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Design and implementation of data warehouse and business intelligence system for decision making within a DT-SACCO ecosystem: case study of DT-SACCO in Nairobi, Kenya.

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Design and Implementation of Data Warehouse and Business Intelligence System for Decision Making Within a DT-SACCO Ecosystem: Case Study of DT-SACCO in Nairobi, Kenya

By

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

Olaoye Adeyemi John

Date: October 2022

Approval

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Abstract

The implementation of data warehouse and business intelligence systems for decision making within a Deposit Taking Savings and Credit Corporative (DT SACCO) ecosystem in Nairobi, Kenya. DT SACCO are a subsection of SACCO which is similar to credit union (CU) in Europe, Americas and other parts of the world. The DT SACCOs perform regular activities similar to that of a regular bank. Banks in Kenya which are one of the major competitors of the DT SACCOs have different technologies to study the market trends and predict in advance what they have to invest in for them to beat their competitions. However, the DT SACCO is still catching up technology-wise. As the use of technology grows amongst the DT SACCOs, the ability to make decisions for the managers is becoming more difficult as it takes longer time for them to wait for reports from different departments to support the decision they make. It is important to have a clear 360-degree view of the business before making critical decisions. For a full view of the business data to be obtained, it is critical to integrate disparate data sources within the ecosystem of the DT SACCO.

An implementation of data warehouse done by the Boeing Employee Credit Union (BECU) has seen the CU members gain in terms of Return-to-Members. "Return-to-member is the number of dollars the member has saved by doing business with BECU, as opposed to doing business with a commercial bank. This metric is calculated by adding the average dollars saved due to no fee services, dollars saved on lower interest loans, and dollars earned due to higher interest on savings. As of July 2000, the return-to-member value at BECU was $272, meaning that each member saves $272 annually by doing business with BECU rather than one of their commercial competitors." (O'Hara & Brohman, 2002).

Implementation of data warehouse and business intelligence system within a DT SACCO ecosystem will provide support for decision making that will make members save more money and access better services from their respective SACCOs.

Keywords: Data Warehouse, Data Mart, Extract Transform Load (ETL), Data Modeling, Star Schema, Snowflakes Schema

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Abbreviations

BI – Business Intelligence

CSF – Critical Success Factor

DW - Data Warehouse

DSS – Decision Support System

ETL – Extract Transform and Load

OLTP - Online Transactional Processing

OLAP – Online Analytical Processing

SACCO – Savings and Credit Cooperative Organization

SASRA – Sacco Societies Regulatory Authority

IT – Information Technology

KPI – Key Performance Indicator

RDBMS - Relational Database Management Systems

MPP - Massive Parallel Processing

CU – Credit Union

SSIS – SQL Server Integration Service

Definition of Terms

Critical Success Factor: Management terminology for an element required for a project or organization to succeed (Yarbrough, 2021).

Data Warehouse: Is the historical data storage that is used for analytical reporting (W. Inmon, 2005).

Extract Transform and Load (ETL): This is the process of gathering data from a single or multiple storage sources, cleaning the data and storing the data in a specified source (Kimball & Caserta, 2004).

Dimension: This is the type of data in a data warehouse that is used to categorise and describe the facts/measures (Kimball & Ross, 2013).

Facts: Facts represent measurable, observable events related to the functional area covered by a data warehouse (Kimball & Ross, 2013).

Primary Key Column: This is a special column in a relational database that uniquely identifies each record in the database (W. Inmon, 2005).

Foreign Key: In relational databases, a foreign key is a column or group of columns that act as a link between two tables (W. Inmon, 2005).

Acknowledgements

I give glory to God Almighty for the opportunity to further my studies and for giving me the strength and good health to complete my Masters course. I ran under His cover to finish this research project. Special thanks to my supervisor, Dr. Nelson Ochieng, for his guidance, steady support, and sincere critique throughout the dissertation process. Also, I give thanks to all my lecturers and administrative staff who helped me enjoy my stay at Strathmore University. I will also like to acknowledge my classmates for their encouragement and knowledge sharing. God bless you all.

Dedication

I dedicate this research project to my parents Elder and Mrs. Joel Olaoye, my dear wife Catherine Nduvi, and our children Anita, Abigail, and Adeoluwa Olaoye, for their support, encouragement, perseverance, and understanding as I was undertaking this research. God bless you all.

Chapter One: Introduction

1.1 Background of the study

In Kenya, savings and Credit Cooperatives (SACCO) are a member of the financial institutions that play vital roles in delivering financial solutions to Kenyans. The SACCO has a very close similarity to Credit Union (CU), which began in Germany and England in the 19th century (Mugo et al., 2018). Credit Union (CU) has been described as “self-help cooperative financial organizations geared to attaining the economic and social goals of members and wider local communities” (McKillop & Wilson, 2011). The CU members can benefit from services that look similar to those of a retail bank, which “includes deposit accounts, provision of credit, and other financial services” (McKillop & Wilson, 2011). Like the CU, the SACCOs in Kenya have also built their business model to focus on their members from the local community and convenience to access financial services.

The SACCO Society Regulatory Authority (SASRA) is by law empowered to guide the activities of SACCOs in Kenya under the Cooperative Societies Act (CAP 450B) of Kenya Laws. SASRA, in its 2020 reports, stated that there are different types of SACCOs in Kenya: Deposit-Taking (DT) SACCOs and Non-Withdrawal Deposit-Taking SACCOs. The Non-Withdrawal Deposit-taking SACCOs include Housing Cooperative, Investments Cooperative, Transport Cooperative, Consumer Cooperative, and Marketing/Production Cooperative. The number of licensed DT-SACCOs in Kenya in the financial year of December 2022 is 175. DT-SACCOs, however, are classified into five common bond clusters; Teacher based (43), Government based (37), Farmer based (49), Private sector based (24), and community based (22) (SASRA, 2020). Figure 1.1 below shows the ontology of the SACCO system in Kenya. The SACCOs have assets, deposits, and gross loans of Kes 627.68 billion, Kes 431.46 billion, and Kes 474.77 billion, respectively, in 2020. The report further stated that the DT-SACCOs have 5,470,192 members (about 10% of Kenya’s population), out of which 4,097,617 are active members, and the remaining 1,372,575 are dormant members as of 2020 (SASRA, 2020).

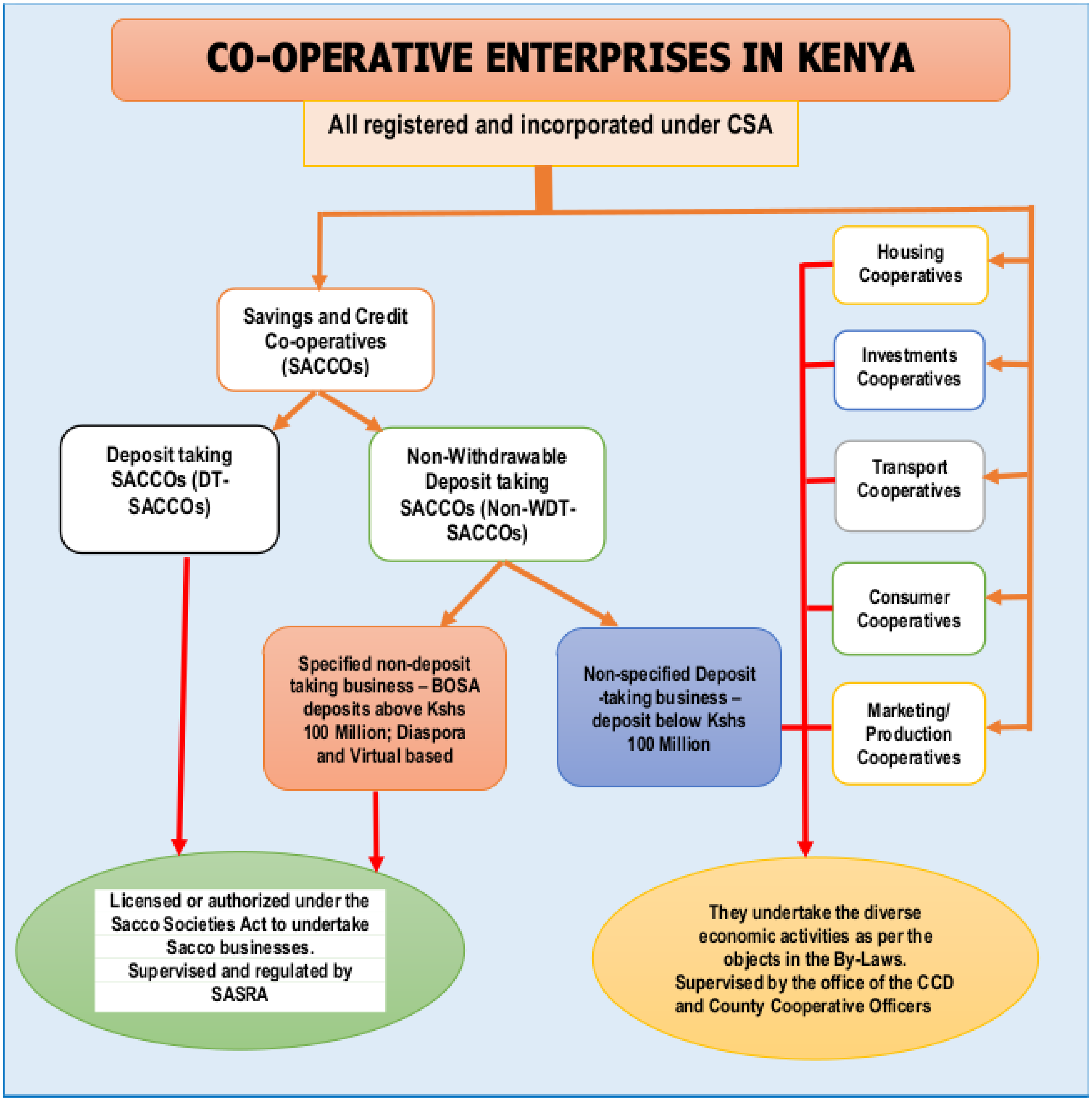

Figure 1.1: Types of Cooperatives Enterprise in Kenya (SASRA, 2020)

1.1.1 Benefits of DT SACCOs to The Kenyan Economy

According to Olando, Jagongo, and Mbewa (2013) the main objective of a SACCO is to mobilize savings, and credit disbursement through which they have been able to empower many of their members. In its vision, the Government of Kenya (GoK) 2008, (as cited by Olando et al., 2013) mentioned that the Savings and Credit Cooperatives (SACCOs) in Kenya are envisioned to play a critical role in the GoK's vision 2030 financial system that will mobilize and allocate resources efficiently in the economy.

1.1.2 Operation of Deposit-Taking SACCOs

The availability of services such as the Front Office Services Activity (FOSA), within the DT-SACCO system presents the quasi-banking operations for eligible members of the SACCO. Members can carry out similar banking operations such has depositing and withdrawing.

1..1.3 Digitizing the SACCOs

Investing in information technology is vital for Boeing Employee Credit Union (BECU) to deliver personalized service to its members (O'Hara & Brohman, 2002). As the SACCO industry grow in Kenya, there is need to improve on the use of technology such as mobile phones for the ease of accessing services by members of the SACCOs. The SACCOs are technologically advancing and adding services like internet banking, social media platforms, credit scoring application and various other technologies to reach out to more customers.

Mugo et al. (2018), mentioned that the use of mobile telecommunication has enhanced the performance of the DT SACCOs in the aspect of mobile messaging, mobile call and mobile chatting services. These platforms are producing data and can be referred as the source systems within the DT-SACCO technological ecosystem. However, the systems are isolated within the ecosystem. The use of technology created other challenges; decision makers find it difficult to reconcile data from the diverse source systems, this has made decision making and data validation process a lot more challenging to be accomplished across departments in the DT SACCO. Also, the data in the source systems can be structured or unstructured data, hence the need for a well architected data warehouse as a central repository to support business intelligence for decision making.

The CEO of Kwara a fintech company in Kenya stated that it is important for SACCOs to digitize their processes in other to optimize their products/services delivery through efficient, convenient and secure means to members. Adding to that, the record shows that it has become essential for SACCOs to deliver services through secure access control and central platform. Furthermore, the fintech leader, elaborated that digital lender pose as a ready alternative for cooperative members because of their fast-moving method of access to loan. It was also reported that in a survey conducted in 2020, 60% of about 50 SACCOs were negatively affected due to COVID-19. The affected SACCOs are those without technological advancement in their operations and members cannot get access to loan without physically applying (Okuoro, 2020).

The analysis of the data generated by the different systems is very crucial for the DT SACCOs hence the need for the integration of the systems. The concepts of data warehousing and business intelligence are important for the DT SACCO to have a wholistic view of their data from a central point.

1.1.4 The Overview of Data Warehouse and Business Intelligence:

The figure 2 below illustrates the overview of data warehouse and business intelligence architecture.

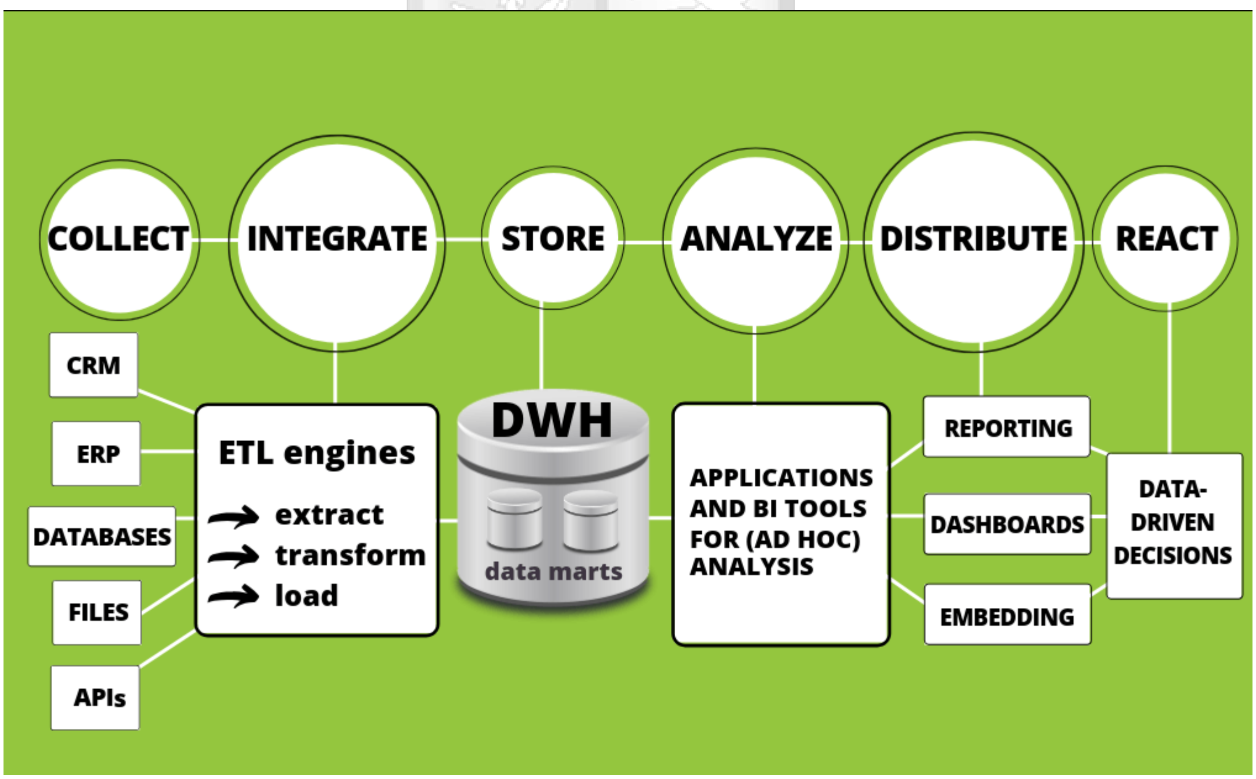

Figure 1.2 : BI Architecture

1.2 Problem Statement

Various DT SACCOs have implemented different CRM and ERP, costing the institutions billions of shillings in investment. However, they fail to meet still the target of quickly deciding within their organization. The problem is that DT SACCOs are collecting so much data through the ERP and CRM that there is no adequate reporting tool to enable practical analysis and decision-making monitoring. Therefore, this research proposes implementing a data warehousing solution and business intelligence system to aid decision-making in DT SACCOs.

The aim of this paper is to give a comprehensive overview of the implementation of Business Intelligence as a success factor in DT-SACCO. The purpose and focus of this work will be in trying to analyze the need for setting up a Data Warehouse and Business Intelligence system to serve as a key component for decision-making in a DT-SACCO. Although there were some analyses regarding business intelligence, more research is needed to validate the challenges found and determine if there are any new ones based on the patterns examined. A conceptual model should be summarized based on the results of the study. The research will focus on answering what are the key requirements for the implementation of data warehouse and business intelligence systems in order to create value for decision-making in a DT-SACCO? In addition to this main question, many studies are mainly focused on existing companies that have already implemented a business intelligence solution. Additionally, the dissertation will provide information on how companies without a business intelligence solution can implement a BI solution in the most effective manner to use for decision-making within a DT-SACCO ecosystem.

1.3 Objectives

To Design and implement data warehouse and business intelligence system in order to support decision-makers and business strategists in making better decisions within the DT SACCO ecosystem.

1.3.1 Specific Objectives

- i To investigate the current technologies used to make decisions in a DT SACCO.
- ii To investigate how business intelligence framework fits the DT SACCO ecosystem.

iii To design a data warehouse and business intelligence system that fits the DT SACCO ecosystem for effective decision making.

iv To implement a data warehouse and business intelligence system that fits the DT SACCO ecosystem for effective decision making.

v To test the business intelligence system.

1.4 Research Questions

I. What are the methods and techniques used to make decision in a DT SACCO?

II. What data warehouse model and business intelligence framework fits a DT SACCO?

III. What are the requirements for developing a data warehouse and business intelligence systems for decision making?

IV. How can a data warehouse and business intelligence system be designed and developed?

V. How can a Data Warehouse and business intelligence system be Tested?

1.5 Justification

Business intelligence is much more than a specific “thing”; it is an umbrella term that describes all the processes and methods for collecting, storing, and analysing data from business activities or operations. In combination, these things help people make better, actionable business decisions. As business intelligence has evolved over the past few years, it has become more comprehensive and important for decision making in an enterprise. It supports in the several processes and activities. Some which are, the use of databases, statistics, and machine learning to uncover patterns in large datasets. Other benefits of business intelligence are data analysis, which is sharing data with stakeholders for them to draw conclusions and make decisions.

Business intelligence (BI) is also used in comparing current performance data to historical data to measure performance in relation to goals, usually through custom dashboards. It also describes the data using descriptive analytics. Some other functions BI is visualization of data in form of graphs, charts, and histograms makes data consumption easier.

According to the above, the research seeks to help give quick access to data in a more convenient manner within an organisation like DT SACCO. Also, it will help decision makers to align their experience with data-driven decision. The research work can be beneficial to the SACCO regulatory body (SASRA). It will serve as a source of knowledge for the implementation of BI within the DT SACCO space.

1.6 Scope

The scope of the project will be limited to three departments (Front Office Service Activity, Back Office Service Activity and Customer Service) within the Deposit-Taking SACCOs (DT-SACCOs) in Nairobi Kenya. The project will sort to view the decision-making challenges faced by business users within the DT-SACCOs space due to disparate data storage systems. The study is limited to integration of operational source systems (databases) to create a data warehouse using the Bill Inmon (top-bottom) approach and business intelligence for data analytics to support decision making within the DT SACCO ecosystem. The system will be a prototype of an on-premises business intelligence system. The technologies to be used will be Microsoft Business Intelligence Suite (Community/Developer Version) which are Microsoft SQL Server, SQL SEREVR Integration Services (SSIS), SQL Server Management Studio (SSMS), Microsoft Excel. The report and dashboard will be developed using Tableau Desktop.

1.7 Limitation

The limitation of the research includes the data collection process which is the use of questionnaire due to time constraints and available funds for the research work. It would have been more appropriate to employ other means of data collection like interviews to improve the research work. Also, some limitations were faced on existing literature focusing on location where the research would be conducted, hence older references were used for the research.

Chapter Two: Literature Review

2.1 Introduction

This chapter briefly introduced reviewing existing methods used by to make decision. Also, the review will focus on the designing and implementation of data warehouse, business intelligence (BI), and common architecture that has been used to successfully implement BI solutions in different industries.

2.2 Review of Data Warehouse/ Business Intelligence

Information processing in the right way is the key factor in having a competitive advantage. Caseiro & Coelho (2019) define Business Intelligence (BI) as a set of processes towards data that are needed in decision making. Big Data is very essential in making predictions due to the huge amount of data that is generated (El Bousty, et al., 2018, p. 170). There are certain reasons why BI is regarded as an advantage to the company. Sangar & Iahad, 2013 (cited in Caseiro & Coelho, 2019) claim that since BI helps in delivering several reports, mining of information, and systematic analysis.

Marjanovic (2015) brings into focus the fact that BI together with analytics supports the organizational context and business users. There are three types of analytics which Riggins & Klamm (2017) give as relation to analytics and the generation of reports that are used to support decision making. They confirm that analytics is precisely helping in creating a better prediction environment for the future of business. The main functions of BI include data collection, analysis, sharing and dissemination of the information to help in effective decision making within an organization (Cheng, et al., 2020).

In addition to the main functions BI has its own components which Niño et al. (2020) define as: system source – collection of data from sources, acquisition of data – Extract Transform Load (ETL) process, data warehousing, reporting and analysis tools. The data is sensitive therefore it should be governed in the right way and have a high quality. The key success factors of BI can be categorized into three main groups which are organizational, users, and Technology. The first group includes management support, service quality, BI & business alignment, service quality and technology driven strategies. The second group includes the flexibility of IT infrastructure which is also related to the source systems and the Data Warehouse design and implementation. It is also important to note that BI heavily has a dependence on IT infrastructure. The third group is more related to the IT knowledge of the team, user involvement and adoption of BI solution by the team which is also classed as a missing factor for organizations that have implemented business intelligence (Ain, et al., 2019).

Considering all the definitions and how the components of BI work there is the question whether this environment is stable enough to comply all the work and if there is the need for another business opportunity. To answer this issue the challenges of BI should first be addressed. One of the starting challenges is Big Data (BD). The data generated in a company will continue to increase and then the issue of data fidelity may be questioned (El Bousty, et al., 2018). El Bousty et al. (2018) discuss that DW also becomes an issue. DW is important in accomplishing the ETL process, but data is not only gathered around one data source. As the company grows, unstructured data is presented and there are also other sources needed. In this case either the DW should be modified, or new ones can be created. In addition to the issue addressed this leads to a lack in having the data governance. Ain et. al (2019) argue that BI systems are critical and some of the challenges that are identified in the study include: insufficient service quality, low level of user acceptance and knowledge: “lack of motivation, capabilities, ability to explore the system and system logics and system errors as key challenges at the user level”. In this presented context, there is the need for a new opportunity such decision makers having quick access to reports to ease decision making within the organization.

Table 2.1: Summary of Pros and Cons of Business Intelligence

PROs	CONS
Flexibility (Imhoff & White, 2011; Stodder, 2015)	Difficult to scale (Imhoff & White, 2011; Eckerson, 2012)
Software architecture (Stodder, 2015)	Data governance and integration. (Imhoff & White, 2011)
Saves resources (Lennerholt , et al., 2018)	User uncertainty (Weiler , et al., 2019)
Improves decision making, agility and efficiency (Schlesinger & Rahman, 2015; Lizotte-Latendresse & Beauregard, 2018; Alpar & Schulz, 2016)	Business users lack the needed skills when using SSBI tools. (Johannessen & Fuglseth, 2016)
Less dependency on the IT department (Alpar & Schulz, 2016)	Implementation challenges (Lennerholt , et al., 2018)

In the technological context the concept of data quality is a very important. Data quality is the capability of data to satisfy needs under certain conditions, provide various services for an organization to reach top services (Taleb, et al., 2016; Panahy, et al., 2014). The dimensions of data quality serve for better classification of the information, so it becomes more valid and goes through a unified process for the company (Sidi, et al., 2012). The important parts of these dimensions include: consistency which covers how the data is in the same format, accuracy which talks about how the data is accurate when it is saved and has real value, uniqueness data cannot be mistaken, validity – data is in the right format so the right information can be conveyed, completeness – the availability of data to be used and timeliness – the extent to which data is appropriated for the task (Sidi, et al., 2012).

2.3 Decision Making

Personality is a key aspect when it comes to decision making. The process of making a decision comprises of two different phases: exploratory phase and convergent phase. In exploratory phase, decision makers use methods like sharing the problem at hand across different organizational department to have different views which leads to several alternatives in making decisions process. The convergent phase is where the decision maker aims at narrowing down on alternatives and then making decisions (Turpin & Marais, 2004). Guts, intuition and personality all play key roles in the decision making process (Clemen & Reilly, 2004).

However, the process of making decision can be made a lot easier by the use of technology. The concept of data warehouse and business intelligence being one of them. It was established that business intelligence can be used as a decision support tool for organizations. With help of integrating the organization's disparate operational sources, decision makers can have 360 overviews of the business. This will in turn aid decision making (Alzeaideen, 2019; Ngure, 2007).

2.4 Data Warehouse

An integrated data warehouse (DW) is an integrated repository of data organized in a way that allows it to be easily understood, interpreted, and analyzed by the people who need it to make informed decisions. According to Inmon, (as cited by Song, 2009), "a data warehouse is a subject-oriented, integrated, nonvolatile, and time-variant collection of data to support management decisions." DWs are subject-oriented, which means the data in them are organized around major entities of interest to the organization. Subjects could include customers, products, and sales. A DW can enable tactical and strategic decision-making by allowing for in-depth analysis of each subject (Song, 2009). A DW integrates data from operational database systems as well as from meta-data and external sources (Song, 2009).

2.5 Data Warehouse Concept

William Inmon and Ralph Kimball are two well-known authors in the realm of data warehouse design. Their approaches to data warehouse design differ. As opposed to Inmon's top-down approach, Kimball's is bottom up. The two approaches are generally adopted by data warehouse practitioners. The widely accepted definition of a data warehouse was developed by Bill Inmon in the 1980s. According to Inmon (2005), In support of management decisions, a data warehouse is characterized to be subject-oriented, integrated, non-volatile collection of data.

2.5.1 Subject Oriented

Subject-Oriented: The data warehouse is to provide Information on the major subjects of a corporation that have been addressed through its high-level corporate data model. Customer, Product, Transaction or Activity, Policy, Loan, and Account are typical subject areas. Physically, each major subject area is implemented as a series of related tables in the data warehouse.

2.5.2 Integrated

Data from separate sources can be collected into a fixed format and merged together within an integrated data warehouse by its nature.

2.5.3 Time Variant

Having a period in the data warehouse means the data in the warehouse is always accurate at that point in time.

2.5.4 Non-volatile

A nonvolatile data warehouse is one in which data is not changed, but is regularly updated by the operational systems.

Kimball indicated that a data warehouse is not just a copy of an operational database that is stored on another server. Although, analyzing the data from this backup copy, will likely improve the performance but cannot deliver the full opportunity that a architected data warehouse will give (Kimball & Ross, 2013).

As the nexus of data integration, the data warehouse (DW) is the first step toward converting data into Information.
According to Claudia, Nicholas and Jonathan (2003), Since the DW is enterprise focused, this allows it to serve the following purposes: In the first place, it provides a common view of enterprise data, regardless of how it may later be consumed. Since this is a standard view of the

data for business customers, it supports flexibility in later interpretation (analysis) of the data. The data warehouse produces a consistent, consistent, and reliable source of historical Information for all consumers.

Also, the data warehouse can grow to a huge percentage (more than 20-100 terabytes!) Due to the great need for historical Information throughout the organization. From the beginning, the design was designed to address this increase in Information in the most efficient way, using the company's business rules for use throughout the organization.

Finally, data warehouses are set up to provide data for all forms of analytical methods in the business world. This means that each data mart can create many data marts from the data contained in the data warehouse, rather than acting as a producer and consumer of its own data (Claudia et al., 2003).

2.6 Data Warehouse Data Model

Claudia, Nicholas, and Jonathan (2003) define a data model as an abstraction or representation of data in a particular environment. This is a collection and subsequent review and communication method to fully document the data requirements used to create an accurate, effective, and efficient physical database. The data model consists of entities, attributes, and relationships. Corresponding metadata such as definitions and physical properties are defined within the complete data model. Also, the data models created for business intelligence environments are important to the overall success of the initiative and the long-term maintenance and sustainability of the environment (Claudia et al., 2003).

2.7 Data Warehouse Modeling Techniques

The two data modeling techniques associated with a data warehousing environment are Entity Relationship (ER) modeling and multidimensional modeling. ER modeling uses two basic concepts: entities and the relationships between them to create a data model for a particular region of interest. The ER model is an abstraction tool because it can be used to understand and simplify ambiguous data relationships in business and complex system environments. Multidimensional modeling uses three basic concepts: measures, facts, and dimensions. Multidimensional modeling is powerful in expressing the needs of business users in the context of database tables. You can use both ER and multidimensional modeling to create abstract models of a particular subject (Patel & Patel, 2012).

2.8 Data Warehouse Design Approach

According to Patel and Patel (2012) data modeling consist of three levels which are conceptual, logical, and physical. The conceptual design and logical design are the two levels of data modeling that will be considered in this research work. While conceptual design is used to depict the concepts that are close to the way regular users would perceive data within an organization, the logical design helps to deals with concepts related to a certain kind of database management system (DBMS). On the other hand, physical design illustrates how data is actually stored in the DW.

Data Warehouse requires efficient and performative means of accessing data. Hence the need for user requirements which serve as the basis for conceptual design modeling, and logical design which involves the definition of structures that enable an efficient access to Information perfectly handles the function. Multidimensional structures are built by the designer after considering the conceptual schema representing the information requirements, the source databases, and non-functional requirements (Performance). The end goal of logical design phase, is a working solution that the end-user uses to access data effortlessly (Patel & Patel, 2012; Teorey et al., 2011).

