An-Najah National University
Faculty of Graduate Studies

FROM DATA TO DECISIONS: USING BUSINESS INTILLEGENCE TOOL- MICROSOFT POWER BI- TO ENHANCE DATA-DRIVEN DECISION MAKING (EVIDENCE FROM JAWWAL'S ANTI-FRAUD SECTION)

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This Thesis was Defended Successfully on 22/12/2025 and approved by

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Dedication

All praise is due to Allah, whose grace made this work possible. To my mother and her prays, to everyone who stood by me and believed in me. you made the impossible happen and you were the heart of this success ……. thank you endlessly.

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Sincere thanks are extended to everyone who contributed to bringing this work to light through their efforts and support.

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

FROM DATA TO DECISIONS: USING BUSINESS INTILLEGENCE TOOL- MICROSOFT POWER BI- TO ENHANCE DATA-DRIVEN DECISION MAKING (EVIDENCE FROM JAWWAL'S ANTI-FRAUD SECTION)

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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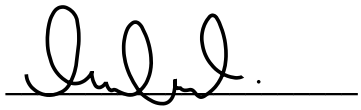
Signature: 

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Abstract

In current data-driven world and on-going technology, organizations started looking for an intelligent tools and systems to help them in enhancing decision making to be more accurate, up to date and smart. Especially in risky and critical areas such as anti-fraud scope in telecommunication field. This research aims to explore the role and importance of business intelligence and analytical tools by using Microsoft power BI to enhancing the decision-making process by reducing time while increasing accuracy. The research applied descriptive analytical approach. Data collected from internal systems at Palestinian telecommunication company -JAWWAL- by using structure query language server management studio (SQL SMS) to use database tables, clean and prepare data by using power query edition in Microsoft power BI, critical analytics done by applying data analysis expression (DAX) and visualized by using power BI dashboard. The findings and outcome of this research demonstrate the contributions and achievement happened by using power BI in increase transparency in data, fast and accurate data driven decision making process and the research recommends to invest in this technology and expand the scope to cover different area such as sales and warehouses managements. As well as integrating machine learning (ML) and artificial intelligence (AI) to further enhance and optimize Microsoft power BI performance.

Keywords: business intelligence, data-driven decision making, data visualization, anti-fraud, telecommunication, data analytics, interactive dashboards, data analysis expression.

Chapter One
Introduction

1.1 Introduction

In the current era characterized by rapid changes, intense competition and increasing in complexity, high competition, complexity, demanding and uncertainty. The organizations are looking for ongoing ways to stay ahead and lead the area. (Dr. Vijai Tiwari, 2024). As a result, companies' data is being complex and expanding in type, size, sources and speed. Since these changes, the data started play a crucial role in discovering unseen patterns, predict the future, spot light on operation leakage and hidden opportunities (Alshawawreh.etal.,2024).

Data has been popular and attractive topic due to the revolution in customer behaviour, needs and universal market changes, in addition, data plays a crucial rule to be an opportunity or a challenge since its value not only depends on the size or the variety the organizations have. But it`s mainly depends on how they analyse, transform and the quality of the decision taken based on it, all of these reasons encouraged the organizations to search about tools or ways help them to transform the data into valuable insights on a real time (Alshawawreh et al., 2024).

As a result for the massive amount of data, the organizations perused they have to change the way of how they make the decision, speed, efficiency and what is it is impact. Decision making is totally shifted being based on experience and intuition to becoming more rational and established on data and insights. Consequently, the emergence of data-driven decision-making has made the deployment of excellent data visualization tool a necessity. All of these reasons encouraged the organizations to search about tools or ways help them to transform the data into valuable insights on a real time(Garudasu et al., 2025).

Therefore, the need for a solution arose in which all the requirements for analysing data and making more accurate and efficient decisions are encompassed. Among the most innovative solutions are the use of business intelligence software such as Microsoft Power BI and the Power Automate platform. (Jeble et al., 2018).

Why business intelligence tools specifically? Because business intelligence tools helped them to find data visualization and data analytics in one tool.

Data visualization display the crucial information on a single screen to facilitate the analyse of complex data (Shroff, 2021) , and data analytics makes organization able to optimize decision making by providing them broad and valuable insight by deep understanding of business and customer behaviour, hidden pattern and risks (Alshawawreh et al., 2024).

This research spots the light on the necessity of business intelligence tools in decision making by implement a real case study in Palestinian telecommunication company – JAWWAL – as a one of the biggest companies in Palestine and provide critical telecommunication and internet services for a huge market share by using Microsoft Power BI that considers as the most famous analytics and visualization tool owned and developed by Microsoft.

1.2 Research Problem

Changing consumer behaviour and evolving demands have significantly increased the demand for advanced technologies with a high degree of secure connectivity and data processing. As a result, the telecommunications sector has become the backbone of most mission-critical verticals, including digital banking, cloud computing, social media, e-commerce, healthcare, and education.

Telco fraud is still a challenge that poses a significant risk, leading to massive financial losses estimated to be over $28 billion every year (CFCA, 2025). The traditional approach, which uses rule-based solutions, is becoming ineffective due to sophisticated fraud patterns. Big data analytics helps to adopt a proactive approach to detect fraud based on anomalous patterns within massive transaction, usage, or location data in near real time. Early warning systems enable telecom operators to identify and counter fraud faster and ensure the protection of their revenues and lawful subscribers. Nevertheless, the efficiency of these systems largely relies on the use of safe and high-quality data, thereby underpinning the crucial role of big data architecture in combating the growing threat of fraud (CFCA, 2025)

At Jawwal, the anti-fraud team examined their capability and determined that standalone reports, although they employ more than a single data source and controls, are insufficient for making efficient decisions (Palestinian telecommunication company – JAWWAL – Anti-Fraud Section Head,May 2025).

They sought solutions that enabled close to real-time monitoring, hidden pattern detection, and forecasting future trends. Standardizing disparate data sources, optimizing security and efficiency of the data, and meaningful reporting of data were the major concerns.

After careful deliberation, they concluded that business intelligence tools offer the best solution by way of collecting, processing, visualizing, and dynamically altering data as required (Palestinian telecommunication company – JAWWAL – Anti-Fraud Section Head, May 2025).

As with any technological advancements, fraudsters are always on the lookout for new ways of exploiting new systems. Fraud is today one of the most severe and sophisticated challenges facing organizations in the contemporary era. Does not only lose service providers funds, but also their reputation and customer loyalty — consequences sometimes harder to recover than the financial losses suffered (Amin et al., 2020).

1.3 Research gab

Previous researches and studies have explored the role and importance of business intelligence in decision making with much focus on different sectors like financial organization, banking, healthcare and inventory management(Tsang, 2023;Ram, 2024a; van Kalsbeek et al., 2025;Kobi, 2024; Jayaraman, 2025; Zhang, 2024; Yerra, 2025) while little attention paid to use business intelligence tool in telecommunication in middle east (Majali et al., 2022;Aburub et al., 2024; Al Habri & Al Syani, 2022).

This gap is significant because telecom companies, particularly in Palestine, face growing challenges in combating fraud but lack empirical evidence on how BI tools can support real-time monitoring and decision-making. Therefore, this study addresses this gap by examining the role of Power BI in enhancing data-driven decision making within Jawwal’s Anti-Fraud Section.

1.4 Research questions

This research seeks to answer the following questions:

1. How the technology acceptance model (TAM) will be measure?
2. How Business intelligence tools such as Microsoft Power BI effects on data driven decision making efficiency in anti-fraud section?
3. What managerial, technical, cost-related and human skills challenges are likely to happen during the concept implementation in anti-fraud section?
4. What are the recommendations or concerns anti-fraud section have to improve using Microsoft Power BI?

1.5 Research goals

This research seeks to achieve a set of goals:

1. To improve the level of decision-making undertaken in the Anti-Fraud Section through the use of business intelligence tools such as Microsoft Power BI in order to have real-time access to vital information through effective data analysis and visualization.
2. Explore what are the limitations and challenges face anti-fraud section members to define their weaknesses or skill-shortage.
3. Analyse the implementation process for business intelligence tool-Microsoft Power BI- in anti-fraud section to understand the logic and tools they already use to convert data into actionable insights.

1.6 Research contribution

The research contribution summarizes in below:

1. Academic Importance: Link the gap between practice and theory for data analytics, data visualization and Data driven decision making by Business intelligence tools such as Microsoft Power BI.
2. Practical Importance: Show how raw data by using the suitable statistical, tool and charts can be converted into strategic insights using Microsoft Power BI to ensure proper data driven decision making in the telecommunication sector in Palestine.
3. Local Importance: it shows how Palestinian telecommunication company - JAWWAL- can leverage modern data visualization tools regardless of external constraints.

4. Technological Importance: it supports general wave of digital transformation by promoting the use of analytics and visualization in business intelligence tools such as Microsoft Power BI in Palestinian telecommunication company -JAWWAL-.

1.7 Conceptual Definition of key terms:

This section provides clear, direct and theoretical definition and explanation for the main terms and concepts in the research based on previous and relevant literatures:

1. Business Intelligence(BI): it refers to the ability to make any organization take better decision, to make it informed one, it has six main steps: data collection, sequence identification, forecasting, predictive analytics, data optimization and visualization(Tsang, 2023). And Gartner defined it as the Umbrella includes several applications, infrastructure and tools to make decision maker able to take prompt decision based on insights. We cans say it`s a decision support system, for any organization (Gartner,2020).
2. Data analytics: Can be defined as the science of data, to divide the data into individual units, perspective and inspection to gain full information(Amin et al., 2020) .and it can be defined as the process of analysing and discovering the hidden pattern and actionable insights (Andersen et al., 2020).
3. Data Visualization: the science of design , enhancement and application of computer software and program to represent the data graphically (Shadare et al., 2016) .In addition, Srivastava said: it`s a powerful tool for enhancing understanding ana communication of complex data, it`s effectively highlight and communicate the data by the various and strong techniques (Srivastava, 2023).
4. Data Driven Decision Making Process: the process of making the decision based on real information and patterns instead of using the intuition (Provost & Fawcett, 2013).
5. Technology Acceptance Model: it`s a model applied to evaluate and determine the level of adoption , acceptance and benefits for information technology(Zaineldeen et al., 2020).Ma and Liu added :when David created and applied this model , he used two main independent variables Perceived of usefulness (PU) and Perceived ease of use (PEOU) , these two variables help to predict the end-use attitude toward technology acceptance(Ma & Liu, 2011).Lazim, Ismail and Tazilah clarified perceived ease of use as an indicator shows the end-user attitude to accept new

technology. If end-user thinks the new technology can be used easily then the technology will be very useful(Lazim et al., 2021).

6. Dashboard: it`s a powerful tool for decision making, deliver the information in a visual way that allows to decision maker to gain insights and take the decision smoothly, dashboard its highly customizable and can include data from different sources to help the decision make what happen, what will happen and what action they should take. In addition, it`s user friendly and can be customized based on user goals to focus or monitor specific things(Sharma, 2023).
7. Microsoft Power BI: it`s a combination of software, applications and connectors works as a one unit to link between different data sources and types to convert your data into interaction visualization insights. Microsoft Power BI consists of three basics items Power BI desktop, Power BI service and Power BI mobile app (Microsoft, 2024).
8. Fraud: defined as illegal use for provided services to gain personal benefits or to avoid charge paid. Amin and et al said fraud contains different types , may it be credit card fraud , money laundering fraud and telecommunication fraud(Amin et al., 2020).Guo and Wand defined telecommunication fraud is to claim the organization and using hidden pattern to stay safe while actually sending false information, set fraud scenarios and schemes to induce the victim pay or transfer money which effects on social security and harm the satiability for a long time(Guo & Wang, 2020).

1.8 Research Framework

This part shows the main structure for the research: Time, Participants, scope…. Etc.

1. Timeframe: The study is restricted to the period from May 2024 to May 2025.
2. Location: Palestine telecommunication company – JAWWAL-, and specifically within the Risk Management Department's Anti-Fraud Section.
3. Subject Focus: The study concentrates on data visualization and analysis application to enhance data driven decision-making in the Anti-Fraud Section.
4. Participant: The research conclusions are based on input from different beneficiaries at Palestinian telecommunication company-JAWWAL- from Microsoft Power BI implementation such as Risk department head, Credit and Control directorate presented by credit team leader, Sales Directorate represented by sales channels department head, Data warehouses management and the kay Pearson is Senior Anti-Fraud Specialist.

5. Methodology: This research applied Mixed method case study. The case study methodology combines both quantitative and qualitative approaches to evaluate comprehensively Microsoft Power BI's contribution to improving decision-making based on data within the Anti-Fraud Section at Jawwal. Results from this study will be useful in measuring improvements in efficiency and accuracy in decision making. Additionally, it will provide valuable information on decision making. Combining approaches will enhance validity.

In addition to the number of stakeholders or Interviewee is seven people research discussed real case and real implementation**.** The process entailed the following steps (Onyemaechi, 2022 ;Amin et al., 2020 ;Zhang, 2024).

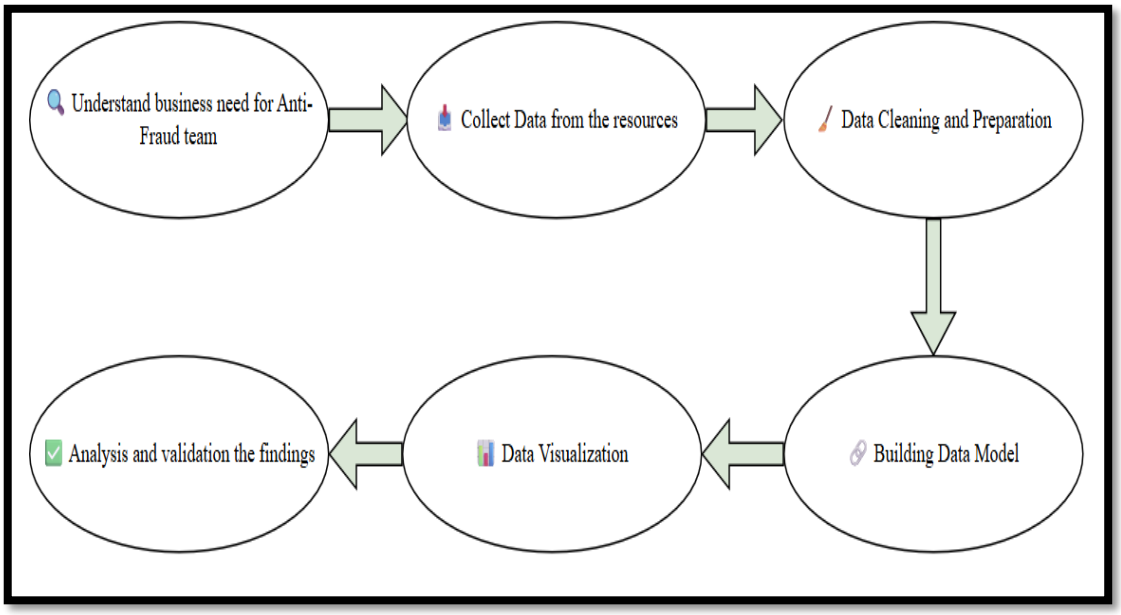
1.9 Time line

Below table represents the time plan for the main steps and journey for the thesis. Starting from Proposal approval stage, through data collection, cleaning and analysis, and finish with thesis final defence. This timeline aims to highlight each stage and assigned the expected time.

Table 1
Time Plan

Phase	Activity	Date
proposal approval	finalize first three chapters	July,2025
Data Collection and cleaning	1-Conduct interviews to Collect. 2-Clean and transform data to fit the objects	Aug,2025
data visualization	1-convert transformed data into dashboard 2-conduct interview to get two-way feedback with Anti-Fraud Section	Aug,2025
Model evaluation	evaluate the efficiency of the model based on the criteria mentioned in model evaluation section through interview with related beneficiaries	Aug,2025
Thesis writing and review	finalize the last chapter of thesis and submit to the supervisor	Sep,2025
Final Submission	final document and submission	Sep,2025
Thesis Defence		Oct,2025

Figure 1
Research Methodology



1. Understand business, workflow and needs: conduct different interviews to understand how anti-fraud team works, what their needs and understand the data to make Microsoft Power BI use meet their needs.
2. Data Collection: Performance data regarding fraud cases, detection patterns, and decision-making processes were collected from Anti-Fraud section internal records from May 2024 to May 2025 by Structured Query Language (SQL) server in Microsoft Power BI used in this level.
3. Data Preparation: Power Query in Power BI was utilized to clean and transform the collected data with the following steps: (I) Remove duplicates and redundant entries. (II) Handle missing values and reconcile discrepancies. (III) Standardize formats and types of the data. (IV) Implement calculated columns and measures with DAX (Data Analysis Expressions) to facilitate intensive analysis.
4. Data Modelling: A relational data model was established to identify relationships among different data tables to support detailed analysis in different dimensions.
5. Data Visualization: Interactive dashboards and reports were designed in Power BI to display key metrics, trends, and patterns of fraud detection and prevention. The visualizations came in the guise of line graphs, bar charts, and heat maps to facilitate intuitive insight.

6. Analysis and Interpretation: The visuals created were examined to identify significant trends, anomalies, and correlations that could be utilized for strategic business decisions by the Anti-Fraud section.
7. Validation: Findings were validated through interviews with the Senior Anti-Fraud Analyst to ensure accuracy and relevance to the section operational setting.
8. Scope Exclusions: (I) other directorates or scope of works in Palestinian telecommunication company-JAWWAL- outside of the specified section are not addressed in the research. (II) other types of risk management, such as credit or operational risks, are not included.

Chapter Two
Literature review

2.1 Business Intelligence (BI)

The vast amount of generated data requires powerful analytical tool to extract the useful insights, business intelligence tools and solutions become integrated with modern organization to make them able analyse data, identify trends and facilitate the decision making (Jayaraman, 2025).

Business intelligence defined as the technology driven of process of extract, store, analyse the data to make it actionable and useful insights to help business and organization make informed decision (Shroff, 2021).

Business intelligence (BI) refers to a technologically-oriented procedure used by organizations to collect, organize, and analyse information with the aim of supporting informed decision-making. Managers, executives, and employees can use Business Intelligence to make operational and strategic choices based on facts rather than assumptions. The objective is ultimately to improve business performance by generating income, becoming more efficient, and gaining a competitive advantage (TechTarget, 2024).

BI integrates analytics, reporting, and data visualization functionality with formal methods of dealing with and analysing data. From the time it debuted in the 1990s, Business Intelligence has propagated throughout organizations of all sizes. Its development has evolved from formal professional-managed systems to self-service Business Intelligence, and in more recent times to augmented analytics based on AI and machine learning. Through these developments, end users are now able to run their own analyses without having to depend only on Business Intelligence experts. In spite of the above, Business Intelligence program deployment and maintenance remain challenging. Some of them include finding funds, integrating data sources, selecting suitable software, educating employees, and ensuring uniformity in self-service portals. Even with self-service methods, Business Intelligence teams still abound to operate systems, configure dashboards, create reports, and provide high-quality insight (TechTarget, 2024).

Overall, BI transforms raw data into actionable knowledge to guide both day-to-day operations and long-term strategic planning and is thus a vital instrument for today's organizations.

Business Intelligence provides a range of facilities that are beneficial for employees, teams, and organizations as a whole. It uses structured and unstructured data to support informed decision-making. Ready access to information and the ability to analyse it according to the needs of the users are vital for modern-day organizations. Business Intelligence can be seen as a modern approach to business and organizational design, whereby it involves the identification and partitioning of inherent patterns in large volumes of business data. Business Intelligence enhances awareness in the business environment and improves decision-making. Business Intelligence is a structured and systematic process by which organizations collect, analyse, and disseminate information from external and internal environments to support their operations and improve decision-making. Business Intelligence systems scan data coming from various sources and give interpretations, patterns, and interactive interfaces that enable companies to gain better insights into their markets, customers, competitors, and environment (Rouhani et al., 2012).

