAD" )))

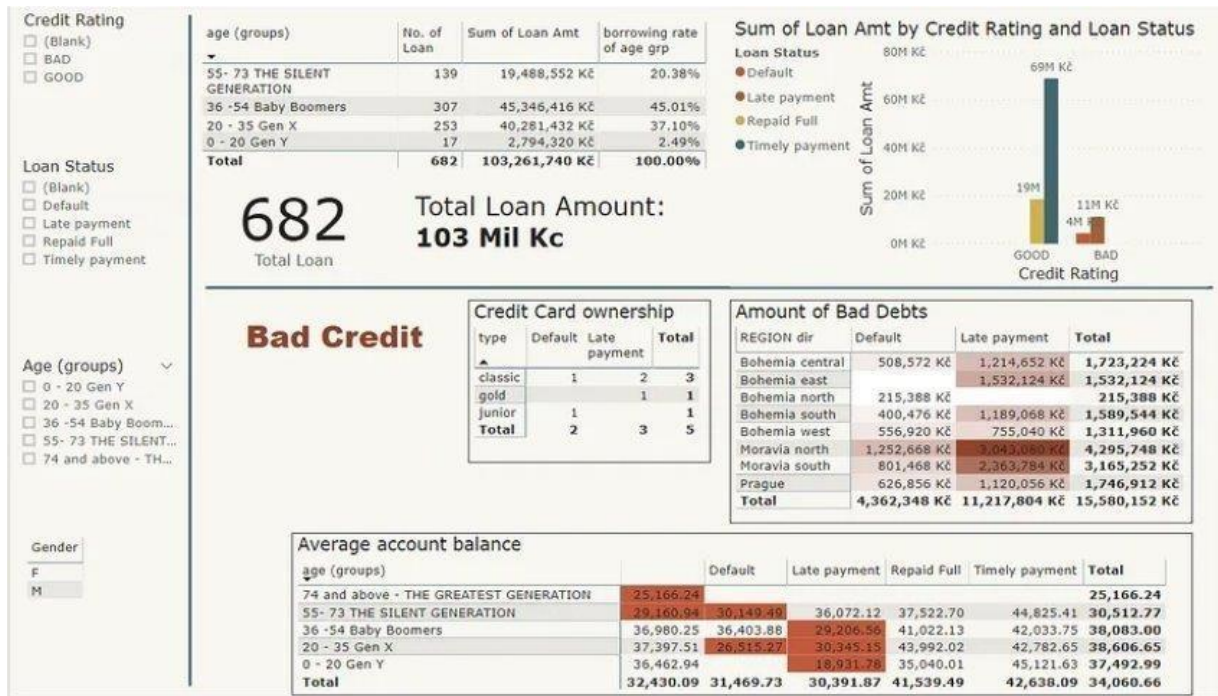
loan_id	account_id	date	Loan Amt	duration	payments	status	Credit Rating	Loan Status
5221	1284	981205	52,512 Kč	12	4376	C	GOOD	Timely payment
5841	4268	981104	41,988 Kč	12	3499	C	GOOD	Timely payment

Values of such as "account Id" have also been set as Text.

And District name have been categorized as place to be use for the map to show the sum of the inhabitants in each region.