2.8.1 Data Warehouse Logical Design

Logical design is abstract; hence, it is a layer before going into physical implementation details. At this level, the designer only defines the type of Information I need to satisfy the business users.

One technique that can be used to model the logical information requirements of an organization is the entity-relationship model. Entity-relationship modeling is the identification of what is essential (entities), their properties (attributes), and how they relate to each other (relationships).

The logical design process involves arranging data in a set of logical relationships called entities and attributes. An entity represents a block of Information. In relational databases, entities are often mapped to tables. Attributes are components of an entity that help define uniqueness. In a relational database, attributes are mapped to columns and should use a unique identifier to ensure data consistency. Unique identifiers are added to the table to be distinguished when the same item appears elsewhere. In physical design, this is usually the primary key.

Entity-relationship diagrams have traditionally been associated with highly normalized models such as OLTP applications. However, methods of dimensional modeling continue to be helpful in data warehousing design. Rather than identifying atomic information items (such as entities and attributes) and all the relationships between them, dimension modeling identifies Information that belongs to the central fact table and Information that belongs to the associated dimension table. They identify business subjects or data fields, define relationships between business subjects, and name the attributes of each subject.

2.9 Data Mart

A data mart is a structure / access pattern used to retrieve client-facing data in data warehouse setups. A data mart is a subset of a data warehouse that is typically focused on a single business line or team. In an organization, we have different needs across departments of the organization ("finance, marketing, sales, finance, engineering, and so forth") which a dart mart helps to provide tailored data need. Data marts are developed on the concept of dimensional data model. Originally, the data mart sources data from the data warehouse (W. H. Inmon & Linstedt, 2015).

2.10 Data Warehouse Design Concepts

The design of a data warehouse depends on two major approaches. The Bill Inmon Approach and Ralph Kimball Model.

2.10.1 Bill Inmon Model

In this model, the procedure begins with an Extraction, Transformation, and Loading (ETL) process that works with legacy and/or external data sources, as introduced by Bill Inmon. Extract data from these sources, transform it, and store it to a centralize Data Staging Area. The centralized enterprise Data Warehouse is then filled with data. Data Marts are built using summarized data warehouse data and metadata once these have been assembled. Integration between the data warehouse and data marts is automatic in the top-down paradigm as long as the discipline of defining data marts as subsets of the data warehouse is maintained.

2.10.2 Ralph Kimball Model

This bottom-up model was introduced by Ralph Kimball and it is primarily aimed at building the data warehouse incrementally over time from separately constructed data marts. Extract Transform and Load (ETL) for one or more data marts is the first step in the process. There is no need for a shared data staging area. Each data mart is usually housed in its own location. (Kimball & Caserta, 2004; Kimball & Ross, 2013).

2.11 Data Warehouse Development Requirements

Data warehouse (DW) development is widely considered to be a complicated, time consuming, and a task with a high failure rate (Luján-Mora & Trujillo, 2005). Also, the increasing multiformity of data sources adds to the complexity of data warehouse projects (Takecian et al., 2013). Hence in data warehouse development, it is important to apply the data warehousing development life cycle principles to achieve the required result.

Data warehousing life cycle refers to the steps a data warehousing system takes during its creation. Consumers use different analytics tools and applications to collect Information from the data warehouse to deliver meaningful decisions to the business. Integrating data sources in one place makes it easier to perform analyses, generate reports, and discover meaningful insights at different levels within the organization. The data warehousing environment includes extraction, transformation, and load (ETL), forming the online analytical processing (OLAP) engine (“Data Warehouse Development Life Cycle Model,” 2021; Golfarelli, 2009).

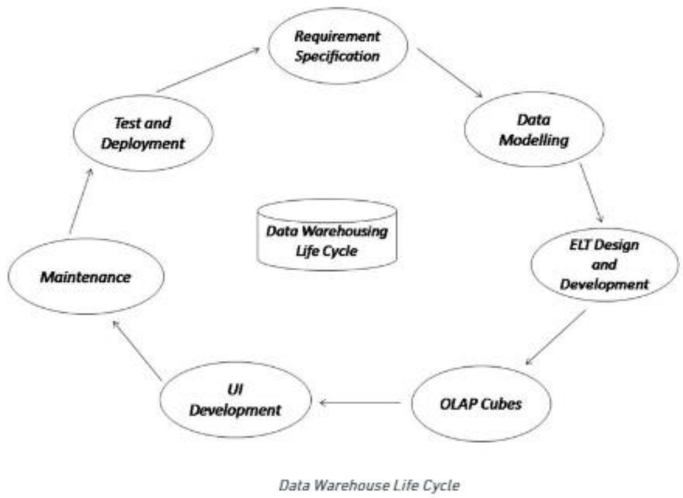

Figure 2.1: DW Development Lifecycle (DWLC) Model ("Data Warehouse Development Life Cycle Model," 2021)

2.12 The Concept of Business Intelligence

BI was first coined as a catch-all name for data analysis software. Meanwhile, the definition of business intelligence (BI) has expanded to include all components of an integrated decision support architecture. Data from OLTP and analytical front ends are used in BI systems to present complicated Information to decision makers. The data warehouse (DW), which integrates OLTP data for analytical activities, is an essential component of BI systems.

BI is viewed as a process in which data from both inside and outside the organization is consolidated and integrated in order to provide Information that will aid in quick and effective data-driven decision. The role of business intelligence (BI) in this case is to build an informational environment and process through which transactional systems data and external sources may be examined and strategic business dimensions are revealed (Department of Informatics, Linnaeus University, Sweden & Sinaj, 2021). Intelligence refers to the act of screening, analysing, and reporting Information in order to convert a large amount of data into knowledge (Stangor & Walinga, 2014).

The technology perspective portrays BI as a collection of tools for storing and analysing data. The focus is on the technology that allow for the recording, retrieval, manipulation, and analysis of data, rather than the process itself. According to Gartner Groups (as cited by Cheng and Cheng, 2011), "defined BI as a series of technology or application systems which consist of data warehouse (or data mart), reporting, data analysis, data mining, data backup and recovery components, and which contribute to a better business decision and finally can help enterprises to keep a leading position in the competitive market." Whether managerial or technological, all of these studies have one thing in common: business intelligence focuses on data collection and analysis with the purpose of assisting decision-making and advancing the company's strategy.

2.12.1 Online Analytical Processing Versus Online Processing Databases.

Because they serve managers and knowledge workers in the field of data analysis, data warehouses are sometimes known as Online Analytical Processing (OLAP) systems. The information systems that support an organization's daily operations are known as online transaction processing (OLTP) systems or operational systems. The primary goal of an OLTP system is to record data regarding an organization's economic activities. One may argue that an OLTP system's goal is to get data into computers, whereas a data warehouse's goal is to get data or Information out of computers.

A customer-oriented OLTP system differs from a market-oriented data warehouse. Combining data warehousing (OLAP) and OLTP capabilities in one system is tough. The relational model used in OLTP systems is substantially less effective for querying than the dimensional data design model used in data warehouses. In addition, data warehouses can leverage many databases as data sources. Because of the duplication and loss of referential integrity of the data, the dimensional design is not ideal for OLTP systems. Organizations can select between two different information systems, one OLTP and the other OLAP (Jensen et al., 2004).

Luján-Mora and Trujillo (2005) It's important to emphasize that OLAP analysis is primarily done through comparisons or by analysing patterns and trends. Sales trends and marketing plans, for example, are evaluated together to establish the relative performance of particular marketing tactics in terms of sales patterns; such study may not be possible with OLTP. Kimball had the same viewpoint, but Inmon (2005) took a different approach to data warehouse building. He claims that, while OLTP starts with requirements and finishes with a clear grasp of the needs, data warehousing begins with the implementation of the data warehouse and ends with a clear understanding of the requirements.

2.13 Conceptual Framework

The following conceptual framework links the reviewed literature with the research problem and objectives. The first part of the proposed data warehouse and business intelligence system is the transactional data sources also called the source system of the DT SACCO. The next stage is extract transform and load (ETL) process which loads the data into a staging area. From the staging area, another ETL process takes place applying the business rules to the data before loading it into the data warehouse. Different data warehousing modeling techniques discussed in section 2.4 is will be performed during the design and implementation phase of the data warehouse. After the data has been aggregated in the data warehouse, different data marts for the focused departments (FOSA, BOSA, Customer Service) will be developed. Finally, the reports and dashboards development to support decision making will be created for business users to consume. The conceptual framework is shown in Figure 2.2 below.

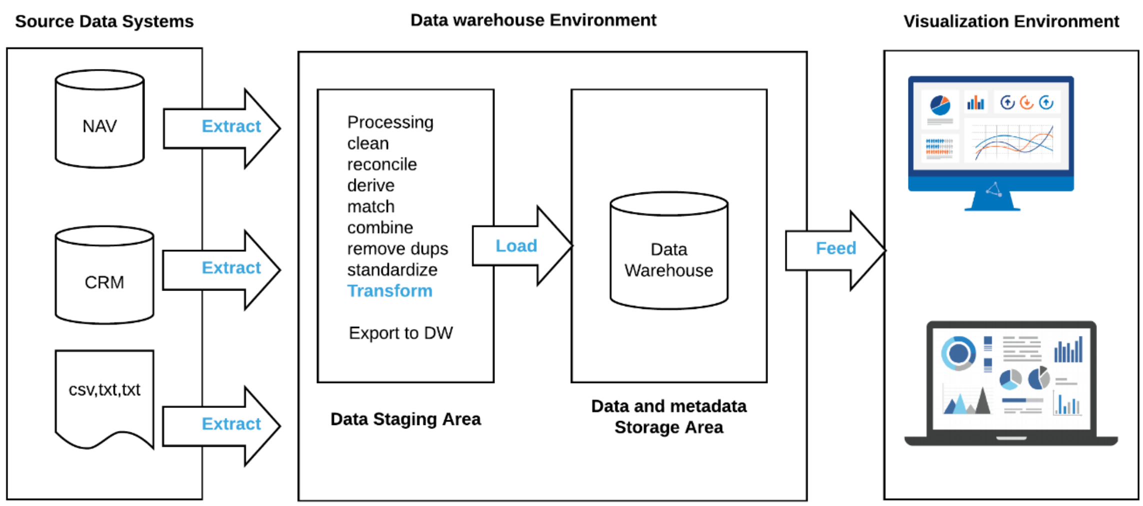

Figure 2.2: Conceptual Framework of Data Warehouse and Business Intelligence System

Chapter 3: Research Methodology

3.1 Introduction

This chapter consists of the approach the researcher has taken to undertake the designing of the data warehouse and business intelligence system. Since the study's business requirements are so important, the implementation will be divided into three phases: analysis, design, and development. According to (Sridhar, 2008), methodology is the study of how to conduct research scientifically through the use of a systematic approach to solve a research problem logically through various steps. The importance of research methodology lies not only in philosophical assumptions, but also in the way it guides the selection of research methods (Long, 2014).

3.2 Research Design

The study aims to use qualitative research design as it aims at investigating and solving a real-world decision-making problem facing DT-SACCOs due to disparate data sources in their ecosystem. The research will focus on building a data warehouse storage solution that will supports a business intelligence system that will aid decision-making in DT-SACCOs.

3.2.1 Secondary Research

Due to the time constraint, existing data collated will be used to give accelerated guidance to the aim of the study. The secondary data analysis is carried out by people who were not involved in the data collection, and this could be original data or published data. According to Church (2002), secondary data analysis could be used in a study where the data is stored in its original form in an archive. In this research, anonymised DT-SACCO transactional data is considered for the project. The collected data is the transactional data stored overtime using the Online Transactional Processing Databases (OLTP DB). The data is essential for the study because the data warehouse solely rely on the historical data (secondary data) already collected by the DT-SACCO.

3.2.2 Primary Research

The researcher believes it is crucial to ask the business users (used interchangeably in this project to denote Decision Makers/Managers) what their expectations are for the design of the data warehouse and business intelligence system for the organization in order to make an informed decision throughout the design stage of the project. To gather further Information about data consumption and what report is relevant to the business user, the researcher will employ a questionnaire that is completely anonymous.

A questionnaire is a type of research tool that consists of a set of questions and other prompts for gathering data from respondents. A self-completion questionnaire allows respondents to answer questions by filling out the form themselves. There is no interviewer to ask questions on the self-completion questionnaire; however, participants will read each question and answer the questions themselves.

3.3 Target Population

As depicted in figure 1.1, the cooperative enterprises in Kenya are all registered and incorporated under the cooperative society act (CSA). The Deposit Taking Saccos (DT-SACCOs) licensed within the financial year ending on 31st December 2022 are 175, out of which 47 are in Nairobi (SASRA, 2022). Following the scope of the study, the project will be focused only on the DT SACCOs in Nairobi, out of which five DT-SACCOs will be randomly selected for questioning via the questionnaire. The study's target population is the senior level managers of the focused departments as stated in section 1.6: the IT manager, FOSA department manager, BOSA department manager, and Customer Service department Manager of the DT SACCOs.

3.4 Sampling Techniques and Sample Size

Due to small budget and limited time, the sample size for the study will be pegged at fifteen managers (Coded as P1 to P15) from different DT-SACCOs willing to participate and complete the questionnaire. The questionnaires will be sent to three different DT-SACCOs coded with alphabets (A, B, and C) located in Nairobi targeting official in different departments.

The DT SACCOs are clustered into five common bonds; the DT SACCOs' daily operations and member's transactions are standardized and regulated by SASRA, as stated in section 1.1. For these reasons, the project will use haphazard sampling (convenient) and purposive sampling to target the population questioned for this project. The two sampling techniques selected are both nonprobability sampling. The haphazard sampling technique is used where members of the target population meet specific practical criteria, like easy accessibility, geographical proximity, availability at a given time, or the willingness to participate, are included in the study (Galloway, 2005). The purposive sampling technique, also called judgment sampling, is the deliberate selection of a participant due to the participant's qualities, like Subject Matter Experts (Robinson, 2014).

Although they are all involved in the project, they each have unique and different characteristics that the project needs to consider, therefore the different sampling methods. A convenient sampling technique will be used to sample the DT-SACCO staff (Business Users) to complete the questionnaires for the business intelligence requirements. At the same time, purposive sampling will be employed for the secondary data to develop the data warehouse.

Table 3.1: Participant

Alias	**Title /Position**	**DT-SACCO**
P1	Head of BI	A
P2	IT Manager	A
P3	FOSA Department Manager	A
P4	BOSA Department Manager	A
P5	Customer Service Manager	A
P6	Head of BI	B
P7	IT Manager	B
P8	FOSA Department Manager	B
P9	BOSA Department Manager	B
P10	Customer Service Manager	B
P11	Head of Analytics	C
P12	IT Manager	C
P13	FOSA Department Manager	C
P14	BOSA Department Manager	C
P15	Customer Service Manager	C

3.5 Data Collection Procedure

The purpose of this section is to provide information about the qualitative data collection used for the study. According to Creswell and Creswell (2014), qualitative research deals with data collected through interviews, questionnaire documents, and observations. In this dissertation, questionnaire is the main data collection instrument. There are many reasons why questionnaires are popular research methods, these include their efficiency, speed, and affordability. Instruments such as these are particularly useful for measuring the behaviour, preferences, intentions, attitudes, and opinions of subjects.

The data was collected using questionnaires. To focus on the big picture, the questions were not too broad instead narrowed down and easy for the participant to understand. The questionnaires were shared with the sample populations to obtain their views concerning decision making using standalone systems, data warehouse development, standard transactional systems used in the DT-SACCO ecosystem, business intelligence systems, and how it aids decision making. Also, the questionnaire received details of business user requirements for the development of the business intelligence system. Through an analysis of the data collected, the research objectives were established. Precaution has been taken not to overstep the project scope and avoid crossing over what the DT-SACCO considers the industry's best practices.

3.6 Method for Data Analysis

Since the dissertation is following a qualitative approach, then thematic analysis will be conducted. Data analysis will be carried on the responses to the questionnaire. Braun and Clarke (2006) discuss about the relations between the questions of a qualitative research. They discuss that the question should be not too broad, but instead narrowed down and eventually those narrow questions bring the big picture. Based on the analysis done by Creswell and Creswell (2014), the data analysis process goes in a hierarchical approach, but the steps can be interrelated and not in a fixed order. Following this explanation, the analysis steps in this dissertation are based on the (Creswell & Creswell, 2014) guidelines which are transcribe the responses, conceptual designing to generate the first information from the raw data, coding technique, themes generation, main themes representation, and interpretation. In order to conduct an efficient data analysis on the responses, basic coding technique will help, since it provides identification for the topic of BI and is valuables when organizing the information. The data analysis from the transcripts of the responses is going to be categorized in relevance with the three main groups which include the main themes: technological, organizational and decision-making context. The process of analysis is classified as an inductive and iterative process. Knowledge will be gained which will be further used in reasoning to make broader generalizations from the data. Another important data analysis method that will be used is data condensation. The analysis done in the upcoming chapters based on all the methods mentioned above, will come into certain forms of visualization: tables, graphs and charts. Furthermore, the analysis process is also based on the literature review done in the second chapter. It is important to make a comparison in the analysis between the experts and literature in order to reach the best conclusions.

The anonymized DT SACCO transactional data (secondary data) received in form of a backup file will be restored into a provisioned Microsoft SQL Server database by the researcher. Other secondary data received inform of flat flies will be ingested into the database using the extract transform and load (ETL) process. A conceptual data model will be created from the secondary data with the help of the business user requirements data collected.

The project will use Microsoft excel spreadsheet in analysing the primary data collected from the questionnaire. The steps for data analysis are as follows: Received questionnaires are prepared, conceptual designing to generate the first Information from the raw data, themes generation, and data interpretation.

The responses from the questionnaires are going to be categorized according to their relevance to three main groups: Technology, Organizational (Users and how they use the reports) and lastly Decision-making context.

Inductive and iterative methods are used in the process of analysis. In this dissertation, condensation will be used to select, simplify, and transform data from the questionnaires. From the data, knowledge will be gained which can be used to make broader generalizations. All the methods described above will be applied to the analysis done in the following chapters, which will be analyzed using various forms of visualization, including tables, graphs, and charts. The analysis process is also based on the systematic literature review in chapter two. It is a critical component of the data analysis stage of this study to compare the experts’ knowledge and literature to reach the best conclusions.

3.7 System Development Methodology

The researcher hopes to study the data that a DT-SACCO has accumulated over time at least for a year. This phase also entails establishing the data warehouse's functions as well as an ideal working environment in which the data warehouse will be developed. Whatever the business needs are, the general goal is to acquire a sense of how the initial data is being used and to identify other stakeholders who may require access to the data.

The business analysis/user requirements are also used at this stage to understand how users interact with the business and how they want to utilize the business intelligence system, as well as what data they currently use and what they want to do with it. This Information can then be decomposed into Business entities and their properties, as well as manage relationships between entities and hierarchies, using this data in a variety of ways. A series of interviews with various stakeholders can be used to obtain needs. These consumers' responses will generate the needs for the data warehouse's future development.

3.8 System Analysis

The answers to the questions of who would use the business intelligence system, what it would do, where and when it would be used were all answered at this phase. This phase mostly consists of gathering business needs. The following steps were taken during the system analysis.

3.8.1 System Design

The major goal of this phase is to convert the system requirements into a set of specifications for the data warehouse by creating logical and physical data models or data marts. Other components, such as data warehouse extractors and transformations, data integration tools, and so on, are created based on the specifications. Managerial decisions are influenced by a variety of factors, including political, economic, and technical factors, yet a badly made decision might derail the entire analysis.

Bill Inmon and Ralph Kimball are the two fathers of data warehouse, as mentioned in the literature study. They use distinct approaches to data warehouse design. The Bill Inmon Method has been selected to be used by the researcher for this investigation. The data from each department is combined, and the researcher can create a complete data warehouse and business intelligence system for the departments specified in the project scope.

The "Spiral model" is to be used by the researcher. The Spiral Model is a set of waterfall models that correlate to a risk-oriented iterative enhancement, and it understands that requirements aren't always explicit and available when the system is first implemented. The spiral technique is one of the development methodologies of choice because developing and building a data warehouse is an iterative process. This ensures that any business requirements that were unclear at the start of the analysis step can be revisited frequently. One waterfall series in a proposed spiral model of a data warehouse life cycle is depicted in the diagram below.

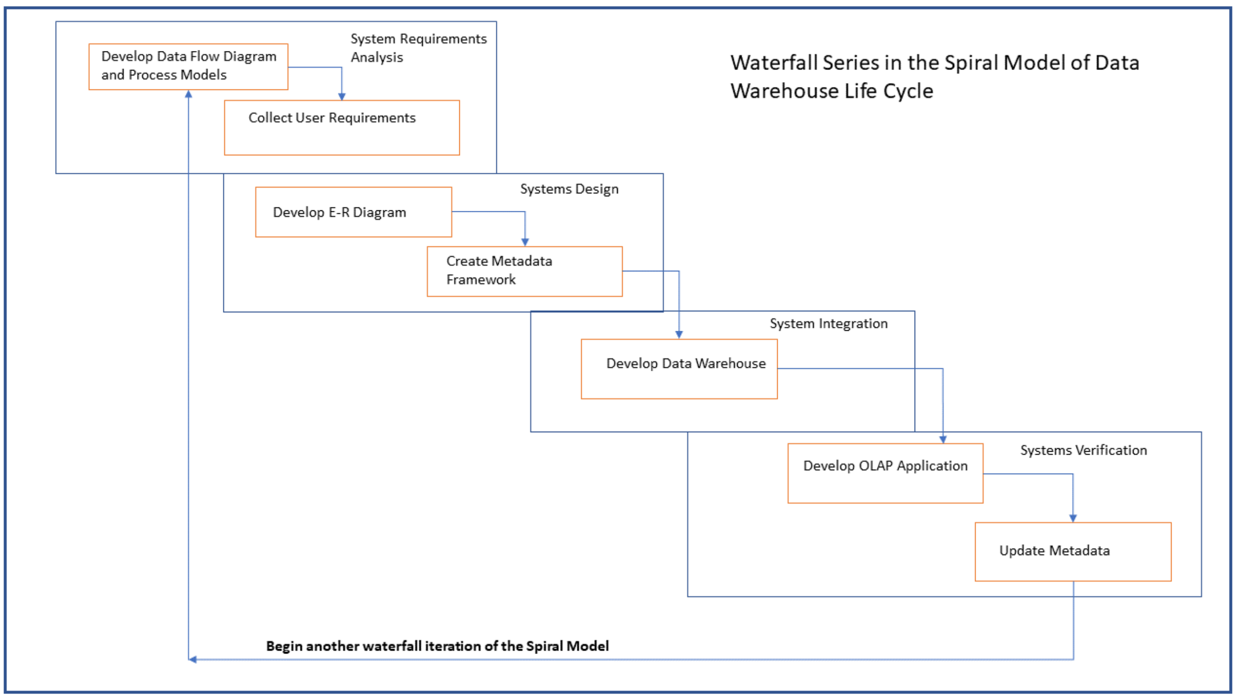

Figure 3.1: Spiral Model of the Data Warehouse Life-cycle

The researcher begins the data warehouse design by defining the measures, which are the foundation and feedback data required by decision makers. The researcher matches these needs to the data in the source system (OLTP). The researcher designed the data warehouse using the star schema for this project. In a data warehouse, the star schema is a relational database schema for storing measures and dimensions. The dimensions are recorded in dimension tables, and the measures are stored in fact tables. The dimensions in the data warehouse (DW) are linked to the measure. Each departmental data mart will be constructed using the star-schema approach, similar to the DW. The fact table is at the centre of the star. The fact table has a column for each dimension that contains the foreign key for a member of that dimension, as well as a column for the measure. Concatenating all of the foreign key fields yields the table's key. The composite key is the name given to the fact table's primary key. The word "Fact" comes from the fact that it contains the measurements. Dimension tables are used to keep track of the dimensions which mostly help the business users to answer the question (WHERE, WHEN, WHO). The dimension table has a column for unique identification of records, which is commonly an integer or a short character value. It features a description column as well.

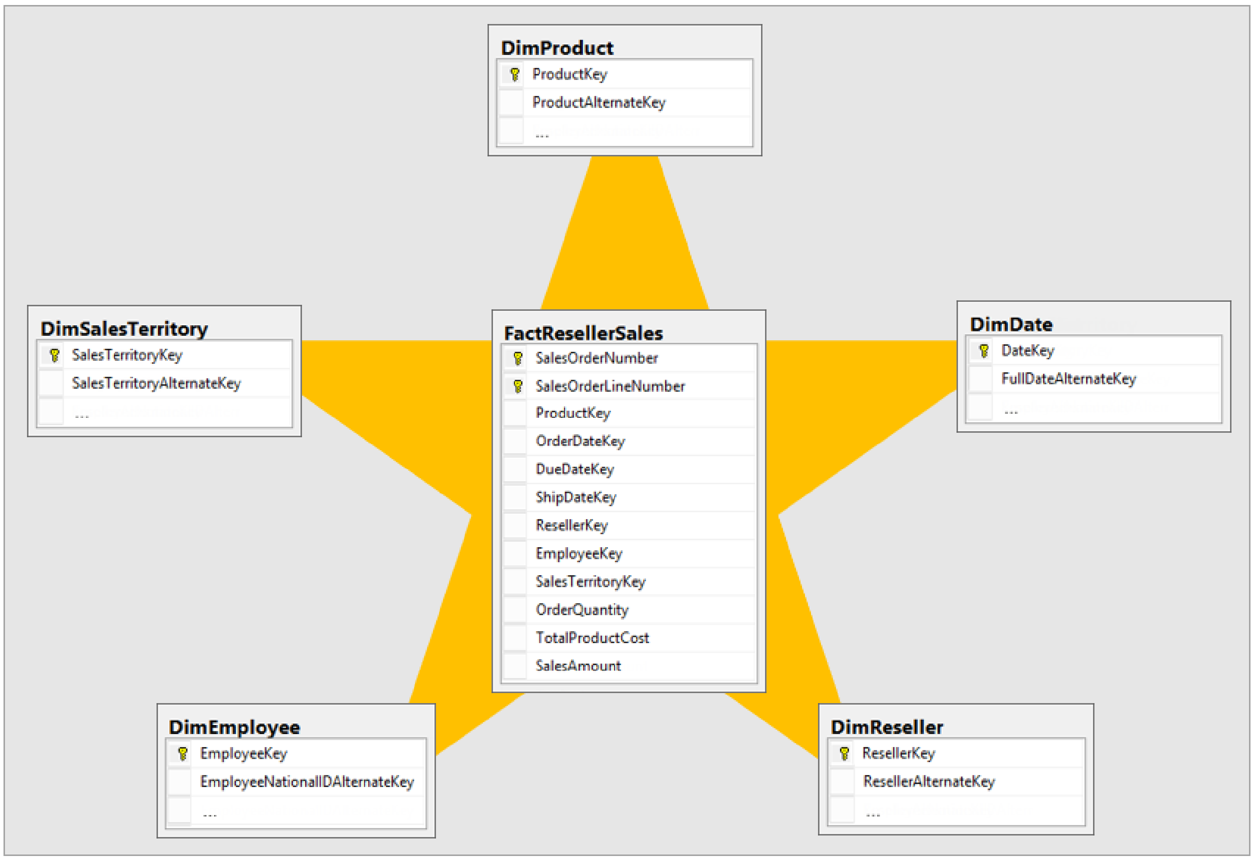

Figure 3.2: Star Schema (peter-myers, n.d.)

3.8.2 System Development and Validation

The actual implementation of the carried-out analysis and design is known as system development. The researcher built the data warehouse (fact and dimension tables), the Extract, Transform, and Load (ETL) task, and connecting the front-end application (Tableau) for this project during this phase. The validation procedure entailed confirming that the business intelligence system has been implemented effectively and meets the needs of the business users.

3.9 Requirement Analysis

Software failures and successes rely primarily on technical documentation, called software requirements specifications (SRS) documentation, as it includes all the requirements and features of the product (Ali et al., 2018). The first step in data warehousing development is to perform the task of requirement specification, which business analysts perform. At this stage, the business analyst creates the business requirements specification. Over half of the requirements are determined by the customer (business users), and it takes three to four months to obtain all the requirements. After the requirements are collected, the data modeler begins to recognize dimensions, facts, and combinations based on the requirements. The overall blueprint for a data warehouse is formed from the steps above. Also, at this phase, identification of business needs occurs and is factored into data warehouse planning ("Data Warehouse Development Life Cycle Model," 2021).

3.10 Ethical Considerations

Ethics is concerned with the appropriate and proper conduct of research. Ethical considerations are addressed throughout the entire research process, including before the study, throughout the study, data collection, data analysis, and reporting (Gajjar, 2013). Because the integrity of the participants is a top priority in this dissertation, there will be no ethical concerns about confidentiality. The participants' approval will be obtained before they complete the questionnaire and analysis carried out on their responses. There will be no instances of scientific malpractice

Chapter Four: System Architecture and Design

4.1 Introduction

Based on the conceptual framework presented in Figure 2.2 and the data collected via the responses of the subject matter expert, this chapter will provide the findings based on the responses and following the literature review chapter. It further explains the design architecture of the data warehouse and business intelligence system for deposit-taking SACCOS in Kenya. Furthermore, the chapter will describe different system components, interactions between the elements, and the interaction between the developed system and its users. These interactions were modelled and illustrated using the use case diagram and system sequence diagram in the Unified Modeling Language (UML).

4.2 Empirical findings

In the first part, the current BI context will be presented based on the technological point of view. In the second part, the organizational aspect of BI will be evaluated, then in the third part the decision-making aspect will be presented. Lastly, how BI can be approached in companies that do not apply it, will be discussed based on the findings.