Business intelligence tools provide three different types of analytics, Predictive to know what will happen, diagnostic to know what is happen and perspective. In addition business intelligence tools make end user to be independent from information technology team to analyse or gain insights(Das et al., 2024).

2.1.1 Benefits of business intelligence tools

Any organization before adopt any solution they ask what is the benefits will we gain for the cost will we pay. Maletics defined some benefits 1- better understand for the business. 2- better communication between all stakeholders. 3- define new opportunities (Maletic,2013). And Das and et al add the organization that use business intelligence tools can reduce the cost, mitigate the risk, support strategic planning and increase the profit and reputation (Das et al., 2024).

In addition, Microsoft emphasized on two main features are automate reports and ability to make predictions (Microsoft, n.d.).In addition, Tunowski added: Business intelligence The ability to drive changes that result in the establishment of a smart, knowledge-

intensive, and learning organization. Also Enhancing decision-making by adopting the use of factual data rather than intuition or routine procedures, enabling effective measurement and analysis of data sets, cutting data collection and processing time by quite a margin, employing cutting-edge data visualization techniques, which have much greater informational capacity than conventional methods and Providing access to sophisticated business analytics solutions, even to small and medium enterprises (Tunowski, 2015).

2.1.2 How business intelligence system works

Microsoft defined four key steps business intelligence follow to transform raw data into actionable and easy to digest insights, listed in below points (Microsoft, n.d.):

1. Collect and transform data from multiple sources: business intelligence tools allow to users to extract, transform and load data (ETL), they the processed data stored in business intelligence tool data warehouse. So, this makes analysis easier.
2. Uncover trends: data discovery uses automation process to hind and discover hidden pattern or outliers' values.
3. Take action in real time: business intelligence tools provide current and historical data; this feature enables decision maker to move toward decision smoothly.

Beside what mentioned from Microsoft side, tech target research shows how business intelligence process works by the following steps (TechTarget, 2024):

1. Data preparation – organizing, transforming, and modelling the data to be analysed.
2. Analytical querying – running queries against the prepared data sets.
3. Visualization and reporting – creating dashboards and reports that highlight key performance indicator and other findings.
4. Distribution – delivering analytics results to decision-makers, either through business intelligence teams directly or from self-service business intelligence users.
5. Decision support – applying performance data and insights to operational and strategic business decision-making.

In some cases, business intelligence projects also include advanced analytics techniques, such as data mining, predictive analytics, text mining, and statistical modelling. For example, predictive models enable organizations to run "what-if" scenarios to predict possible outcomes. However, while advanced analytics is typically handled by

specialized data science teams, business intelligence teams usually handle querying, visualization, and straightforward analysis of business data. business intelligence systems draw on both historic and real-time data from internal information technology infrastructure and external sources. Such raw material needs to be passed through integration, consolidation, and cleansing in order to be eligible for analysis purposes (TechTarget, 2024).

2.1.3 Business Intelligence Platforms and Fundamental Functions

Business intelligence platforms trace their heritage from the initial decision support systems of the 1960s, which were designed to provide information to senior executives. Unlike those initial systems, Business intelligence platforms today are utilized by a broader group of users and contain more varied functions. According to new industry studies, Business intelligence platforms today include capabilities beyond querying and analysis, including data preparation, visualization, reporting, and governance. They increasingly support collaboration, automated insight generation, and data storytelling, which combines visualizations with explanations in the form of narratives so as to communicate better. A majority of Business intelligence vendors have begun to include conversational interfaces with generative artificial intelligence (GenAI) technologies so that users can analyse their data more easily (TechTarget, 2024).

The advent of augmented analytics also transformed the landscape of Business intelligence platforms. artificial intelligence and machine learning–powered features now automate data cleansing and transformation, provide recommendations on the right visualizations, and help find patterns, trends, and anomalies in datasets. Such features enhance user productivity and analysis accuracy(Chioma Ann Udeh et al., 2024).

The major functions facilitated by BI platforms can be enumerated as follows (TechTarget, 2024):

1. Business measurement and tracking: Tracking of KPIs and performance indicators in real time to spot difficulties and opportunities in the early stages.
2. Data analysis: Running queries and complex analytics in order to build insights into operations, strategies, and market patterns.

3. Reporting and information delivery: Information presentation through reports, dashboards, and portals. Dashboards, in particular, facilitate interactive exploration of information.
4. Predictive analysis: Using historical and real-time data to forecast situations and support proactive decision-making.

2.1.4 Business intelligence tools

Business intelligence tools mainly classified into 3 types : (I) spreadsheets , (II)software, (III) programming libraries(Srivastava, 2023).

i. Spreadsheets: such as Microsoft excel and google sheets, both are considered as the most common used sheets, they including basics charts such as line graph, scatter plots and bar charts.
ii. Software: they are specified to provide powerful techniques for data analytics and visualization such as Tableau, Power BI and QlikView, they are providing interactive dashboards.
iii. Programming libraries: they are more flexible and providing more customization in visualization but requires high technical skills, like matplotlib.

Below list contains data visualization tools:

(I) Python Libraries: it`s a variety and strong programming language gained a significant rule in data science and analysis because of the ability to interpret and visualize different and massive amount of data such as Pandas, NumPy, Scikit-learn, Matplotlib, seaborn, ploty…etc. (Lavanya, Gaurav, et al., 2023).

Key features:

- Dealing with massive amount of data.
- High – level programming language.
- Open source.

(II) Microsoft Power BI: it`s a powerful visualization tool, effectively generate the business useful insights, Power BI help organizations by providing them real-time data, interactive and user-friendly dashboard. also, make them able to use a different type of graphs, process large and different type of data from different data source (Lavanya, Sindhuja, et al., 2023).

Key features:

- Interactive and user friendly.
- Real-time data.
- Integration with SQL server but limited with MySQL.

(III) QlikView: it`s a cloud platform integrates and analysis real-time data by using different data sources, developed by Qlik (Lavanya, Sindhuja, et al., 2023).

Key features:

- AI-driven and automation.
- Drag and drop interface.
- Powerful data exploration.

(IV) Tableau: visualization tool simplifies the process of turning raw data into useful and actionable insights, provides a powerful drag and drop interface, strong data manipulation capabilities and great storytelling features (-, 2024a).

Key features:

- Integration with different data sources.
- AI-driven and forecasting.

(V) Excel: Microsoft spreadsheet uses to organize, analyse and visualize the data, consists from a cell organized into rows and columns. offers different and high-level calculations and formulas in addition to the graphs to present the data visually (-, 2024b).

(VI) Google looker: modern Business intelligence platform developed and owned by google, offering advanced analytics real-time reporting.

Key Features:

- cloud-based with SQL modelling.
- strong integration and Collaboration.

2.1.5 Business intelligence applications

Tech target discussed how business intelligence tools are employed across a wide range of industries to support decision-making, increase efficiency, and optimize operations. Their applications vary with the unique demands of each industry (TechTarget, 2024):

1. Financial and banking services: Banks use business intelligence to examine financial risks associated with the approval of mortgage and loan applications and customer portfolios for cross-selling opportunities. Financial institutions utilize business intelligence to develop tailored offers and improve customer engagement.
2. Insurance: Insurers use business intelligence to examine risks in homeowner, auto, and life policy applications. They also use analytics to price policies and establish trends in claims.
3. Manufacturing: business intelligence is utilized for planning production, material purchasing, supply chain management, and real-time management of manufacturing processes for reduced expenses and enhanced efficiency.
4. Retail: Retailers employ business intelligence for campaign design, product promotion planning, and inventory control. Analytics also guide product replenishment strategies to meet customer demand better.
5. Hospitality: Hotel companies use business intelligence to monitor room utilization and dynamically price based on demand. business intelligence also assists in the management of customer loyalty programs and the improvement of the guest experience.
6. Airlines: Airlines use business intelligence to track ticket sales, flight load factors, and revenue performance. Airlines also use it for operation planning, including flight scheduling, crew planning, and catering management.
7. Logistics and transportation: business intelligence tools are used for route planning, distribution scheduling, and vehicle tracking. Companies use business intelligence to track fuel consumption, optimize processes, and improve delivery performance.
8. Healthcare: Hospitals use business intelligence to analyse patient outcomes, readmissions, and treatment effectiveness. Physicians use business intelligence and clinical data analysis to help diagnose and improve quality of care.

2.1.6 Telecommunication and business intelligence

Telecom companies use BI tools more and more to remain competitive and handle concerns such as fraud detection, traffic observation, and customer retention. Uses include fraud management, market analysis, performance tracking of finance, customer relationship management (CRM), and network optimization. Telecommunications utilize the tools to manage costs, improve services, and retain customers(Shima & Rani, n.d.).

2.1.7 Importance of business intelligence in telecommunication

In telecommunications, business intelligence plays a crucial role in gauging customer behaviour, predicting churn, improving services, and fraud detection. It facilitates strategic goals like market segmentation, customer satisfaction, performance monitoring, and profitability over the long term. Risk analysis and fraud detection have been the latest peak uses of business intelligence, which have helped telecommunications firms lock up revenues and protect customers.

2.1.8 Business intelligence types

The paper categorizes BI into three forms (Shima & Rani, n.d.):

Strategic BI: Long-term planning with aggregated facts and advanced analytics.

Tactical BI: Day-to-day data analysis for short-term decision-making.

Operational BI: Applied in daily business processes, e.g., responding to situations in real-time.

Each is characterized by frequency and purpose of data capturing and reporting.

2.1.9 Business intelligence user categories

Geeks discussed and represent Business Intelligence tools and technologies are only as effective as those who use them. Throughout an organization, users interact with business intelligence differently, depending on their job role, technical capabilities, and decision-making responsibilities. The following are the primary categories of business intelligence users and how each contributes to data-driven success (geeks, 2022; Tunowski, 2015):

1. Power Users

- Profile and Capabilities

Power users are highly proficient in data analysis and business intelligence tools. They possess high-level technical and analytical skills, along with deep understanding of business processes and objectives.

- Tools and Usage

They are inclined to utilize sophisticated tools such as Structure query language, data mining tools, and predictive analytics software. They are able to create complex queries, ad-hoc reports, and sophisticated dashboards that offer deep insights and drive decision-making.

2. Business Users

- Role in Daily Operations

Business users rely on business intelligence tools for operationally decision-making. They may not have deep technical expertise but are familiar with using business intelligence reports and dashboards to support their functional responsibilities.

- Use of BI Tools

They use business intelligence to access relevant data to carry out tasks such as sales forecasting, market analysis, and performance measurement. business intelligence enables them to make informed, data-driven decisions that drive efficiency and outcomes.

3. Executive Users

- Strategic Oversight

Executives employ business intelligence for making high-level strategic decisions. They require quick access to summary information reflecting organizational performance and support long-term planning.

- Preferred business intelligence Features

Executive business intelligence systems typically offer graphical dashboards of key performance indicators (KPIs) with drill-down facilities to scrutinize detailed data as and when necessary.

4. Data Analysts

- Data Analysts

Data analysts specialize in extracting knowledge from large and complex datasets. They are an indispensable component of any organization for identifying trends, discovering anomalies, and making actionable recommendations.

- Techniques and Tools

They regularly use statistical software, data visualization tools, and machine learning algorithms to analyse information and support business strategy with fact-based intelligence.

5. information technology Specialists

- Infrastructure and Integration

Information technology professionals ensure the infrastructure of business intelligence systems is secure, scalable, and well-integrated with existing business systems.

- Responsibilities

They manage data architecture, system performance, and integration. They also ensure data security, access control, and compliance with applicable standards and regulations.

6. Casual Users

- Basic Usage

Casual users utilize business intelligence tools at a basic level. They may look at standard dashboards or reports to obtain information necessary for everyday tasks.

- Needs and Interface

These users are supported by simplified interfaces, simple visualizations, and canned reports that don't require deep analytical capabilities.

7. External Stakeholders

- Extended Ecosystem Participation

External users—partners, vendors, or customers—can also interact with business intelligence tools to consume relevant shared data.

- Collaboration and Access

Through secure portals and customized dashboards, business intelligence tools facilitate collaboration, visibility, and improved coordination with external stakeholders, taking the overall business ecosystem to the next level.

8. Data Stewards

- Data Governance Role

Data stewards provide quality, accuracy, and consistency of organizational data. They execute data governance policy and ensure there is compliance with internal standards.

- Focus on Data Integrity

They strive to resolve data quality issues, standardize data definitions, and ensure data remains trustworthy and usable across the organization.

In conclusion ach business intelligence user category plays an individual but complementary role in the process of data value extraction. The different user profiles need to be understood in order to create business intelligence systems that are complete, effective, and positioned to address the varied needs of an organization.

2.2 Data analytics

The process of meaning-making from something called analysis, and the process of meaning-making from data called data analytics, the management of data which include storage, analyse, secure and the use become as the heart of any organization and any area (Challa, 2023). So, data analytics can be defined as the diagnosis of raw data to discover and derive valuable hidden insights. (Jeyadevi J, 2023), in addition it`s the whole process of collecting, transforming and organizing the data to draw conclusion, discover pattern and derive informed decision making. (Staff, 2025) and Coursera staff defined as a multidisciplinary science using different and wide range of analysis techniques such as statics, math and computer science to extract the hidden pattern that help organizations to enhance the decision making (Staff, 2025).

2.2.1 Data Analytics Process

Some research divided data analytics process into 5 steps and other divided it into 7 steps listed in below:

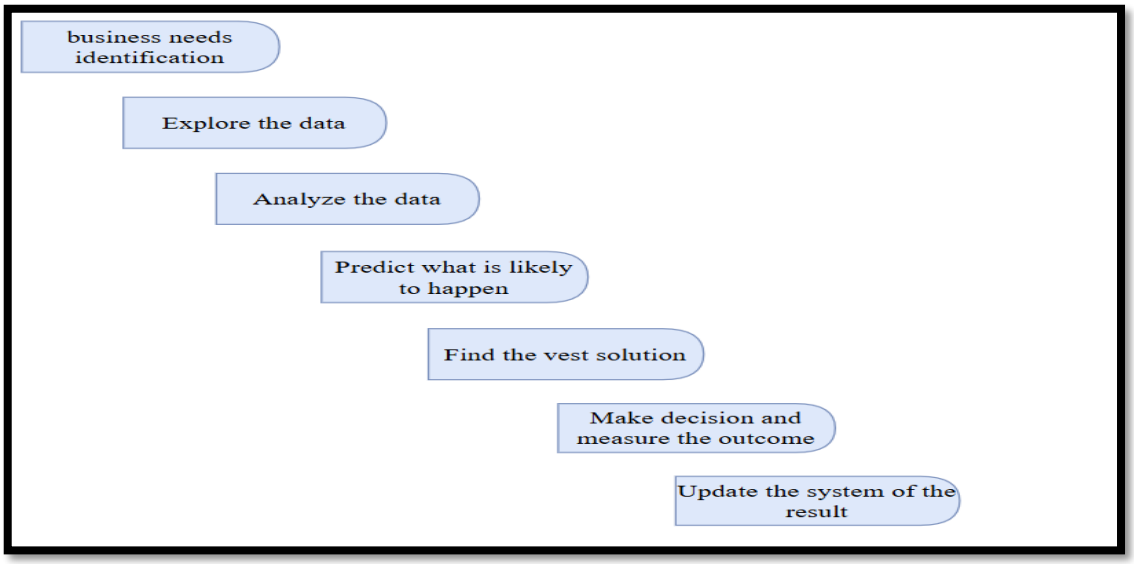
1. Identify the problem: understand the business issue, set the organization objectives and set feasible and doable solutions. (Challa, 2023).
2. Collect data: after address the business problem you need to gather all needed data from the past few years, this data very crucial to shape the future because it`s provide insights into past trends and helps to identify pattern that can inform future decision (Challa, 2023).
3. Clean the data: the data collected may contains missing or disorder values, so it`s crucial to remove duplicate, redundant and irrelevant values. this step helps that the data now is accurate, complete and ready for analysis (Challa, 2023).
4. Analyse the data: in this step you will start to investigate and analyse the data by different intelligence tools, after this step the hidden valuable insights will be discovered and other important information (Challa, 2023).

Interpret the results: after discovering the hidden pattern and predict of the future, it`s time to make sense of the findings and support data driven decision -making, it`s very important step to ensure the result meet your expectations and to validate if you are aligning with your business goals or not (Challa, 2023).

Figure 2
Data Analytics Process

On the other hand, Abdul-Jabbar and Farhan considered the process contains 7 main steps listed in below(Abdul-Jabbar & K. Farhan, 2022) : business needs identification.2- Explore the data.3- analyse the data.4- Predict what is likely to happen.5- Find the vest solution.6- Make decision and measure the outcome.7-Update the system of the result.

Figure 3
Data Analytics Process 2

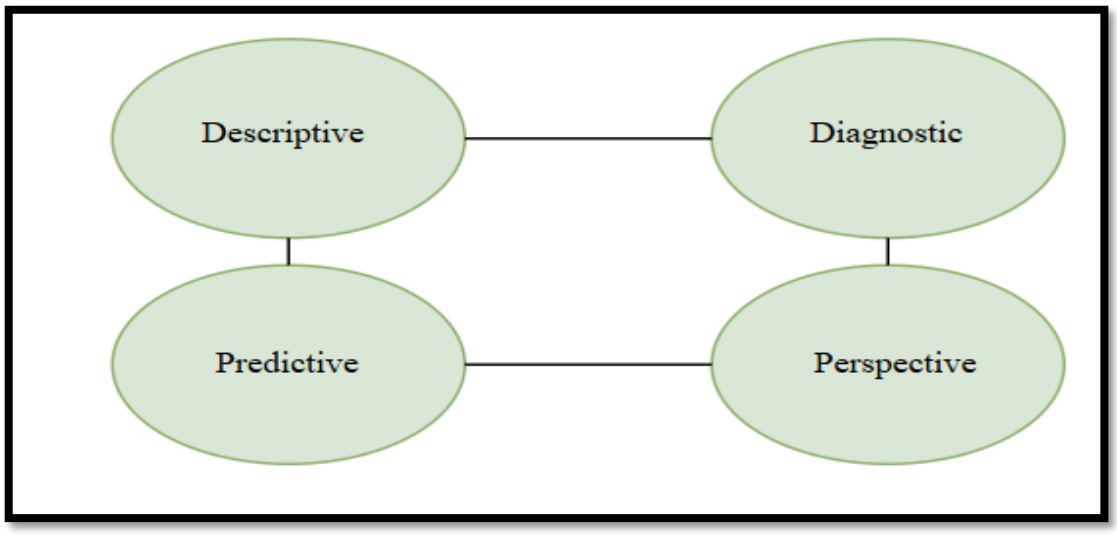


2.2.2 Data analytics types

This section discussed the main types of data analytics, Harvard School for business divided them into four main types (School,2021): (I) Descriptive Analytics: answer the question "what happened "from raw data. (II) Diagnostic Analytics: take the analysis into new area to address a new question "why did this happen? "And this type of analytics is very useful to get the root of the issue. (III) Predictive Analytics: use to predict about the future and find the answer for 'what will happen?' this type helps the organization and stakeholders to formulate strategies and plans (IV) Perspective Analytics: take into consideration all possible factors and set actionable plans, this will answer the question "what is the next plan? what should we do in the future?".

On the other hand, Jable and el al divided them into three types: (I) Descriptive analytics: clarify the phenomenon from past by using raw data, this will help to understanding what happened. (II) Predictive analytics: clarify what can happen. Depends on historical data and correlations between variables to predict about the future. (III) Prescriptive analytics: helps to understand different outcomes under different scenarios.