# Dashboard



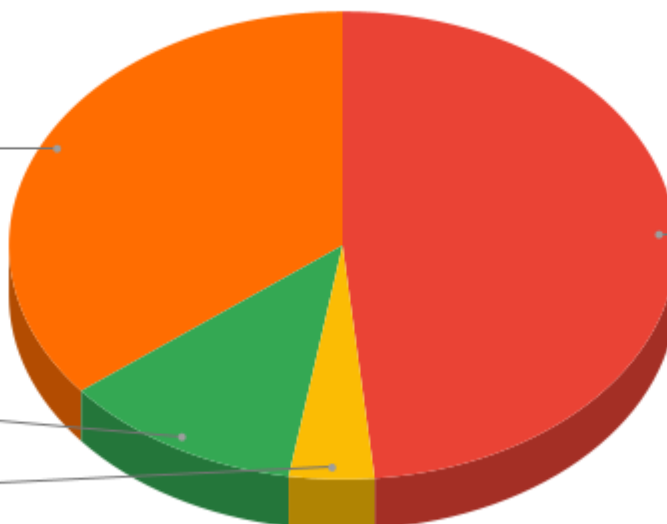


Scotland  
35.7%

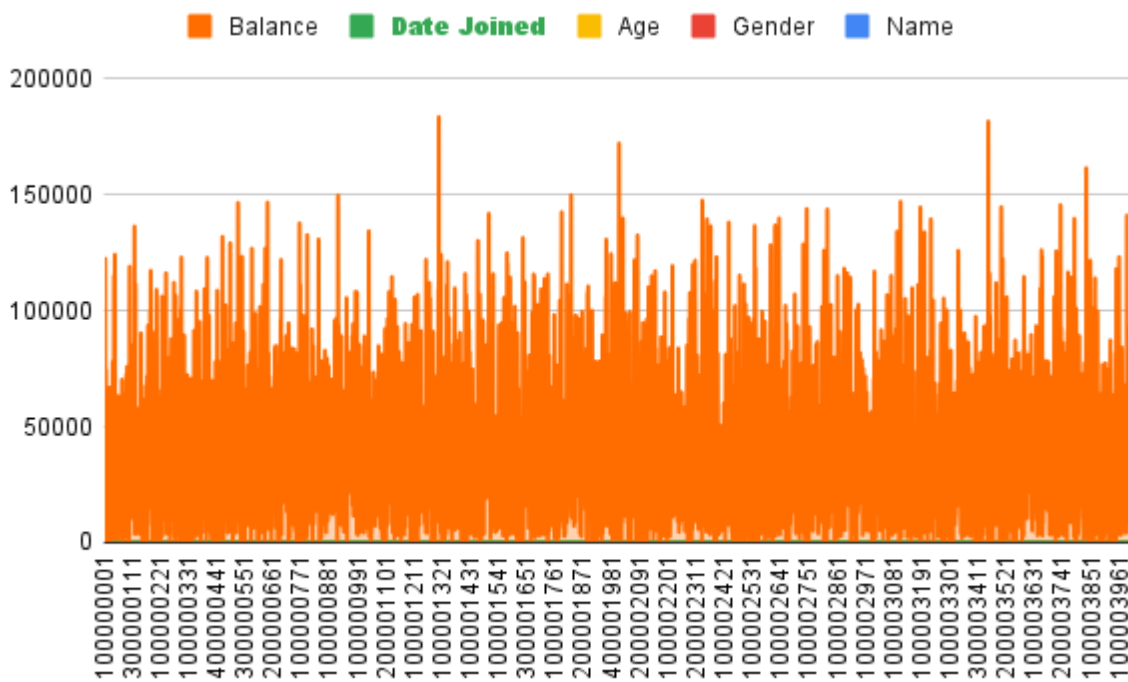
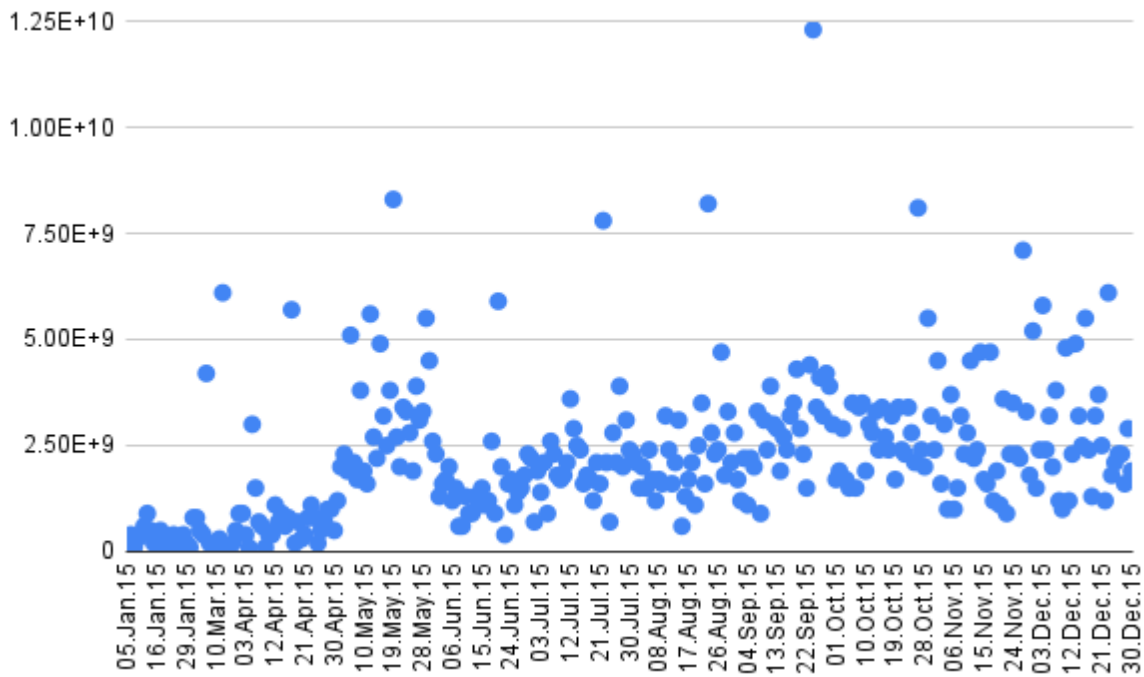
England  
48.5%

Wales  
11.7%

Northern Ireland  
4.1%







## CONCLUSION

The project “Real-Time Analysis of Bank Customers” using PowerBI has successfully demonstrated the potential of data analytics in the banking sector. The real-time analysis of customer data has provided valuable insights into customer behavior, preferences, and trends, thereby facilitating informed decision-making. The interactive dashboards and reports have offered a comprehensive view of customer data, enabling the identification of patterns and correlations. This has not only improved the efficiency of data analysis but also enhanced the bank’s ability to provide personalized services to its customers. The project has also highlighted the importance of data visualization in making complex data more understandable and accessible. The use of PowerBI has made it possible to present data in a visually appealing and easy-to-understand format, thereby aiding in better decision-making.

## FUTURE SCOPE

The future scope of this project is vast. With the advent of advanced analytics and machine learning, PowerBI can be leveraged to predict future trends based on historical data. Integrating these predictive analytics into the

project could enable the bank to anticipate customer needs and proactively offer solutions. Furthermore, PowerBI's capability to integrate with various data sources opens up the possibility of incorporating more diverse datasets for a more holistic view of customers. As data privacy and security become increasingly important, future iterations of this project should focus on implementing robust data governance strategies. This would ensure the secure handling of sensitive customer data while complying with data protection regulations. Additionally, the project could explore the integration of real-time data streams to provide even more timely and relevant insights. This could potentially transform the way banks interact with their customers, leading to improved customer satisfaction and loyalty.

## REFERENCES

<https://medium.com/analytics-vidhya/analysis-of-bank-customers-using-dashboard-in-power-bi-a366f2b3e5>