4.2.1 Current BI System Environment

The summary of the transcribed data for the DT-SACCO BI ecosystems can be seen as depicted in Table 4.1 below to summarize the empirical findings of the first category. The experts of BI had several years working in that environment. In order to better understand the BI environment, first there were some questions presented to them, with the aim to discover what was lacking within the current environment.

Table 4.1: Summary of transcribed data for BI Ecosystem (Organizational and Decision-making Context)

Question / **Position**	**Challenges in the current BI environment for DT-SACCO**
P1, P6, P11	The correctness of data, consistency and get all the people of different departments agree on one definition
P2, P7, P12	Query performance, administrative problems, poor data governance.
P3, P8, P13	Time taken to develop reports and dashboards and validating the data
P4, P9, P14	Poor data governance and company politics rank.
P5, P10, P15	Handling request and Data Quality

The group P1, P2, P3, P4, P6, P7, P8, P9, P11, P12, P13, P14 mentioned that in the BI environment where they had been working on for a long time now, see data as something important in business decision-making, marketing activities and giving customers a good offer or journey. It was also noted from the transcript that they have moved from using data from just reporting to giving value to company. In addition to this statement, P1, P6, P11 further explains that data consistency was an issue that many years ago they were not focused on. According to Caseiro and Coelho (2019) firms in order to stay competitive should gather the right information in order to improve their decisions, which is a hard task. This is directly related to data quality that P5, P10, P15 in their responses pointed out. Foster et.al (2015) discuss that one of the goals for companies is to have data quality processes proactive and reactive respectively meaning that the goal is helping in the improvement of the process for issues not to occur (proactive aspect) and getting feedback for future resolving of the issues (reactive aspect).

Based on the evaluation of the answers for the BI environment, it could be assessed that the usage of BI is generating the reports in order to gain insights from the data and use them in several main departments inside the organizations to reach the operations and serve the main management S.M.A.R.T (Specific, Measurable, Achievable, Relevant, Time bound) (Ogbeiwi, 2017, p. 326) objectives. In order to create better value, decisions and do them in a faster way, there is needed more analytics. As described in the second chapter in this paper, analytics is about getting value from the data, owing of the fact that factual decisions must be based and proven in real data, so they can be objective and more accurate. Eventually, the BI environment needs a more innovative solution to approach the needs for creating better value within the organization. Business intelligence comes as a crucial impacting factor in the BI setting. The need of shifting to SSBI is growing rapidly and it is becoming a real valuable necessity.

4.2.2 BI Technological Context

The table 4.2 below groups the tools that were mentioned by the participants.

Table 4.2 BI tools mentioned by responders.

BI Ecosystem Technological Context	
Question / **Position**	**Business Intelligence Tool Used or heard about**
P1, P3, P6, P14, P15	Microsoft Power BI, Tableau, SSRS
P4, P7, P8	Qlik Sense, Jaspersoft
P5, P10, P11, P13	OBIEE 12c for Business Agility

From careful analysis of the responses, the following was deduced; When choosing the appropriate Business Intelligence tool, training of the staff about it is a challenge that is commonly faced, but not too substantial. Generally, the software that will be implemented, contains introductory materials. It is very crucial to convey some sort of special training to solidify understanding of the tools. The manual work is one of the most problematic aspects that has made organizations shift to BI together with the independence of the users. The tools mentioned above, each one has unique features and there are some other tools for BI such as: Sisense, Google Analytics etc., but the reasons for choosing a specific tool according to the experts is previous knowledge about that tool, specific business needs, money invested on that tool together with time and effort for implementing it.

P2 argues that it is difficult to bring all the data for analysis into the data warehouse (DW) and that is considered as a challenge in the implementation of a business intelligence system. The extract transforms and load (ETL) process, which serve as a conveyor of all the data, perform cleaning and reorganization of the data and eventually storing the data to the data warehouse. Related to this issue, P3 would claim that they built new data warehouses for business intelligence purposes. New data warehouses eventually mean new architecture or modification of it. P4 and P5 mention that it is not necessary to create new data warehouses from the beginning, instead it depends on the existing DW and how well established the existing environment is. They also make a distinction regarding the internal and external data, which in this case the second one does not necessarily have to be stored in DW. It is dependent on the BI technology that is used. The traditional process of BI uses one DW as its central infrastructure, but a more modern BI environment should adopt better infrastructures that offer better real-time DW. It is not appropriate to say that DW are obsolete, because they are essential in data management in the BI environment. Despite the decision whether to keep the same data warehouses or modify them based on the needs and the BI tools used, what can be implied by the answers of the responders, is that there exists the same definition for the same thing, and this shows that technology plays an important role for data to be more valuable for decision-making.

4.3 System Requirements

The system requirements are described in this section based on the research objectives. As one of the objectives of this research, the requirements collected were categorized based on the content analysis practices employed and organized into functional and non-functional requirements.

4.3.1 Functional Requirement

These are the requirements that focus on essential functions to be performed by the system.

I. The system should have the ability to connect to several isolated databases within the ecosystem.
II. The system should have a decentralized data warehouse for analytical reporting.
III. The system should collaborate and share Information via its dashboarding and data visualization platform.

4.3.2 Non-functional Requirement

These requirements dictate the performance constraints of the data warehouse and business intelligence systems.

I. Availability: The system should be available for use at all time
II. Security: The role base security should be implemented in the system
III. Performance: The system should return the result set with minimal latency.
IV. The system should be web-based

4.4 System Architecture

The system architecture in figure 4.1 describes the different commonly used operational systems that the DT-SACCOs use for their daily operations. It also illustrates the tools, software, and applications employed to develop the data warehouse and the business intelligence system. The processes of the DT-SACCO were investigated, and three departments were chosen for this study. The study entailed a complete review of the current system, which led to the development of specifications for the new integrated system. Necessary data were collected to support the development of the data warehouse. The data collected from the interviews and questionnaires suggest that the following technologies/application were commonly used within the DT-SACCO ecosystem.

i. Navision ERP system
ii. Microsoft Dynamic CRM
iii. Microsoft Excel Spreadsheet (Flat file)
iv. Credit Reference Bureau (CRB) System

Within this project's scope, data from three departments were received to develop the data warehouse and business intelligence system. They are BOSA, FOSA, and customer service departments. Since the data warehouse relies mainly on the data collected by the DT-SACCO via their daily transactions and operations, a request for an anonymized database copy was placed to the IT department to support the business intelligence system.

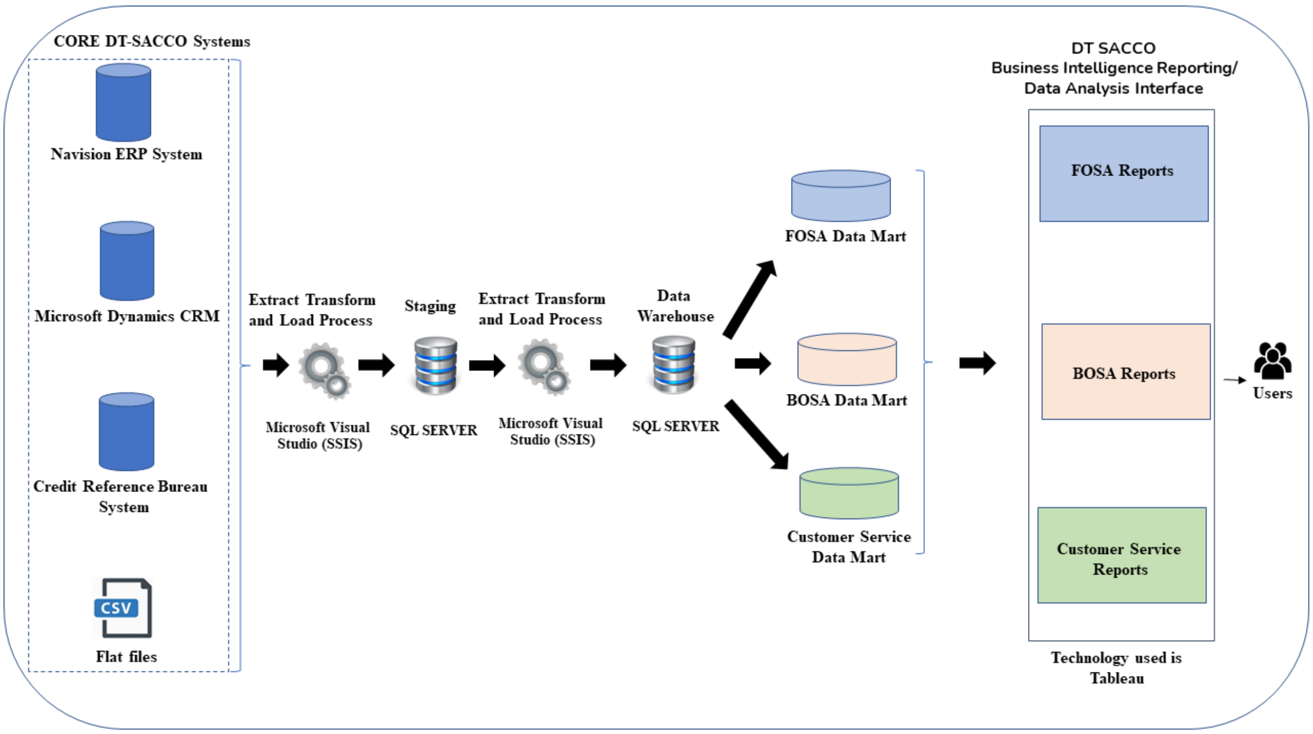

Figure 4.1: System Architecture

4.4.1 Navision ERP System

The Navision enterprise resource planning (ERP) application assists with the day-to-day core banking operations and transactions carried out by the members of a DT-SACCO. The ERP is mainly used for banking activities like Front Office Service Activities (FOSA) and Back Office Service Activities (BOSA).

4.4.2 Microsoft Dynamics CRM

The Microsoft Dynamic Customer Relationship Management (CRM) System is used to manage help SACCOs to manage customer accounts, keep contact details up to date, and track every interaction with customers. The system also helps to improve on increasing Customer Lifetime Value (CLV).

4.4.3 Credit Reference Bureau System

This is an external system that the that credit/loan officers in the DT-SACCO uses to track the credit status of members.

4.4.4 Flat Files

The flat files consist of other files that are both structured and unstructured such as spreadsheets, PDF files, CSV files, Word processing, JSON, XML… etc. These files are used during budgeting and planning.

4.4.5 Extract Transform Load Process

The process of extracting transforming, and loading data requires data integration tools that will use different connectors to access data in core systems. The tool will extract data from the transaction systems transform/clean data according to business logic where necessary and load the data into a staging area or the data warehouse the case may be. The system will be making use of Microsoft visual studio as the extract transform and load tool

4.4.6 Staging Area

The staging area serves as the location to hold data flowing from different source systems. It serves as the first layer of integration and no heavy business rule occurs at this stage. The mapping technique used to migrate data from source systems to the staging database is discussed in the next chapter.

4.4.7 Data Warehouse

The data warehouse is the central data silo that the system will use to support the analytical capabilities of the business intelligence system. The data warehouse was developed using the SQL SERVER storage to implement the data warehouse.

4.4.8 Business Intelligence Reporting Interface

The DT- SACCO business intelligence interface is the reporting end of the system which serves as the user interaction platform. The tool used here is Microsoft Power BI. Microsoft Power BI.

4.4.9 Users

The users are different department heads, managers and various department staff responsible for reporting that will use the developed system.

4.5 System Design

The design modeling of the data warehouse and business intelligence system was done using unified Modelling Language (UML). The tools used for modelling are entity relationship diagram, use case diagram, sequence diagram.

4.6 Data Warehouse Entity Relationship (ER) Diagram

The ER diagram shows the relationship between the dimension table and the corresponding Fact table from the staging database of the Navision system.

4.6.1 Fact_NavLoan Entity and Related Dimension Entities ER Model

Primary Key: Fact_NavLoanID

Table 4.1: Fact NavLoan Entity Description

Fact Table	**Related Dimension Table**	**Relationship**
Fact_NavLoan	Dim_NavGlobalDimension	Dim_NavGlobalDimensionValue_SK
	Dim_NavMemberLedgerEntry	Dim_NavMemberLedgerEntry_SK
	Dim_NavMember	Dim_NavMember
	Dim_NavLoans	Dim_NavLoans_SK
	Dim_NavGuarantor	DimNavGuarantors_SK
	Dim_NavLoanSecurity	Dim_NavLoanSecurity_SK
	Dim_NavLoanPaymentSchedule	Dim_NavLoanPaymentSchedule_SK
	Dim_NavMemberApplication	Dim_NavLoanMemberApplication_SK
	Dim_NavVendor	DimNavVendor_SK

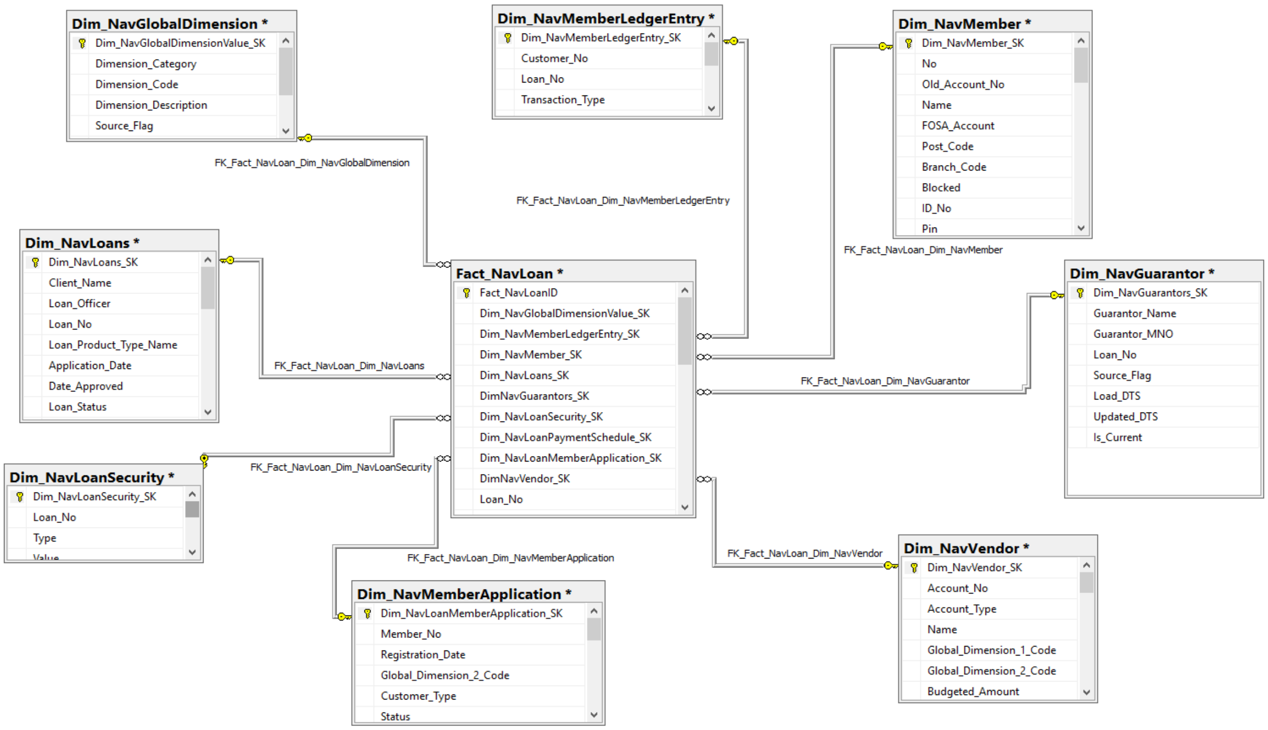

Figure 4.2: Fact_NavLoan ER Model

4.6.2 Fact_NavLoanTopUp Entity and Related Dimension Entity ER Model

Primary Key: Fact_ NavLoanTopUp

Table 4.2: Fact NavLoanTopUp Entity Description

Fact Table	**Related Dimension Table**	**Relationship**
Fact_NavLoanTopUp	Dim_NavLoans	Dim_NavLoans_SK_SK

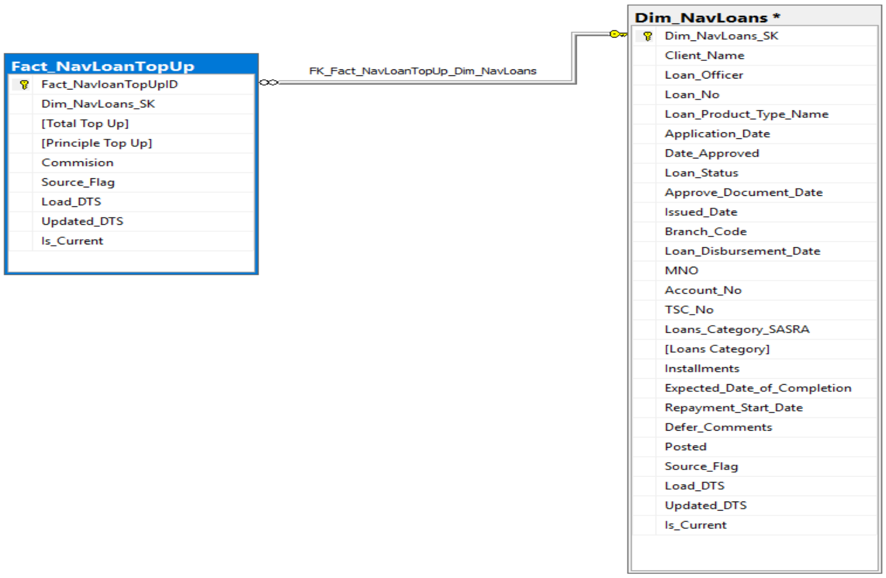

Figure 4.3: Fact_NavLoanTopUP ER Model

4.6.3 Fact_BankAccountLedgerEntry Entity and Related Dimension Entity ER Model

Primary Key: Fact_NavBankLedgerEntityID

Table 4.3: Fact NavBankLedgerEntry Entity Description

Fact Table	Related Dimension Table	Relationship
Fact_BankAccountLedger Entry	Dim_NavBankAccountLedger	Dim_NavBankAccountLedgerEntry_SK
	Dim_Date	Dim_Date_SK
	Dim_NavGlobalDimension	Dim_NavGlobalDimensionValue_SK

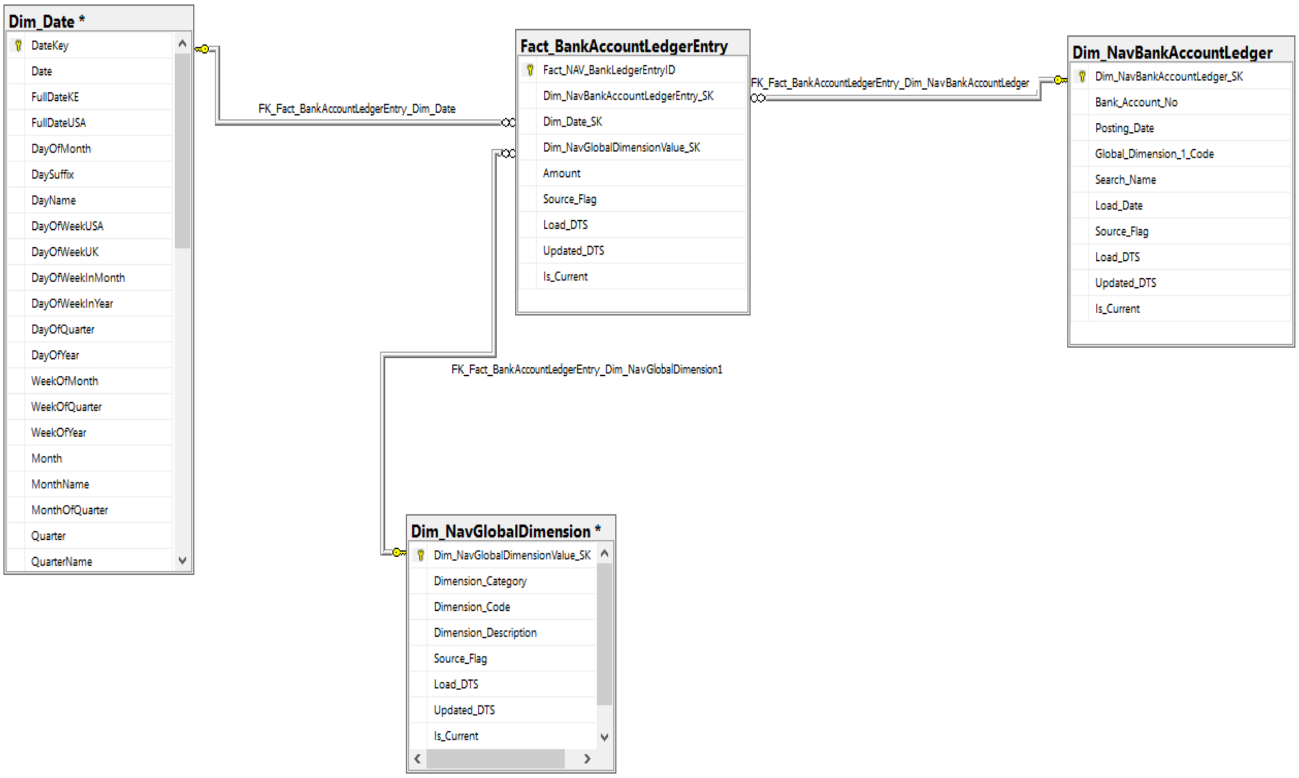

Figure 4.4: Fact_Nav Bank Ledger Entry ER Model

4.6.4 Fact_Nav Member Ledger Entry Entity and Related Dimension Entity ER Model

Primary Key: Fact_NavMemberLedger Entity ID

Table 4.4: Fact Nav Member Ledger Entry Entity Description

Fact Table	Related Dimension Table	Relationship
Fact_NavMemberLedgerEntry	Dim_Nav Member Ledger Entry	Dim_NavMemberLedgerEntry_SK
	Dim_Date	Dim_Date_SK
	Dim_Nav Account Closure	Dim_Nav AccountClosure_SK
	Dim_Nav Member	Dim_NavMember_SK
	Dim_NavGlobalDimension	Dim_NavGlobalDimensionValue_SK

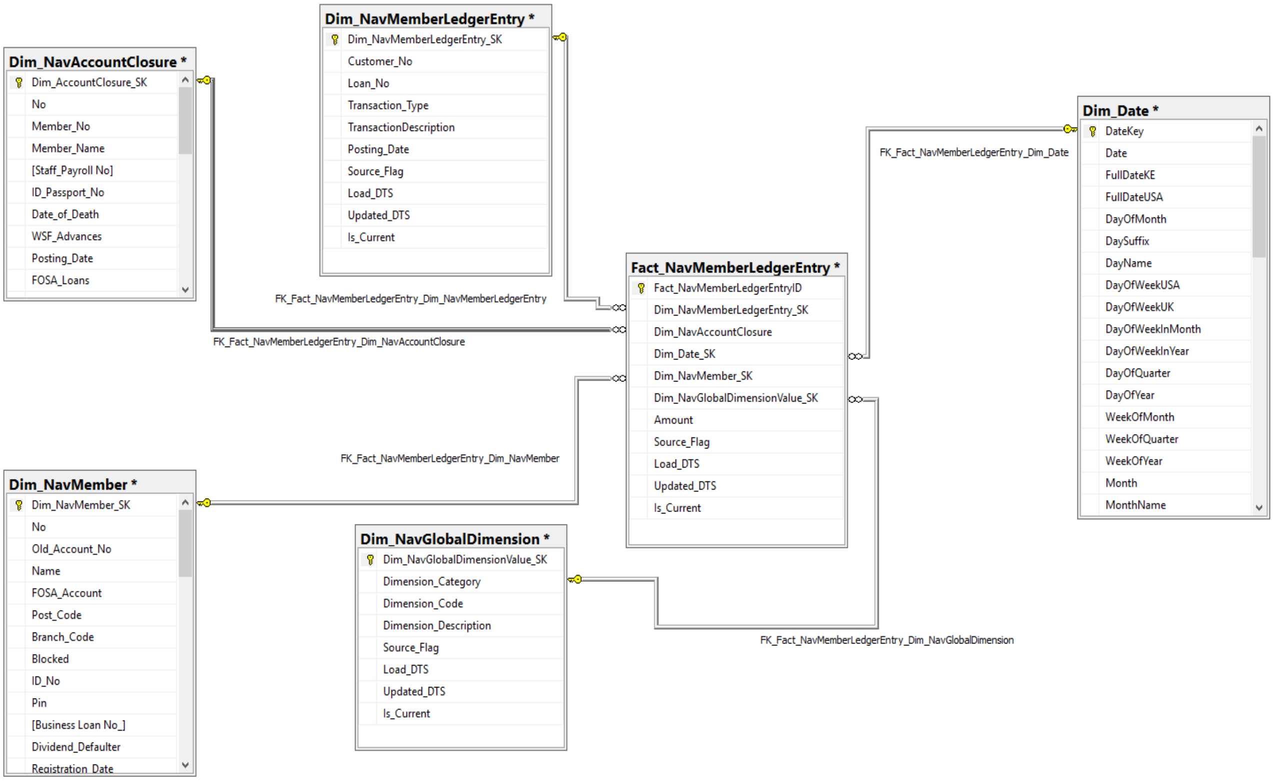

Figure 4.5: Fact_NavMemberLedgerEntry ER Model

4.6.5 Fact_NavSalaryBuffer Entity and Related Dimensions Entity ER Model

Primary Key: Fact_NavSalaryBufferID

Table 4.5: Fact NavSalaryBuffer Entity Description

Fact Table	Dimension Table	Relationship
	Dim_NavSalaryBuffer	Dim_NavSalaryBuffer_SK
Fact_NavMemberLedgerEntry	Dim_Date	Dim_Date_SK
	Dim_NavVendor	Dim_NavVendor_SK

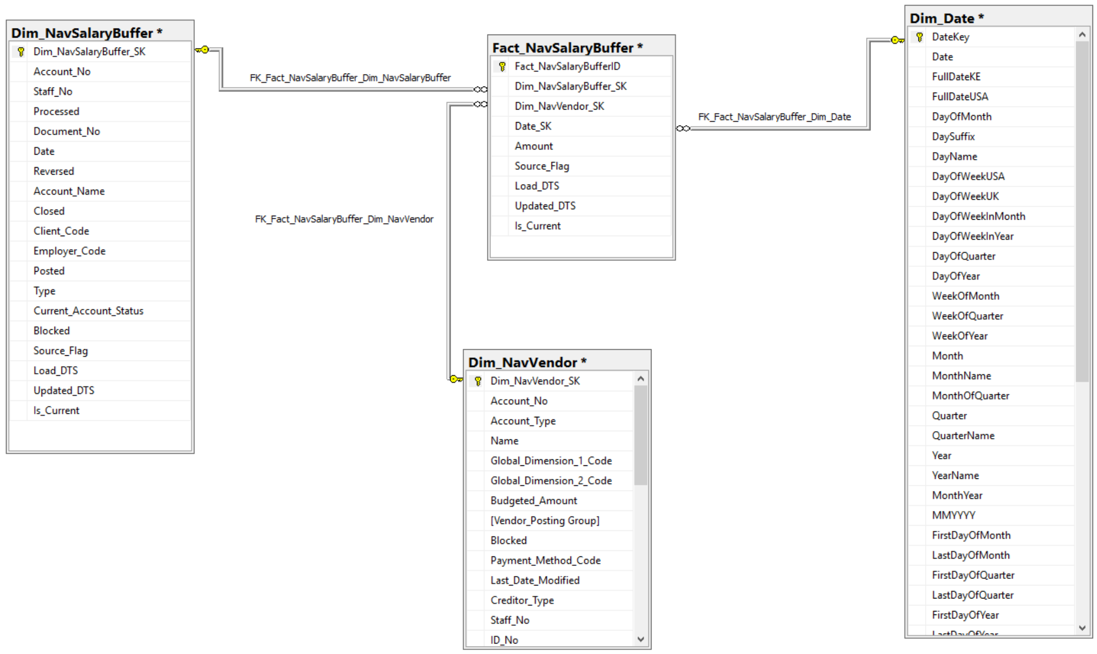

Figure 4.6: Fact_NavSalaryBuffer ER Model

4.6.6 Fact_NavStoreUsage Entity and Related Dimensions Entity ER Model

Primary Key: Fact_NavStoreusageID

Table 4.6: Fact NavStoreUsage Entity Description

Fact Table	Dimension Table	Relationship
Fact_NavStoreUsage	Dim_NavStoreUsage	Dim_NavStoreUsage_SK
	Dim_Date	Dim_Date_SK

Figure 4.7: Fact_NavStorageUsage ER Model

4.6.7 Fact_NavTransaction Entity and Related Dimensions Entity ER Model

Primary Key: Fact_TransactionID

Table 4.7: Fact NavTransaction Entity Description

Fact Table	**Dimension Table**	**Relationship**
Fact_NavTransaction	Dim_NavTransaction	DimNavTransactions_SK
	Dim_Date	Dim_Date_SK
	Dim_NavGlobalDimension	Dim_NavGlobalDimensionValue_SK
	Dim_NavLoans	Dim_NavLoans_SK