Figure 4
Data Analytics Types



2.2.3 Essential Skill for data analytics

To extract the crucial meaningful insights from various dataset to help the organization you must have a critical and main skills discussed by Pub in his research(Pub, 2024): (I) Technical proficiency: the core of data analytics depends on technical expertise and a solid understanding of programming language such as python, R language and structured query language (SQL) (university, 2024), also it`s very crucial to use them in data cleaning, manipulation or implementing machine learning algorithms. (II) Statistical knowledge: statistical skills shape the foundations of drawing accurate conclusion and making an informed decision based on hidden pattern. (III) Data visualization: the ability to visualize data effectively it`s a crucial skill in data analytics, the capabilities in using visualization tools such as tableau, Power BI and the competence in understating the data exploration empowers data analytics to uncover the patterns that may not be apparent. (IV) Problem-solving skills: data analytics is problem solver at their core, ability to understand the needs, set hypothesis, design the experiment and address the real challenges. (V) Domain knowledge: in addition to technical and software skills, data analytics can`t help and do the needed without business and domain understanding. the success starts from ability to ask the appropriate questions. (VI) Continuous learning: because of the rapid changes in data field, scientist should be a committed to continuous learning to know the trend and techniques.

In addition, Ismail and Zainal Abidin emphasized regarding the main and essential skill that each data analytics should have(Ismail & Zainal Abidin, 2016): (I)Deep analytical

skills such as machine learning, database and programming. (II) personnel skills: highly communicated. (III) service skills: decision making and business knowing.

2.2.4 Data analytics applications

To gain useful insights that increase the profitability, operation, enhance the customer experience you have to analyses massive amount of data. below are some of the main applications show how using data analytics enhance of the decision making (Dr. Vijai Tiwari, 2024):

1. Marketing and sales: by analysing the customer data, organization can define the targeted groups, create new campaign and evaluate the values for launched campaign, this will help to enhance marketing strategy and increase the sales.
2. Supply chain management and working operations: by analyses the historical data, organization may found insufficient operation, unused resources or shortage in resources, this will help to forecast demand and supply and enhance the operations.
3. Human resource: predict turnover rate, track employee performance and be sure their strategy for talent management is aligned with business objectives and goals.
4. Risk management: by analyses the transactions history organization can detect frauds and may be able to create a new revenue stream.
5. Predictive maintenance: predict when any machine will stop it`s very crucial for business, and by analysing the historical data for faults the organization can be able to enable proactive maintenance to reduce the downtime and increase the efficiency overall the organization.

Also, more research discussed different data analytics application, for example in finance they used data analytics to identify fraudulent activities and optimize investment portfolio.(Jeyadevi J, 2023). in insurance, using predictive analysis to increase sales and profitability and understating their client by analyse social media and different sources.(Jeyadevi J, 2023). also in government they using predictive analysis and historical data analysis to make accurate strategic plans.(Jeyadevi J, 2023).

2.3 Data visualization

There are a lot of researches discussed the meaning of data visualization , for example Srivastava said : it`s powerful tool improves the understanding the complex data, involves display the data in charts to make it simpler to interpret (Srivastava, 2023). Olowe et al said : it`s a tool using to discover the hidden pattern, trend and correlation that might be hard to detected through raw data - the graphical representation of information and data (Olowe et al., 2024).

Data visualization refers to the visual and interactive display of data, regardless of size, type (structured or unstructured), or source. Its applications are diverse, including making information easier to comprehend and understand, assisting in analysis and decision-making, assisting information seeking and navigating, and enabling good storytelling. In addition to utilitarian application, data visualization is also employed as a tool of creative expression and aesthetic appreciation, and sometimes merely as an entertaining or aesthetically pleasing means of communication (Airinei & Homocianu, 2010).

And Eberhard added: Visualization defined as a critical representation of business information that designed to rapidly and effectively deliver the idea or message to enhance the understanding (Eberhard, 2023). In addition, Bagchi clarify data visualization is presenting data on a map, chart or graph makes brain able to understand and make the conclusion, visualization simplify explore pattern, outlier and trends (Bagchi, 2024).

At the end Manchekar and Jain said: can defined as the logic and science that convert the raw data into actionable insights, aids the decision makers, analytics and audience to digest and understand the information (Manchekar & Jain, 2023).

A chart is a graphical or tabular display of data as a graph, diagram, map, or table. Tables and Geospatial visualizations are thus to some extent subcategories of charts. However, drawing a distinction between them helps determine the best approach for particular data. The most common types of charts include Scatterplots, Pie Charts, Line Graphs, and Bar Charts. These, used alone or in combination, answer all but the most esoteric questions of analysis for relational data and form the foundation of visual analysis of non-geospatial data (Tabluea, 2023).

Charting relies on graphing data points onto Cartesian coordinates (e.g., X, Y, Z) based on given dimensions and measures. Dimensions (e.g., categories or time intervals) cluster the data, while measures (e.g., profit, mortality rates, temperature) are mapped to coordinates to build the visualization. Certain visualizations, e.g., ordered bar charts, are effective in representing multiple dimensions, while others, e.g., pie charts, function well with fewer dimensions to provide simplicity (TechTarget, 2024) (Tabluea, 2023).

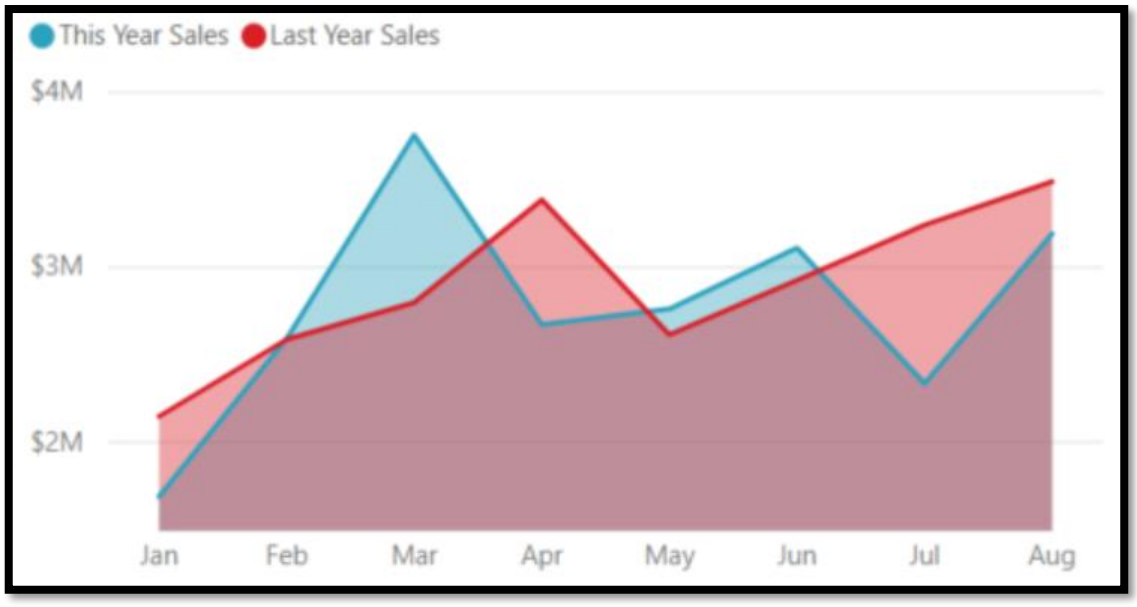
2.3.1 Data Visualization Techniques

Histogram, Bar charts, line graphs, pie chart, heat maps, and network diagrams are all types of data visualizations that can represent different data types, many of research and websites discussed these techniques to define the appropriate scenario to use them(Srivastava, 2023; Micrososft, 2023).

1. Area chart: it depends in the line charts and the area between two axis and lines fill with colours to highlight the volume or area. This type uses to emphasize the volume if changes over the time.

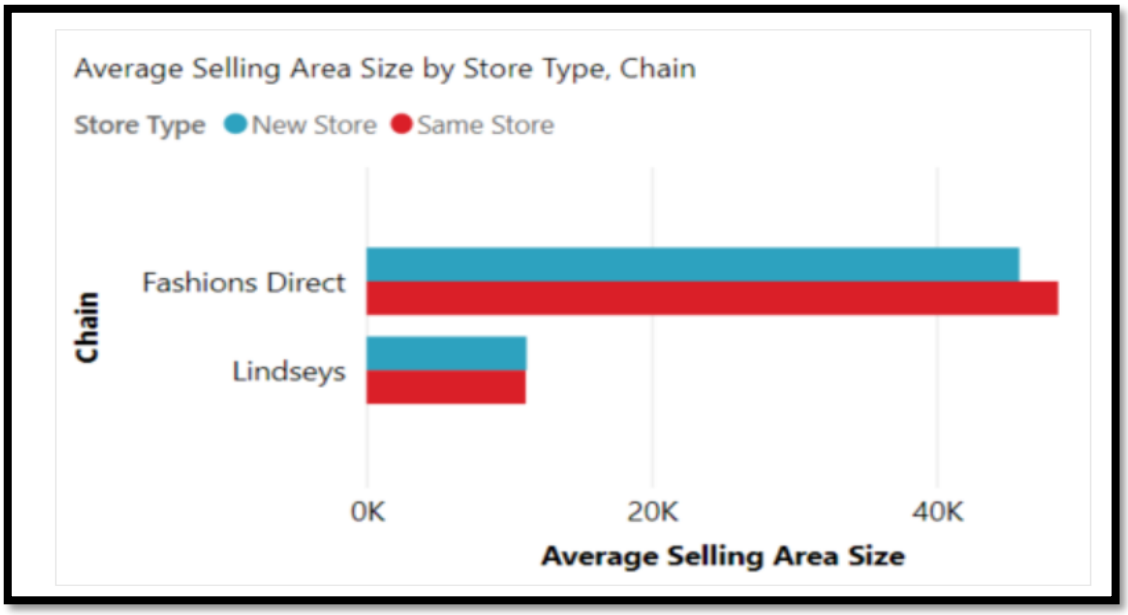
When to use a basic area chart: it`s an appropriate when you need to compare the volume of changes over time series.

Figure 5
Area chart



2. Bar chart: uses rectangular bars to reflect the values depends on the length and bars can be vertical or horizontal.

Figure 6
Bar chart



When to use bar chart: it`s appropriate in Showing distribution across categories, comparing categories and represent the changes over time.

3. Cards chart: it can be single or multirow cards. Multirow cards uses to represent one or more data points, one per row. But single card uses to represent single fact or a single data point.

When to use Cards chart: to highlight or display the most important things you want to track in the dashboard.

Figure 7
Cards chart

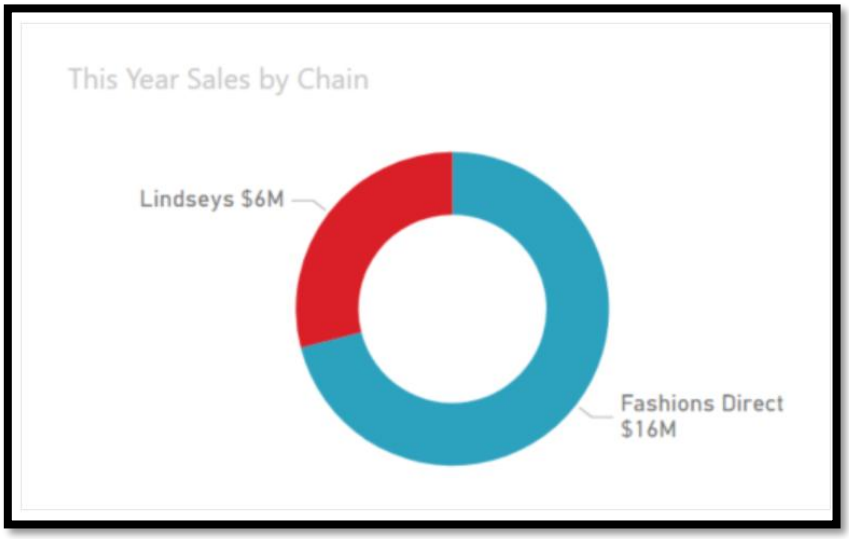
4. Combo Chart: It`s a combination of a column and line chart, which allows for easy comparison of two measures on the same X-axis. It can have one or two Y-axes.

When to use Cards chart: 1- Comparing two chart types with the same X-axis.2- Displaying multiple measures with a different range of values.3- Emphasizing the correlation between two measures.4- Monitoring if one measure is reaching a target set by another.5- Conserving space by combining visuals.

Figure 8
Combo chart

5. Doughnut Chart: Similar to a pie chart, a doughnut chart shows parts of a whole but empties out the middle for labels or icons.

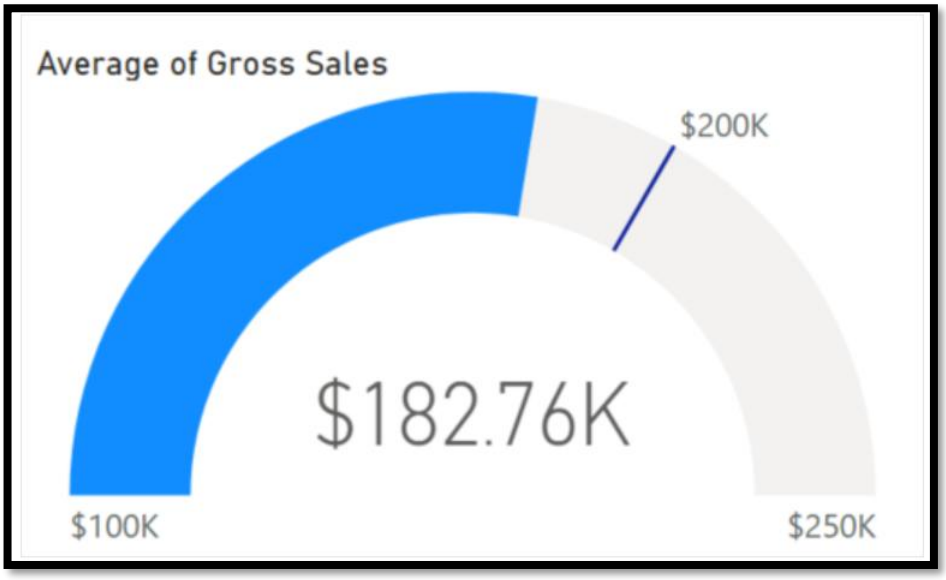
Figure 9
Doughnut chart



6. Gauge Chart (Radial Gauge): A radial gauge illustrates progress toward a target on a circular arc. The needle points to the target, and shading shows actual progress.

When to use Gauge Chart: Measuring progress toward targets.

Figure 10
Gauge chart



7. Key Performance Indicators Visual (KPI): shows progress toward a measurable goal with simple visual cues. See Figure A.1 in appendix A

When to use KPI visual:1-Tracking performance.2-Actual vs. target comparisons.

8. Line Chart: A line chart emphasizes trends over time, showing the overall shape of data movement. See Figure A.2 in appendix A
9. Maps: Power BI provides a few types of maps:

- Basic Map – maps both categorical and quantitative data by geographic location. See Figure A.3 in appendix A
- ArcGIS Map – rich mapping with themes, reference layers, and spatial analysis. See Figure A.4 in appendix A
- Azure Map – new option for Power BI mapping. See Figure A.5 in appendix A
- Filled Map (Choropleth) – shows value range by shading intensity. See Figure A.6 in appendix A
- Shape Map – compares regions by colouring them (without precise point plotting). See Figure A.7 in appendix A

10. Q&A Visual

The Q&A visual allows users to type in natural language questions, and Power BI generates the visualization based on that question (e.g., "What were sales in 2019?"). See Figure A.8 in appendix A

11. Scatter Plots: Scatter chart – plots points according to X and Y values See Figure A.9 in appendix A
12. Tree map: A tree map employs nested rectangles sized and coloured by value. See Figure A.10 in appendix A

When to use Tree map:1- Displaying proportions within hierarchies.2- Handling large categorical data where bar charts would be cluttered.

13. Waterfall Chart: A waterfall chart shows running totals, emphasizing how positive and negative changes affect an overall value. See Figure A.11 in appendix A

When to use Waterfall chart:1- analysing contributions to profit/loss.2- Illustrating how starting and ending values are achieved.

2.3.2 Principals for Effective Visualization

Visualization it`s not only colours and charts, it`s a storytelling tool and wrong visualization means wrong decision making. Because of this Midway discussed most important things should be taken in data visualization (Midway, 2020).

First, diagram first: make the purpose and message first, then choose the visual form. It is about what you want to say, not how you show it. Second, Use the Right Software: Good pictures require good tools. Basic spreadsheet programs can be limiting, so familiarity with powerful visualization packages. Third, choose a suitable visual form (e.g., bar, box, scatter plots) based on data type and message. Show raw data wherever possible. Fourth, Colours Always Mean Something.

The Last one, Request an Opinion: Share your graphics with other people and ask for feedback. Other-people review helps reveal confusing or deceptive designs and enhance clarity for all concerned. In addition, Olowe, Edoh and et al emphasized on some essential principles of effective data visualization(Olowe et al., 2024). (I) clear, simple and relevant charts. (II) reduce the unnecessary items or information from the dashboard. (III) select

the suitable chart for example line is better for trend over the period. (IV) using interactive dash allows to user to filter and drill down the data. Also, Ajax added: each data visualization should include Data accuracy, security and consistency and use real-time data refresh.” poor data leads to poor decision”(Ajax, 2025).

At the end, Anandaram and et al focused on 3 main points each organization should take into consideration in visualization efficiency(Anandaram et al., 2025): (I)Easy to access from server, desktop and mobile. (II)Capacity to transform and analyse massive amount of data. (III)Capacity to adopt the organization changes.

2.3.3 Colours theory in visualization (Bagchi, 2024)

Good colours use and implementation help viewers to understand the information behind the visualization, so it`s very important for data analytics or the people those do not have any background in design all in all to study the colours theory and understand how they effect on human eye. Colours theory can be defined as study the science of colours to understand the effect on human perception and how to use this science to enhance decision making process and communication, so it`s very important to know and use the colours theory and schema listed below:

1- Colours harmony: you should learn how to use and choose good colours by analysing the colours harmony on the colour wheel.
2- Be consist: use same colours to describe and define same item or related subjects.
3- Reduce the use of colours: using more and more of colours may make overwhelming, be careful while choosing the colours and be sure they contributing to deliver the idea and the information from you visualization not only attract the viewers to the colours itself.

2.3.4 Importance of data visualization

Zheng discussed data visualization and showed how it helps the organization to gain many benefits describe in below(Airinei & Homocianu, 2018):

1. It reduces the amount of work done to process information and allows information to be easily recalled by presenting it in a visible form.
2. Methods of visualization give a clear picture of complex sets of data, which helps to reveal patterns, relationships, structures, and trends.

3. Visual signals provide directions of interest or departure and allow decision-makers to quickly focus their attention and determine where additional examination needs to be carried out.
4. By leveraging the benefits of the human visual system, visualization allows users to uncover hidden meanings and produce intuitive comprehension.

2.3.5 Charts and Diagrams

Block visuals take relatively more room in a report or dashboard but remain a fundamental part of the overall presentation. Block visuals are more independent and standalone pieces of visualization, and where there are many data points or where interactions among them are complex, even a block visual can stand alone. The most universally recognized forms of block visuals are charts and diagrams (Manchekar & Jain, 2023).

Charts are created by using the graphical marks—e.g., lines, points, and areas—together with visual variables like shape, colour, and size, all of which correspond directly to data. While the words chart and diagram are sometimes interchangeable, diagrams are generally considered a broader category within which charts fall. In business data visualization, a chart tends to be more abstract in its intent to represent quantitative measures (e.g., business performance metrics), whereas a diagram may also represent qualitative elements like structures, relationships, sequences, and workflows (Kobi, 2024; Zakaria, 2021).