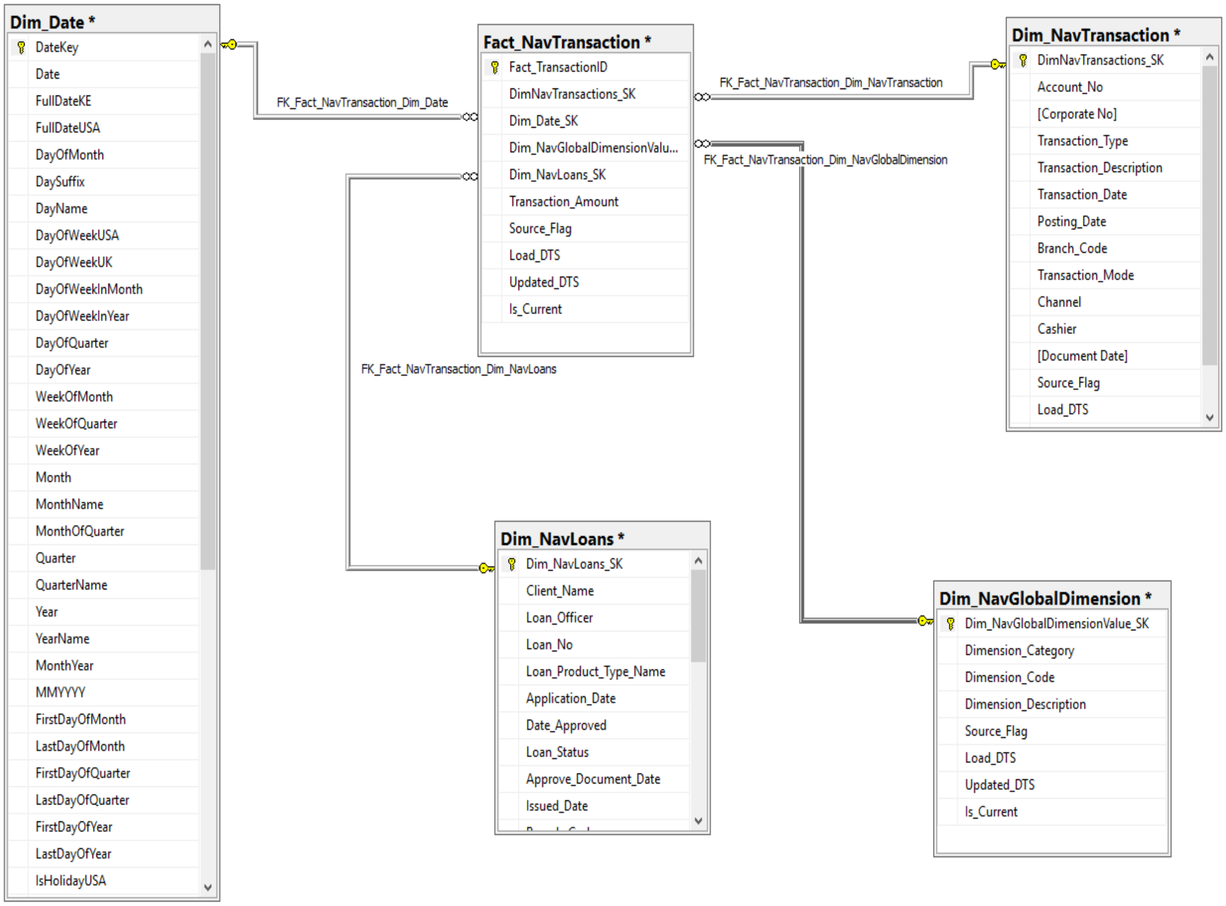

Figure 4.8: Fact_NavTransaction ER Model

4.6.8 Fact_Flat_FOSABudget Entity and Related Dimensions Entity ER Model

Primary Key: FosaBudgetID

Table 4.8: Fact FOSABudget Entity Description

Fact Table	Dimension Table	Relationship
Fact_Flat_FosaBudget	Dim_Flat_FosaBudget	DimFlatBudget_SK

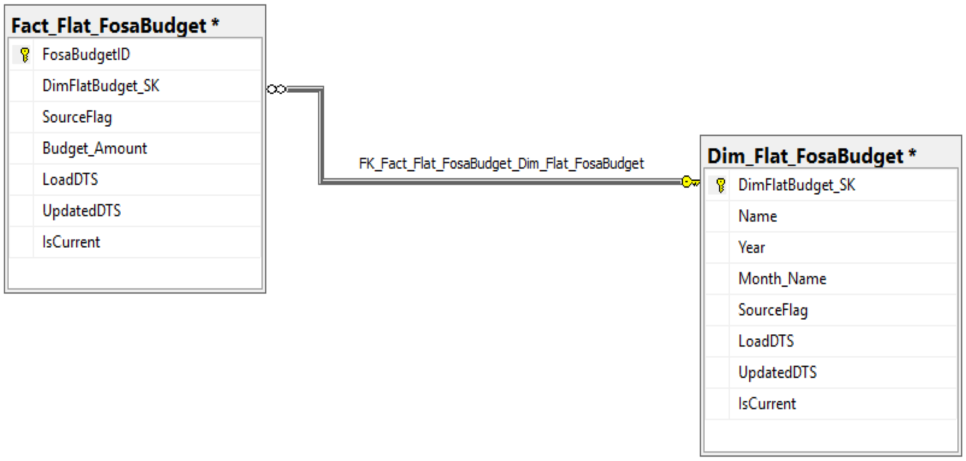

Figure 4.9: Fact_Flat_FosaBudget ER Model

4.6.9 Fact_Flat_ConferenceBookingSchedule Entity and Related Dimensions Entity ER Model

Primary Key: Fact_FLAT_ConferenceBookingScheduleID

Table 4.9: Fact ConferenceBookingSchedule Entity Description

Fact Table	Dimension Table	Relationship
Fact_Flat_ConferenceBookingSchedule	Dim_Flat_ConferenceBookingSchedule	Dim_FlatConferenceBookingSchedule_SK

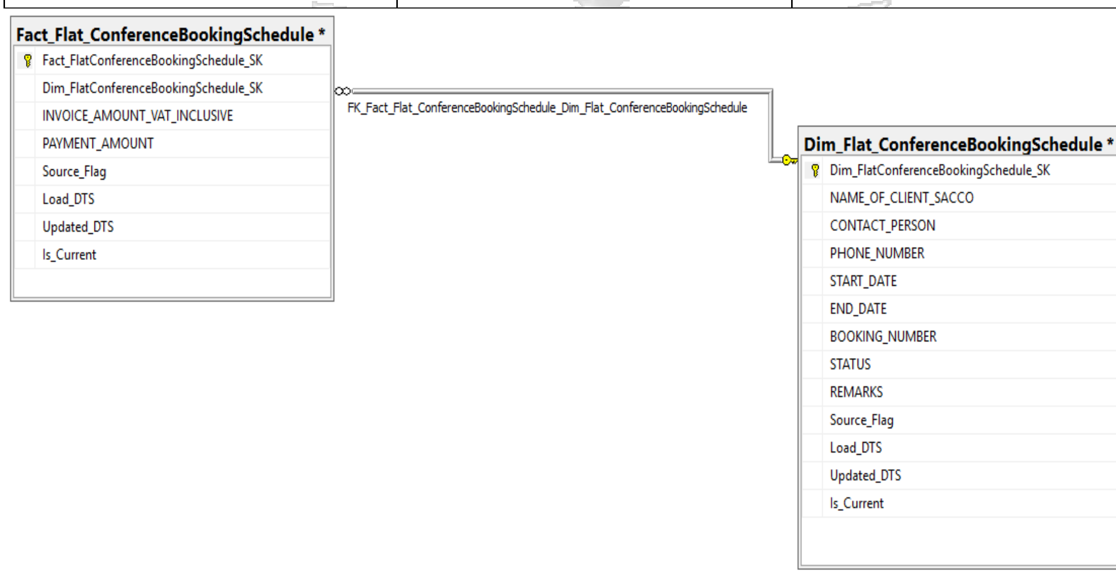

Figure 4.10: Fact_Conference BookingSchedule ER Model

4.6.10 Fact_Flat_HRStaffPerformance Entity and Related Dimensions Entity ER Model

Primary Key: Fact_FLAT_HRStaffPerformanceID

Table 4.10: Fact HRStaffPerformance Entity Description

Fact Table	Dimension Table	Relationship
Fact_Flat_HRStaffPerformance	Dim_Flat_HRStaffPerformance	Dim_Flat_HRStaffPerformance_SK

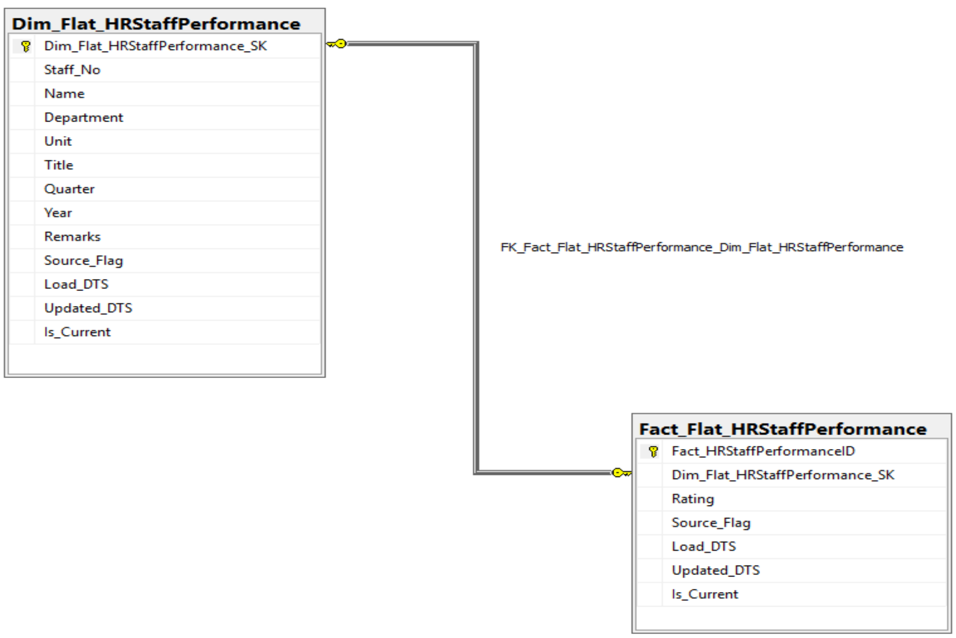

Figure 4.11: Fact_HR Staff Performance ER Model

4.6.11 Fact_Flat_Records Deductions Entity and Related Dimensions Entity ER Model

Primary Key: ID

Table 4.11: Fact Records Deductions Entity Description

Fact Table	**Dimension Table**	**Relationship**
Fact_Flat_Records Deductions	Dim_Flat_Records_Deductions	Dim Flat Records Deductions_SK

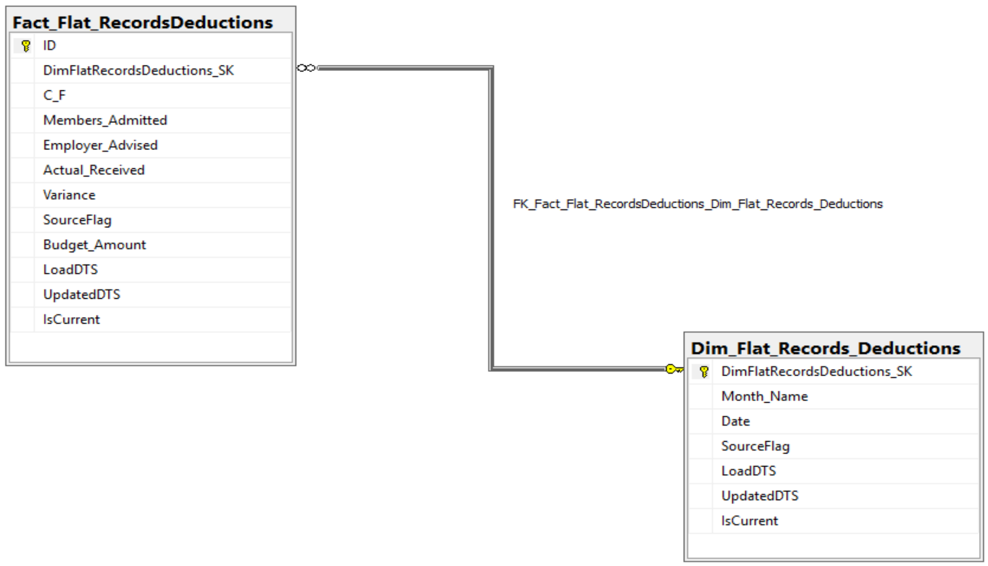

Figure 4.12: Fact_Records Deductions ER Model

4.6.12 Fact_Flat_Vehicle Running Costs Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Flat_Vehicle Running Costs ID

Table 4.12: Fact Vehicle Running Costs Entity Description

Fact Table	**Dimension Table**	**Relationship**
Fact_Flat_Vehicle Running Costs	Dim_Flat_Vehicle Running Costs	Dim Flat Vehicle Running Costs SK
	Dim_Date	Date_SK

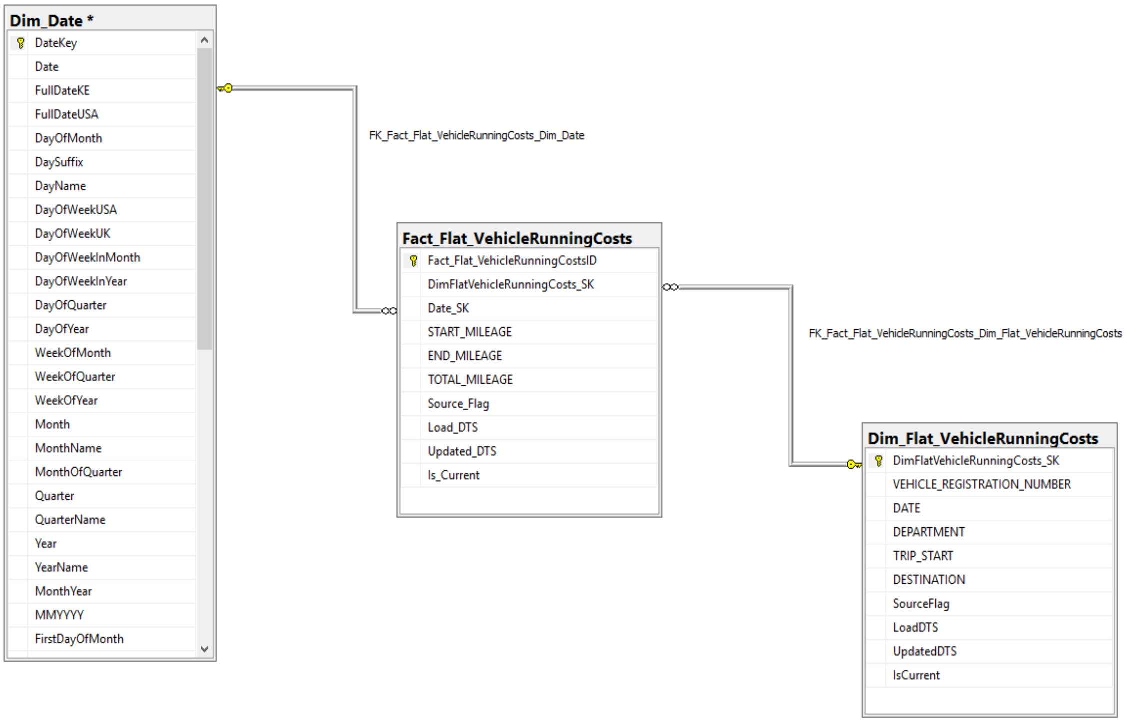

Figure 4.13: Fact_Vehicle Running Costs ER Model

4.6.13 Fact_Nav Benevolent Claim Entity and Related Dimensions Entity ER Model

Primary Key: Fact_NavBenevolentClaimID

Table 4.13: Fact NavBenevolentClaim Entity Description

Fact Table	**Dim Table**	**Mapping**
Fact_Nav Benevolent Claim	Dim_Nav Benevolent Claim	Dim_Nav Detailed Vendor Ledger Entry_SK
	Dim_Date	Date_SK
	Dim_Nav Member	Dim_Nav Member_SK

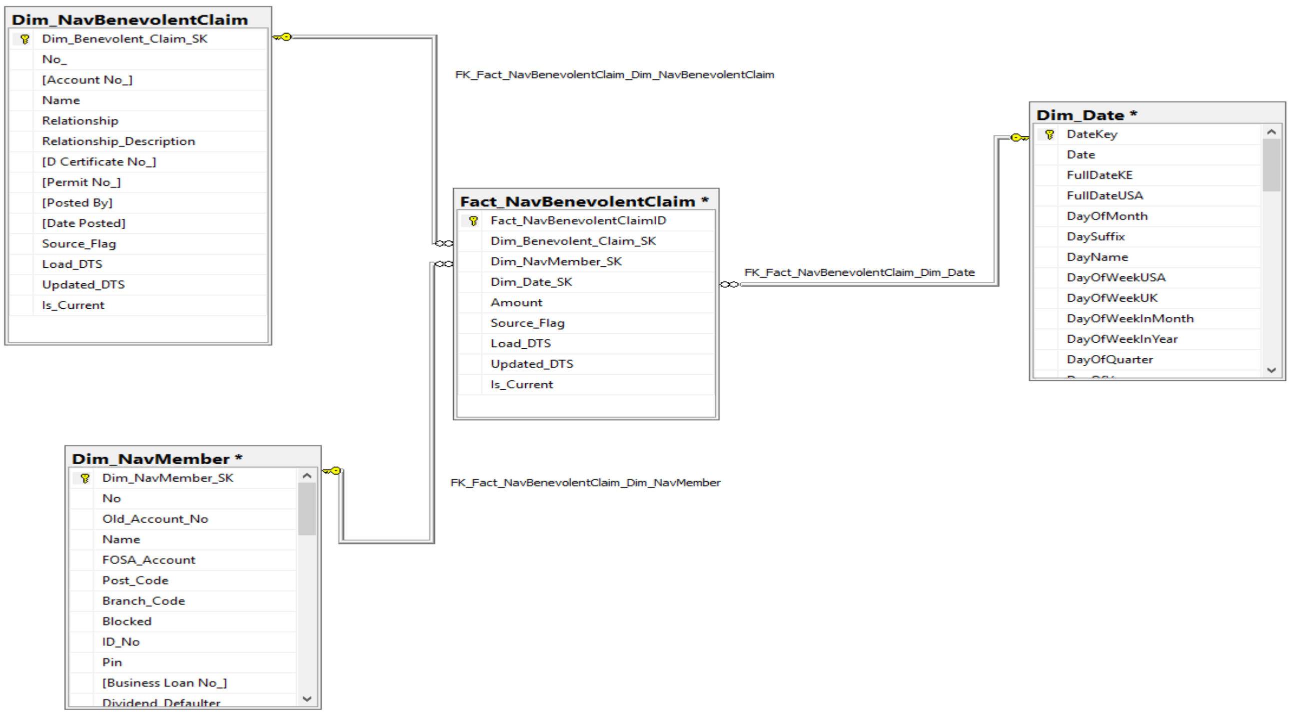

Figure 4.14: Fact_Nav Benevolent Claim ER Model

4.6.14 Fact_Nav Guarantor Entity and Related Dimensions Entity ER Model

Primary Key: Fact_ Nav Guarantor ID

Table 4.14: Fact Nav Guarantor Entity Description

Fact Table	Dimension Table	Relationship
Fact_Nav Benevolent Claim	Dim_Nav Benevolent Claim	Dim_Nav Detailed Vendor Ledger Entry_SK
	Dim_Date	Date_SK
	Dim_Nav Member	Dim_Nav Member_SK

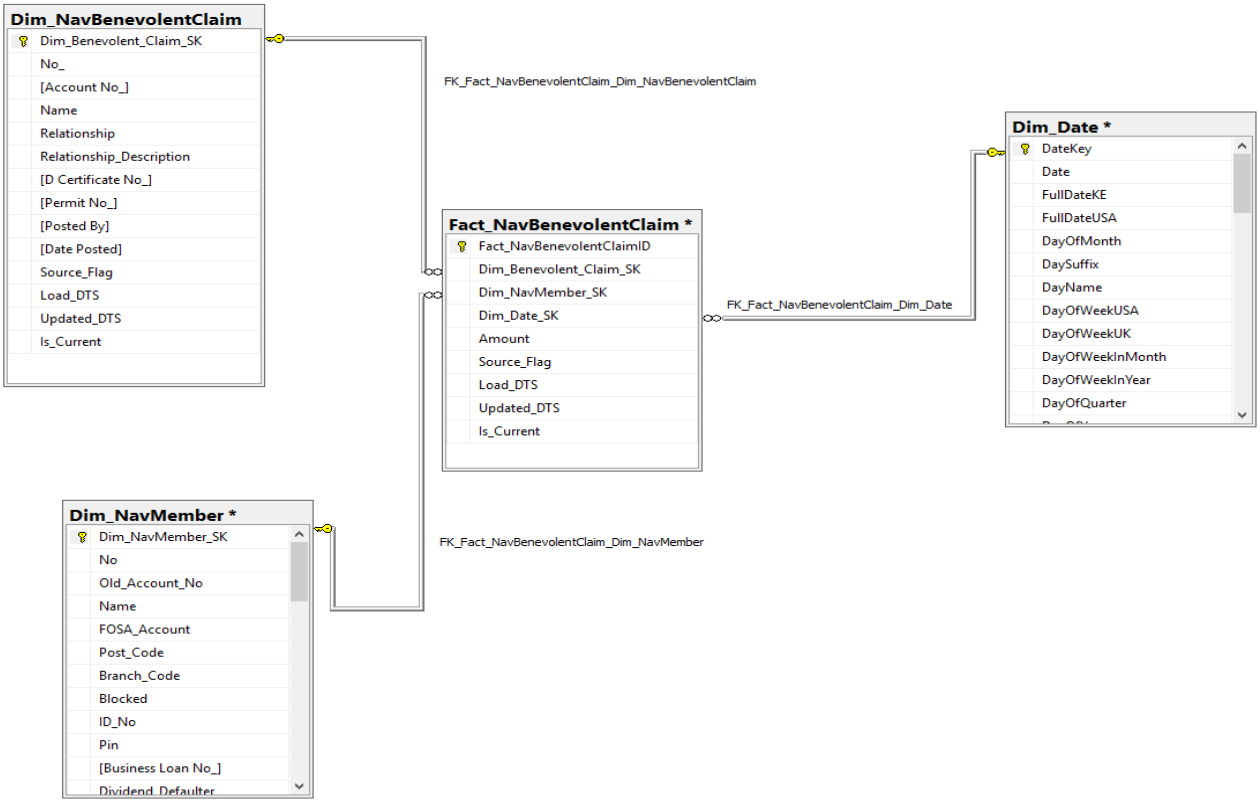

Figure 4.15: Fact_Nav Guarantor ER Model

4.6.15 Fact_Nav HR Leave Application Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Nav HR Leave Application ID

Table 4.15: Fact Nav HR Leave Application Entity Description

Fact Table	Dimension Table	Relationship
Fact_Nav Guarantor	Dim_Nav HR Leave Application	Dim_NavHR Leave Application_SK
Fact_Nav Guarantor	Dim_Nav Bio Data	Dim Nav Bio Data_SK

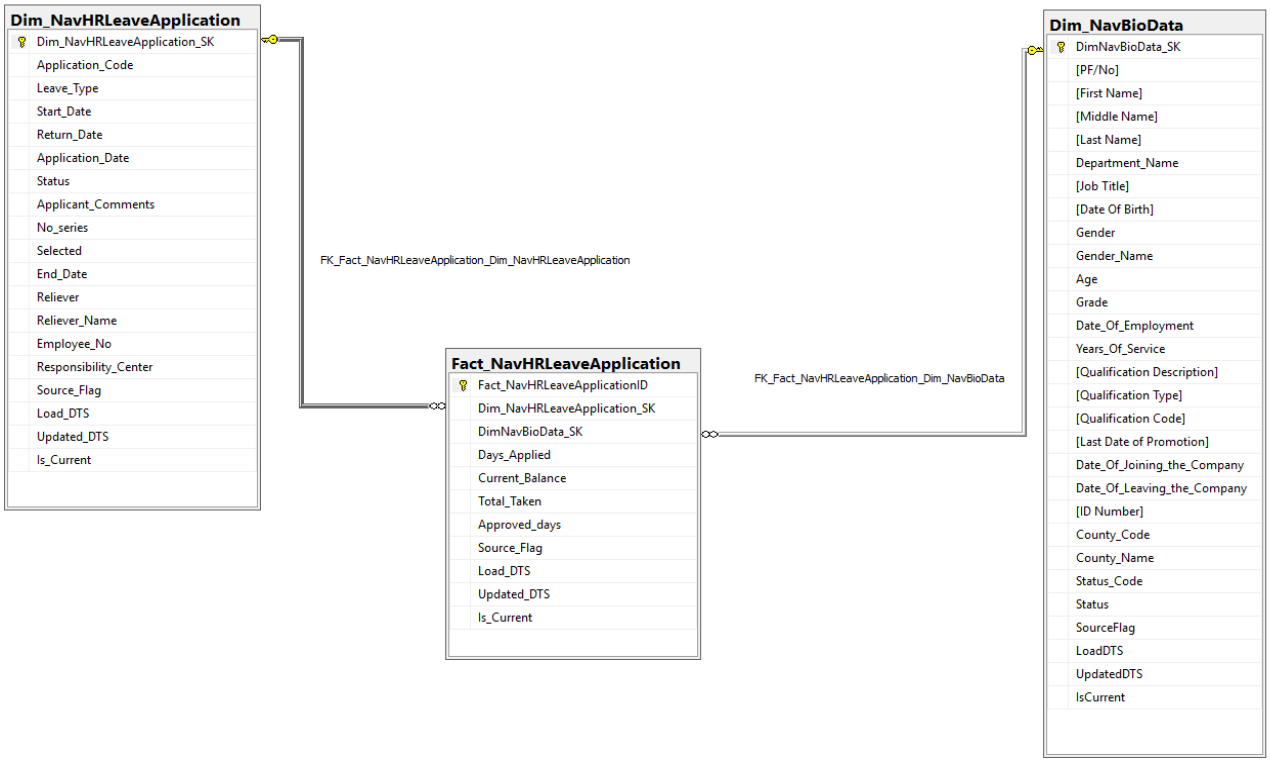

Figure 4.16: Fact_Nav HR Leave Application ER Model

4.6.16 Fact_Nav HR Leave Ledger Entry Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Nav HR Leave Ledger Entry ID

Table 4.16: Fact Nav HR Leave Ledger Entry Entity Description

Fact Table	Dimension Table	Relationship
Fact_Nav HR Leave Ledger Entry	Dim_Nav HR Leave Ledger Entry	Dim_Nav HR Leave Ledger Entry_SK
	Dim Nav Bio Data	Dim Nav Bio Data_SK
	Dim_Nav HR Leave Application	Dim_Nav HR Leave Application_SK

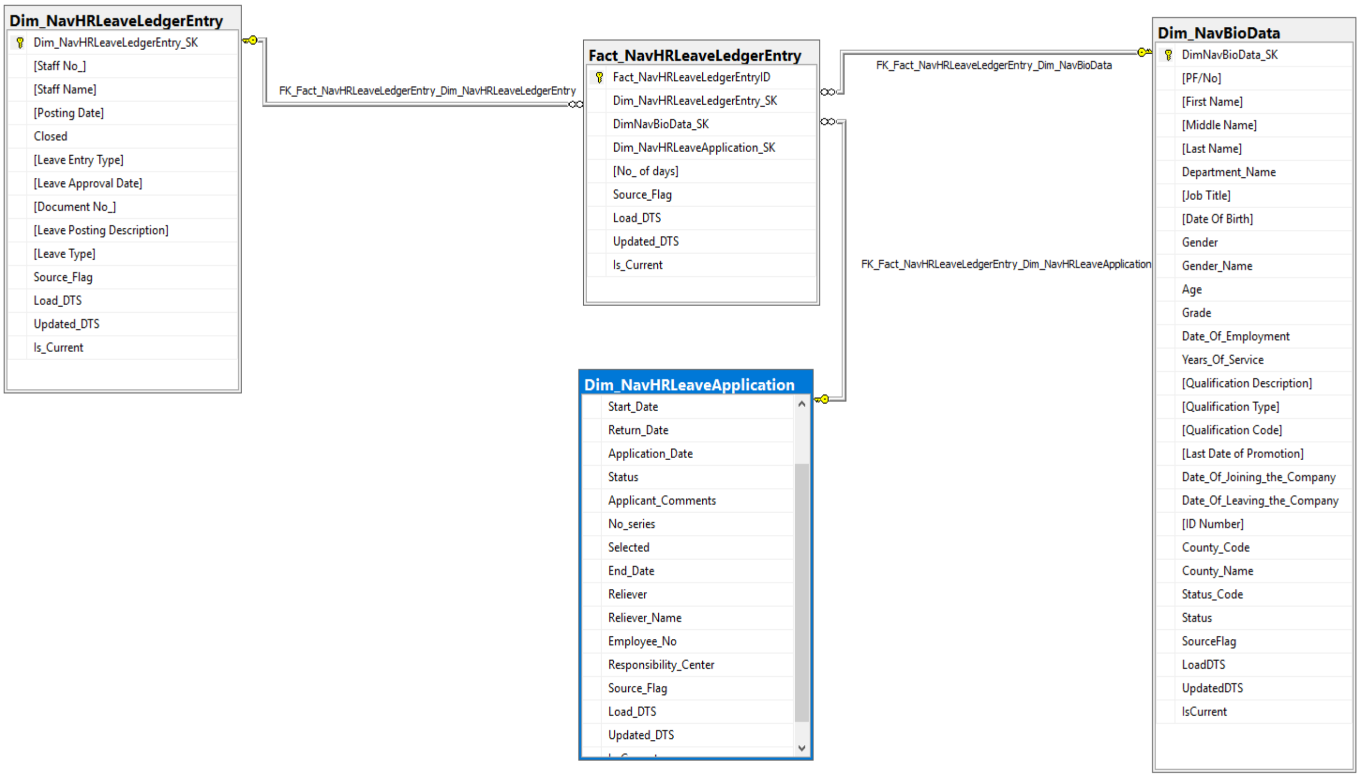

Figure 4.17: Fact_Nav HR Leave Ledger Entry ER Model

4.6.17 Fact_Nav Item Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Nav Item ID

Table 4.17: Fact Nav Item Entity Description

Fact Table	Dimension Table	Relationship
Fact_Nav Item	Dim_Nav Item	Dim_Nav Item_SK
	Dim Nav Bio Data	Dim Nav Bio Data_SK

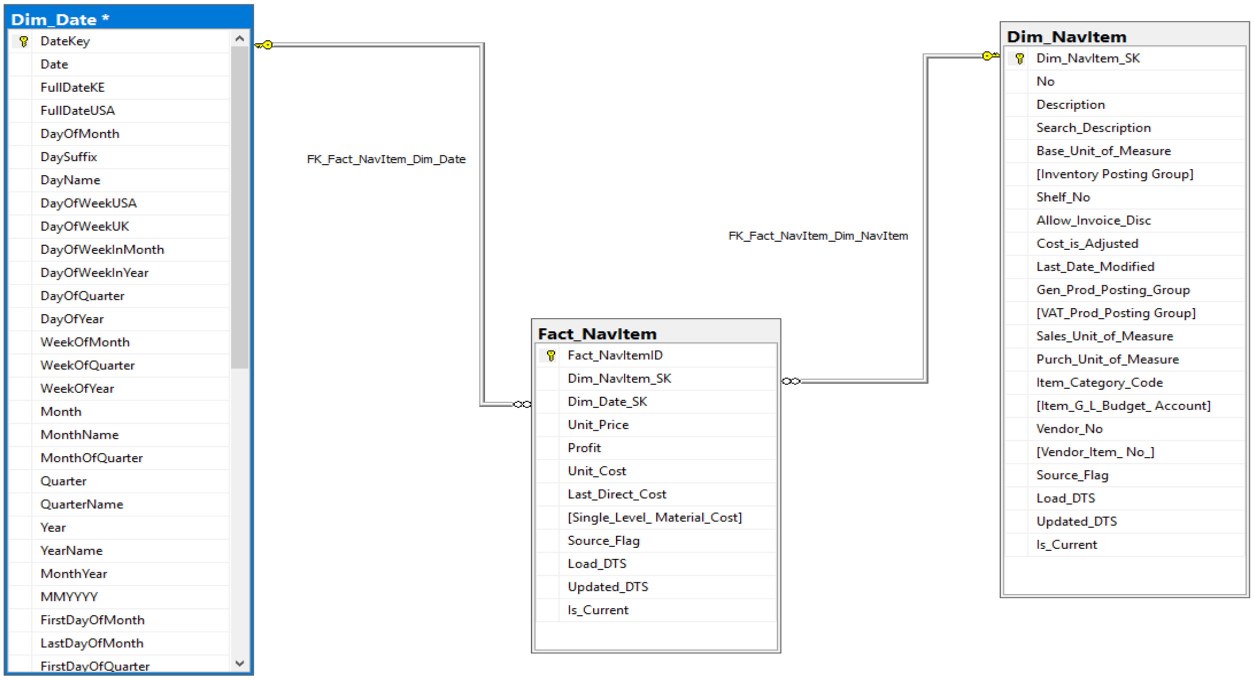

Figure 4.18: Fact_NavItem ER Model

4.6.18 Fact_Nav Item ledger Entry Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Nav Item Ledger Entry ID

Table 4.18: Fact Nav Item Ledger Entry Entity Description

Fact Table	**Dimension Table**	**Relationship**
Fact_Nav Item Ledger Entry	Dim_NavI tem Ledger Entry	Dim_Nav Item Ledger Entry_SK
	Dim_Date	Date_SK

Figure 4.19: Fact_Nav Itemledger Entry ER Model

4.6.19 Fact_Flat_Finance Budget Entity and Related Dimensions Entity ER Model

Primary Key: ID

Table 4.19: Fact_Flat_Finance Budget Entity Description

Fact Table	**Dimension Table**	**Relationship**
Fact_Flat_Finance Budget	Dim_Flat_Finance Budget	Dim Flat Budget Finance_SK

Figure 4.20: Fact_Flat_Finance Budget ER Model

4.6.20 Fact_Flat_Projected Disbursment Entity and Related Dimensions Entity ER Model

Primary Key: ID

Table 4.20: Fact_Flat_Projected Disbursment Entity Description

Fact Table	Dim Table	Mapping
Fact_FLAT_Projected Disbursment	Dim_Flat_ProjectedDisbursment	Dim_FLAT_ProjectedDisbursment_SK

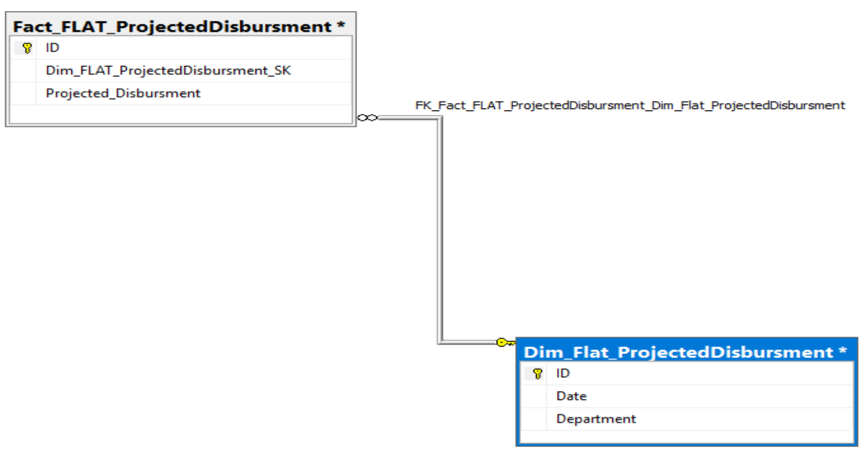

Figure 4.21: Fact_Flat_FinanceBudget ER Model

4.6.21 Fact_NavDetailedVendorLedgerEntry Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Nav Detailed Vendor Ledger Entry ID

Table 4.21: Fact_Nav Detailed Vendor Ledger Entry Entity Description

Fact Table	Dimension Table	Relationship
Fact_Nav Detailed Vendor Ledger Entry	Dim_Nav Detailed Vendor Ledger Entry	Dim_Nav Detailed Vendor Ledger Entry_SK
Fact_Nav Detailed Vendor LedgerEntry	Dim_Date	Dim_Date_SK

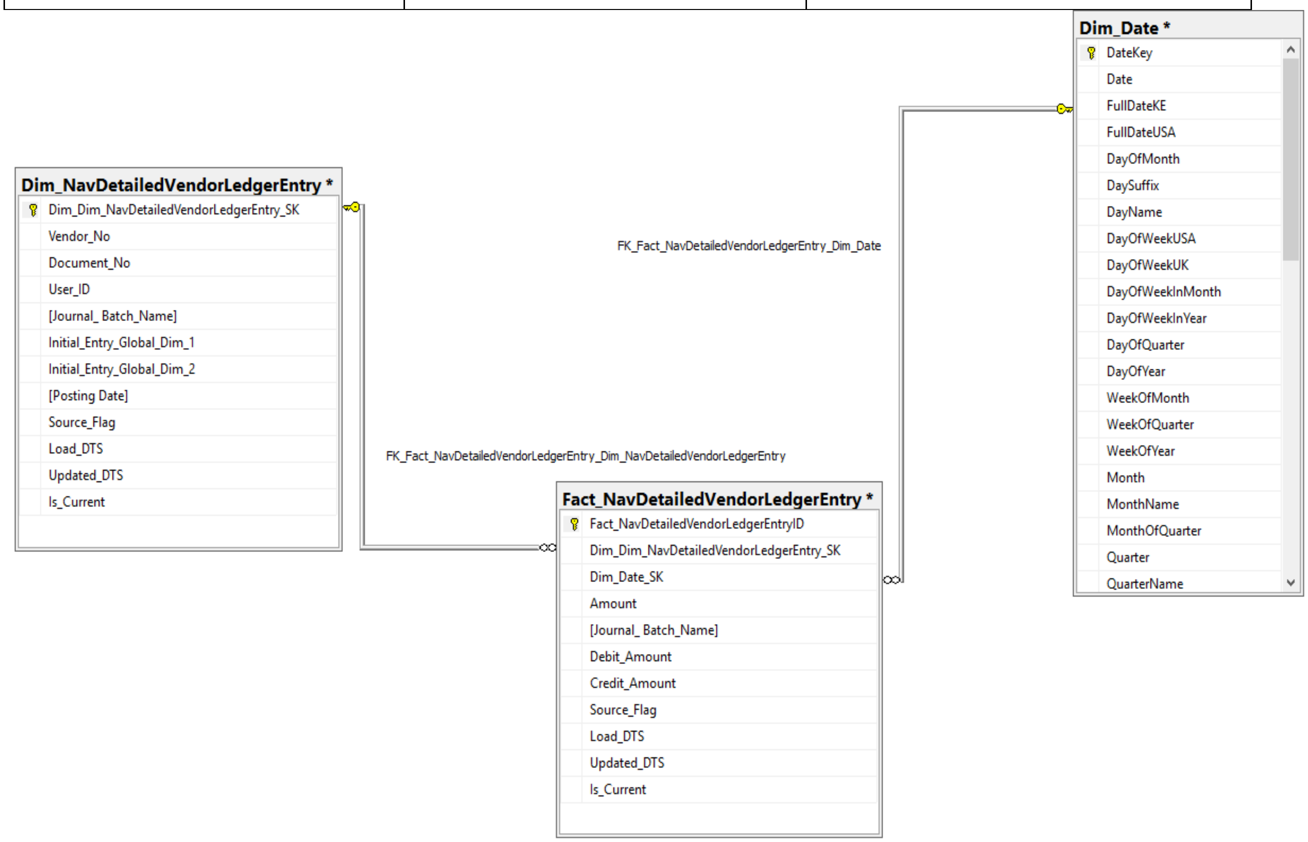

Figure 4.22: Fact_NavDetailed Vendor Ledger Entry ER Model

4.6.22 Fact_Flat_Finace Bank Overdraft Entity and Related Dimensions Entity ER Model

Primary Key: Fact_Finace Bank Overdraft ID

Table 4.22: Fact_Flat_Finace Bank Overdraft Entity Description

Fact Table	**Dim Table**	**Mapping**
Fact_Flat_Finace Bank Overdraft	Dim_Flat_Finace Bank Overdraft	Dim_Flat_Finance Bank Overdraft _SK

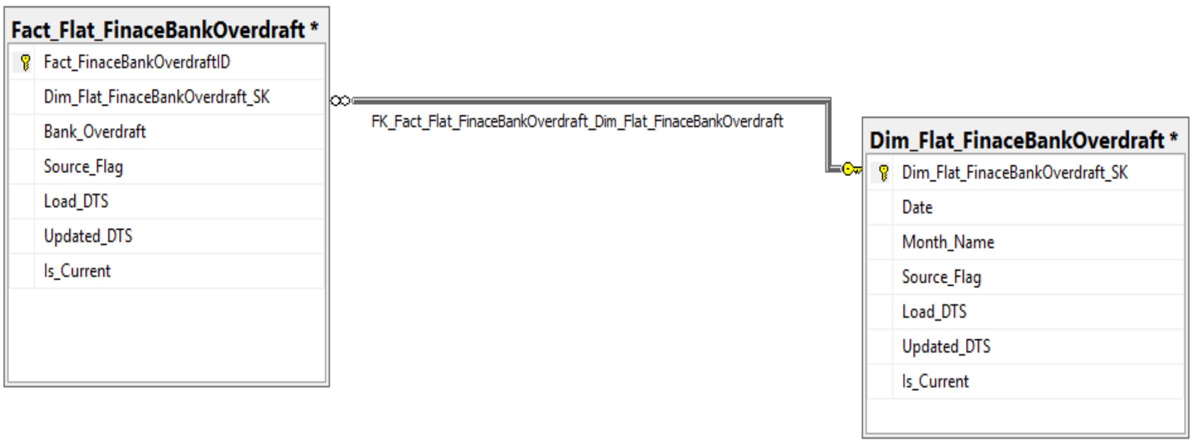

Figure 4.23: Fact_Flat_Finace Bank Overdraft ER Model

4.7 Use Case Diagram

A use case diagram illustrates how the system interacts with its external actors. Generally, use case diagrams are made up of use cases, actors, associations, and a system boundary. Each use case describes a requirement in the system, such as connecting to the core systems data source, creating a data warehouse, and performing data analysis. These requirements are shown to relate to other requirements or actors via associations. An association describes a relationship between two diagram elements that represent communication or interaction between them. The interaction between Actors and the proposed prototype has been illustrated in Figure 4.3

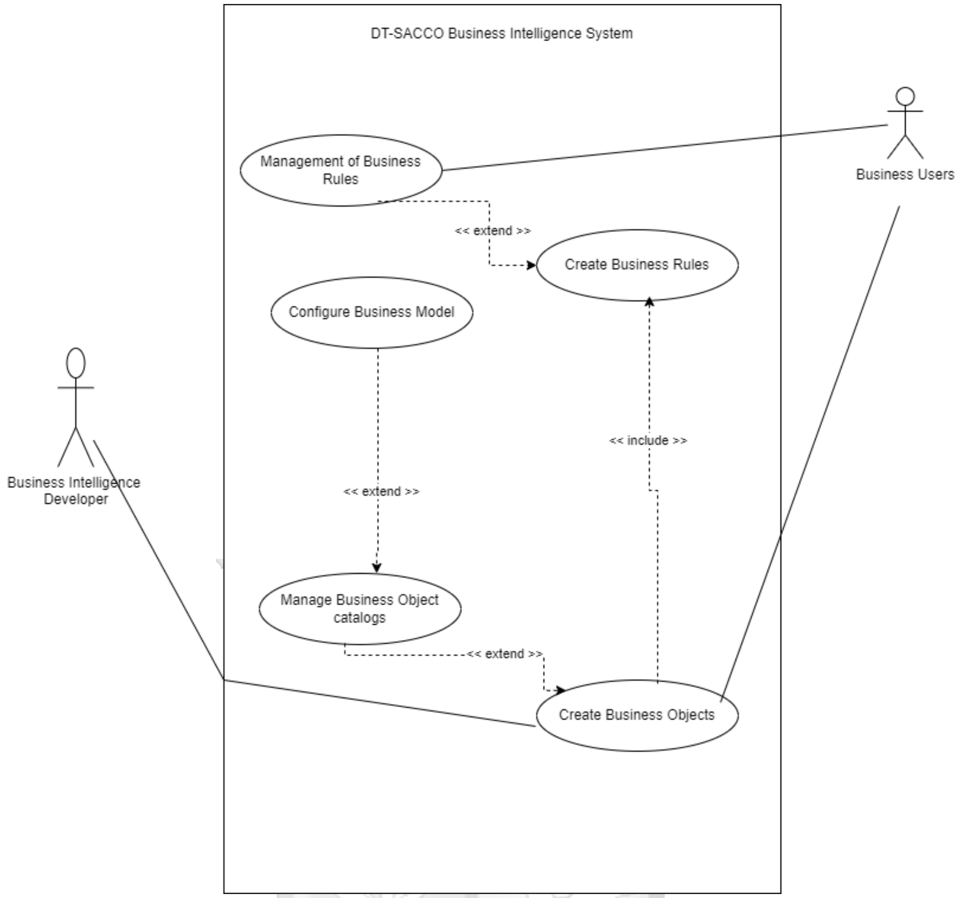

Figure 4.24: Use Case Diagram of DT-SACCO Business Intelligence System

4.7.1 Sequence Diagram

The business intelligence sequence diagram shows the interactions between the main entities in the system. Figure 4.4 below illustrates the flow of activities in sequence. The BI developer connects the ETL tool to the required core systems by creating SSIS packages to run the required records from the source system to the staging area database. Another ETL packages are then ran to apply the business rules already incorporated in the transformation step, extracts data from the staging database to into the data warehouse. The business intelligence user interface tool is then connected to the data warehouse to generate reports that business users can use for analytics and decision making.

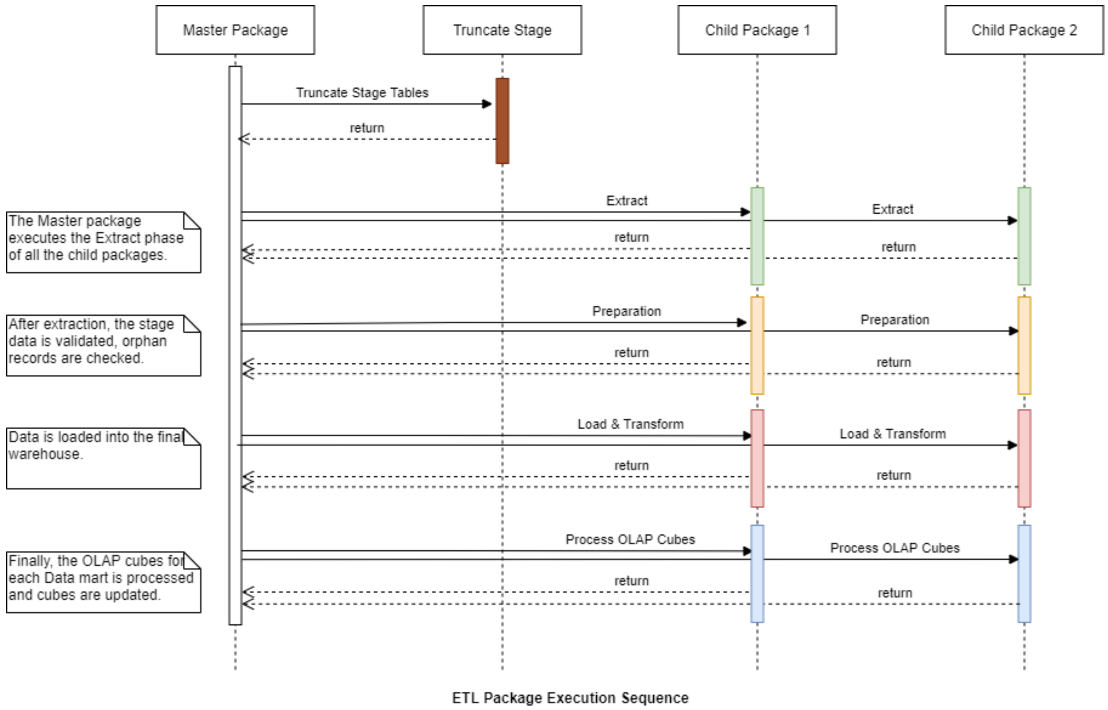

Figure 4.25: DT-SACCO Business Intelligence System ETL Sequence Diagram

4.7.2 User Interface Design

The user interface for the business intelligence system is designed to fit the user requirements for the analytical purposes to enhance decision-making. The interface comprises of charts, and graphs supported by the data warehouse for reporting. As shown below in figure 4.6 below.

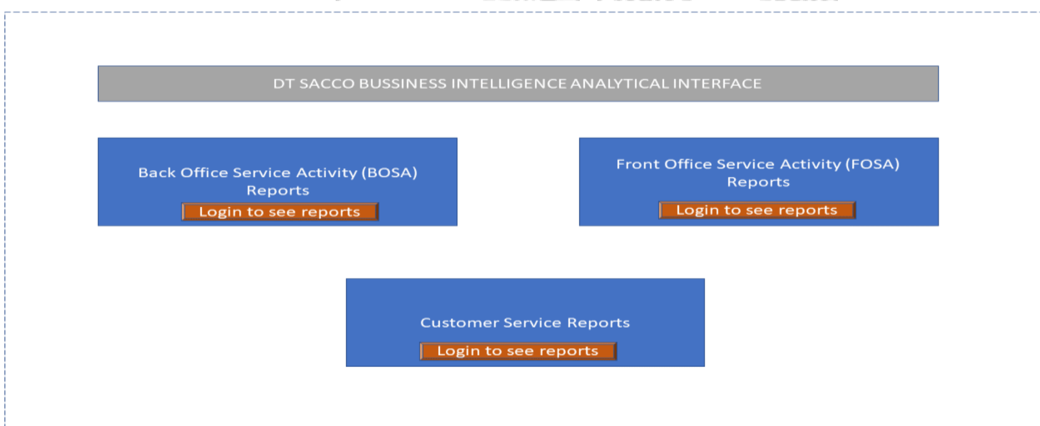

Figure 4.26: ETL of DT-SACCO Business Intelligence System Sequence Diagram

Chapter Five: Implementation

5.1 Introduction

This chapter illustrates the implementation, testing and results from the DT-SACCO data warehouse and business intelligence system. The data ware warehouse system was developed by using multiple ETL packages to integrate data from disparate sources into a centralized data silo (data warehouse).

5.2 System Requirements

5.2.1 Hardware Requirements

These are the hardware requirements for running the prototype data warehouse and business intelligence system.

Table 5.1 Hardware Requirements

Hardware	Version Used
Processor	Core i7
Hard Disk Space	10GB
RAM	16GB

5.2.2 Software Requirements

The software requirements to develop the prototype of the system

Table 5.2 Software Requirements

Software	Version Used
Operating System	Windows 10
Microsoft Excel	Version 2202 (Build 14931)
Microsoft SQL Server Management Studio (SSMS)	15.0.18358.0
Microsoft SQL Server Database	2015
Microsoft Visual Studio 2017	15.9.45
Microsoft SQL SERVER Integration Services (SSIS)	15.0.2000.128
Tableau	

5.3 Staging to Data Warehouse Data Mapping

Mapping involves matching the fields in one dataset with those in another dataset. Relationships and integration of data of different formats are established, ensuring interoperability. Source table are mapped to their related target fields in the Data warehouse destination. Analysis and business processes are made possible by Data Mapping. It improves the usability and quality of the data. In addition to Data Mapping, Schema Mapping involves mapping source schemas with destination schemas. The tool used for the data mapping process is Microsoft Excel as shown in Appendix C.

5.4 Logical Model

The main components of the logical model are attributes, entities and relationships as describes in section 4.6. It is important to note that all database design and implementation starts with logical design. In this study, the design was focused on developing the data warehouse through the facts and dimension tables.

5.5 Staging and Data Warehouse Physical Design and Implementation

Facts are the measurements of transactions related to a business process found in the fact table. An entry in a fact table is a measurement, and a measurement event will always result in an entry in a fact table. Such events usually have numerical measurements that quantify their magnitude. These measurements are called facts or measures by an analysis service. The fact table also houses the foreign keys of the dimension table as shown in section 4.6.

The actual database design and implementation on the SQL Server database management system was done after designing a logical model of the fact and dimensional tables shown in figure 4.6. SQL SERVER Management Studio (SSMS) 2015 was used to implement the physical design of the database creation scripts. In the implementation of the physical database, referential integrity (Parent-Child relationship between two relational tables) between the dimension and fact table was key component to ensure data quality in both the staging area and data warehouse. Dimension tables describe the dimensions of business objects such as Members, loan types, and other tables. All dimensions are linked to the fact table via its primary key which act as the foreign key in the fact table. Appendix A demonstrates the source query used to create the dimensions and facts table.

5.6 Extract Transform and Load Implementation

The data migration process between the data source to staging area and staging area to data warehouse was implemented using SQL SERVER Integration Service demonstrated in Appendix D.

5.7 Visualization Implementation

The visualization was developed to serve as the interactive platform for business users. Tableau Desktop was used to implement the user interface of the reports and dashboards based on requirements gathered from the questionnaire in Appendix B.

5.7.1 Service Desk, Membership Summary, Loan Application, Repayment, and Loan Product Performance Dashboards

The Service Desk, Membership Summary, Loan Application, and Repayment Dashboards were developed to fit the user requirements as shown in figure (5.1, 5.2, 5.3, 5.4, 5.5, and 5.6).