Charts and diagrams are both the primary tool of business data visualization in business intelligence and the foundation for reports and presentations. Common chart types include line charts, bar charts, and pie charts, while common examples of diagrams include organizational charts, tree diagrams, network diagrams, and workflow diagrams. Abela (2008) offered a common division of charts by purpose that is excellent advice on selecting the correct visual forms. The above division has been augmented by the profile purpose as a special instance of comparing more than one data item for higher completeness (Ram, 2024a).

2.3.6 User Interface and user experience (UI/UX):

1. User Experience (UX) Design

As Edward Stull explains, human beings are really a collection of experiences—most of which are becoming more digital, whether in the form of websites, emails, or video games. Don Norman describes User Experience (UX) as the goodness of a user's interaction with a product or system. For an experience to qualify as successful, it should address the needs of the user first, with the least number of complications and no barriers that interfere with their work. UX is thus all about understanding the user—not only their needs but also their limitations. The goal is to make people feel like they gain something from the platforms or systems they use (Martins, 2023).

Martins developed a seven-point model of the key factors that help establish an effective user experience. They are considered to be key to whether a product succeeds or fails (Martins, 2023):

- Useful – The solution must support decision-making by streamlining the process and making it more effective.
- Usable – The computer program must be easy and easy to use.
- Findable – Users must be able to locate the information they need with ease.
- Desirable – The system should provide a delightful and stimulating user experience for everyday use.
- Accessible – The interface should be usable for everybody, including disabled people.
- Credible – The site should demonstrate its reliability and trustworthiness from the initial stages.
- Valuable – The product should provide value to the user, both in terms of content and functionality.

To optimize UX, the design process must begin in a user-oriented manner. This involves the acquisition of user requirements, evaluation of current platforms for data processing and management, and studying the concept and principles of designing dashboards (Martins, 2023).

Second, a comprehensive user profile must be created, usually via interviews with employees and focus groups. Additional sessions with users who are stakeholders,

including managers and operations personnel, facilitate the identification of the user's motivations, goals, and potential problems when using the system. In this phase, the designers can learn the user's work environment, facilitating improved evaluation of the solution's usability. Open discussion between end-users and designers is critical. This interaction provides contextually derived scenarios that define a system more attuned to the very needs of real life(Martins, 2023). Among the characteristic steps of creating dashboard interfaces is constructing wireframes—low-fidelity mock-ups that facilitate rapid testing of layout, positioning of content, and ordering of functions. These preliminary drawings help identify usability issues prior to development(Kobi, 2024; Martins, 2023).after the wireframes are complete, the designers ought to organize user behaviour and design a navigation flow that allows unbroken and consistent interaction with the dashboard system(Zhang, 2024).

2. User Interface (UI) Design

UI Design is an iterative and interactive process with a focus on enhancing the visual and interactive elements of a digital product. As stated by Martin this process features repeated user research, prototyping, and testing of the system in order to ascertain if the system guarantees an engaging experience of interaction (Martins, 2023).

UI Design assists UX with considerations for visual design, interaction design, and information architecture. UI Design's primary purpose is to create an engaging and effective interface that minimizes user friction. In the process of developing the dashboard, wireframes and navigation flows will evolve as a result of new learning. Wireframes are therefore not a destination but a tool of discovery and iteration. It is within the UI process that essential details such as colour palettes, font, and visual identity are determined. UI design is by nature iterative, and there are a number of cycles of prototyping and feedback. As Saffer (2020) explains, prototypes typically go through a number of iterations before arriving at a fully effective solution. With each iteration, there is an opportunity to improve functionality, usability, and appearance (-, 2024b; Bagchi, 2024).

2.3.7 Interaction Design

Interaction Design (ID) deals with users' interaction with digital systems, taking into account cognitive and behavioural. defines it as the discipline that enables intuitive human and digital tool interaction, balancing functionality and usability.

Martins' names three basic questions to which Interaction Design must respond (Martins, 2023):

1. How do you DO? – Understanding what the users need to do, how the application functions, and how the actions affect the user experience.
2. How do you FEEL? – Assessing user feedback from the emotional feeling by the user in the course of the process.
3. How do you KNOW? – Understanding that users can determine the system actions and understand how the application functions.

The interaction design process is all about establishing problems or initial ideas that give meaning to the project. It requires coming up with various scenarios so that one may comprehend how, where, and why the system will be used and what users will encounter. All these expectations are then used to create a conceptual model of user requirements and express it through control mechanisms and visual mappings (Martins, 2023).

Last but not least, the goal of Interaction Design is to create systems that are naturally responsive to user action with regard to utility needs. It informs the user of what is happening at every moment in the interaction and can use the product confidently and effectively.

Table 2
Purposes and Examples of Charts in Business Data Visualization

Purpose	Meaning	Example Charts
Comparison	Used to compare and sort different data points against each other.	Bar chart, Column chart, Line chart, Radar chart
Composition	Illustrates how individual parts contribute to a whole.	Stacked column chart, Stacked area chart, Pie chart
Distribution	Shows the aggregated values (often counts) of data points grouped into categories, such as value ranges or over time (trends).	Histogram, Scatter plot, Bubble chart
Relationship	Depicts how different data items are related or positioned within a broader context.	Scatter plot, Bubble chart
Profiling	Enables comprehension of data through visual patterns and shapes.	Radar chart, Parallel coordinates

2.4 Data Driven Decision Making (DDDM)

In the opposite of intuitive decision there is a data driven and rational decision making, both of them mean when people use information, analysis and insights to make the decision(Uzonwanne, 2020).In general, decision making can clarify as the step-by-step process human makes since they open their eyes till they close it again, and decision making usually means chose one from different options(Uzonwanne, 2020).And business dictionary defined the decision-making process as the thinkingly process to choose the most logical and appropriate choice from different choices (dictionary, n.d.).Day after day, decision making became more complex and it`s not enough to use last experience and intuitive to take decision may lead whole organization to lose, and since that, stake holders and cession maker started to use data, pattern and analytics to decide (school, n.d.).

Emma defined data driven decision making It`s the process of extract the and recognize the critical pattern to make the decision to improve the efficiency and accuracy overall the organization (Emma, 2024).

And Harvard business school defined it the process of using data ton enhance and inform the decision-making process and to validate the action before make it real (school, n.d.).

2.4.1 importance of data driven decision making (DDDM)

1. stay competitive: having real time data make organization able to adapt with rapid changes, discover patterns and increase proactivity.
2. mitigate the risk: decision based on data will make organization to be better in anticipated challenges and make more reliable and calculated investments.
3. identify the threats and opportunities: easier threat and opportunity discovering better planning and forecasting.

In addition to what Emma mentioned, Harvard business school said: confidence, proactive and cost-saving all of these are the main benefits you will gain from data driven decision making (school, n.d.; Emma, 2024)

2.4.2 How data analytics effects on driven decision making (DDDM)

This most important things achieved by using data analytics it the enhancement and improvement happened on decision making process and efficiency. Previously the

organization was depended on gut the feelings or intuitions which may will cause a great mistakes and bias. But after started using data analytics the decision being to be done based on facts and information. by this the organization reduce the human bias and that's increase the objectivity also increase the accuracy by using reliable data (Emma, 2024).

Furthermore, decision-making today encompasses environmental, social, and. economic factors. Through data visualization, businesses are able to get a better understanding of complex data, quickly identify trends, respond to market dynamics, uncover opportunities for growth, and actively minimize risks (Ram, 2024b).

Also Emma provided more and more of benefits from using data analytics in data driven decision making process as shown in below (Emma, 2024).

1. Achieve strategic goals.
2. Solve problems successfully.
3. Allocate resources optimally.
4. Manage risk effectively.
5. Generate innovation.
6. Solve conflicts.
7. Build personal and organizational skills
8. Build trust and confidence.
9. Fit into changing environments, and ensure long-term sustainability.

2.4.3 How visualization enhance data driven decision making (DDDM)

Data visualization helps organizations to understand the complex data, identify risk and mitigate it immediately, monitoring key performance indicator, understand the customer behaviours to know how to increase the customer satisfaction and make the decision maker up-to-date since the dashboard able to provide real time fresh information (Sharma, 2023).

Also added data visualization helps in better customer sentiment analysis , exploration of trend , detect outlier and abnormal values or behaviour (Sharma, 2023).

And het summarize the value of using visualization to enhance data driven decision making in below points (Ram, 2024b).

1. Makes complex information easier to understand for individuals.

2. Engage the individuals effectively more than raw data or text.
3. Transparency for shareholders.
4. Enhance the communication process between the decision makers.
5. Enhance the monitoring.

2.4.4 Real world problem using data analytics and visualization to enhance decision making

Different organization implemented data driven decision making to enhance their position and to stay the leader such as Walmart to optimize inventory management: using predictive analytics to forecast in demand, Netflix to enhance customer experience: using data analytics tool to personalized recommendation and General Electric company: using data driven decision and internet of things (IOT) to enhance predictive maintenance(Das et al., 2024).

2.4.5 How to be data driven decision maker

1. Ask about pattern everywhere: data analytics is the heart of data driven decision making, helps to find pattern and correlation between different points (school, n.d.).
2. Make any decision by data: do your best to avoid use the past behaviour or intuitive and do your best to get data and apply analytical mindset (school, n.d.).
3. Visualize the data: it`s probably possible to derive the meaning correctly from tables, so you have to make yourself familiar with visualization tools and technique (school, n.d.).

2.5 Technology Acceptance Model (TAM)

In recent years, many of organization started using data analytics and visualization tools to handle, refine and utilize the use of data. The suitable and correct use of these data help decision maker to make correct and rational decision on real time (Shiau, 2014).

When the organization need to use analytics and visualization tools such as Microsoft Power BI, they have to know how to evaluate, enhance and increase the decision makers intention to use these technological tools by implementing any technological adoption model (Shiau, 2014).

One of the most model use to predict the end-user behaviour for technology is technology acceptance model created by Davis at 1986, evaluate the resistance to change , technostress, digitalization anxiety … etc by using to main factors perceived ease of use and perceived usefulness (Schorr, 2023).

2.5.1 Technology Acceptance Model (TAM) revolution

Zaineldeen and et al defined the revolution of technology acceptance model by 3 main phases (Zaineldeen et al., 2020):

TAM 1: this model uses to clarify and predict the end-ser technology acceptance and it depends on two main factors ease of use as well as usefulness and both of them works to determine the “intention to use “. They also added these usefulness and ease of use may affected by external factors.

TAM 2: this model created by Davis and Venkatesh, they expanded the model to know what are the factors impact on perceive of usefulness. They divided the factors into 1-

Social: Subjective norms, image and enforcement of voluntariness. 2- cognitive or mental factors: job relevance, result demonstrability and output quality.

They applied this concept on 156 employee's id 4 different companies multiple time, one of them was voluntary and the other one was by enforcement. At the end the test showed the model was success in both and once the employee has more experience, he\she becomes careless about people opinion.

But this model has one of big limitation, it did not take the factors affected on perceived of use.

TAM 3: this model addresses the factors affected on perceived ease of use and perceived of usefulness. In addition to what addressed in TAM 2 Davis and Venkatesh assumed the perceived of use.

This model shows when the end-user has no experience about new technology, they use their own opinion "Anchors" including computer anxiety, computer self-ability, perception of external support and computer passion.

In addition, it shows when the end-user has more experience the computer anxiety and passionate will reduced over the time. On the other hand, the level of experience impact positively on self-ability and perception of external support.

2.5.2 Technology Acceptance Model (TAM) Practical application

Technology acceptance model has been implemented in different information technology areas; many researchers clarified these areas. for example, Moon and Kind used the model to evaluate the acceptance of using internet in education, Chen clarified this model in e-stock stern et al in online auctions(Lazim et al., 2021).In this context, this model is the most successful mode to inform technology designers on the impact of the system to the end-user's behaviour (Lazim et al., 2021).

2.6 Telecommunication fraud

This chapter gives a comprehensive definition of fraud per se, and fraud specifically within the telecommunications sector. It also discusses the numerous motivations that compel people to participate in fraud in this industry.

Fraud has been described in many definitions. According to the Cambridge Advanced Learner's Dictionary, fraud is "the crime of getting money by deceiving people." The Merriam-Webster Dictionary states that fraud is "the crime of using dishonest means to get something valuable from another person." Essentially, fraud is any deliberate act with the goal of achieving unfair or illegal gain (Amin et al., 2020). In the telecommunication sector, fraud is a term used specifically to denote the illegal use of telecom operators' voice or data services without any intention of paying for such services(Babaei et al., 2019). Fraud detection is, therefore, the identification and prevention of such unwanted activities (Guo & Wang, 2020). Such unwanted activities in most instances include delinquency, intrusion, and defaulting an account.

We should know what motivates fraudulent activity. The most common motivation is self-use—utilizing services for free. The second common motivation is income, when swindlers sell good-quality telecom services to customers at a discounted price, generating illegal income(Babaei et al., 2019). As stated in, deceptive intentions could be broadly divided into two categories according to revenue: revenue fraud, in which the perpetrator is seeking money benefits, and non-revenue fraud, in which the only objective is to acquire free services (Al Habri & Al Syani, 2022). In addition, fraudsters can exploit the anonymity of telecom systems to carry out untraceable communications and cover their tracks. This feature is especially appealing to terrorists and criminals who want to be unknown when carrying out evil schemes (Babaei et al., 2019).

The cover provided by such communications partly stems from the extremely intricate topology and very large size of contemporary telecom networks, which render the effort to identify fraudsters highly challenging, time-consuming, and expensive.

2.6.1 Telecommunication fraud types

Telecommunication fraud can occur in numerous forms, and diverse studies have proposed different categorizations. Nevertheless, most categorize them according to the tactics used by fraudsters to obtain unauthorized access (Babaei et al., 2019; Guo & Wang, 2020).

A general categorization was proposed in, in which fraud was categorized into subscription fraud and superimposed fraud.

Subscription Fraud occurs when fraudsters obtain an account but do not intend to pay for consumed services. High-debt fraud also falls within this category where the account is legitimate but fraud begins with activation. A case in point here is registration in a pseudonym name. Importantly, there are two types of users: domestic users and commercial users. Since commercial accounts pay more for their extensive usage, fraudsters register as domestic users to minimize costs. Subscription fraud has also been divided into two subcategories:

1. profit fraud, and
2. personal use fraud.

Subscription fraud is one of the most difficult problems to detect in telecommunications, and it usually causes considerable revenues for operators (Babaei et al., 2019).

Superimposed Fraud is committed by fraudsters hijacking an account that belongs rightfully to a legitimate customer. One of the common ways of identifying such incidents is through verification of call records in billing statements. In superimposed fraud was also divided into types such as phone cloning, ghosting, insider fraud, and tumbling, while insolvent ones were classified under subscription fraud (Babaei et al., 2019).

Another perspective that was introduced by concealed fraud to internal and external fraud based on nature and source (Alshawawreh et al., 2024).

Internal Fraud originates inside the organization, and hence it is comparatively easy to probe. Common examples are:

Ghosting: using technical tools for avoiding or reducing charges.

Sensitive Information Disclosure: disclosure of valuable or confidential information to third parties.

Fake Activation: exchange of hidden profits (e.g., vouchers) for goods and services.

External Fraud, then, begins outside the organization, often with secret identities and minimal or no geographical limitations. A few examples include:

Surfing: unauthorized use of another customer's services, for example, through SIM cloning or PBX manipulation.

Roaming Fraud: exploiting delay in forwarding Call Detail Records (CDRs) between visited and home networks in an attempt not to pay.

Another classification, suggested in below, classified fraud into four types (Babaei et al., 2019):

Contractual Fraud – illegal acquisition of services for free (e.g., subscription fraud, PRS fraud).

Hacking Fraud – leveraging system vulnerabilities to achieve benefits from or resell capabilities, such as network attacks and PABX fraud.

Technical Fraud – leveraging network vulnerabilities. Even though the identification of such vulnerabilities is typically the work of technical professionals, once discovered, even non-technical players can benefit from it (e.g., SIM cloning, technical internal fraud).

Procedural Fraud – directed towards business processes used to minimize fraud exposure, often to gain system access (e.g., roaming fraud, voucher ID cloning).

VoIP has become a promising communications channel with the burgeoning expansion of smartphones and broadband Internet because it is cheaper. This has opened up new types of fraud, including registration hijacking, spamming, and message manipulation. In addition, fraudsters nowadays exploit cell phone advertising platforms by using automated programs to create fake click events to then create profits from advertisements. in the end, no telecommunication fraud classification system has a worldwide consensus. Researchers have presented several categorizations, tend towards converging subscription fraud and superimposed fraud as the two dominant categories (Shima & Rani, n.d.).

2.6.2 Fraud Management Systems

Some of the various fraud management systems and the most prevalent methods utilized in each are the subject matter of this chapter. The growing number of fraudulent calls in the telecommunication industry and the associated heavy losses have prompted organizations to seek automated and intelligent solutions that can assist them in fighting fraud. For the most part, the systems are divided into two broad categories: fraud

prevention systems (FPSs) and fraud detection systems (FDSs). The subsequent subsections highlight the variation between these frameworks.

Fraud prevention mechanisms are used to deter or prevent fraud in advance [8], [34]. They provide the initial line of defence against fraud. Various mechanisms are firewalls, encryption, and procedural controls like the use of Personal Identification Numbers (PINs) or Subscriber Identity Modules (SIMs) on Private Branch Exchange (PBX) systems [34]. Application analysis and identification of potential customers before permitting access to services is another approach [20].

Even though they are widely in use, FPSs are not perfect. They succeed for the most part in the short term only, with criminals learning to modify and negate prevention quickly [18]. Furthermore, such systems are experienced by their end users as intrusive [8]. An example is the use of security codes to protect SIM cards [16]. Unfortunately, because the codes are rarely used by users, they are forgotten and repeated mistaken inputs can result in SIM lock—a sure inconvenience.

Fraud detection systems are implemented as the second line of protection on the assumption that fraudsters may have outsmarted the fraud prevention system (FPS). That is, fraud has already taken place, and the purpose of the fraud detection system (FDS) is to detect it and report(Chioma Ann Udeh et al., 2024;Babaei et al., 2019).The optimal fraud detection system is one with the capacity to detect and notify fraudulent behaviour in real time so prompt action may be taken. Round-the-clock monitoring allows fraud detection system to neutralize most of the inherent weaknesses of fraud prevention system.

According to fraud detection systems can be categorized into three broad classes (Amin et al., 2020; Babaei et al., 2019):

- Rule-based systems
- Visualization systems
- User-profiling systems

Also classified the detection systems as statistical/probabilistic models, machine learning techniques, and rule-based techniques.

Offline and online modes of data mining constitute another significant distinction. Offline systems employ existing data that has already been collected and stored beforehand in order to train those models that can then be applied in unseen instances. In contrast, online systems process real-time streams of data, which is better for fraud detection. Online fraud detection system not only learn dynamically from emerging patterns of fraud but also allow for real-time countermeasure. terminating a suspicious call while it is in progress. For these reasons, online systems have generated huge amounts of attention from researchers and industry practitioners.

Rule-Based Systems

In rule-based fraud detection system, a domain expert defines a set of rules, and alerts are triggered when specific conditions are met. They are simple to implement, effective, and very efficient, but they have great disadvantages:

- They are highly vulnerable to unknown fraud attacks.
- Rules must be specially programmed for every possible fraud scenario.
- There is a requirement of expertise to define new rules.
- Human errors may occur during defining the rules.
- The process of rule generation and rule changing is time-consuming and complex.

Moreover, rule systems are easily bypassed since attackers are used to shifting their tactics so as not to be caught. For instance, created a rule-based expert system for the identification of superimposed fraud through examination of user accounts upon demand, but such systems are limited in scope.