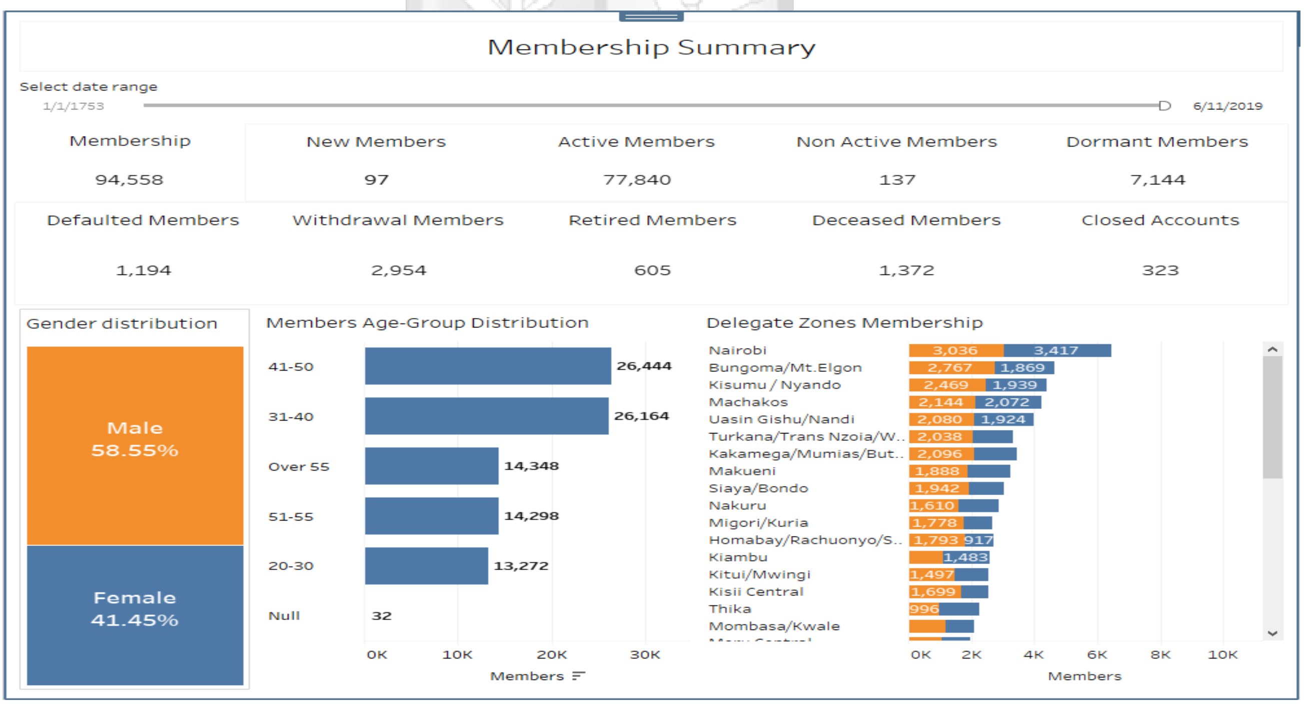

Figure 5.1: Membership Summary Dashboard

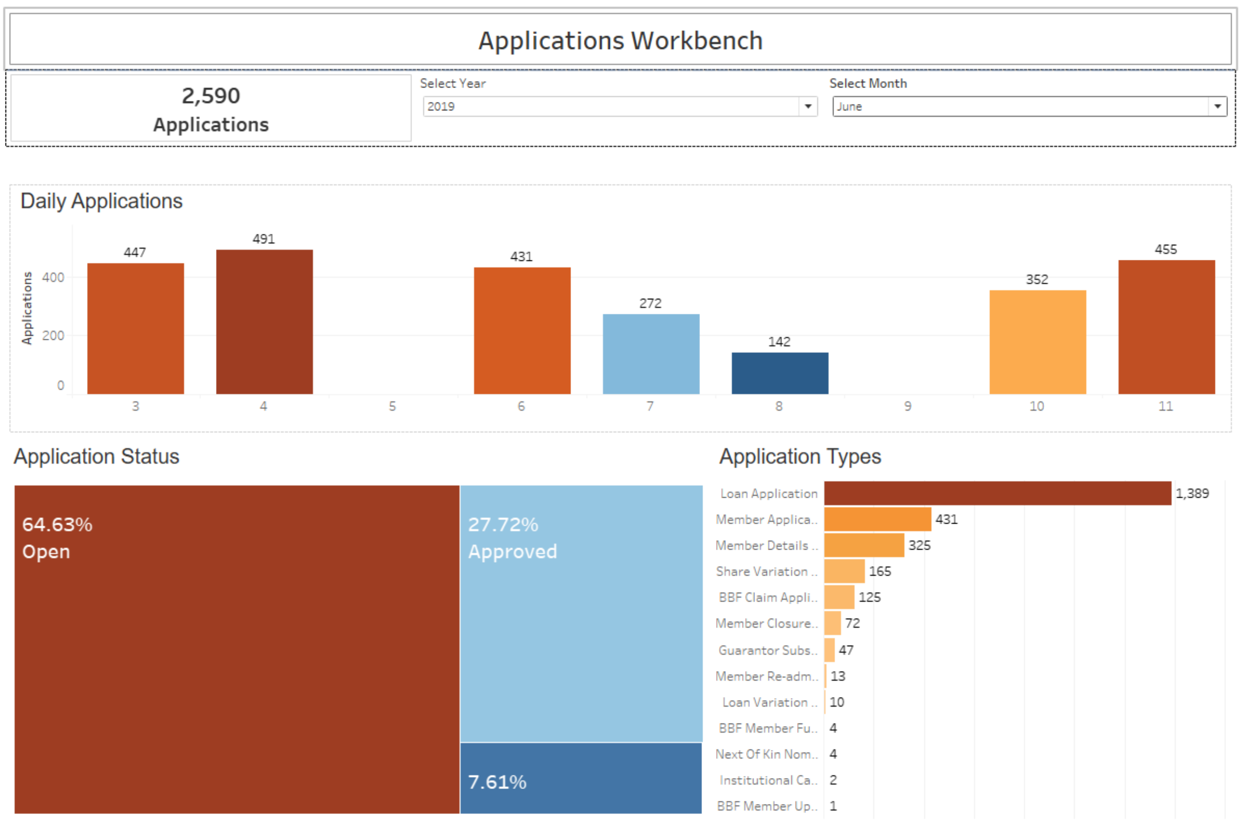

Figure 5.2 : Loan Application Dashboard

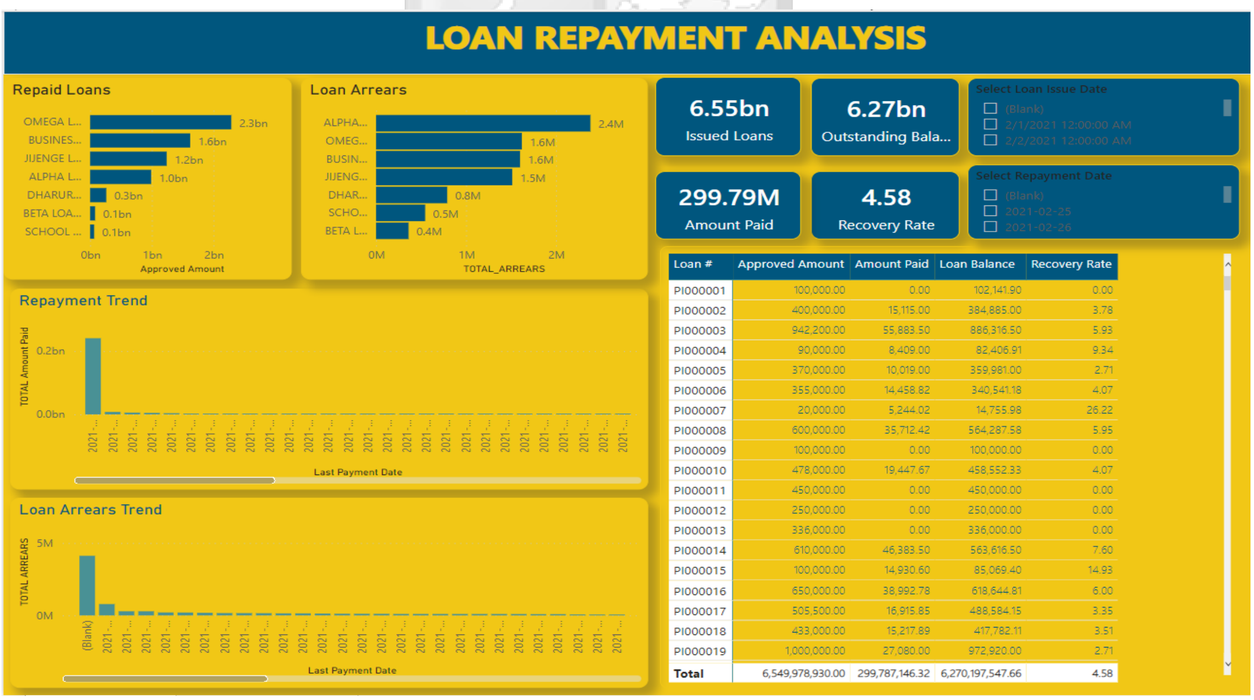

Figure 5.3:Loan Repayment Dashboard

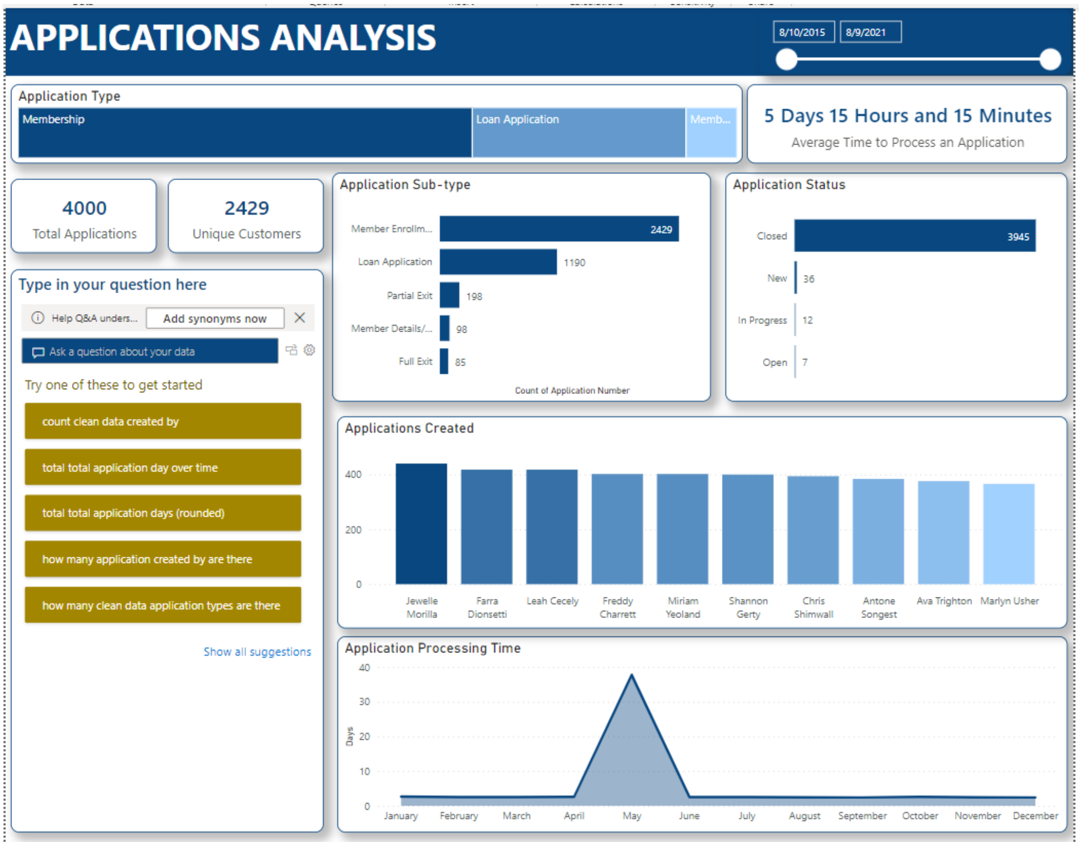

Figure 5.4 : Loan Application Analysis Dashboard

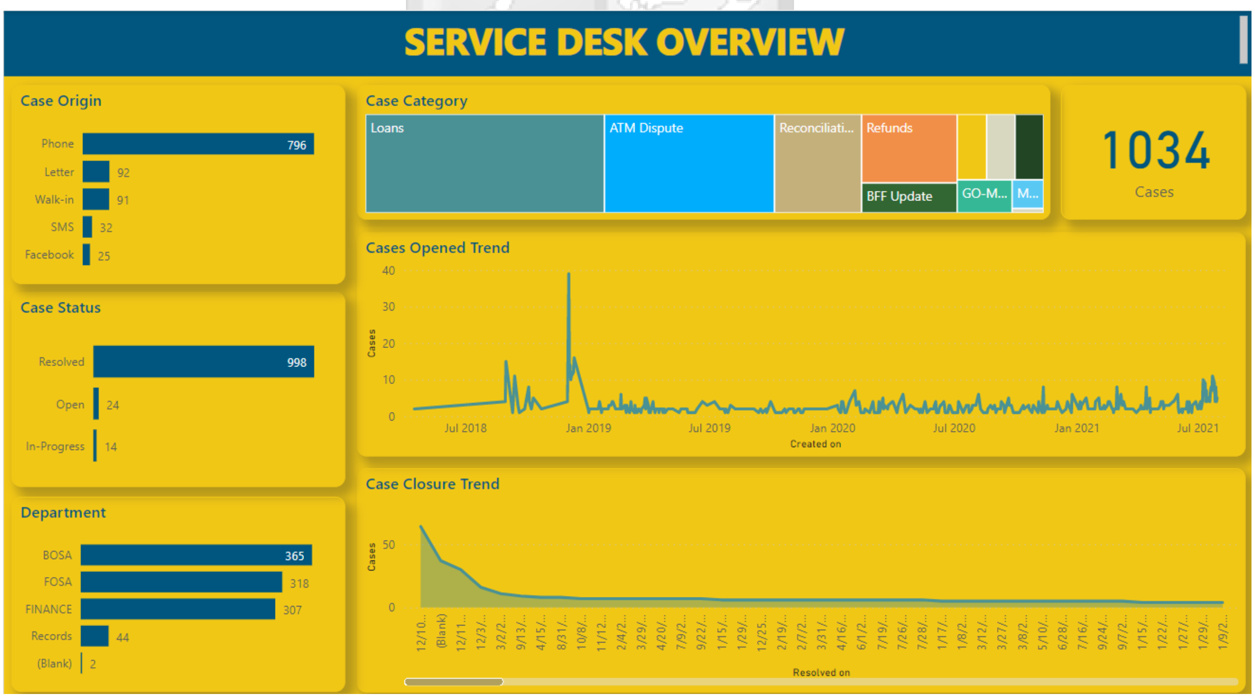

Figure 5.5 : Service Desk Dashboard

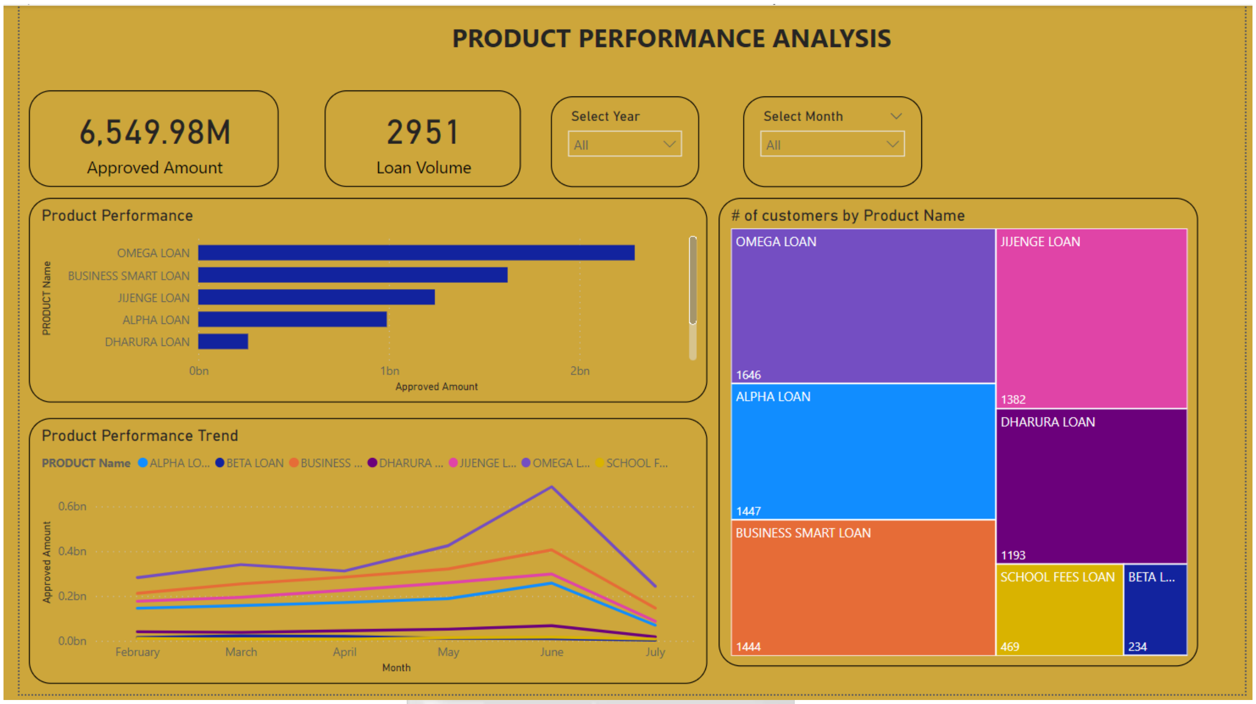

Figure 5.6 : Loan Product Performance Dashboard

Chapter Six: Discussion

6.1 Overview

The overview of the project is to develop a prototype data warehouse and business intelligence system that a DT SACCO could use to support decision-making within their ecosystem. This prototype utilized anonymized secondary data generated by the business transacting members. A data warehouse is developed using the top-bottom approach of data warehouse development. Also, a star-schema design was used to develop the data warehouse. The underlying layer of data warehouse data flow is the staging, which acts as the first step in integrating data from different sources. The process of data extraction, transformation, and loading into the data warehouse and later loaded into different departments to fits the business requirements of the business was carried out by the ETL process as shown in figure 4.1.

Business Intelligence is becoming a trending innovation for the current business environment. The purpose of this dissertation was to study the business intelligence environment within the DT-SACCO and how they generate value from it. In the literature review some gaps were found which are related to the deep understanding of the business intelligence technological, organizational and decision-making context in a more qualitative approach. To give answer to the research question a literature review was conducted for BI ecosystem. In order to reach a concrete finding, it was important to understand the current BI environment's challenges, then continue with the analysis in the BI setting for DT-SACCOs.

The study from the literature review led to certain advantages and challenges for companies that applied it. BI showed to provide more data driven decisions for the users, hence showing its needs for the DT-SACCO space for decision-making. Decision-making environment can be improved because of the decreasing of user uncertainty. End users of BI can use the data independently and make better decisions for their actions. In order to succeed with BI in the operational and organizational level, the level of confidence is essential towards the users who hold the main position in relation to BI tools. On the technological perspective, data governance is an issue which is improved by BI, but there are still open issues such as data security in which DT-SACCOs needs to focus more, so better data quality can be provided. In addition, the visualization is a service option that BI tools offer to depict more data based and analytical graphs. As conclusion BI can be regarded as a necessity for DT-SACCOs which generates great values for business.

6.2 Data Validation

Data warehouse validation involves testing the data contained within the warehouse. It is common to use an ad hoc query tool (Excel) to retrieve data in a format like existing operational reports in order to perform this test. It is critical to validate the completeness and accuracy of dimension members, base measures, and business calculations. The data warehouse and operational report must match the data to be valid. By verifying several reports, you can confidently say that the data contained in the warehouse is accurate. A data warehouse team verifying the data within the warehouse is marginal at best. In addition to the data warehouse team that can detect some issues, the most familiar individuals with the data are necessary to validate the data. A representative of your business must conduct validation of data. For this study, the researcher validated the data both from the source and within the data warehouse.

6.3 Result Summary

The first objective of the study was to analyze the methods and techniques used to make decision in a DT SACCO. This was addressed by conducting a comprehensive literature review to establish the current solutions that DT SACCOs which are also similar in nature with the credit union based on the way they operate. It was found out that many DT SACCOs rely on downloading data from different data sources and analyze them separately hence causing difficulty in data validation and in turn affects the easy of making decisions. It was also made know from chapter 2 that a data warehouse could support the decision-making process of a DT SACCO. Secondly, the object of the research is also focused on possible approaches that DT SACCOs can use to implement Data Warehousing and Business intelligence to support their decision making. In chapter 3, the research focused on the approaches that can be used to develop a robust data warehouse that supports a data analytics and reporting efficiently within the DT SACCO ecosystem. The Top-Bottom approach by Bill Inmon was chosen to support the data warehouse implementation. The result and validation of the data were presented in chapter 6.2.

Chapter Seven: Conclusions and Recommendation

7.1 Summary and Conclusions

The researcher has been able to show that business intelligence and the data warehouse can be implemented within DT-SACCOs because both business users and executives can benefit from the project. For this project, the data warehouse was designed based on three units of a DT-SACCO. The principle followed can be adopted for any DT-SACCO. The project is scalable industry-wise. Future integration of the business intelligence window into collaboration tools is possible.

DT-SACCOs usually store transactional data for an extended period, and they have amassed substantial data assets. From this study, it has been established that the data warehouse collects, consolidates, organizes, and summarizes this structured and unstructured data. Data collected from disparate sources will be used to make business decisions. SQL SERVER Management Studio (SSMS) 2015 was used to implement the physical design of the database creation scripts.

The processes of data mapping and data design are also critical to data warehousing. An effective data warehouse begins with an efficient data design. Industry users know data needs and usage preferences. Users are involved in a complementary study by determining what data they require, locating the resources, and organizing the Information into a dimensional model representing their business needs. An industry growing rapidly cannot achieve its full potential with data analysis and reporting alone. We must also find a way for the right needed Information to reach the right people as soon as possible. The Information must also be acted upon for the benefits to be realized. Business intelligence must be integrated into business processes within the management sector. In addition to understanding the past, Business Intelligence must discover new opportunities and emerging trends for the future!

7.2 Recommendations and Future Research

More research needs to be done on improving the real-time analytics technology usage of data warehouse and business intelligence systems for the DT-SACCOs. Also, future research can look into why the business intelligence systems are not being taken as a priority within the DT-SACCO ecosystem.

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Appendices

Appendix A: Data Warehouse Physical Design and Implementation Source Query

```
/****** Object:  Table [dbo].[Dim_NavLoans]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavLoans](
	[Dim_NavLoans_SK] [int] IDENTITY(1,1) NOT NULL,
	[Client_Name] [nvarchar](50) NULL,
	[Loan_Officer] [nvarchar](30) NULL,
	[Loan_No] [nvarchar](20) NULL,
	[Loan_Product_Type_Name] [nvarchar](100) NULL,
	[Application_Date] [date] NULL,
	[Date_Approved] [date] NULL,
	[Loan_Status] [int] NULL,
	[Approve_Document_Date] [datetime] NULL,
	[Issued_Date] [date] NULL,
	[Branch_Code] [nvarchar](20) NULL,
	[Loan_Disbursement_Date] [date] NULL,
	[MNO] [nvarchar](20) NULL,
	[Account_No] [nvarchar](20) NULL,
	[TSC_No] [nvarchar](20) NULL,
	[Loans_Category_SASRA] [int] NULL,
	[Loans Category] [int] NULL,
	[Installments] [int] NULL,
	[Expected_Date_of_Completion] [date] NULL,
	[Repayment_Start_Date] [date] NULL,
	[Defer_Comments] [nvarchar](50) NULL,
	[Defaulted_Loan_No] [nvarchar](50) NULL,
	[Posted] [tinyint] NULL,
	[Loan_Product_Code] [nvarchar](20) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK__DimNavLoans__C36AF930197DFC02] PRIMARY KEY CLUSTERED
(
	[Dim_NavLoans_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO

/****** Object:  Table [dbo].[Fact_NavLoan ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Fact_NavLoan](
	[Fact_NavLoanID] [int] IDENTITY(1,1) NOT NULL,
	[Dim_NavGlobalDimensionValue_SK] [int] NULL,
	[Dim_NavMember_SK] [int] NULL,
	[Dim_NavLoans_SK] [int] NULL,
```

```
	[DimNavGuarantors_SK] [int] NULL,
	[Dim_NavLoanSecurity_SK] [int] NULL,
	[Amount_Disbursed] [numeric](38, 20) NULL,
	[Outstanding_Interest_To_Date] [numeric](38, 20) NULL,
	[Net_Liability] [numeric](38, 20) NULL,
	[Approved_Amount] [numeric](38, 20) NULL,
	[Amount_Guaranteed] [numeric](38, 20) NULL,
	[Total Top Up] [numeric](38, 20) NULL,
	[Principle Top Up] [numeric](38, 20) NULL,
	[Commision] [numeric](38, 20) NULL,
	[Requested_Amount] [numeric](38, 20) NULL,
	[Current_Shares] [numeric](38, 20) NULL,
	[Shares_Balance] [numeric](38, 20) NULL,
	[Repayment] [numeric](38, 20) NULL,
	[Loan_Principle_Repayment] [numeric](38, 20) NULL,
	[Out_standing_Balance_to_Date] [numeric](38, 20) NULL,
	[IssuedDate_SK] [int] NULL,
	[Recovered_Balance] [numeric](38, 20) NULL,
	[Guarantor_Amount] [numeric](38, 20) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Dim_NavMemberLedgerEntry] PM ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavMemberLedgerEntry](
	[Dim_NavMemberLedgerEntry_SK] [int] IDENTITY(1,1) NOT NULL,
	[Customer_No] [nvarchar](20) NULL,
	[Entry_No] [int] NULL,
	[Loan_No] [nvarchar](20) NULL,
	[Transaction_Type] [int] NULL,
	[TransactionDescription] [varchar](22) NULL,
	[Posting_Date] [date] NULL,
	[Global_Dimension_1_Code] [nvarchar](20) NULL,
	[Global_Dimension_2_Code] [nvarchar](20) NULL,
	[Description] [nvarchar](50) NULL,
	[Document_No] [nvarchar](20) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK__DimNavMe__8CEB15EB516221FF] PRIMARY KEY CLUSTERED
(
	[Dim_NavMemberLedgerEntry_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Fact_NavMemberLedgerEntry]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
```

```sql
CREATE TABLE [dbo].[Fact_NavMemberLedgerEntry](
	[Fact_NavMemberLedgerEntryID] [int] IDENTITY(1,1) NOT NULL,
	[Dim_NavMemberLedgerEntry_SK] [int] NULL,
	[Dim_NavMember_SK] [int] NULL,
	[Amount] [numeric](38, 20) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL
) ON [PRIMARY]
GO


/****** Object:  Table [dbo].[Fact_Flat_RecordsDeductions]    PM ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Fact_Flat_RecordsDeductions](
	[ID] [int] IDENTITY(1,1) NOT NULL,
	[DimFlatRecordsDeductions_SK] [int] NULL,
	[C_F] [int] NULL,
	[Members_Admitted] [int] NULL,
	[Employer_Advised] [int] NULL,
	[Actual_Received] [int] NULL,
	[Variance] [int] NULL,
	[SourceFlag] [nvarchar](50) NULL,
	[Budget_Amount] [numeric](18, 2) NULL,
	[LoadDTS] [datetime] NULL,
	[UpdatedDTS] [datetime] NULL,
	[IsCurrent] [bit] NULL,
 CONSTRAINT [PK__RecordsDeductions_SK__CE7AFFF727042562] PRIMARY KEY CLUSTERED
(
	[ID] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Dim_Flat_Records_Deductions]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_Flat_Records_Deductions](
	[DimFlatRecordsDeductions_SK] [int] IDENTITY(1,1) NOT NULL,
	[Month_Name] [nvarchar](50) NULL,
	[Date] [date] NULL,
	[SourceFlag] [nvarchar](50) NULL,
	[LoadDTS] [datetime] NULL,
	[UpdatedDTS] [datetime] NULL,
	[IsCurrent] [bit] NULL,
 CONSTRAINT [PK__DimFlatRecordsDeductions__CE7AFFF727042562] PRIMARY KEY CLUSTERED
(
	[DimFlatRecordsDeductions_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
```

```
GO
/****** Object:  Table [dbo].[Dim_NavGlobalDimension]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavGlobalDimension](
	[Dim_NavGlobalDimensionValue_SK] [int] IDENTITY(1,1) NOT NULL,
	[Dimension_Category] [nvarchar](30) NULL,
	[Dimension_Code] [nvarchar](30) NULL,
	[Dimension_Description] [nvarchar](50) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK__DimGlobalDimensionValue__CE7AFFF727042514] PRIMARY KEY CLUSTERED
(
	[Dim_NavGlobalDimensionValue_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Dim_NavMember]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavMember](
	[Dim_NavMember_SK] [int] IDENTITY(1,1) NOT NULL,
	[No] [nvarchar](20) NULL,
	[Old_Account_No] [nvarchar](20) NULL,
	[Name] [nvarchar](50) NULL,
	[FOSA_Account] [nvarchar](20) NULL,
	[Post_Code] [nvarchar](50) NULL,
	[Branch_Code] [nvarchar](20) NULL,
	[Blocked] [int] NULL,
	[ID_No] [nvarchar](20) NULL,
	[Pin] [nvarchar](20) NULL,
	[Business Loan No_] [nvarchar](20) NULL,
	[Business_Loan_Officer] [nvarchar](30) NULL,
	[Dividend_Defaulter] [tinyint] NULL,
	[Registration_Date] [datetime] NULL,
	[Registration_Fee_Paid] [numeric](18, 0) NULL,
	[BBF_Application_Date] [datetime] NULL,
	[Payroll_Staff_No] [nvarchar](20) NULL,
	[Phone_No] [nvarchar](50) NULL,
	[Customer_Posting_Group] [nvarchar](10) NULL,
	[E-Mail] [nvarchar](80) NULL,
	[Office_Branch] [nvarchar](20) NULL,
	[Employer_Code] [nvarchar](20) NULL,
	[Date_Of_Birth] [datetime] NULL,
	[Gender_Code] [int] NULL,
	[Gender_Name] [varchar](6) NULL,
	[Delegates_Zones] [nvarchar](20) NULL,
	[Delegate_Zone_Name] [varchar](30) NULL,
	[Delegate] [tinyint] NULL,
	[Last_Date_Modified] [datetime] NULL,
	[Work_Station] [nvarchar](20) NULL,
```

```
	[Status] [int] NULL,
	[Status_Name] [varchar](16) NULL,
	[Global_Dimension_1_Code] [nvarchar](20) NULL,
	[Global_Dimension_2_Code] [nvarchar](20) NULL,
	[BBF_Status] [int] NULL,
	[Department] [nvarchar](20) NULL,
	[Benevolent_Fund No] [nvarchar](30) NULL,
	[Group_Account_No] [nvarchar](10) NULL,
	[Group_Account] [tinyint] NULL,
	[Group Code] [nvarchar](20) NULL,
	[Withdrawal_Date] [datetime] NULL,
	[Monthly_Contribution] [numeric](38, 20) NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK__DimMembe__34780631B0903ABC] PRIMARY KEY CLUSTERED
(
	[Dim_NavMember_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO

/****** Object:  Table [dbo].[Dim_NavGLAccount]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavGLAccount](
	[DimNavGLAccount_SK] [int] IDENTITY(1,1) NOT NULL,
	[No_] [nvarchar](20) NULL,
	[Name] [nvarchar](50) NULL,
	[Expense Code] [nvarchar](10) NULL,
	[SourceFlag] [nvarchar](50) NULL,
	[LoadDTS] [datetime] NULL,
	[UpdatedDTS] [datetime] NULL,
	[IsCurrent] [bit] NULL,
 CONSTRAINT [PK__DimNavGL__CE7AFFF727042562] PRIMARY KEY CLUSTERED
(
	[DimNavGLAccount_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Fact_NavGLEntry]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Fact_NavGLEntry](
	[Fact_NavGLEntryID] [int] IDENTITY(1,1) NOT NULL,
	[Dim_NavGLEntry_SK] [int] NULL,
	[Dim_NavGLAccount_SK] [int] NULL,
	[Date_SK] [int] NULL,
	[Amount] [numeric](38, 20) NULL,
	[Debit_Amount] [numeric](38, 20) NULL,
	[Credit_Amount] [numeric](38, 20) NULL,
```

```
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK_FactGLEntry] PRIMARY KEY CLUSTERED
(
	[Fact_NavGLEntryID] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
/****** Object:  Table [dbo].[Dim_NavGLEntry]    ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_NavGLEntry](
	[Dim_NavGLEntry_SK] [int] IDENTITY(1,1) NOT NULL,
	[ID] [int] NULL,
	[GL_Account_No] [nvarchar](20) NULL,
	[Posting_Date] [datetime] NULL,
	[Global Dimension 1 Code] [nvarchar](20) NULL,
	[Global Dimension 2 Code] [nvarchar](20) NULL,
	[Journal Batch Name] [nvarchar](10) NULL,
	[Document_No] [nvarchar](20) NULL,
	[Description] [nvarchar](50) NULL,
	[Source_No] [nvarchar](20) NULL,
	[Source Type] [int] NULL,
	[Source_Flag] [nvarchar](50) NULL,
	[Load_DTS] [datetime] NULL,
	[Updated_DTS] [datetime] NULL,
	[Is_Current] [bit] NULL,
 CONSTRAINT [PK__DimNavGL__CE7AFFF727042560] PRIMARY KEY CLUSTERED
(
	[Dim_NavGLEntry_SK] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO


/****** Object:  Table [dbo].[Dim_Date ******/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
CREATE TABLE [dbo].[Dim_Date](
	[DateKey] [int] NOT NULL,
	[Date] [date] NULL,
	[FullDateKE] [char](10) NULL,
	[FullDateUSA] [char](10) NULL,
	[DayOfMonth] [varchar](2) NULL,
	[DaySuffix] [varchar](4) NULL,
	[DayName] [varchar](9) NULL,
	[DayOfWeekUSA] [char](1) NULL,
	[DayOfWeekUK] [char](1) NULL,
	[DayOfWeekInMonth] [varchar](2) NULL,
```

```
	[DayOfWeekInYear] [varchar](2) NULL,
	[DayOfQuarter] [varchar](3) NULL,
	[DayOfYear] [varchar](3) NULL,
	[WeekOfMonth] [varchar](1) NULL,
	[WeekOfQuarter] [varchar](2) NULL,
	[WeekOfYear] [varchar](2) NULL,
	[Month] [varchar](2) NULL,
	[MonthName] [varchar](9) NULL,
	[MonthOfQuarter] [varchar](2) NULL,
	[Quarter] [char](1) NULL,
	[QuarterName] [varchar](9) NULL,
	[Year] [char](4) NULL,
	[YearName] [char](7) NULL,
	[MonthYear] [char](10) NULL,
	[MMYYYY] [char](6) NULL,
	[FirstDayOfMonth] [date] NULL,
	[LastDayOfMonth] [date] NULL,
	[FirstDayOfQuarter] [date] NULL,
	[LastDayOfQuarter] [date] NULL,
	[FirstDayOfYear] [date] NULL,
	[LastDayOfYear] [date] NULL,
	[IsHolidayUSA] [bit] NULL,
	[IsWeekday] [bit] NULL,
	[HolidayUSA] [varchar](50) NULL,
	[IsHolidayKE] [bit] NULL,
	[HolidayKE] [varchar](50) NULL,
	[FiscalDayOfYear] [varchar](3) NULL,
	[FiscalWeekOfYear] [varchar](3) NULL,
	[FiscalMonth] [varchar](2) NULL,
	[FiscalQuarter] [char](1) NULL,
	[FiscalQuarterName] [varchar](9) NULL,
	[FiscalYear] [char](4) NULL,
	[FiscalYearName] [char](7) NULL,
	[FiscalMonthYear] [char](10) NULL,
	[FiscalMMYYYY] [char](6) NULL,
	[FiscalFirstDayOfMonth] [date] NULL,
	[FiscalLastDayOfMonth] [date] NULL,
	[FiscalFirstDayOfQuarter] [date] NULL,
	[FiscalLastDayOfQuarter] [date] NULL,
	[FiscalFirstDayOfYear] [date] NULL,
	[FiscalLastDayOfYear] [date] NULL,
PRIMARY KEY CLUSTERED
(
	[DateKey] ASC
)WITH (PAD_INDEX = OFF, STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY = OFF, AL-
LOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS = ON) ON [PRIMARY]
) ON [PRIMARY]
GO
```

Appendix B: Sample Questionnaire

I am a graduate student at Strathmore University, and I am here to assess the data repositories (databases or data storage software) you use in your organization. In order to implement a solution that meets your needs, I will gather Information about the challenges and needs related to separate data repositories within an organization. This solution will try to make sure that the data stored at different locations is utilized effectively and efficiently without changing your way of working.