Visualization-Based Systems

Visualization techniques employ human pattern detection abilities to identify anomalies in subscriber behaviour. Sudden location switches or high spikes in usage, for example, are signatures of fraud. Anomalies are then further pursued in the visualized data to confirm fraud.

Even if visualization methods are helpful in highlighting suspicious activity, they are not automatic. They require a specialist to manually sort through the information and find the fraud cases within it and are therefore not effective for real-time or bulk detection.

2.6.3 Fraud and visualization

Financial institutions have recently faced a sharp rise in financial crimes, pushing them to adopt advanced tools and technologies, such as artificial intelligence (AI) and big data analytics, to detect and prevent fraud. categorized big data analytics into four groups (Amin et al., 2020):

- Advanced analytics (AI, machine learning, predictive models, real-time dashboards, and text mining), which are gaining rapid popularity.
- Data warehouses and in-database analytics, widely adopted for easier data auditing.
- Distributed computing tools (e.g., Hadoop), which handle global and diverse datasets but remain less familiar to auditors.
- Traditional database systems, which are becoming obsolete due to limited scalability.

Several studies highlight the effectiveness of visualization dashboards in fraud detection.(Amin et al., 2020; Babaei et al., 2019) showed that interactive dashboards simplify the analysis of accounts payable data, helping auditors quickly detect hidden patterns. Combined process mining with red-flag indicators to detect 15 out of 31 fraud cases with a very low false-positive rate. reinforced the value of visualization dashboards by combining traditional fraud detection techniques (vertical and horizontal analysis) with modern trend analysis, enabling managers to investigate anomalies more effectively (Das et al., 2024).

Overall, literature shows that big data analytics and visualization are essential in combating fraud. They help auditors handle information overload, improve detection accuracy, and enhance decision-making in complex financial environments (Zakaria, 2021).

Chapter Three
Methodology

3.1 Research Methodology

This research aims to evaluate and shows how real case in Palestinian telecommunication company -JAWWAL- at Anti-fraud section by using data analytics and evaluation by Microsoft Power BI enhance and shifting the decision-making accuracy and efficiency. So, to achieve this aim, the research applied Mixed method case study. The case study methodology combines both quantitative and qualitative approaches to evaluate comprehensively Microsoft Power BI's contribution to improving decision-making based on data within the Anti-Fraud Section at Jawwal.

3.2 Research Variables

- Data Analytics: it`s a group of crucial activities, make organization able to collect, transform and analyze the data will empowering them to gain insights and make informed decisions (Alshawawreh et al., 2024). It`s measured by multiple data sources integration, analysing large volumes of fraud-related data, identifying new fraud types or patterns and human skills.
- Data Visualization: it`s a vital tool in data analysis, using visual techniques to interpret complex and various datasets. Using to discover hidden pattern trends, and relationships within data, all of these actions aid decision maker in decision making process. (Ram, 2024a). It`s measured by ease of interpretation, clarity, interactivity and count of dashboards.
- Data Driven Decision Making: iterative process including several steps with clear strategy to pass these steps successfully and in general starts with define the problem, then define the requirements, set goal, determine the alternatives, validating, evaluate the alternatives, select the tool and finishes with determine the criteria (Taherdoost, 2020). It`s measured by speed, accuracy and prevented loss.

See Figure B.1 in appendix B

Also, data driven decision making defines as depending on the insights derived from the data analytics Instead of depending on feeling, intention or gut to uncover patterns and trends to take the decision (Emma, 2024).

3.3 Data collection Tool

The main tool used in research to collect, transform, model, load and visualize is Microsoft Power BI. Data collected from main sources by structured query language server available in Microsoft Power BI (SQL). Power Query for Extract, transform and load the data. Power Pivot for modelling and data analysis expression (DAX) for mathematical and manipulation.

Also the researcher used semi-structured interview (Jayaraman, 2025; Goel et al., 2021; Garudasu et al., 2025) to exploring the data , the business needs , the do ability and limitations, and Anti-Fraud key performance indicators.

3.3.1 What is Microsoft Power BI and why Microsoft Power BI

Many researches discussed and used Microsoft power BI, Gonçalves and et al defined it as the analytical and visualization tool for business decision major to monitor business performance and stay up to date(Gonçalves et al., 2023). And defined Microsoft Power BI as a suite of business analytics and visualization tool offered by Microsoft provide crucial and useful insights for business owner, these insights make decision making process easier (Onyemaechi, 2022). See Figure C.1 in appendix C

This research used Microsoft Power BI as analytical and visualization tool to show how these features will improve decision making in anti-fraud section, and the reasons behind using this tool from other business intelligence tool such as tableau, Qlik and google looker summarize in below. See Figure C.2 in appendix C:

1. Cost: Microsoft Power BI classified as low-cost tool in comparison with the features it provides (Lavanya et al., 2023).
2. Integrity: Microsoft Power BI has capability to read and link between different data sources. In addition, it integrates excellently with the rest of Microsoft office wallet (Inc, 2024; Lavanya et al., 2023).
3. User friendly: Microsoft Power BI allows to end user to interact, drill down and modify any graph or data (Onyemaechi, 2022; Garudasu et al., 2025).
4. Advanced analytical features: Microsoft Power BI has main and key features it`s the capability to provide and perform sophisticated data analysis, Power Query for data transformation, power pivot for data modelling and data analysis expression (DAX) for calculations (Goel et al., 2021; Jayaraman, 2025;Microsoft, 2024).

5. Automated reports and alerting model: Microsoft Power BI allows to organization to update data automatically any time they want. In addition, it has features to send an alert to specific users once any abnormal behaviour happened (Gonçalves et al., 2023;Microsoft, 2024).
6. Accessibility: Microsoft Power BI enables end user to download Power BI mobile APP and monitor the insights anytime and everywhere(Jayaraman, 2025; Onyemaechi, 2022).

At the end, the decision between business intelligence tools should be based on the specific needs and circumstances of an organization.

3.3.2 Microsoft Power BI main tools`

1. Power Query

Data transformation and data connection tool (ETL: Extract, Transform, Load). Allows the connection to different data sources (e.g., database, web page, Excel file), cleansing, transforming, and combining data interactively through a straightforward, non-technical interface without extensive programming. Utilized for the preparation of data that can be automatically updated in Power BI or Excel (Microsoft, 2024; Yerra, 2025) See Figure C.3 in appendix C

2. Power Pivot

A tabular data model-based in-memory data modelling technology. It facilitates the creation of advanced data models through table-to-table relationships and DAX-based complex computations. It is utilized for fast and effective analysis of large data in Power BI or Excel with the capability for interactive reports and advanced analytics(Garudasu et al., 2025; Goel et al., 2021) See Figure C.4 in appendix C

3.3.3 How to get started with Microsoft Power BI

The steps to get started with Microsoft Power BI are: 1- Download the application from Microsoft store. 2- Get started by sign in to desktop of mobile application. 3- connect and prepare the data: connect with the source like excel, structured Query Language (SQL) and shape your data. 4- model data: create the relation and calculation between the tables. 5- build the dashboard: explore and analyse, sort filter drill down. 6- share and

collaborate. 7- administer and secure: manage access and set up the security role (Microsoft, 2024).

3.4 Research population and sample

Senior Anti-Fraud Specialist at Palestinian telecommunication company-JAWWAL- is the key Pearson in the research since the impact of Microsoft Power BI on decision making measured based on their real experience.

In addition, risk department head, Credit and Control directorate presented by credit team leader, Consumer Directorate (Sales channels department head), Data warehouses team and auditing team are included in tool evaluation phase because the also affected by this use-case.

Regarding sample the research used anti-fraud section data sample such as sales data (point of sales, dealers ...etc), Collection issue and customer churns from May 2024 to May 2025.

3.5 Data analysis methods

The Data were pe-processed by using Power Query in Microsoft Power BI to remove duplicates, non-important fields and handling the missing values. Following that, some descriptive statistical methods applied to display trend, occurrence and so on by data analysis expression (DAX) in Microsoft Power BI .And the final step conducted by using main function of Microsoft Power BI to visualize the cleaned data which enabled the identification of anomalies, misuse, abnormal behaviours and fraud cases volume .Comparative analysis also implemented to evaluate the decision-making performance before and after using Microsoft Power Bi tool.

3.6 Model Evaluation

Conducted a comparative between traditional tools or ways were used in Anti-fraud section and Microsoft Power BI based on:

Table 3
Model evaluation

Ease of use	Dependency
User adoption	Support
Data accuracy	working-area improvement
Data security	limitations and challenges
integration	Preventive cost
Impact on decision making	

Chapter Four

Data Analysis

This Chapter describes the data and shows the analysis result step by step to deliver the main idea from the research. Started with database preparation, tables relations, extract, clean and finished with visualizations:

4.1 Database tables Preparation

This phase aims to organise the needed tables as the fundamental for the visualization. All necessary tables were structured in specific database by using Structured Query Language server management studio (SQL SMS) See Figure D.1 in appendix D

Tables have relations and integrity built by using primary key and foreign key to reflect the goal of visualization.in addition each table must have fields and each field must have a defined data type.

In summary, this phase can be summarized in below main points:

1. Define the needed tables.
2. Define the needed fields.
3. Establish tables relations.

4.2 Database tables

This section shows and describes the database tables used in this research

Database contains 10 main tables to cover the desired fraud scenarios:

Table 4
Database tables name

Showrooms	Dealers_profile
Employees	Customers
queue_sys	Employee_Lines_Activation
E_wallet	Dealer_Lines_Activation
Transactions	FTTH_Activation

1- Showrooms table: used to store and retrieve the data related to showrooms. It contains 4 columns: showroom id, showroom name, district, QR id.

2- Employees table: used to store and retrieve the data related to employees. It contains 3 columns: employee id, employee name, showroom id.

3- Queue system table: used to store and retrieve the data related to queue system using in showrooms. It contains 4 columns: ticket id, employee id, start time, end time.
4- E-wallet table: used to store and retrieve the data related to E-wallet activation done by showrooms employees. It contains 4 columns: wallet id, employee id, refill amount, creation date.
5- Transactions table: used to store and retrieve the data related to the transactions done via E-wallet quick response code (E-wallet QR code). It contains 7 columns : transactions id, Wallet id, Transaction type, Amount, transaction time, showroom id, QR id.
6- Customers table: used to store and retrieve the data related to customer information. It contains 7 columns: customer id, id type, customer name, account number, district, birthdate, age.
7- Dealer lines activation tables: used to store and retrieve the data related to Subscriber Identity Module (SIM) activation orders done by dealers.it contains 7 columns: activation id, dealer code, customer id, id type, line id, activation date, status
8- Dealers profile table: used to store and retrieve the date related to dealers' profile. It contains 4 columns: dealer code, dealer name, District, account manager.
9- Fiber-To-The-Home (FTTH) table: used to store and retrieve the data related to Fiber-To-The-Home (FTTH) activation orders from dealers. It contains 8 columns: activation id, dealer code, customer id, id type, line id, ref number, activation date, status.
10- Employee line activation: used to store and retrieve the data related to Subscriber Identity Module (SIM) activation orders done by employees. It contains 7 columns: activation id, employee id, customer id, id type, line id, activation date, status.

4.3 Data importing and cleaning

This phase starts with importing and extracting data from tables in the database by using the available power BI data sources via server management studio. Then tables transformed into power BI by Power query editor in power BI. See Figures from E.1 to E.6 in appendix E

This phase helps in below points:

1. Remove null and duplicated values.
2. Split or merge the tables.

3. Modify data type.

4.4 Tables model and analytical calculation

In this phase the logical relations between tables in power BI data model were established. And advanced calculation and statistical applied by using data analysis expression (DAX) to get measure or calculated columns to track the analysis. See Figures from F.1 to F.8 in appendix F

Measures applied to get count, MAX, MIN, average…. Etc. and new columns applied to get new information from each row.

4.5 Data analysis expression (DAX) applications:

In this section all of applied measures or calculated columns discussed to show the reason behind using:

Table 5
Measures and calculated columns

Name	Goal	Type
Average group measure	to classify the customer based on age	Measure
Customers by age group	count of customers in each age group	Measure
New age	calculate customer age	calculated column
Passport_per_city	calculate count of passport activation	Measure
under_18	count of customer less than 18 years	calculated column
active_lines	count of active lines	Measure
deactive_lines	count of deactive lines	Measure
refill amount category	category of refill amount	calculated column
service duration	calculation serving duration	Measure
wallet_deposit_withdraw	calculate difference between deposit and withdraw amount	Measure

Chapter Five
Discussion and conclusion

5.1 Power BI dashboards

This section discussed dashboards name as the final result of the research, summarized in below points. See Figures G.1 and G.2 in appendix G

1. Count_E-wallet_per_employee: to monitor e-wallet activation trend day by day.
2. E-wallet_AVG Refill_per employee: to monitor refill values movements for activated e-wallet.
3. Cases_Under_1_Minute by EmployeeID: to detect misuse in queue system happened from showroom employees to gain more commission.
4. Count of CustomerID by dealer_code : to monitor activation trend done by same dealer for customer in different time.
5. Count_activation per employee per CustomerID: to monitor activation trend in employees channel to detect fraud or misuse from showroom employees.
6. Count of Ref_number per CustomerID: to detect misuse in reference number to pretend the company.
7. Active VS In-active: to compare count of active lines and deactivate lines
8. In addition, dashboard have many of cards to highlight the most important information such as total activation, count of customer under 18, count of activated wallet…. etc.

5.2 Discussion of Key Performance Indicators (KPI) used to evaluate Microsoft Power BI in enhancing decision making

The main objective of this research is to determine how Microsoft Power BI, being a business intelligence (BI) tool, facilitates the decision-making process for the Anti-Fraud Section of the Palestinian telecom corporation JAWWAL based on some specified key performance indicators (KPIs).

In order to answer this question, many interviews were conducted with different stakeholders in an attempt to illuminate us about their real experiences depends on specific criteria mentioned in model evaluation section.

And below the result we got from interviews firstly with Anti-fraud section head

- Ease of use: 30 hours of training were enough for anti-fraud teams to get acquainted with all available tabs, understand how to interact with dashboards and visualizations, and access the underlying data that those visuals represented. This process now became much like a drag-and-drop experience to create or modify reports, whereas previously, any adjustment or new addition required formal engagement in the form of technical support from the technical support team.
- Data accuracy and security: We had to re-engage with the data engineers each week in order to re-validate the accuracy of the data since any change in the underlying query, typically in the form of requests for similar data to other stakeholders, would directly impact ours. As such, the reconciliation process between the data warehouse and the system that generates the data was some of the work that we had to do. Once the connection of the query to Power BI was established, that process was eliminated, except when there were major changes needed in the process to keep up with the required business changes.
- Integration: Being able to integrate data from multiple tables in the database, execute calculation transformations, and display the data in a single graph is one of the biggest achievements made possible with the use of Power BI capabilities. Using this function, we managed to detect 8 newly fraud types in fixed and mobile services, which could not have been detected and properly assessed in terms of their significance with the method that used – standalone sheets on a monthly basis-. In addition, we were able to increase the percentage of cases detect internally from 78% to 92% during the years.
- Impact on Decision making: This variable has been identified to be amongst the most crucial for the effective implementation of Power BI, with its main reliance on the speed of decision making and accuracy. Before, decisions would take a maximum of 30 days to make, a major challenge which posed a great risk because fraud cases would be identified after the time when appropriate action would not be effective. In contrast, decisions would be made within a maximum of 24 hours, with cases being referred to the relevant parties because the newer data would be displayed on the dashboards a maximum of eight times each day.

Furthermore, the accuracy of decisions has also been greatly improved thanks to the provision of accurate and optimally processed data with the aim of not surpassing an interval of 2% per quarter.

- Working area improvement: the previous setup was only able to monitor and investigate a very thin portfolio of cases. These also required huge time and effort to be taken care of, even on holidays, since it has to be continuously followed up depending on a particular case's risk type. On the other hand, after several pieces of database table mapping and the development of another set of analytical scenarios covering points of sale, value-added services, recharge activities, and with both the fixed-mobile convergence, we were able to include the whole Commercial Department, one of the biggest departments in our company, together with a huge portion of subscriber and technical profiling activities. We will try to increase our scope whenever we can since we now have adequate analytical skills, and Power BI could now be accessed in handheld devices for monitoring anytime and anywhere.
- Preventive loss: within one year, we were able to recover about 50,000 ILS by detection the case on a near real time and immediately taking action to stop them. These would have caused far greater losses to the company and would have been much more difficult to recover if continued.

Also, Data Engineering added: Before, we had several issues providing the Anti-Fraud team with the data they asked for because they required complicated data daily and an overview of the entire directorates. But when we began using Microsoft Power BI, we were able to provide them with what they wanted, when they wanted it.

For cost avoidance and enhancing the work environment, the Credit Unit-Head added: "We can say it's a big success for the Anti-Fraud team in the way they boosted operations, making us able to monitor hidden key information and risky points, such as abuse of activation processes and breach of our business rules."

"In the last few months, ever since Anti-Fraud obtained access to the different important information, we have modified the different business rules and privileges of employees

At the end, the Head of Anti-Fraud Section proudly stated: "Having implemented Microsoft Power BI, I am sure that we have time to watch and work in new fields, since most significant topics are now under control."

5.3 Research Limitation:

1. Scope of the Company: The study is on the Palestinian telecommunication service provider Jawwal and does not include other telecommunications providers in Palestine or internationally.
2. Departmental Focus: The research aims directly at Jawwal's Anti-Fraud Section. Marketing, Customer Service, or Technical Operations departments are not included.
3. Tool Limitation: Microsoft Power BI is itself deemed to be a business intelligence tool. Other BI tools (e.g., Tableau, QlikView, SAS) are not included in this study.

5.4 Research Recommendations

1. broaden the Scope: Conduct future studies with other departments (e.g., Marketing, Customer Service) or other telecom companies for comparison.
2. Compare BI Tools: Analyse other business intelligence tools (e.g., Tableau, QlikView) to identify the optimal tool for multiple purposes.
3. explore Advanced Analytics: Include predictive analytics and machine learning to enable proactive fraud detection and decision support.

5.5 future works

This section highlight main points can enhance the dashboard result and performance for future work and researches:

1. Integrate between Microsoft power BI and machine learning and artificial intelligence.
2. Real-time alerting.
3. Advanced training for staffing or employees.
4. Incorporating with other external and related system such as banking.
5. Expand the scope to cover more fraud scenarios.
6. Apply similar case study on different database type such as MySQL to help the companies how to pass the challenge will they face.

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Appendices

Appendix A

Data Visualization Techniques

Figure A.1
Key Performance Indicators Visual (KPI)

Figure A.2
Line chart

Figure A.3
Basic map chart

Figure A.4
ArcGIS map chart

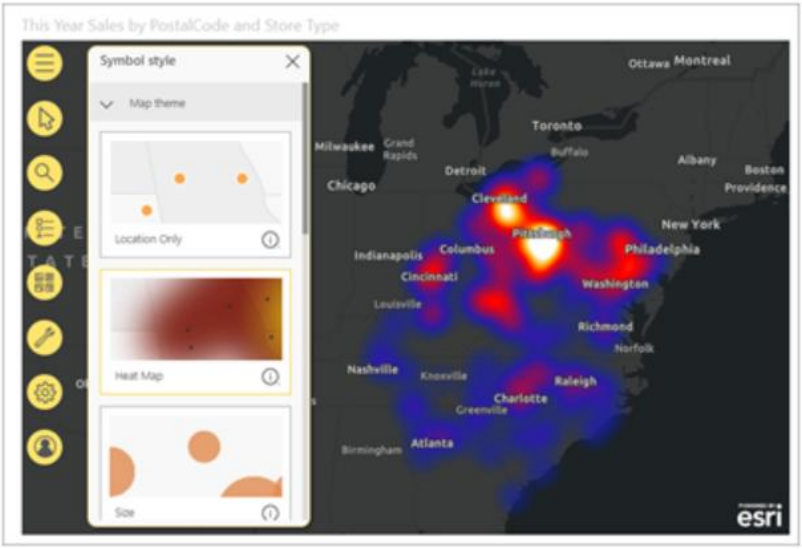


Figure A.5
Azure map chart

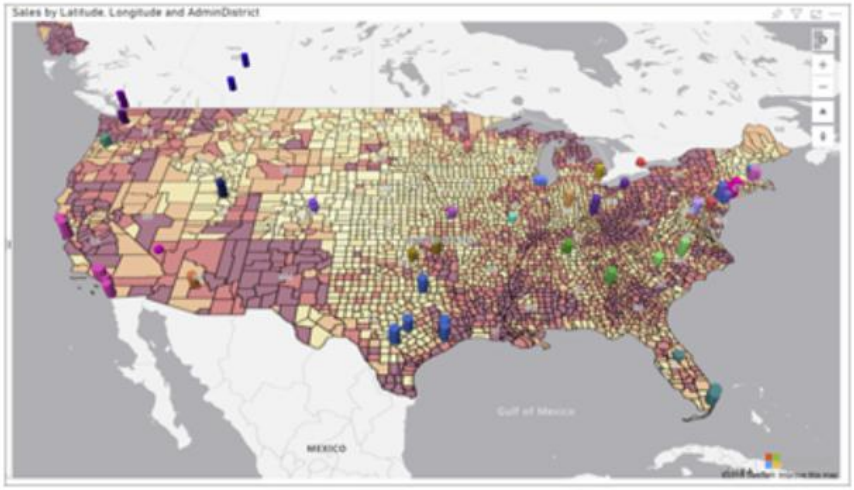


Figure A.6
Filled map chart

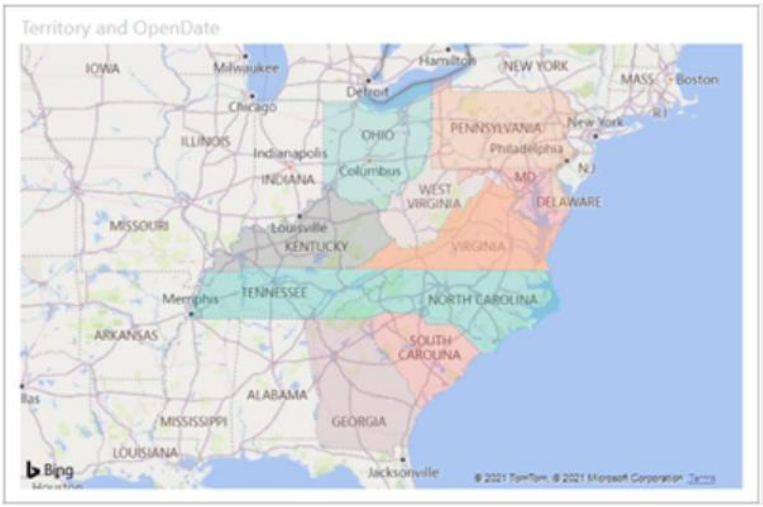


Figure A.7
Shape map chart

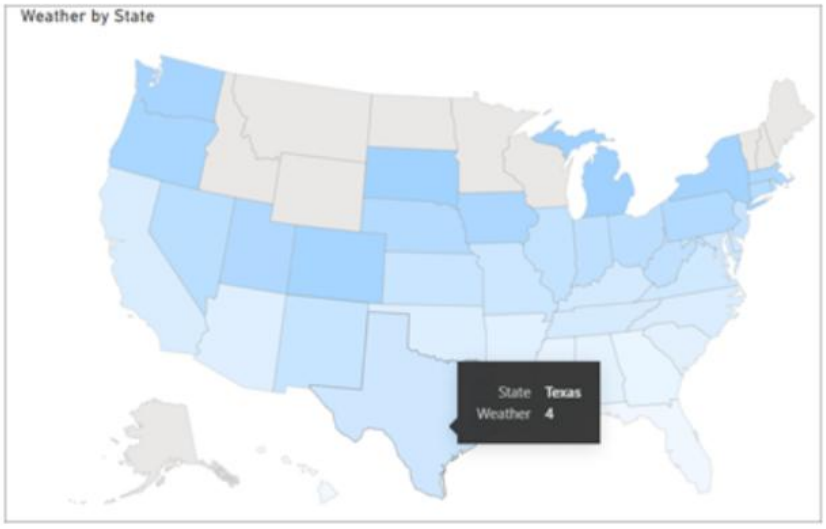


Figure A.8
Q&A visual

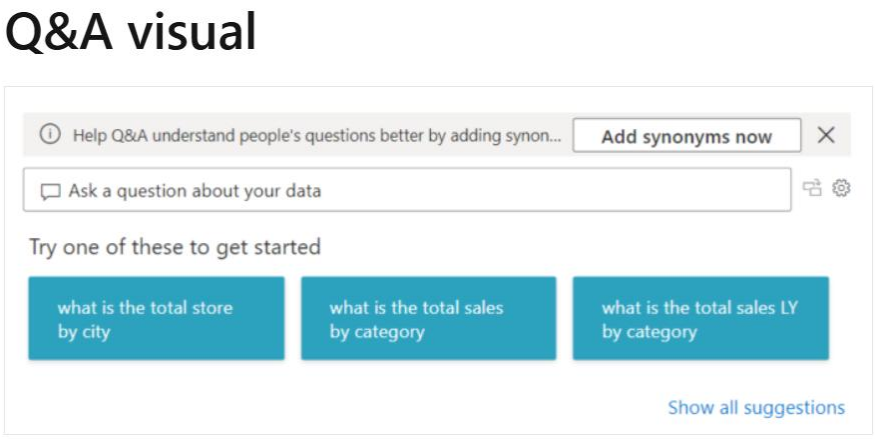


Figure A.9
Scatter plot chart

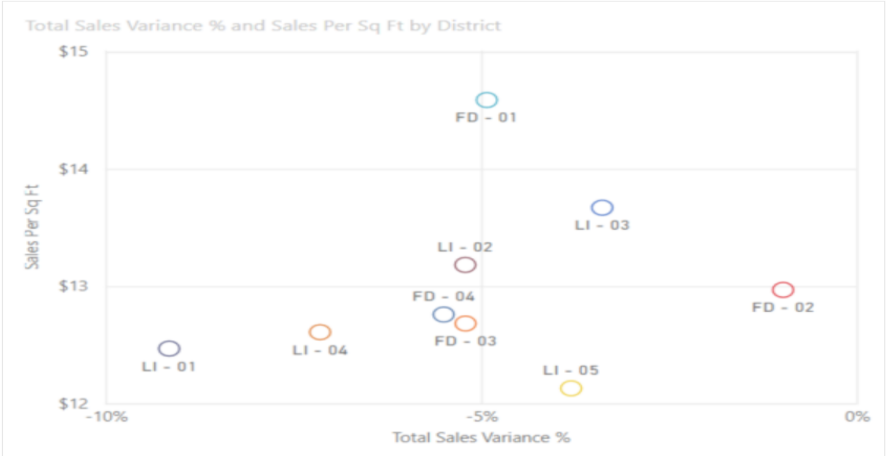


Figure A.10
Tree map chart

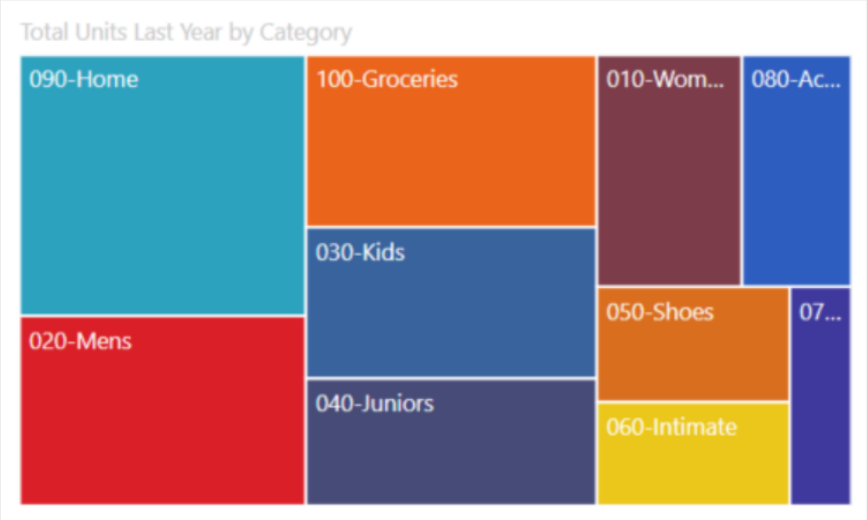
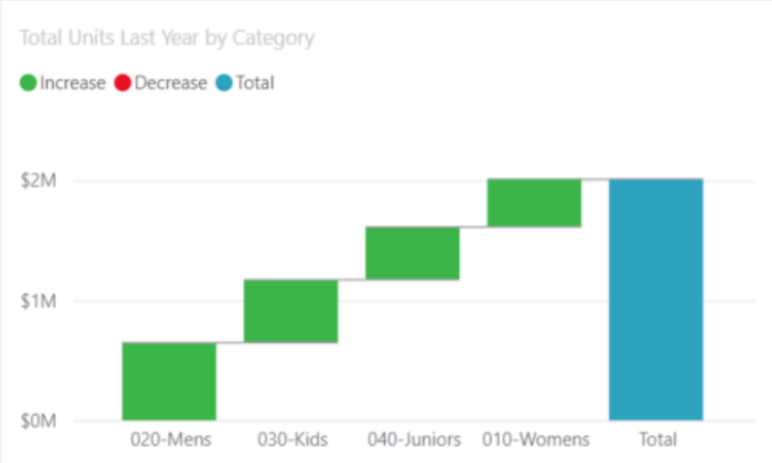


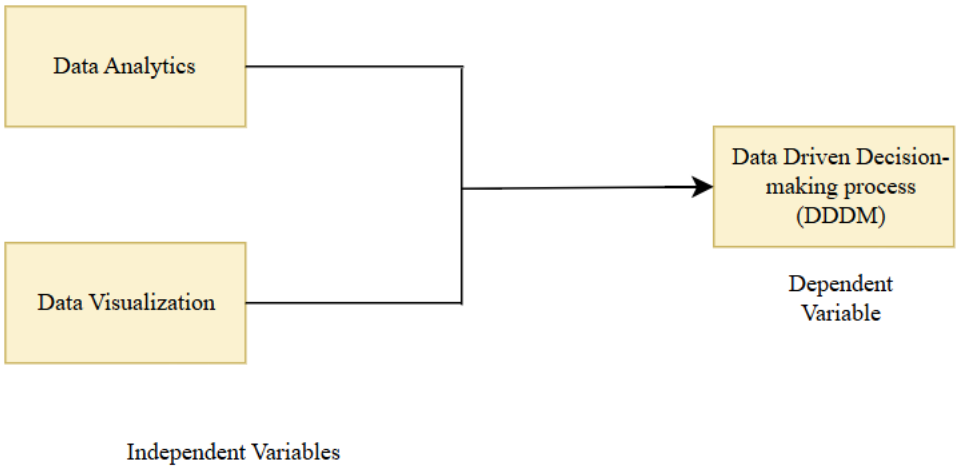
Figure A.11
waterfall chart



Appendix B

Research Variables

Figure B.1
Research Variables



Appendix C

Microsoft Power BI

Figure C.1
Microsoft Power BI

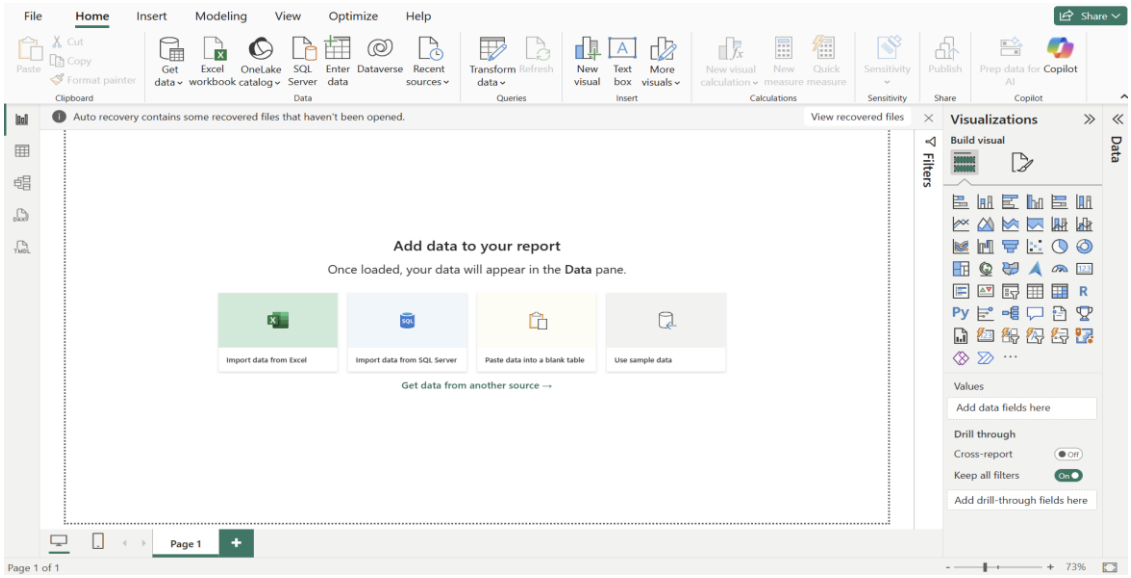


Figure C.2
Microsoft Power BI Features

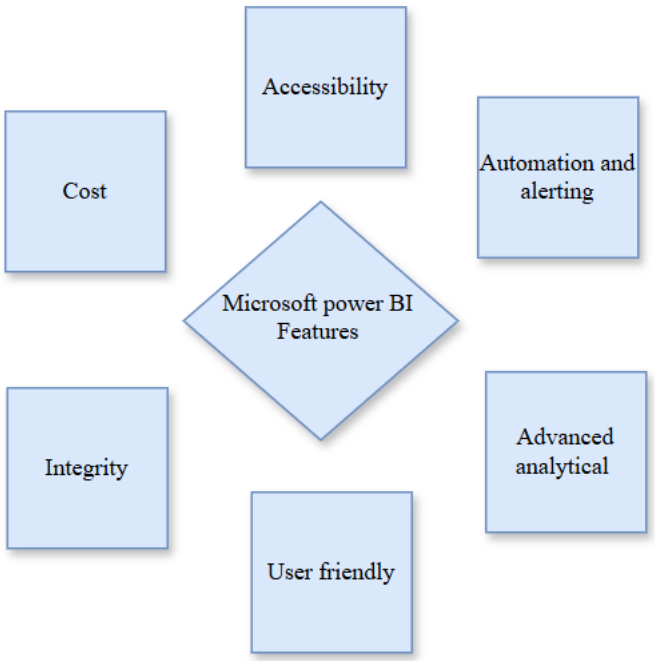


Figure C.3
Power Query

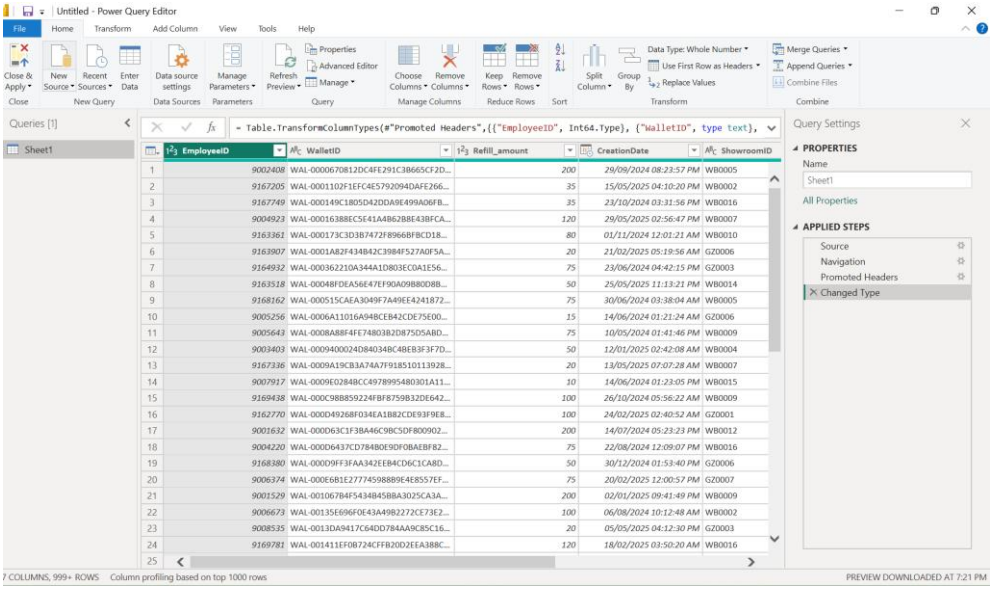
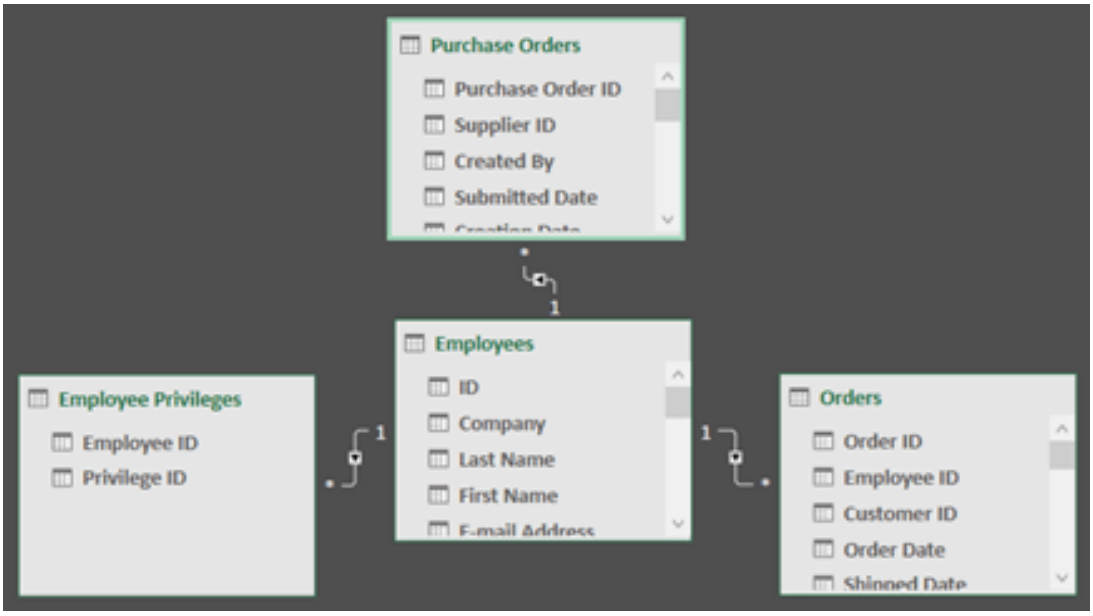