It should take you about 8 minutes to complete the survey, and your participation is completely voluntary. Your responses will be kept private, as only summary results will be included in the final report.

Thank you,

John Adeyemi Olaoye

Background Information Questionnaire

Name: Organization:

1.Do you think that there is need to create a single point of access to all organizational data? [Yes\No]

If no, what are the reasons against it / fears?

2. Do you consider yourself as a technical or non-technical staff in relation to the existing databases in the organization and why?

General Reporting information

3. Would you wish that the data you access be represented in graphs and charts? [Yes\No]

4. What are the weaknesses with the existing data warehousing tools that you have used if any?

5. What functionalities would you like to have most in the system based on your role in the organization?

- Browse Data
- Generate report
- Edit data
- Add and Delete Data
- Others (Specify) ---

This section of the questionnaire should be filled by the technical experts in the organization.

Technical Information: - For technical staff

1. List all the database management systems that are used in the organization.
2. Do these databases store different or related Information?
3. What issues or inconveniences do you face as a result of storing data in separate databases?
4. How do you go about merging or relating the Information from the separated data repositories?

End-User Requirement Analysis (Survey Questionnaire)

S/No	Question	Strongly Agree	Tends to Agree	Neither Agree nor Disagree	Tends to Disagree	Strongly Disagree
1	Data warehouse should support various data sources as possible and have the ability to integrate more data sources with the reporting, modeling, analysis strategy, in the near future.					
2	Close synchronization among functional area units within the business, so that it can help managers make decision on the overall working together of the units and how they affect each other.					
3	Users should be able to access the data more easily and quickly, and able to extract singular reports that can make them make decision quicker.					

4	Organization should be able to identify what part of the business is bringing more revenue by the structured queries and reporting generated by DW.					
5	I will like to be involved in the design (and implementation) of any system that will impact my job					
6	Senior managers must be able to generated One report that can describe the state of the business and its units per time.					
7	DW can adjust to new business processes and easily support future and new requirements.					
8	Data values in DW correctly represent the real-world objects and events being described.					
9	Able to handle increase in the complexity and number of simultaneous					

	queries without impacting system performances.					
10	Level of Data correctness in DW should be at its highest possible					

S/N	Factors/Bench Marks	Strongly Agree	Tends to Agree	Neither Agree nor Disagree	Tends to Disagree	Strongly Disagree
1	The Data warehousing system implemented is a success					
2	The Data warehousing system does not satisfy my requirements					
3	The Data warehousing system is easy to use					
4	It is easy to retrieve data from the system and understand such data.					
5	Using the system make my job easier for me.					
6	The report/output in line with the business requirements					
7	You have access to timely information when you need it					
8	The system provide sufficient information					
9	You are satisfied with the system accuracy					

Signature:_____________________ Date:___________

Appendix C: Staging to Data Warehouse Mapping Document

DIMENSION TABLE Mapping

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
						1			
						Dim_NavMember_SK	int	NO	NULL
	No_	nvarchar	YES	20		No	nvarchar	YES	20
	Old Account No_	nvarchar	YES	20		Old_Account_No	nvarchar	YES	20
	Name	nvarchar	YES	50		Name	nvarchar	YES	50
	FOSA Account	nvarchar	YES	20		FOSA_Account	nvarchar	YES	20
	PostCode	nvarchar	YES	50		Post_Code	nvarchar	YES	50
	BranchCode	nvarchar	YES	20		Branch_Code	nvarchar	YES	20
	Blocked	int	YES	NULL		Blocked	int	YES	NULL
	ID No_	nvarchar	YES	20		ID_No	nvarchar	YES	20
	Pin	nvarchar	YES	20		Pin	nvarchar	YES	20
	Dividend Defaulter	tinyint	YES	NULL		Dividend_Defaulter	tinyint	YES	NULL
	Registration Date	datetime	YES	NULL		Registration_Date	datetime	YES	NULL
	Registration_Fee_Paid	numeric	YES	NULL		Registration_Fee_Paid	numeric	YES	NULL
	BBF Application Date	datetime	YES	NULL		BBF_Application_Date	datetime	YES	NULL
	Payroll_Staff No	nvarchar	YES	20		Payroll_Staff No	nvarchar	YES	20
	Phone_No	nvarchar	YES	50		Phone_No	nvarchar	YES	50
Stg_NAV_Members	Customer Posting Group	nvarchar	YES	10		Customer_Posting_Group	nvarchar	YES	10
	E-Mail	nvarchar	YES	80		E-Mail	nvarchar	YES	80
	Office Branch	nvarchar	YES	20		Office_Branch	nvarchar	YES	20
	Employer Code	nvarchar	YES	20	Dim_Members	Employer_Code	nvarchar	YES	20
	Date of Birth	datetime	YES	NULL		Date_of_Birth	datetime	YES	NULL
	Gender_Code	int	YES	NULL		Gender_Code	int	YES	NULL
	Gender_Name	varchar	YES	6		Gender_Name	varchar	YES	6
	Delegates Zones	nvarchar	YES	20		Delegates_Zones	nvarchar	YES	20
	Delegate	tinyint	YES	NULL		Delegate	tinyint	YES	NULL
	Last Date Modified	datetime	YES	NULL		Last_Date_Modified	datetime	YES	NULL
	Work_Station	nvarchar	YES	20		Work_Station	nvarchar	YES	20
	status	int	YES	NULL		Status	int	YES	NULL
	Status_Name	varchar	YES	16		Status_Name	varchar	YES	16
	Global Dimension 2 Code	nvarchar(20)	YES	20		Global_Dimension_2_Code	nvarchar	YES	20
	BBF Status	int	YES	NULL		BBF_Status	int	YES	NULL
	Department	nvarchar(20)	YES	20		Department	nvarchar	YES	20
	BenevolentFund No_	nvarchar(30)	YES	30		Benevolent_Fund_No	nvarchar	YES	30
	Group Account No	nvarchar(10)	YES	10		Group_Account_No	nvarchar	YES	10
	Group Account	tinyint	YES	NULL		Group_Account	tinyint	YES	NULL
						Source_Flag	nvarchar	YES	50
						Load_DTS	datetime	YES	NULL
						Updated_DTS	datetime	YES	NULL
						Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
					Dim_CrmApplication	Dim_CrmApplication_SK	int	NO	NULL
Stg_CRM_Application	coretec_no_	nvarchar	YES	100	Dim_CrmApplication	Coretec_No	nvarchar	YES	100
Stg_CRM_Application	coretec_FormNo	nvarchar	YES	100	Dim_CrmApplication	Coretec_Form_No	nvarchar	YES	100
Stg_CRM_Application	coretec_MemberName	uniqueidentifier	YES	NULL	Dim_CrmApplication	Coretec_MemberName	uniqueidentifier	YES	NULL
Stg_CRM_Application	coretec_Name	nvarchar	YES	160	Dim_CrmApplication	Coretec_Name	nvarchar	YES	160
Stg_CRM_Application	Apptype	int	YES	NULL	Dim_CrmApplication	Apptype	int	YES	NULL
Stg_CRM_Application	Application Type	varchar	YES	27	Dim_CrmApplication	Application_Type	varchar	YES	27
Stg_CRM_Application	Status	int	YES	NULL	Dim_CrmApplication	Status	int	YES	NULL
Stg_CRM_Application	StatusValue	nvarchar	YES	4000	Dim_CrmApplication	StatusValue	nvarchar	YES	4000
Stg_CRM_Application	CreatedByName	nvarchar	YES	200	Dim_CrmApplication	Created_By_Name	nvarchar	YES	200
Stg_CRM_Application	CreatedOn	datetime	YES	NULL	Dim_CrmApplication	Created_On	datetime	YES	NULL
Stg_CRM_Application	coretec_ResolvedBy	nvarchar	YES	100	Dim_CrmApplication	Coretec_ResolvedBy	nvarchar	YES	100
Stg_CRM_Application	coretec_ResolutionDate	datetime	YES	NULL	Dim_CrmApplication	Coretec_ResolutionDate	datetime	YES	NULL
Stg_CRM_Application	Turn Around Time	int	YES	NULL	Dim_CrmApplication	Turn_Around_Time	int	YES	NULL
Stg_CRM_Application	CreatedBy	uniqueidentifier	YES	NULL	Dim_CrmApplication	Created_By	uniqueidentifier	YES	NULL
Stg_CRM_Application	MemberNO	nvarchar	YES	20	Dim_CrmApplication	Member_No	nvarchar	YES	20
Stg_CRM_Application	Load_Date	datetime	YES	NULL	Dim_CrmApplication	Load_Date	datetime	YES	NULL
					Dim_CrmApplication	Source_Flag	nvarchar(50)	YES	50
					Dim_CrmApplication	Load_DTS	datetime	YES	NULL
					Dim_CrmApplication	Updated_DTS	datetime	YES	NULL
					Dim_CrmApplication	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
						3			
					Dim_CrmCases	Dim_CrmCases_SK	int	NO	NULL
Stg_CRM_Cases	ID	int	NO	NULL	Dim_CrmCases	ID	int	NO	NULL
Stg_CRM_Cases	TicketNumber	nvarchar	YES	100	Dim_CrmCases	Ticket_Number	nvarchar	YES	100
Stg_CRM_Cases	Title	nvarchar	YES	200	Dim_CrmCases	Title	nvarchar	YES	200
Stg_CRM_Cases	CaseOriginCode	int	YES	NULL	Dim_CrmCases	Case_Origin_Code	int	YES	NULL
Stg_CRM_Cases	SubjectId	uniqueidentifier	YES	NULL	Dim_CrmCases	Subject_Id	uniqueidentifier	YES	NULL
Stg_CRM_Cases	Department	nvarchar	YES	500	Dim_CrmCases	Department	nvarchar	YES	500
Stg_CRM_Cases	coretec_Category	int	YES	NULL	Dim_CrmCases	Coretec_Category	int	YES	NULL
Stg_CRM_Cases	Status	varchar	YES	6	Dim_CrmCases	Status	varchar	YES	6
Stg_CRM_Cases	StatusCode	int	YES	NULL	Dim_CrmCases	Status_Code	int	YES	NULL
Stg_CRM_Cases	CreatedByName	nvarchar	YES	200	Dim_CrmCases	Created_By_Name	nvarchar	YES	200
Stg_CRM_Cases	OwnerIdName	nvarchar	YES	160	Dim_CrmCases	Owner_Id_Name	nvarchar	YES	160
Stg_CRM_Cases	ModifiedByName	nvarchar	YES	200	Dim_CrmCases	Modified_By_Name	nvarchar	YES	200
Stg_CRM_Cases	CreatedOn	datetime	YES	NULL	Dim_CrmCases	Created_On	datetime	YES	NULL
Stg_CRM_Cases	ModifiedOn	datetime	YES	NULL	Dim_CrmCases	Modified_On	datetime	YES	NULL
Stg_CRM_Cases	new_BranchName	nvarchar	YES	100	Dim_CrmCases	New_Branch_Name	nvarchar	YES	100
Stg_CRM_Cases	Turn around time	int	YES	NULL	Dim_CrmCases	Turn_Around_Time	int	YES	NULL
Stg_CRM_Cases	CaseTypeCode	int	YES	NULL	Dim_CrmCases	Case_Type_Code	int	YES	NULL
Stg_CRM_Cases	Case_Type	varchar	YES	26	Dim_CrmCases	Case_Type	varchar	YES	26
Stg_CRM_Cases	Category	nvarchar	YES	4000	Dim_CrmCases	Category	nvarchar	YES	4000
Stg_CRM_Cases	Status_Reason	varchar	YES	19	Dim_CrmCases	Status_Reason	varchar	YES	19
Stg_CRM_Cases	Case_Origin	varchar	YES	10	Dim_CrmCases	Case_Origin	varchar	YES	10
					Dim_CrmCases	Source_Flag	nvarchar	YES	50
					Dim_CrmCases	Load_DTS	datetime	YES	NULL
					Dim_CrmCases	Updated_DTS	datetime	YES	NULL
					Dim_CrmCases	Is_Current	bit	YES	NULL
						4			
					Dim_CrmStringMapbase	Dim_CrmStringMapbase_SK	int	NO	NULL
Stg_CRM_Stringmapt	value	nvarchar	YES	4000	Dim_CrmStringMapbase	value	nvarchar	YES	4000
Stg_CRM_Stringmapt	AttributeName	nvarchar	YES	100	Dim_CrmStringMapbase	Attribute_Name	nvarchar	YES	100
Stg_CRM_Stringmapt	AttributeValue	int	YES	NULL	Dim_CrmStringMapbase	Attribute_Value	int	YES	NULL
Stg_CRM_Stringmapt	ObjectTypeCode	int	YES	NULL	Dim_CrmStringMapbase	Object_Type_Code	int	YES	NULL
					Dim_CrmStringMapbase	Source_Flag	nvarchar(50)	YES	50
					Dim_CrmStringMapbase	Load_DTS	datetime	YES	NULL
					Dim_CrmStringMapbase	Updated_DTS	datetime	YES	NULL
					Dim_CrmStringMapbase	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
						5			
					Dim_NavBioData	Dim_NavBioData_SK	int	NO	NULL
Stg_NAV_BioData	PF/No	nvarchar	YES	20	Dim_NavBioData	PF/No	nvarchar	YES	20
Stg_NAV_BioData	First Name	nvarchar	YES	80	Dim_NavBioData	First_Name	nvarchar	YES	80
Stg_NAV_BioData	Middle Name	nvarchar	YES	50	Dim_NavBioData	Middle_Name	nvarchar	YES	50
Stg_NAV_BioData	Last Name	nvarchar	YES	50	Dim_NavBioData	Last_Name	nvarchar	YES	50
Stg_NAV_BioData	Department_Name	nvarchar	YES	80	Dim_NavBioData	Department_Name	nvarchar	YES	80
Stg_NAV_BioData	Job Title	nvarchar	YES	50	Dim_NavBioData	Job_Title	nvarchar	YES	50
Stg_NAV_BioData	Date Of Birth	datetime	YES	NULL	Dim_NavBioData	Date_Of_Birth	datetime	YES	NULL
Stg_NAV_BioData	Gender	int	YES	NULL	Dim_NavBioData	Gender	int	YES	NULL
Stg_NAV_BioData	Gender_Name	varchar	YES	6	Dim_NavBioData	Gender_Name	varchar	YES	6
Stg_NAV_BioData	Age	int	YES	NULL	Dim_NavBioData	Age	int	YES	NULL
Stg_NAV_BioData	Grade	nvarchar	YES	20	Dim_NavBioData	Grade	nvarchar	YES	20
Stg_NAV_BioData	Date_Of_Employment	datetime	YES	NULL	Dim_NavBioData	Date_Of_Employment	datetime	YES	NULL
Stg_NAV_BioData	Years_Of_Service	int	YES	NULL	Dim_NavBioData	Years_Of_Service	int	YES	NULL
Stg_NAV_BioData	Qualification Description	nvarchar	YES	100	Dim_NavBioData	Qualification_Description	nvarchar	YES	100
Stg_NAV_BioData	Qualification Type	nvarchar	YES	20	Dim_NavBioData	Qualification_Type	nvarchar	YES	20
Stg_NAV_BioData	Qualification Code	nvarchar	YES	200	Dim_NavBioData	Qualification_Code	nvarchar	YES	200
Stg_NAV_BioData	Last Date of Promotion	datetime	YES	NULL	Dim_NavBioData	Last_Date_of_Promotion	datetime	YES	NULL
					Dim_NavBioData	Source_Flag	nvarchar(50)	YES	50
					Dim_NavBioData	Load_DTS	datetime	YES	NULL
					Dim_NavBioData	Updated_DTS	datetime	YES	NULL
					Dim_NavBioData	Is_Current	bit	YES	NULL
						6			
					Dim_NavGLAccount	DimNavGLAccount_SK	int	NO	NULL
Stg_NAV_G_L Accoun	No_	nvarchar	YES	20	Dim_NavGLAccount	No	nvarchar	YES	20
Stg_NAV_G_L Accoun	Name	nvarchar	YES	50	Dim_NavGLAccount	Name	nvarchar	YES	50
Stg_NAV_G_L Accoun	Expense Code	nvarchar	YES	10	Dim_NavGLAccount	Expense_Code	nvarchar	YES	10
					Dim_NavGLAccount	Source_Flag	nvarchar	YES	50
					Dim_NavGLAccount	Load_DTS	datetime	YES	NULL
					Dim_NavGLAccount	Updated_DTS	datetime	YES	NULL
					Dim_NavGLAccount	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
						6			
					Dim_NavGLAccount	DimNavGLAccount_SK	int	NO	NULL
Stg_NAV_G_L Accoun	No_	nvarchar	YES	20	Dim_NavGLAccount	No	nvarchar	YES	20
Stg_NAV_G_L Accoun	Name	nvarchar	YES	50	Dim_NavGLAccount	Name	nvarchar	YES	50
Stg_NAV_G_L Accoun	Expense Code	nvarchar	YES	10	Dim_NavGLAccount	Expense_Code	nvarchar	YES	10
					Dim_NavGLAccount	Source_Flag	nvarchar	YES	50
					Dim_NavGLAccount	Load_DTS	datetime	YES	NULL
					Dim_NavGLAccount	Updated_DTS	datetime	YES	NULL
					Dim_NavGLAccount	Is_Current	bit	YES	NULL
						7			
					Dim_NavGLEntry	Dim_NavGLEntry_SK	int	NO	NULL
Stg_NAV_G_L Entry	G_L Account No_	nvarchar	YES	20	Dim_NavGLEntry	GL_Account_No	nvarchar	YES	20
Stg_NAV_G_L Entry	Posting Date	datetime	YES	NULL	Dim_NavGLEntry	Posting_Date	datetime	YES	NULL
Stg_NAV_G_L Entry	Global Dimension 1 Code	nvarchar	YES	20	Dim_NavGLEntry	Global_Dimension_1_Code	nvarchar	YES	20
Stg_NAV_G_L Entry	Global Dimension 2 Code	nvarchar	YES	20	Dim_NavGLEntry	Global_Dimension_2_Code	nvarchar	YES	20
Stg_NAV_G_L Entry	Journal Batch Name	nvarchar	YES	10	Dim_NavGLEntry	Journal_Batch_Name	nvarchar	YES	10
Stg_NAV_G_L Entry	Credit Amount	numeric	YES	NULL	Dim_NavGLEntry	Credit_Amount	numeric	YES	NULL
Stg_NAV_G_L Entry	Source Type	int	YES	NULL	Dim_NavGLEntry	Source_Type	int	YES	NULL
					Dim_NavGLEntry	Source_Flag	nvarchar	YES	50
					Dim_NavGLEntry	Load_DTS	datetime	YES	NULL
					Dim_NavGLEntry	Updated_DTS	datetime	YES	NULL
					Dim_NavGLEntry	Is_Current	bit	YES	NULL
						8			
					Dim_NavGuarantor	Dim_NavGuarantors_SK	int	NO	NULL
Stg_NAV_Guarantors	Guarantor_Name	nvarchar	YES	200	Dim_NavGuarantor	Guarantor_Name	nvarchar	YES	200
Stg_NAV_Guarantors	Guarantor_MNO	nvarchar	YES	20	Dim_NavGuarantor	Guarantor_MNO	nvarchar	YES	20
Stg_NAV_Guarantors	Loan_No	nvarchar	YES	20	Dim_NavGuarantor	Loan_No	nvarchar	YES	20
					Dim_NavGuarantor	Source_Flag	nvarchar	YES	50
					Dim_NavGuarantor	Load_DTS	datetime	YES	NULL
					Dim_NavGuarantor	Updated_DTS	datetime	YES	NULL
					Dim_NavGuarantor	Is_Current	bit	YES	NULL
						9			
					Dim_NavItemLedgerEntry	Dim_NavItemLedgerEntry_SK	int	NO	NULL
Stg_NAV_ItemLedger	Item_No	nvarchar	YES	20	Dim_NavItemLedgerEntry	Item_No	nvarchar	YES	20
Stg_NAV_ItemLedger	Entry_No	int	YES	NULL	Dim_NavItemLedgerEntry	Entry_No	int	YES	NULL
Stg_NAV_ItemLedger	Posting Date	datetime	YES	NULL	Dim_NavItemLedgerEntry	Posting_Date	datetime	YES	NULL
Stg_NAV_ItemLedger	Entry Type	int	YES	NULL	Dim_NavItemLedgerEntry	Entry_Type	int	YES	NULL
Stg_NAV_ItemLedger	Document No_	nvarchar	YES	20	Dim_NavItemLedgerEntry	Document_No	nvarchar	YES	20
Stg_NAV_ItemLedger	Description	nvarchar	YES	50	Dim_NavItemLedgerEntry	Description	nvarchar	YES	50
					Dim_NavItemLedgerEntry	Source_Flag	nvarchar	YES	50
					Dim_NavItemLedgerEntry	Load_DTS	datetime	YES	NULL
					Dim_NavItemLedgerEntry	Updated_DTS	datetime	YES	NULL
					Dim_NavItemLedgerEntry	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	AXIMUM_LENG
						10			
					Dim_NavLedgerEntry	Dim_NavLedgerEntry_Sk	int	NO	NULL
Stg_NAV_LedgerEntr	Loan No	nvarchar	YES	20	Dim_NavLedgerEntry	Loan_No	nvarchar	YES	20
					Dim_NavLedgerEntry	Transaction_Type	int	YES	NULL
					Dim_NavLedgerEntry	Source_Flag	nvarchar	YES	50
					Dim_NavLedgerEntry	Load_DTS	datetime	YES	NULL
					Dim_NavLedgerEntry	Updated_DTS	datetime	YES	NULL
					Dim_NavLedgerEntry	Is_Current	bit	YES	NULL
						11			
					Dim_NavLoanMemberAppli	Dim_NavLoanMemberApplication_SK	int	NO	NULL
Stg_NAV_LoanMemb	Member_No	nvarchar	YES	20	Dim_NavLoanMemberAppli	Member_No	nvarchar	YES	20
Stg_NAV_LoanMemb	Registration Date	datetime	YES	NULL	Dim_NavLoanMemberAppli	Registration_Date	datetime	YES	NULL
Stg_NAV_LoanMemb	Global Dimension 2 Code	nvarchar	YES	20	Dim_NavLoanMemberAppli	Global_Dimension_2_Code	nvarchar	YES	20
Stg_NAV_LoanMemb	Customer Type	int	YES	NULL	Dim_NavLoanMemberAppli	Customer_Type	int	YES	NULL
Stg_NAV_LoanMemb	Status	int	YES	NULL	Dim_NavLoanMemberAppli	Status	int	YES	NULL
Stg_NAV_LoanMemb	Status_Name	varchar	YES	8	Dim_NavLoanMemberAppli	Status_Name	varchar	YES	8
Stg_NAV_LoanMemb	Created	tinyint	YES	NULL	Dim_NavLoanMemberAppli	Created	tinyint	YES	NULL
Stg_NAV_LoanMemb	Group Account	tinyint	YES	NULL	Dim_NavLoanMemberAppli	Group_Account	tinyint	YES	NULL
Stg_NAV_LoanMemb	Customer Posting Group	nvarchar	YES	10	Dim_NavLoanMemberAppli	Customer_Posting_Group	nvarchar	YES	10
					Dim_NavLoanMemberAppli	Source_Flag	nvarchar	YES	50
					Dim_NavLoanMemberAppli	Load_DTS	datetime	YES	NULL
					Dim_NavLoanMemberAppli	Updated_DTS	datetime	YES	NULL
					Dim_NavLoanMemberAppli	Is_Current	bit	YES	NULL
						12			
					Dim_NavLoanPaymentSche	Dim_NavLoanPaymentSchedule_SK	int	NO	NULL
Stg_NAV_LoanPayme	Loan_No	nvarchar	YES	20	Dim_NavLoanPaymentSche	Loan_No	nvarchar	YES	20
Stg_NAV_LoanPayme	Member_No	nvarchar	YES	20	Dim_NavLoanPaymentSche	Member_No	nvarchar	YES	20
					Dim_NavLoanPaymentSche	Monthly_Repayment	numeric	YES	NULL
					Dim_NavLoanPaymentSche	Source_Flag	nvarchar	YES	50
					Dim_NavLoanPaymentSche	Load_DTS	datetime	YES	NULL
					Dim_NavLoanPaymentSche	Updated_DTS	datetime	YES	NULL
					Dim_NavLoanPaymentSche	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
							13		
					Dim_NavLoans	Dim_NavLoans_SK	int	NO	NULL
Stg_NAV_Loans	Client_Name	nvarchar	YES	50	**Dim_NavLoans**	Client_Name	nvarchar	YES	50
Stg_NAV_Loans	Loan_No	nvarchar	YES	20	**Dim_NavLoans**	Loan_No	nvarchar	YES	20
Stg_NAV_Loans	Loan_Product_Type_Name	nvarchar	YES	100	**Dim_NavLoans**	Loan_Product_Type_Name	nvarchar	YES	100
Stg_NAV_Loans	Application_Date	datetime	YES	NULL	**Dim_NavLoans**	Application_Date	datetime	YES	NULL
Stg_NAV_Loans	Date_Approved	datetime	YES	NULL	**Dim_NavLoans**	Date_Approved	datetime	YES	NULL
Stg_NAV_Loans	Loan_Status	int	YES	NULL	**Dim_NavLoans**	Loan_Status	int	YES	NULL
Stg_NAV_Loans	Approve_Document_Date	datetime	YES	NULL	**Dim_NavLoans**	Approve_Document_Date	datetime	YES	NULL
Stg_NAV_Loans	Issued_Date	datetime	YES	NULL	**Dim_NavLoans**	Issued_Date	datetime	YES	NULL
Stg_NAV_Loans	Branch_Code	nvarchar	YES	20	**Dim_NavLoans**	Branch_Code	nvarchar	YES	20
Stg_NAV_Loans	Loan_Disbursement_Date	datetime	YES	NULL	**Dim_NavLoans**	Loan_Disbursement_Date	datetime	YES	NULL
Stg_NAV_Loans	Branch_Name	nvarchar	YES	50	**Dim_NavLoans**	Branch_Name	nvarchar	YES	50
Stg_NAV_Loans	MNO	nvarchar	YES	20	**Dim_NavLoans**	MNO	nvarchar	YES	20
Stg_NAV_Loans	Account_No	nvarchar	YES	20	**Dim_NavLoans**	Account_No	nvarchar	YES	20
Stg_NAV_Loans	TSC_No	nvarchar	YES	20	**Dim_NavLoans**	TSC_No	nvarchar	YES	20
Stg_NAV_Loans	Loans_Category_SASRA	int	YES	NULL	**Dim_NavLoans**	Loans_Category_SASRA	int	YES	NULL
Stg_NAV_Loans	Loans Category	int	YES	NULL	**Dim_NavLoans**	Loans_Category	int	YES	NULL
					Dim_NavLoans	Source_Flag	nvarchar	YES	50
					Dim_NavLoans	Load_DTS	datetime	YES	NULL
					Dim_NavLoans	Updated_DTS	datetime	YES	NULL
					Dim_NavLoans	Is_Current	bit	YES	NULL
							14		
					Dim_NavLoanSecurity	Dim_NavLoanSecurity_SK	int	NO	NULL
Stg_NAV_LoanSecuri	Loan_Type	nvarchar	YES	20	**Dim_NavLoanSecurity**	Loan_Type	nvarchar	YES	20
Stg_NAV_LoanSecuri	Type	int	YES	NULL	**Dim_NavLoanSecurity**	Type	int	YES	NULL
					Dim_NavLoanSecurity	Value	int	YES	NULL
					Dim_NavLoanSecurity	Source_Flag	nvarchar	YES	5
					Dim_NavLoanSecurity	Load_DTS	datetime	YES	NULL
					Dim_NavLoanSecurity	Updated_DTS	datetime	YES	NULL
					Dim_NavLoanSecurity	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA	DW Table	DW Fields	Data Type	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
							15		
						Dim_CrmCallLog_SK	int	NO	
Stg_CRM_Call_Log	Category	nvarchar	YES	4000	**Dim_CrmCallLog**	Category	nvarchar	YES	4000
Stg_CRM_Call_Log	Date	datetime	YES	NULL	**Dim_CrmCallLog**	Date	datetime	YES	NULL
Stg_CRM_Call_Log	ID	int	NO	NULL	**Dim_CrmCallLog**	ID	int	YES	NULL
Stg_CRM_Call_Log	IssueType	nvarchar	YES	4000	**Dim_CrmCallLog**	Issue_Type	int	YES	4000
Stg_CRM_Call_Log	Load_Date	datetime	YES	NULL	**Dim_CrmCallLog**				
Stg_CRM_Call_Log	Member	nvarchar	YES	4000	**Dim_CrmCallLog**	Member	nvarchar	YES	4000
Stg_CRM_Call_Log	new_Description	int	YES	NULL	**Dim_CrmCallLog**	New_Description	int	YES	NULL
Stg_CRM_Call_Log	new_IssueType	int	YES	NULL	**Dim_CrmCallLog**	New_Issue_Type	int	YES	NULL
Stg_CRM_Call_Log	Notes	nvarchar	YES	MAX	**Dim_CrmCallLog**	Notes	nvarchar	YES	MAX
Stg_CRM_Call_Log	OwnerID	uniqueidentifier	YES	NULL	**Dim_CrmCallLog**	OwnerID	uniqueidentifi	YES	NULL
Stg_CRM_Call_Log	OwnerIDName	nvarchar	YES	160	**Dim_CrmCallLog**	Owner_ID_Name	nvarchar	YES	160
Stg_CRM_Call_Log	PhoneNumber	nvarchar	YES	200	**Dim_CrmCallLog**	PhoneNumber	nvarchar	YES	200
						Source_Flag	uniqueidentifi	YES	50
						Updated_DTS	datetime	YES	NULL
						Is_Current	bit	YES	NULL
						Load_DTS	datetime	YES	NULL
							16		
					Dim_NavMemberLedgerEn	Dim_NavMemberLedgerEntry_SK	int	NO	NULL
Stg_NAV_MemberLe	Customer_No	nvarchar	YES	20	**Dim_NavMemberLedgerEn**	Customer_No	nvarchar	YES	20
Stg_NAV_MemberLe	Loan_No	nvarchar	YES	20	**Dim_NavMemberLedgerEn**	Loan_No	nvarchar	YES	20
Stg_NAV_MemberLe	Transaction Type	int	YES	NULL	**Dim_NavMemberLedgerEn**	Transaction_Type	int	YES	NULL
					Dim_NavMemberLedgerEn	Source_Flag	nvarchar	YES	50
					Dim_NavMemberLedgerEn	Load_DTS	datetime	YES	NULL
					Dim_NavMemberLedgerEn	Updated_DTS	datetime	YES	NULL
					Dim_NavMemberLedgerEn	Is_Current	bit	YES	NULL
							17		
					Dim_NavStoreUsage	Dim_NavStoreusage_SK	int	NO	NULL
Stg_NAV_Storeusage	No_	nvarchar	YES	20	**Dim_NavStoreUsage**	No	nvarchar	YES	20
Stg_NAV_Storeusage	Description	nvarchar	YES	50	**Dim_NavStoreUsage**	Description	nvarchar	YES	50
Stg_NAV_Storeusage	Required Date	datetime	YES	NULL	**Dim_NavStoreUsage**	Required_Date	datetime	YES	NULL
Stg_NAV_Storeusage	Branch_Code	nvarchar	YES	20	**Dim_NavStoreUsage**	Branch_Code	nvarchar	YES	20
Stg_NAV_Storeusage	Branch	nvarchar	YES	50	**Dim_NavStoreUsage**	Branch	nvarchar	YES	50
Stg_NAV_Storeusage	Department_Code	nvarchar	YES	20	**Dim_NavStoreUsage**	Department_Code	nvarchar	YES	20
Stg_NAV_Storeusage	Department	nvarchar	YES	50	**Dim_NavStoreUsage**	Department	nvarchar	YES	50
					Dim_NavStoreUsage	Source_Flag	nvarchar(50)	YES	50
					Dim_NavStoreUsage	Load_DTS	datetime	YES	NULL
					Dim_NavStoreUsage	Updated_DTS	datetime	YES	NULL
					Dim_NavStoreUsage	Is_Current	bit	YES	NULL