Figure C.4
Power Pivot



Appendix D

Database tables Preparation

Figure D.1
Data preparation steps

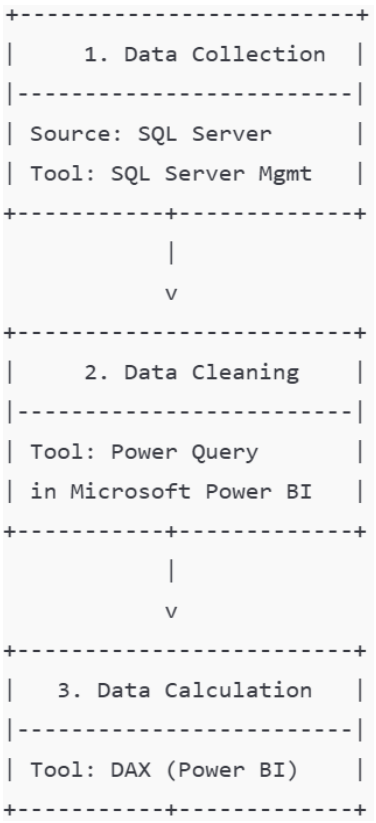
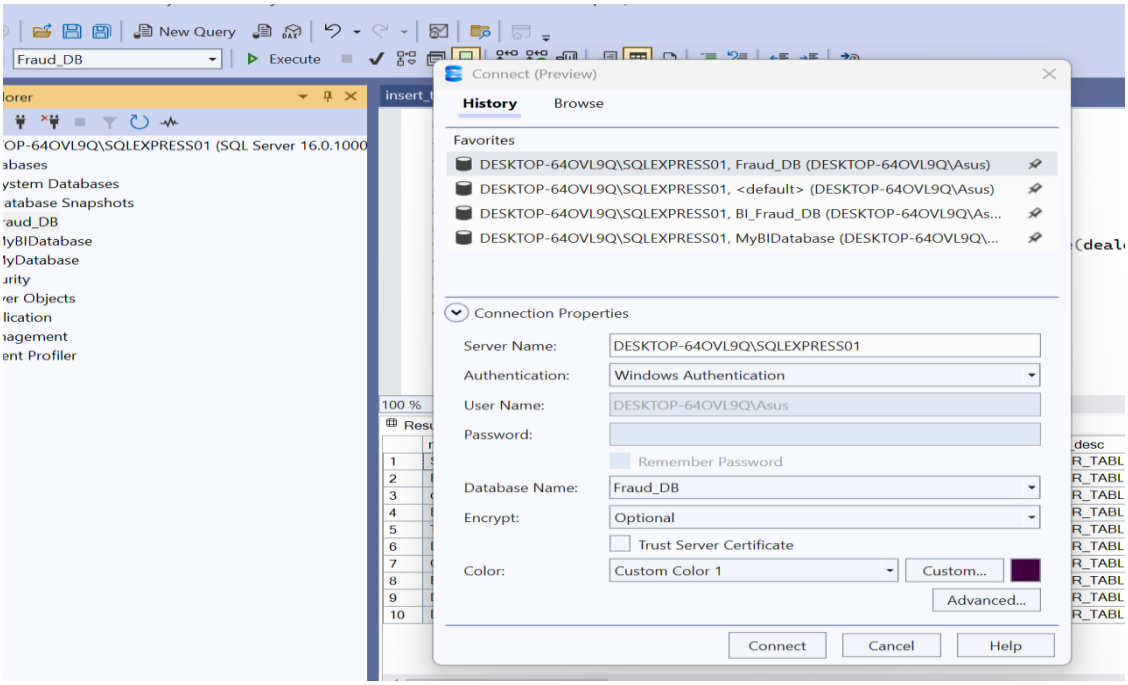


Figure D.2
Server Connection



Appendix E

Data importing and cleaning

Figure E.1
Microsoft Power BI data sources

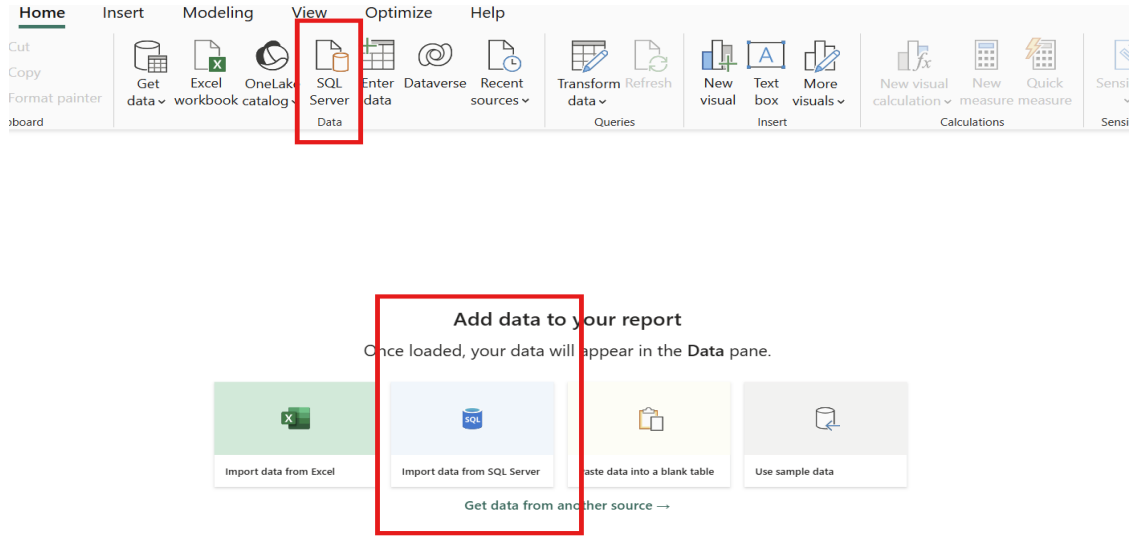


Figure E.2
connection creation

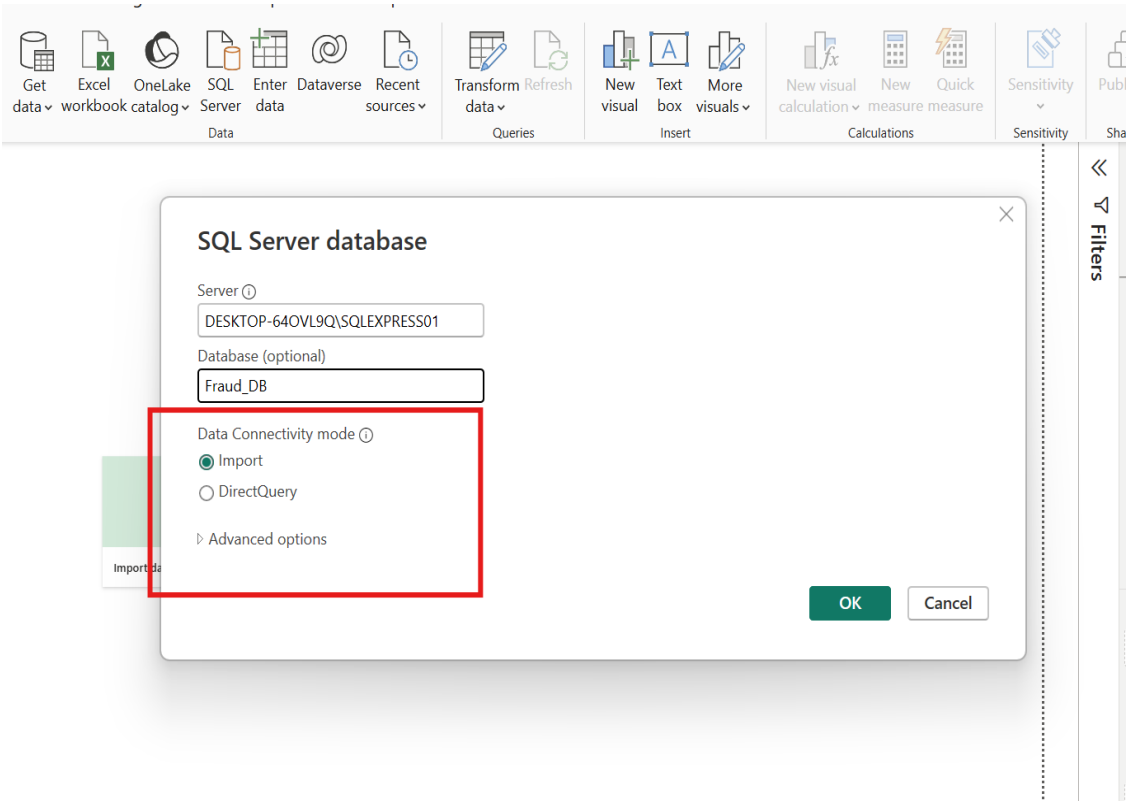


Figure E.3
Data tables

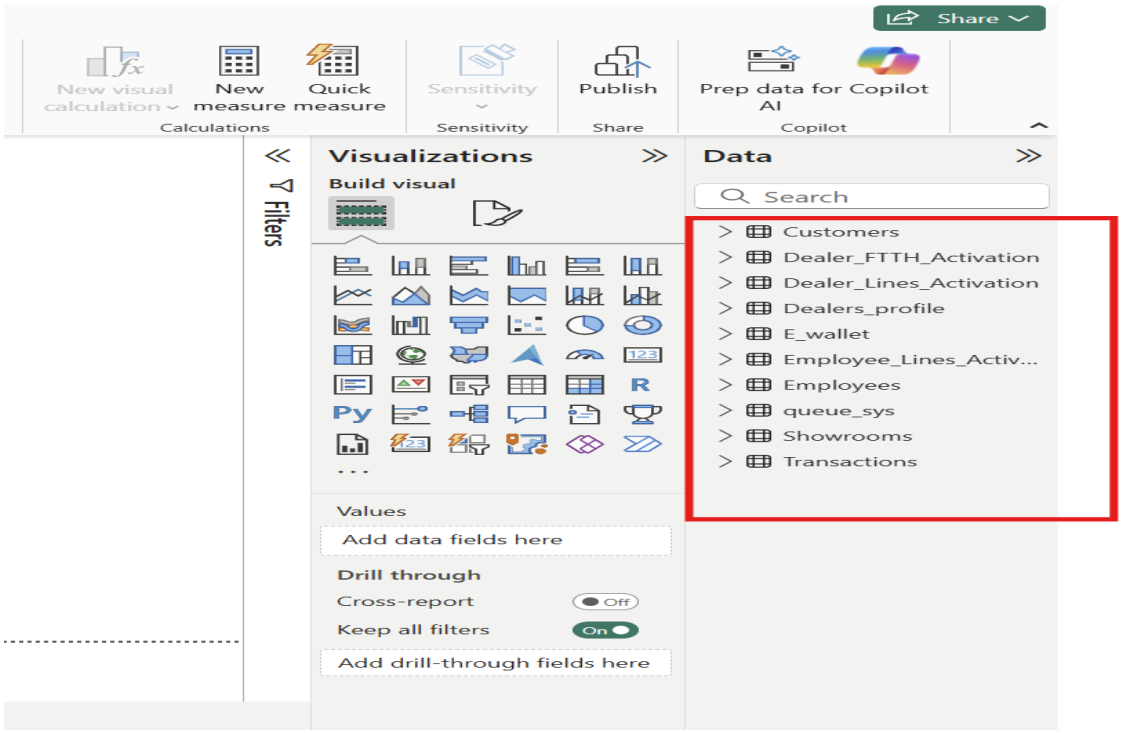


Figure E.4
data model phase

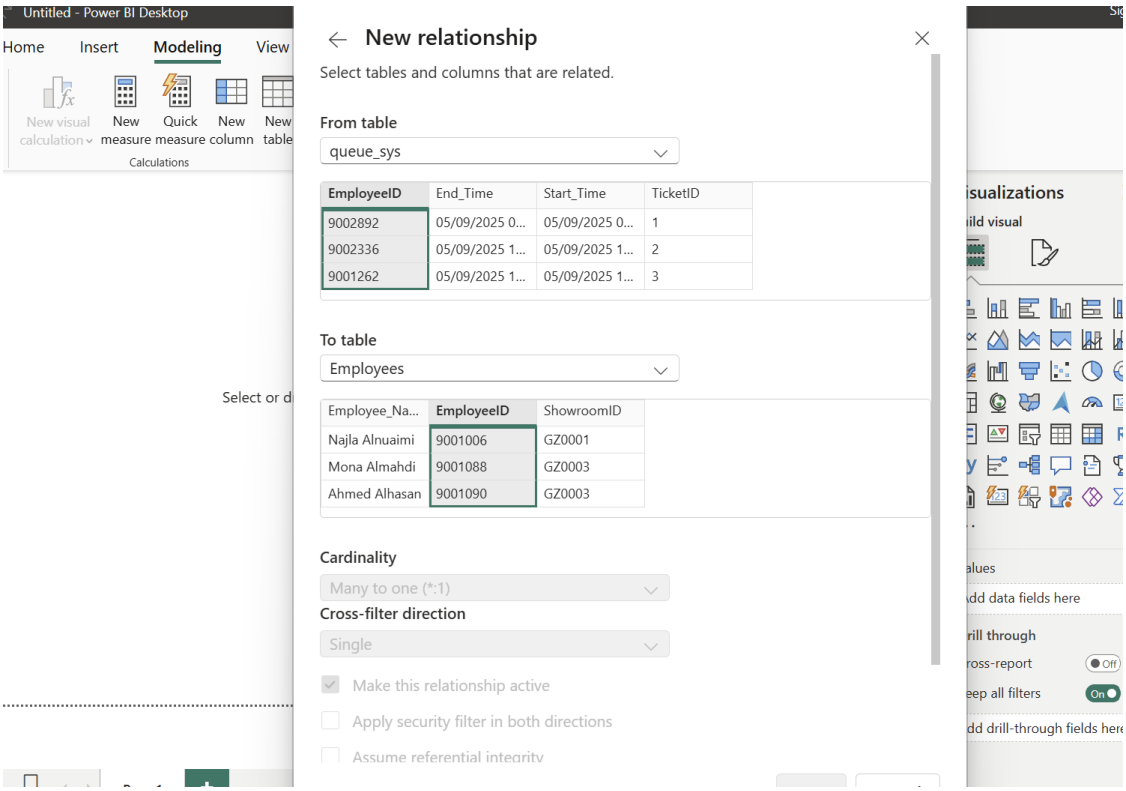


Figure E.5
data model phase

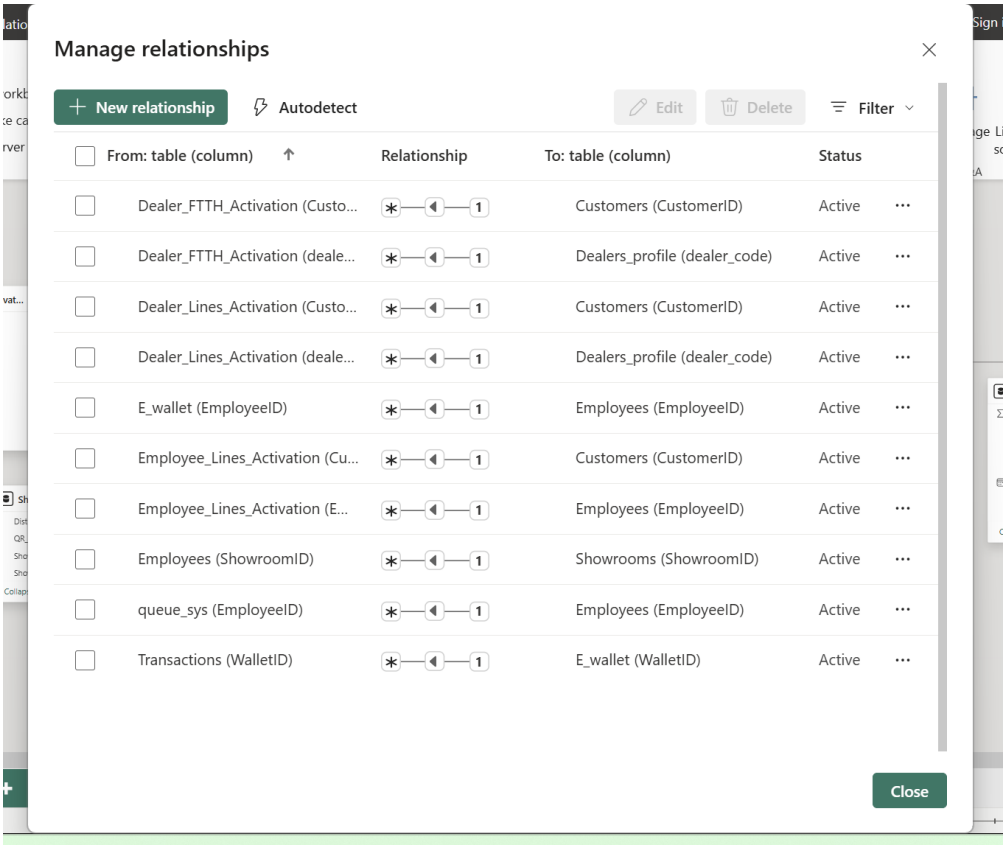
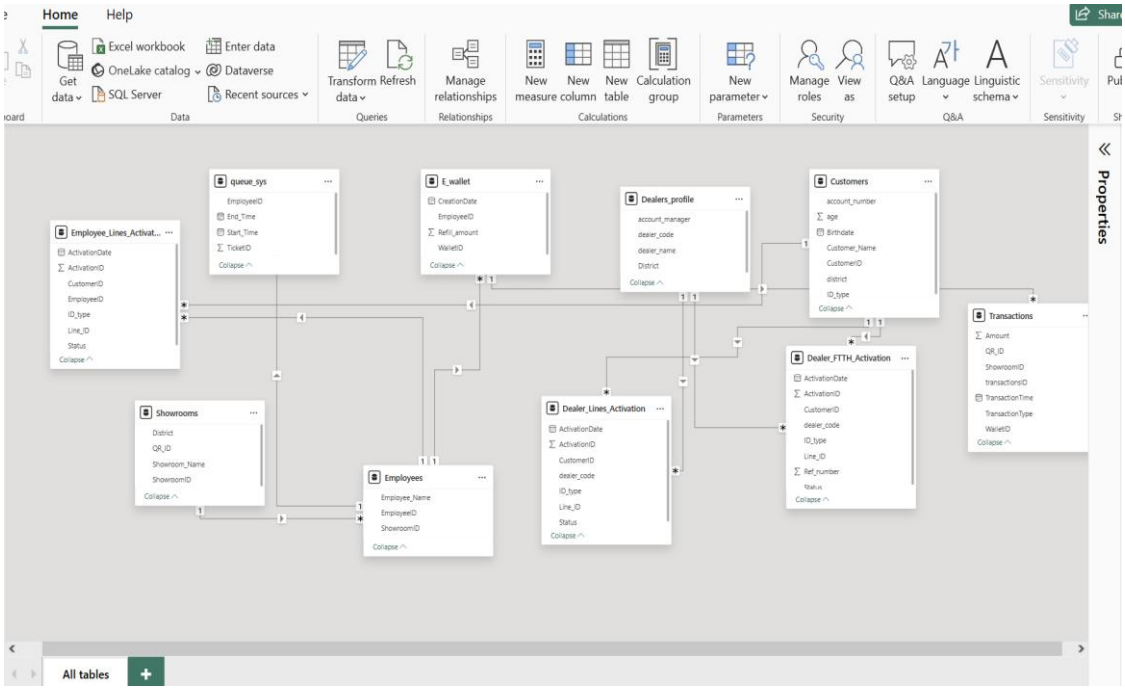


Figure E.6
table relationship



Appendix F

Tables model and analytical calculation

Figure F.1
Calculations Options

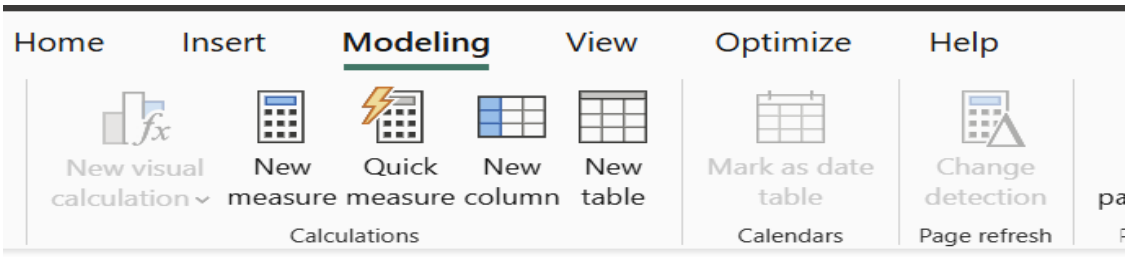


Figure F.2
Time difference measure

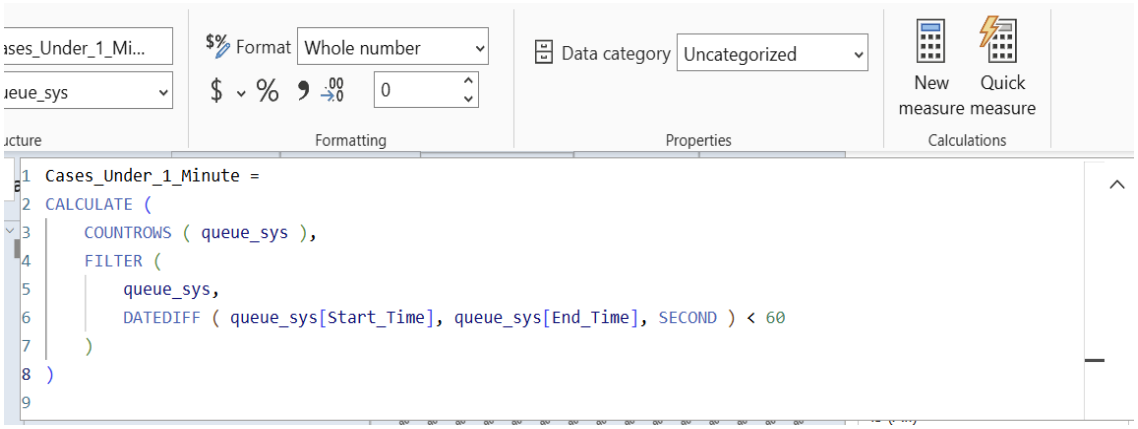


Figure F.3
count of E-wallet per employee measure

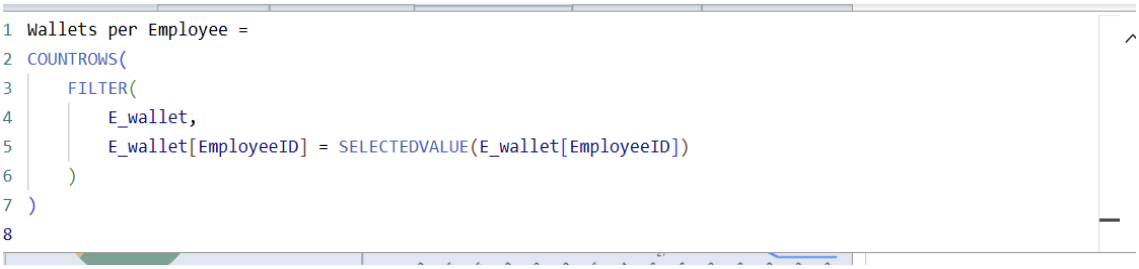
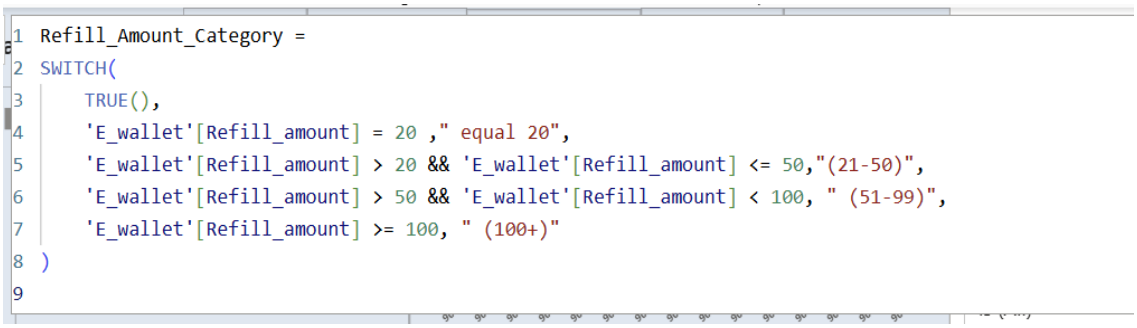


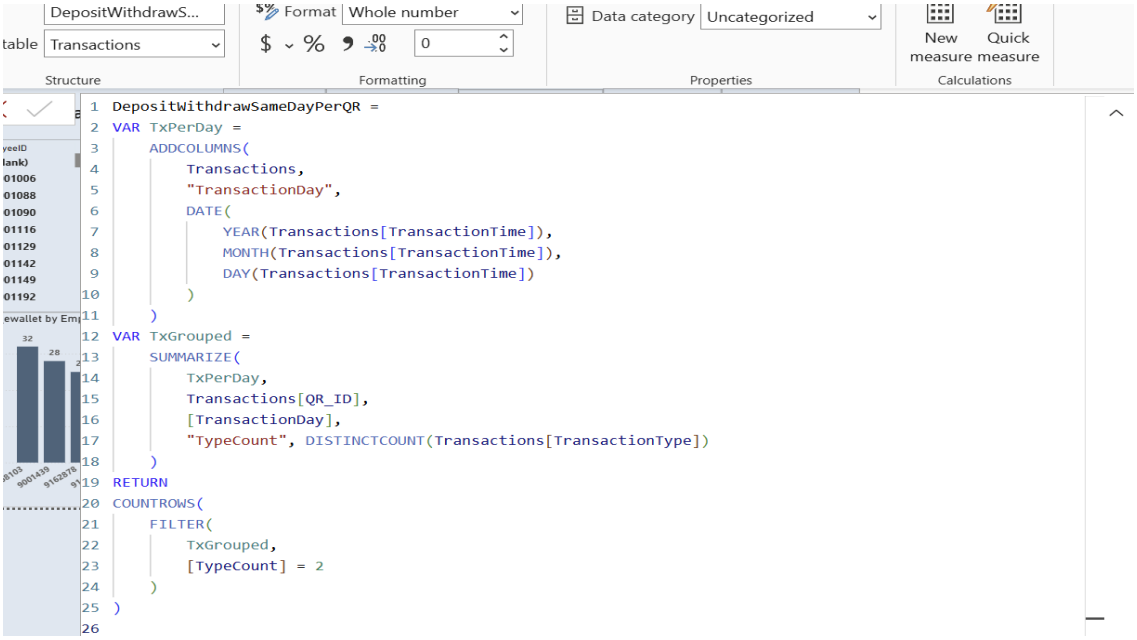
Figure F.4
Refill amount category measure



```
Refill_Amount_Category =
SWITCH(
    TRUE(),
    'E_wallet'[Refill_amount] = 20 ," equal 20",
    'E_wallet'[Refill_amount] > 20 && 'E_wallet'[Refill_amount] <= 50,"(21-50)",
    'E_wallet'[Refill_amount] > 50 && 'E_wallet'[Refill_amount] < 100, " (51-99)",
    'E_wallet'[Refill_amount] >= 100, " (100+)"
)

```

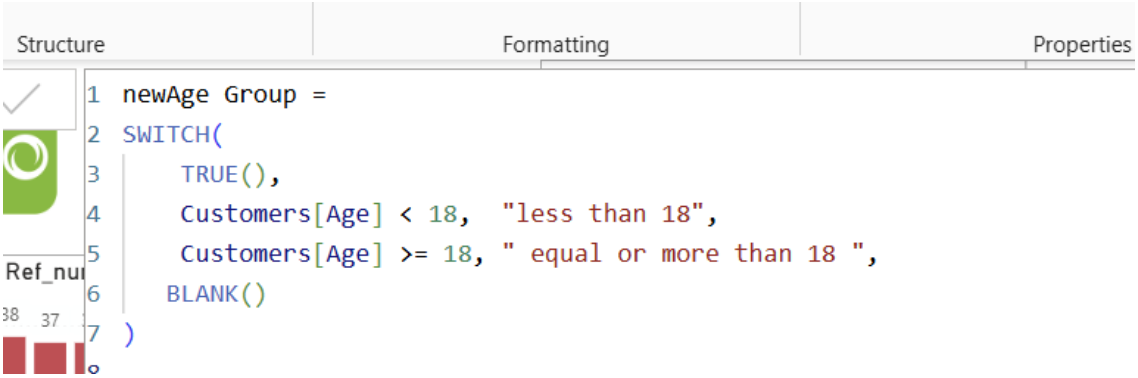
Figure F.5
Transactions measure



```
DepositWithdrawSameDayPerQR =
VAR TxPerDay =
    ADDCOLUMNS(
        Transactions,
        "TransactionDay",
        DATE(
            YEAR(Transactions[TransactionTime]),
            MONTH(Transactions[TransactionTime]),
            DAY(Transactions[TransactionTime])
        )
    )
VAR TxGrouped =
    SUMMARIZE(
        TxPerDay,
        Transactions[QR_ID],
        [TransactionDay],
        "TypeCount", DISTINCTCOUNT(Transactions[TransactionType])
    )
RETURN
COUNTROWS(
    FILTER(
        TxGrouped,
        [TypeCount] = 2
    )
)

```

Figure F.6
age classification measure



```
newAge Group =
SWITCH(
    TRUE(),
    Customers[Age] < 18,  "less than 18",
    Customers[Age] >= 18, " equal or more than 18 ",
   BLANK()
)
```

Figure F.7
active line calculation

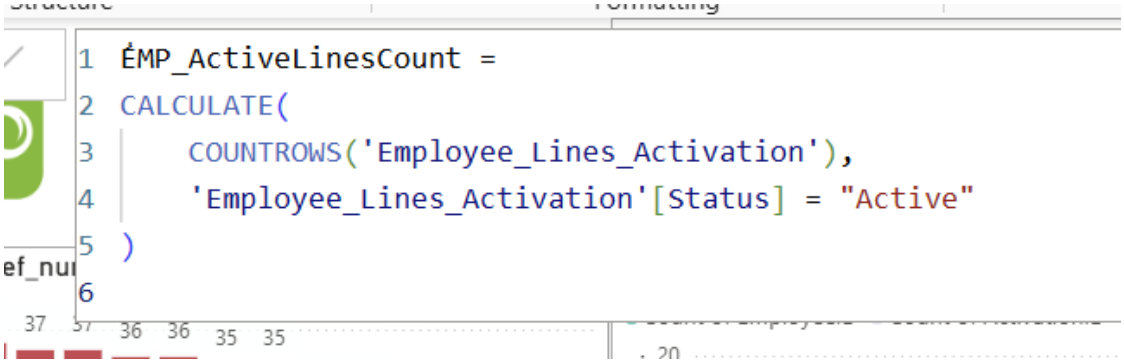
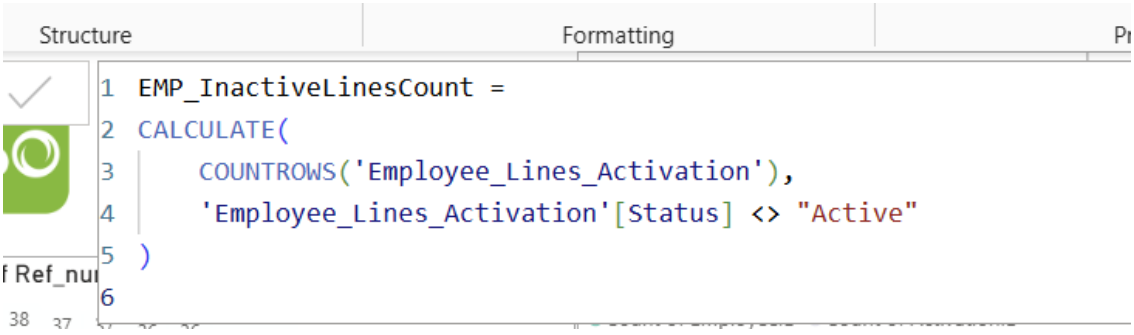


Figure F.8
in-active line calculation



Appendix G

Dashboards

Figure G.1
J-wallet and que-system dashboard

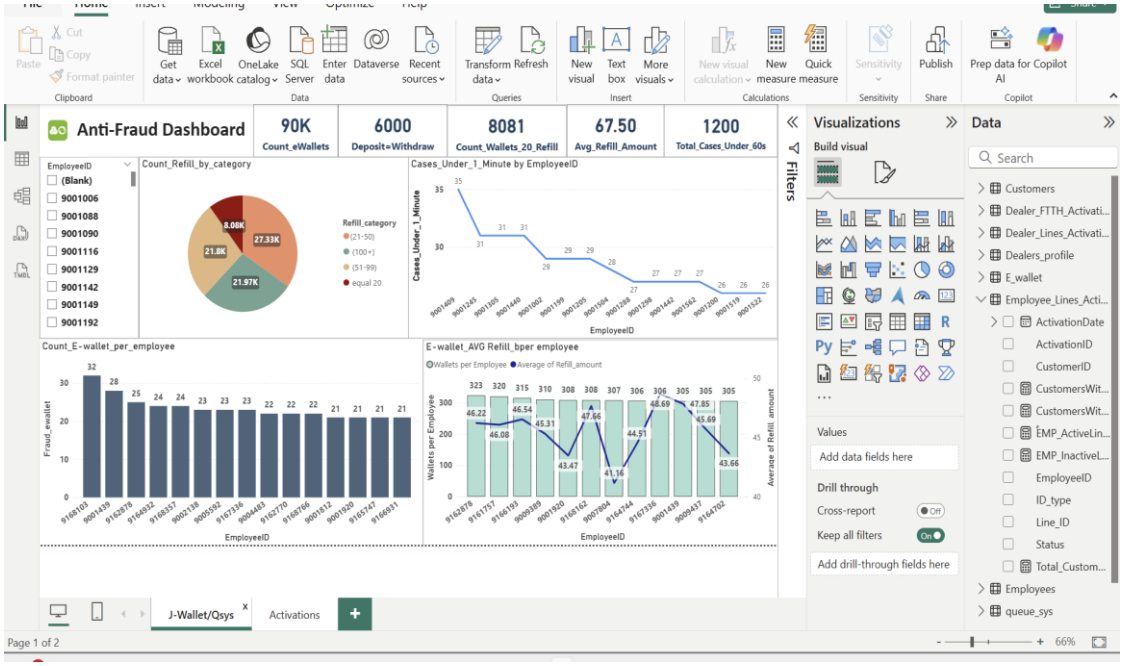
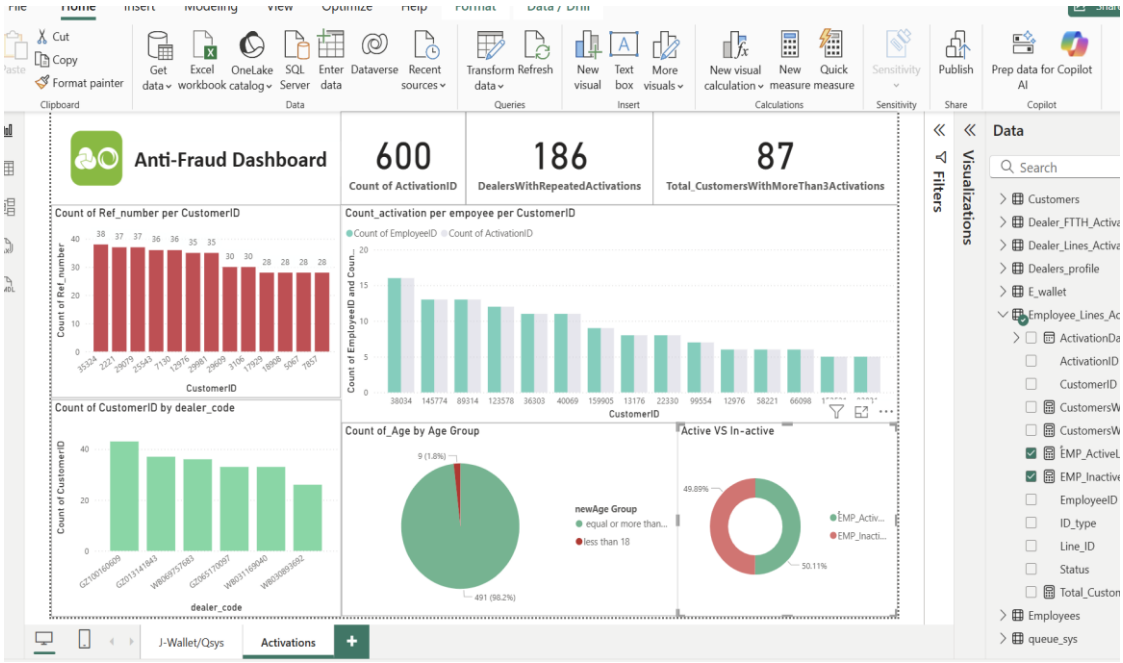


Figure G.2
activation process trend Dashboards



جامعة النجاح الوطنية
كلية الدراسات العليا

من البيانات الى القرارات: استخدام اداة ذكاء الاعمال Microsoft Power BI لتعزيز اتخاذ القرار المبني (على البيانات دراسة حالة من قسم مكافحة الاحتيال في شركة جوال)

إعداد
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إشراف
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قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في ذكاء الأعمال وتحليل البيانات، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس–فلسطين.

2026

من البيانات الى القرارات: استخدام اداة ذكاء الاعمال MICROSOFT POWER BI لتعزيز اتخاذ القرار المبني على البيانات (دراسة حالة من قسم مكافحة الاحتيال في شركة جوال)

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الملخص

في ظل العالم الحالي الذي يُدار بالبيانات والتطورات التكنولوجية المستمرة، بدأت المؤسسات بالبحث عن أدوات وأنظمة ذكية تساعدها في تعزيز عملية اتخاذ القرار لتصبح أكثر دقة، وحداثة، وذكاء، خصوصًا في المجالات الحساسة وذات الخطورة مثل مكافحة الاحتيال في قطاع الاتصالات. تهدف هذه الدراسة إلى استكشاف دور وأهمية تقنيات ذكاء الأعمال (Business Intelligence) والأدوات التحليلية، من خلال استخدام أداة Microsoft Power BI، في تحسين عملية اتخاذ القرار والتحول إلى قرارات مدفوعة بالبيانات (Data-Driven Decisions). اعتمدت الدراسة على المنهج الوصفي التحليلي، حيث تم جمع البيانات من الأنظمة الداخلية لشركة الاتصالات الفلسطينية "جوال" باستخدام SQL Server Management Studio (SSMS) للوصول إلى جداول قواعد البيانات، ثم تم تنظيف البيانات وتحضيرها باستخدام أداة Power Query داخل Power BI. كما تم إجراء تحليلات متقدمة باستخدام لغة DAX (Data Analysis Expressions)، وتم عرض النتائج من خلال لوحات تحكم تفاعلية عبر Power BI. تشير نتائج الدراسة إلى أن استخدام Power BI ساهم بشكل كبير في زيادة الشفافية في عرض البيانات، وتسريع عملية اتخاذ القرار، وتحسين دقتها بشكل ملحوظ. وتوصي الدراسة بالاستثمار في هذه التكنولوجيا وتوسيع نطاق استخدامها لتشمل مجالات إضافية مثل إدارة المبيعات والمخازن، مع التركيز على دمج

Power BI مع تقنيات التعلم الآلي (Machine Learning) والذكاء الاصطناعي (AI) لتعزيز أدائه إلى أقصى حد ممكن.

الكلمات المفتاحية: ذكاء الأعمال، اتخاذ القرار المدفوع بالبيانات، تصور البيانات، مكافحة الاحتيال، الاتصالات، التحليلات البيانية، لوحات التحكم التفاعلية، تعبيرات تحليل البيانات.