Stage Tables	Field Name	Data Type	IS_NULLABLE	TER_MA		DW Table	DW Fields	Data Type	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								18		
						Dim_NavTransaction	Dim_NavTransactions_SK	int	NO	NULL
Stg_NAV_Transaction	Account_No	nvarchar	YES	20		**Dim_NavTransaction**	Account_No	nvarchar	YES	20
Stg_NAV_Transaction	Transaction_Type	nvarchar	YES	20		**Dim_NavTransaction**	Transaction_Type	nvarchar	YES	20
Stg_NAV_Transaction	Transaction_Description	nvarchar	YES	50		**Dim_NavTransaction**	Transaction_Description	nvarchar	YES	50
Stg_NAV_Transaction	Transaction_Date	datetime	YES	NULL		**Dim_NavTransaction**	Transaction_Date	datetime	YES	NULL
Stg_NAV_Transaction	Transaction_Branch	nvarchar	YES	20		**Dim_NavTransaction**	Transaction_Branch	nvarchar	YES	20
Stg_NAV_Transaction	Branch_Name	nvarchar	YES	50		**Dim_NavTransaction**	Branch_Name	nvarchar	YES	50
Stg_NAV_Transaction	Transaction_Mode	int	YES	NULL		**Dim_NavTransaction**	Transaction_Mode	int	YES	NULL
						Dim_NavTransaction	Source_Flag	nvarchar(50)	YES	50
						Dim_NavTransaction	Load_DTS	datetime	YES	NULL
						Dim_NavTransaction	Updated_DTS	datetime	YES	NULL
						Dim_NavTransaction	Is_Current	bit	YES	NULL
								19		
						Dim_NavVendor	Dim_NavVendor_SK	int	NO	NULL
Stg_NAV_Vendor	Loan_No	nvarchar	YES	100		**Dim_NavVendor**	Loan_No	nvarchar	YES	100
Stg_NAV_Vendor	Account Type	nvarchar	YES	Dim_NavGLEntry		**Dim_NavVendor**	Account_Type	nvarchar	YES	20
Stg_NAV_Vendor						**Dim_NavVendor**	Source_Flag	nvarchar(50)	YES	50
Stg_NAV_Vendor						**Dim_NavVendor**	Load_DTS	datetime	YES	NULL
Stg_NAV_Vendor						**Dim_NavVendor**	Updated_DTS	datetime	YES	NULL
Stg_NAV_Vendor						**Dim_NavVendor**	Is_Current	bit	YES	NULL
								20		
						Dim_NavGlobalDimension	Dim_NavGlobalDimensionValue_SK	int	NO	NULL
Stg_NAV_DimensionV	Dimension_Category	nvarchar	NO	30		**Dim_NavGlobalDimension**	Dimension_Category	nvarchar	YES	30
Stg_NAV_DimensionV	Dimension_Code	nvarchar	NO	30		**Dim_NavGlobalDimension**	Dimension_Code	nvarchar	YES	30
Stg_NAV_DimensionV	Dimension_Description	nvarchar	NO	50		**Dim_NavGlobalDimension**	Dimension_Description	nvarchar	YES	50
						Dim_NavGlobalDimension	Source_Flag	nvarchar(50)	YES	50
						Dim_NavGlobalDimension	Load_DTS	datetime	YES	NULL
						Dim_NavGlobalDimension	Updated_DTS	datetime	YES	NULL
						Dim_NavGlobalDimension	Is_Current	bit	YES	NULL
								21		
						Dim_NavBankAccountLedg	Dim_NavBankAccountLedger_SK	int	NO	NULL
Stg_NAV_BankAccou	Bank Account No_	nvarchar	YES	20		**Dim_NavBankAccountLedg**	Bank_Account_No	nvarchar	YES	20
Stg_NAV_BankAccou	Global Dimension 1 Code	nvarchar	YES	20		**Dim_NavBankAccountLedg**	Global_Dimension_1_Code	nvarchar	YES	20
Stg_NAV_BankAccou	ID	int	NO	NULL						
Stg_NAV_BankAccou	Load_Date	datetime	YES	NULL		**Dim_NavBankAccountLedg**	Load_Date	datetime	YES	NULL
Stg_NAV_BankAccou	Posting Date	date	YES	NULL		**Dim_NavBankAccountLedg**	Posting_Date	date	YES	NULL
Stg_NAV_BankAccou	Search Name	nvarchar	YES	50		**Dim_NavBankAccountLedg**	Search_Name	nvarchar	YES	50
						Dim_NavBankAccountLedg	Source_Flag	nvarchar(50)	YES	50
						Dim_NavBankAccountLedg	Load_DTS	datetime	YES	NULL
						Dim_NavBankAccountLedg	Updated_DTS	datetime	YES	NULL
						Dim_NavBankAccountLedg	Is_Current	bit	YES	NULL

Fact TABLE Mapping

SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M	DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMU
						1			
					FactMembers	Fact_Members_SK	int	NO	NULL
Stg_NAV_Members	BenevolentFund	numeric	YES	NULL	**FactMembers**	BenevolentFund	numeric	YES	NULL
	Dividend Defaulter	tinyint	YES	NULL	**FactMembers**	Dividend Defaulter	tinyint	YES	NULL
						2			
					FactNavGLEntry	Fact_G_L_Entry_SK	int	NO	NULL
Stg_NAV_G_L Entry	Amount	numeric	YES	NULL	**FactNavGLEntry**	Amount	numeric	YES	NULL
	FactNavGLEntry	Debit Amount	numeric	YES	**FactNavGLEntry**	Debit Amount	numeric	YES	NULL
	FactNavGLEntry	Credit Amount	numeric	YES	**FactNavGLEntry**	Credit Amount	numeric	YES	NULL
						3			
Stg_NAV_Guarantors	Amount_Guaranteed	numeric	YES	NULL	**Fact_NAV_Guarantors**	Fact_NAV_Guarantors_SK	int		
						Amount_Guaranteed	numeric	YES	NULL
						4			
Stg_NAV_ItemLedgerEntry	Quantity	numeric	YES	NULL	**Fact_NAV_ItemLedger**	Fact_NAV_ItemLedgerEntry_SK	int		
						Quantity	numeric	YES	NULL
						5			
Stg_NAV_LedgerEntry	Amount	numeric	YES	NULL	**Fact_NAV_LedgerEntr**	Fact_NAV_LedgerEntry_SK	int		
						Amount	numeric	YES	NULL
						6			
Stg_NAV_LoanPaymentSche	Monthly_Repayment	numeric	YES	NULL	**Fact_NAV_LoanPayme**	Fact_NAV_LoanPaymentSchedule_SK	int		
						Monthly_Repayment	numeric	YES	NULL

SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M		DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								7		
Stg_NAV_Loans	Amount_Disbursed	numeric	YES	NULL		Fact_NAV_Loans	Fact_NAV_Loans_SK	int	NO	NULL
	Outstanding_Interest_To_Date	numeric	YES	NULL			Amount_Disbursed	numeric	YES	NULL
	Net_Liability	numeric	YES	NULL			Outstanding_Interest_To_Date	numeric	YES	NULL
	Approved_Amount	numeric	YES	NULL			Net_Liability	numeric	YES	NULL
	Requested_Amount	numeric	YES	NULL			Approved_Amount	numeric	YES	NULL
	Current_Shares	numeric	YES	NULL			Requested_Amount	numeric	YES	NULL
	Shares_Balance	numeric	YES	NULL			Current_Shares	numeric	YES	NULL
							Shares_Balance	numeric	YES	NULL
							Dim_NAV_LoansTopUp_SK	int	NO	NULL
							Dim_NAV_Transactions_SK	int	NO	NULL
							Dim_NAV_MemberLedgerEntry_SK	int	NO	NULL
							DimMembers_SK	int	NO	NULL
							Dim_NAV_Guarantors_SK	int	NO	NULL
							Dim_NAV_G-L_Entry_SK	int	NO	NULL
							Dim_NAV_LoanMemberApplication_SK	int	NO	NULL
							Dim_NAV_LoanPaymentSchedule_SK	int	NO	NULL
							Source_Flag	nvarchar(50)		
							Load_DTS	datetime		
							Updated_DTS	datetime		
							Is_Current	bit		
								8		
Stg_NAV_LoanSecurity	Value	numeric	YES	NULL		Fact_NAV_LoanSecuri	Fact_NAV_LoanSecurity_SK	int		
							Value	numeric	YES	NULL
								9		
Stg_NAV_LoansTopUp	Total Top Up	numeric	YES	NULL		Fact_NAV_LoansTopU	Fact_NAV_LoansTopUp_SK	int		
	Principle Top Up	numeric	YES	NULL			Total Top Up	numeric	YES	NULL
	Commision	numeric	YES	NULL			Principle Top Up	numeric	YES	NULL
							Commision	numeric	YES	NULL
								10		
Stg_NAV_MemberLedgerEntr	Amount	numeric	YES	NULL		Fact_NavMemberLedg	Fact_NavMemberLedgerEntryID	int		
							Dim_NavMemberLedgerEntry_SK	numeric	YES	NULL
							Amount			

SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M		DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								8		
Stg_NAV_LoanSecurity	Value	numeric	YES	NULL		Fact_NAV_LoanSecuri	Fact_NAV_LoanSecurity_SK	int		
							Value	numeric	YES	NULL
								9		
Stg_NAV_LoansTopUp	Total Top Up	numeric	YES	NULL		Fact_NAV_LoansTopU	Fact_NAV_LoansTopUp_SK	int		
	Principle Top Up	numeric	YES	NULL			Total Top Up	numeric	YES	NULL
	Commision	numeric	YES	NULL			Principle Top Up	numeric	YES	NULL
							Commision	numeric	YES	NULL
								10		
Stg_NAV_MemberLedgerEntr	Amount	numeric	YES	NULL		Fact_NavMemberLedg	Fact_NavMemberLedgerEntryID	int		
							Dim_NavMemberLedgerEntry_SK	numeric	YES	NULL
							Amount			
								11		
Stg_NAV_Storeusage	Quantity	numeric	YES	NULL		Fact_NAV_Storeusage	Fact_NAV_Storeusage_SK	int	NO	NULL
							Dim_NavGlobalDimensionValue_SK	int	NO	NULL
							Quantity	numeric	YES	NULL
							Source_Flag	nvarchar(50)		
							Load_DTS	datetime		
							Updated_DTS	datetime		
							Is_Current	bit		
								12		
Stg_NAV_Transactions	Amount	numeric	YES	NULL		Fact_NAV_Transaction	Fact_NAV_Transactions_SK	int		
							Dim_NAV_Guarantors_SK	int		
							Dim_NAV_Loans_SK	int		
							Dim_NAV_LoansTopUp_SK	int		
							Amount	numeric	YES	NULL
							Source_Flag	nvarchar(50)		
							Load_DTS	datetime		
							Updated_DTS	datetime		
							Is_Current	bit		

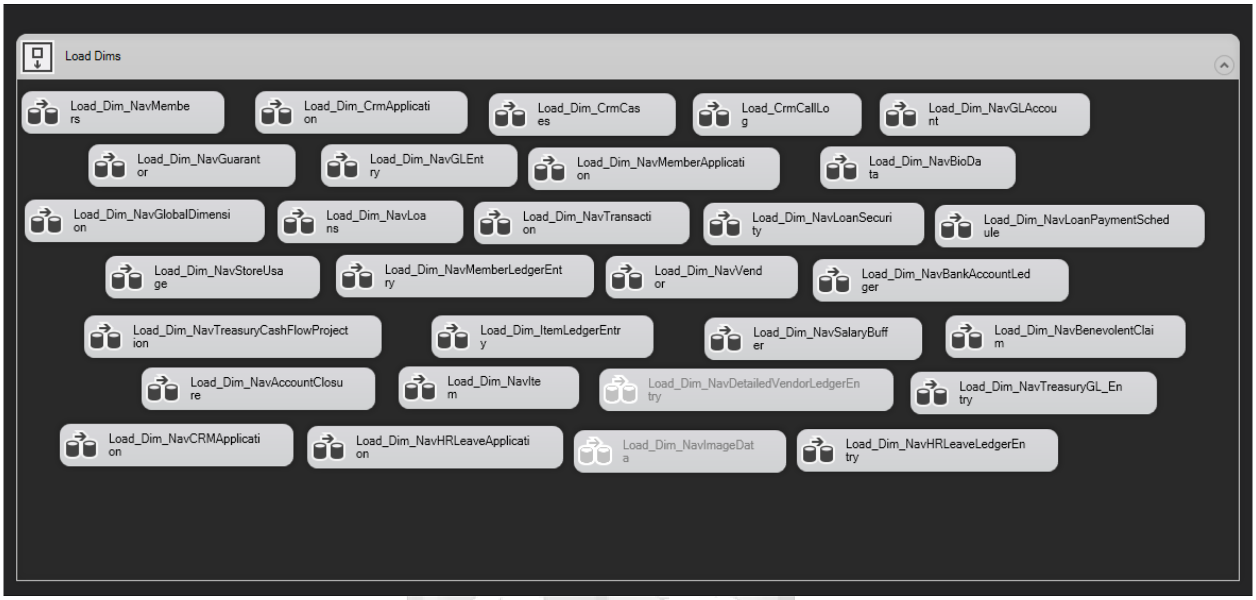
SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M		DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								13		
Stg_NAV_Vendor	Oustanding_Balance	numeric	YES	NULL		Fact_NAV_Vendor	Fact_NAV_Vendor_SK	int	NO	NULL
							Dim_NavGlobalDimensionValue_SK	int	NO	NULL
							Dim_NAV_Loans_SK	int	NO	NULL
							Oustanding_Balance	numeric	YES	NULL
							Source_Flag	nvarchar(50)		
							Load_DTS	datetime		
							Updated_DTS	datetime		
							Is_Current	bit		
								14		
						Fact_BankAccountLed	Fact_NAV_BankLedgerEntryID	int	NO	NULL
Stg_NAV_BankAccountLedge	Amount	numeric	YES	NULL		Fact_BankAccountLed	Amount	numeric	YES	NULL
						Fact_BankAccountLed	Dim_Date_SK	int	YES	NULL
						Fact_BankAccountLed	Dim_NavBankAccountLedgerEntry_SK	int	YES	NULL
						Fact_BankAccountLed	Dim_NavGlobalDimensionValue_SK	int	YES	NULL
						Fact_BankAccountLed	Is_Current	bit	YES	NULL
						Fact_BankAccountLed	Load_DTS	datetime	YES	NULL
						Fact_BankAccountLed	Source_Flag	nvarchar	YES	50
						Fact_BankAccountLed	Updated_DTS	datetime	YES	NULL

SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M		DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								15		
Stg_NAV_Loans	Amount_Disbursed	numeric	YES	NULL		**Fact_NavLoan**	Amount_Disbursed	numeric	YES	NULL
Stg_NAV_Loans	Approved_Amount	numeric	YES	NULL		**Fact_NavLoan**	Amount_Guaranteed	numeric	YES	NULL
Stg_NAV_Loans	Current_Shares	numeric	YES	NULL		**Fact_NavLoan**	ApplicationDate_SK	int	YES	NULL
Stg_NAV_Loans	Net_Liability	numeric	YES	NULL		**Fact_NavLoan**	Approved_Amount	numeric	YES	NULL
Stg_NAV_Loans	Outstanding_Interest_To_Date	numeric	YES	NULL		**Fact_NavLoan**	ApprovedDate_SK	int	YES	NULL
Stg_NAV_Loans	Requested_Amount	numeric	YES	NULL		**Fact_NavLoan**	Commision	numeric	YES	NULL
Stg_NAV_Loans	Shares_Balance	numeric	YES	NULL		**Fact_NavLoan**	Current_Shares	numeric	YES	NULL
						Fact_NavLoan	Dim_NavGlobalDimensionValue_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavLoanMemberApplication_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavLoanPaymentSchedule_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavLoans_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavLoanSecurity_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavMember_SK	int	YES	NULL
						Fact_NavLoan	Dim_NavMemberLedgerEntry_SK	int	YES	NULL
						Fact_NavLoan	DimNavGuarantors_SK	int	YES	NULL
						Fact_NavLoan	DimNavVendor_SK	int	YES	NULL
						Fact_NavLoan	DisbursementDate_SK	int	YES	NULL
						Fact_NavLoan	Fact_NavLoanID	int	NO	NULL
						Fact_NavLoan	Is_Current	bit	YES	NULL
						Fact_NavLoan	IssuedDate_SK	int	YES	NULL
						Fact_NavLoan	Load_DTS	datetime	YES	NULL
						Fact_NavLoan	Net_Liability	numeric	YES	NULL
						Fact_NavLoan	Outstanding_Interest_To_Date	numeric	YES	NULL
						Fact_NavLoan	Principle Top Up	numeric	YES	NULL
						Fact_NavLoan	Requested_Amount	numeric	YES	NULL
						Fact_NavLoan	Shares_Balance	numeric	YES	NULL
						Fact_NavLoan	Source_Flag	nvarchar	YES	50
						Fact_NavLoan	Total Top Up	numeric	YES	NULL
						Fact_NavLoan	Updated_DTS	datetime	YES	NULL

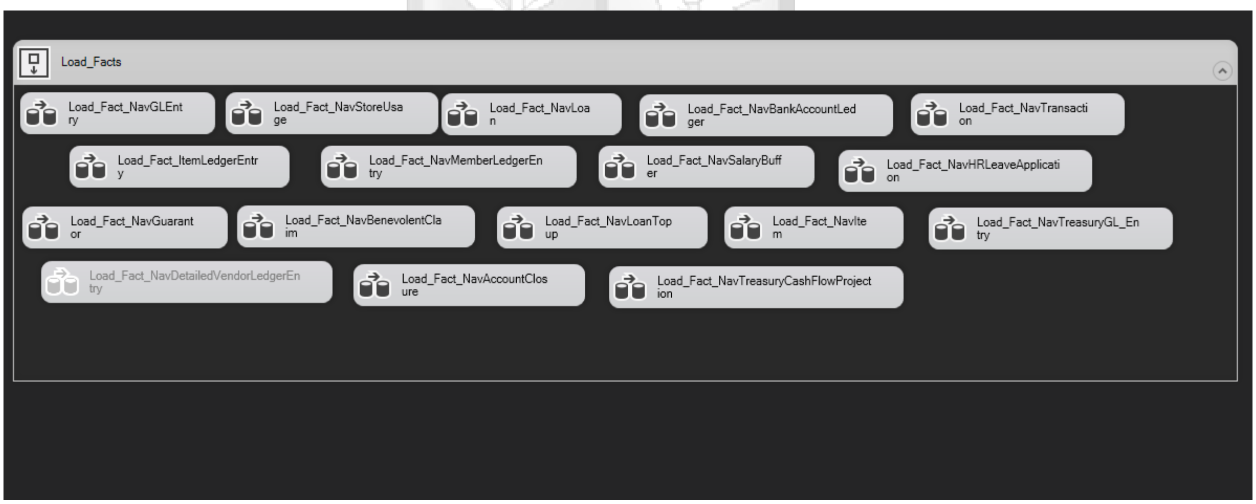
SourceTable	FieldName	DATA_TYPE	IS_NUL	CHARACTER_M		DWTable	FieldName	DATA_TYPE	IS_NULLABLE	CHARACTER_MAXIMUM_LENGTH
								16		
Stg_NAV_G_L Entry	Amount	numeric	YES	NULL		**Fact_NavGLEntry**	Amount	numeric	YES	NULL
Stg_NAV_G_L Entry	Credit Amount	numeric	YES	NULL		**Fact_NavGLEntry**	Credit_Amount	numeric	YES	NULL
Stg_NAV_G_L Entry	Debit Amount	numeric	YES	NULL		**Fact_NavGLEntry**	Date_SK	int	YES	NULL
						Fact_NavGLEntry	Debit_Amount	numeric	YES	NULL
						Fact_NavGLEntry	Dim_NavGLAccount_SK	int	YES	NULL
						Fact_NavGLEntry	Dim_NavGLEntry_SK	int	YES	NULL
						Fact_NavGLEntry	Fact_NavGLEntryID	int	NO	NULL
						Fact_NavGLEntry	Is_Current	bit	YES	NULL
						Fact_NavGLEntry	Load_DTS	datetime	YES	NULL
						Fact_NavGLEntry	Source_Flag	nvarchar	YES	50
						Fact_NavGLEntry	Updated_DTS	datetime	YES	NULL
								17		
Stg_NAV_StoreUsage	Quantity	numeric	YES	NULL		**Fact_NavStoreUsage**	Dim_NavGlobalDimensionValue_SK	int	YES	NULL
						Fact_NavStoreUsage	Fact_NavStoreusageID	int	NO	NULL
						Fact_NavStoreUsage	Is_Current	bit	YES	NULL
						Fact_NavStoreUsage	Load_DTS	datetime	YES	NULL
						Fact_NavStoreUsage	Quantity	numeric	YES	NULL
						Fact_NavStoreUsage	Source_Flag	nvarchar	YES	50
						Fact_NavStoreUsage	Updated_DTS	datetime	YES	NULL

Appendix D: ETL Implementation SSIS Packages

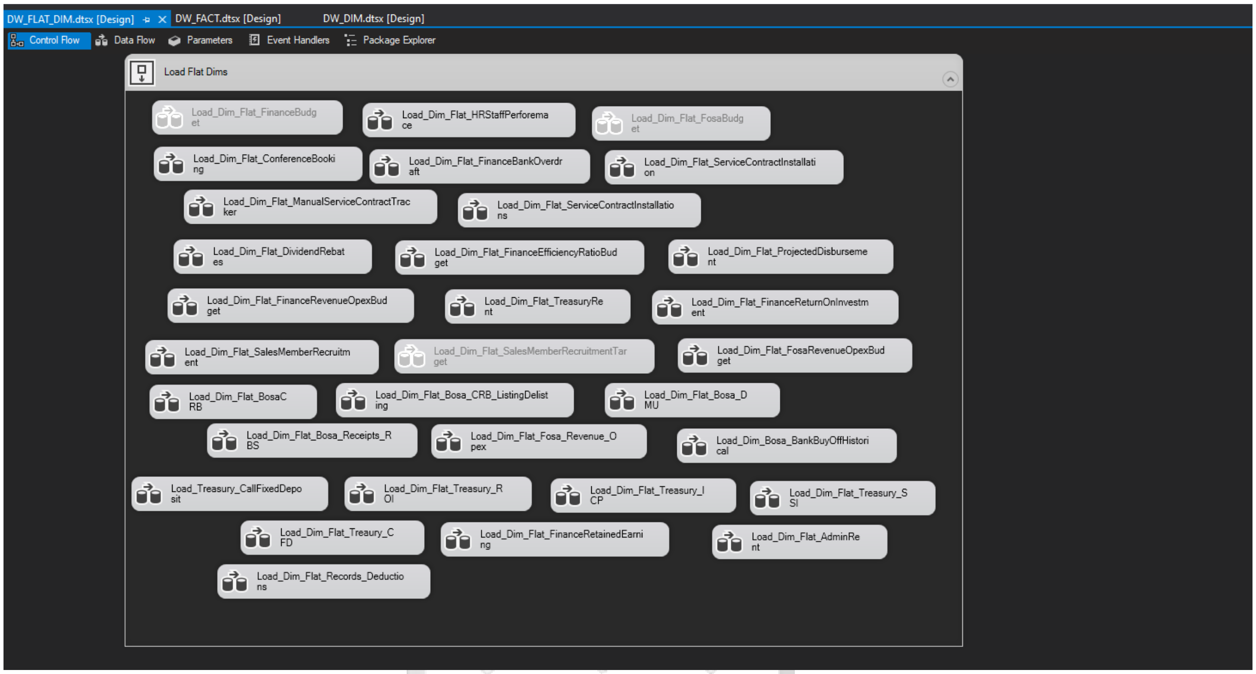
ETL Package to Load Staging Area Data to Dimension Tables in Data Warehouse



ETL Package to Load Staging Area Data to Fact Tables in Data Warehouse

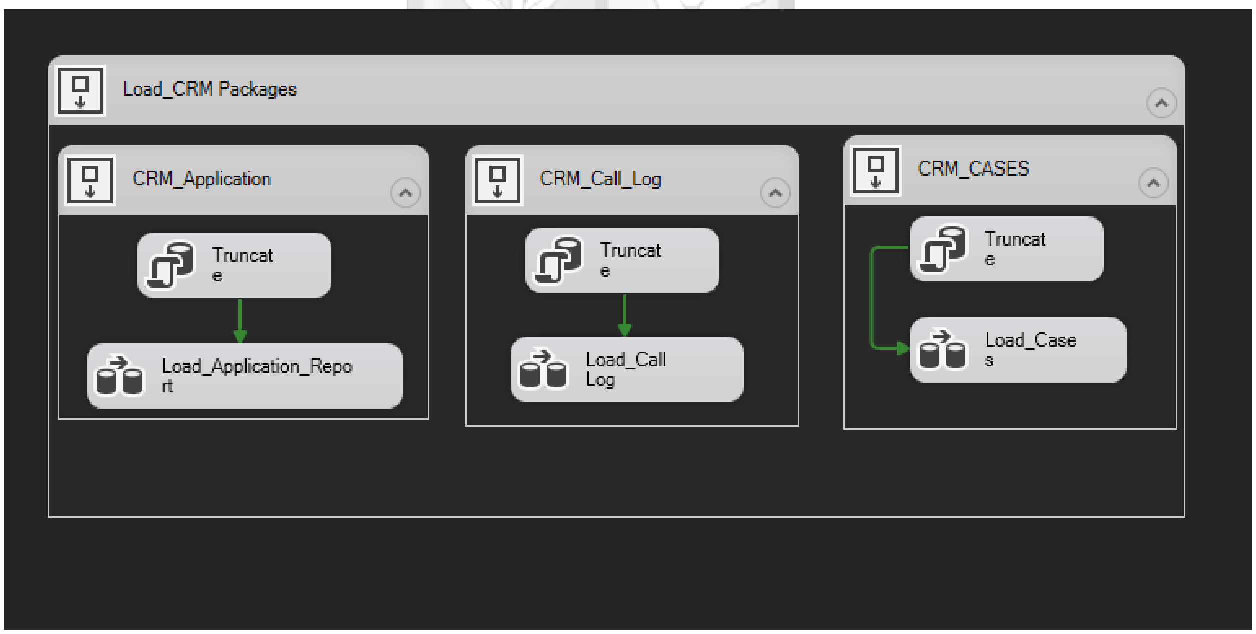


ETL to Loading Flat Files Data into the Dimension Table in SQL SERVER



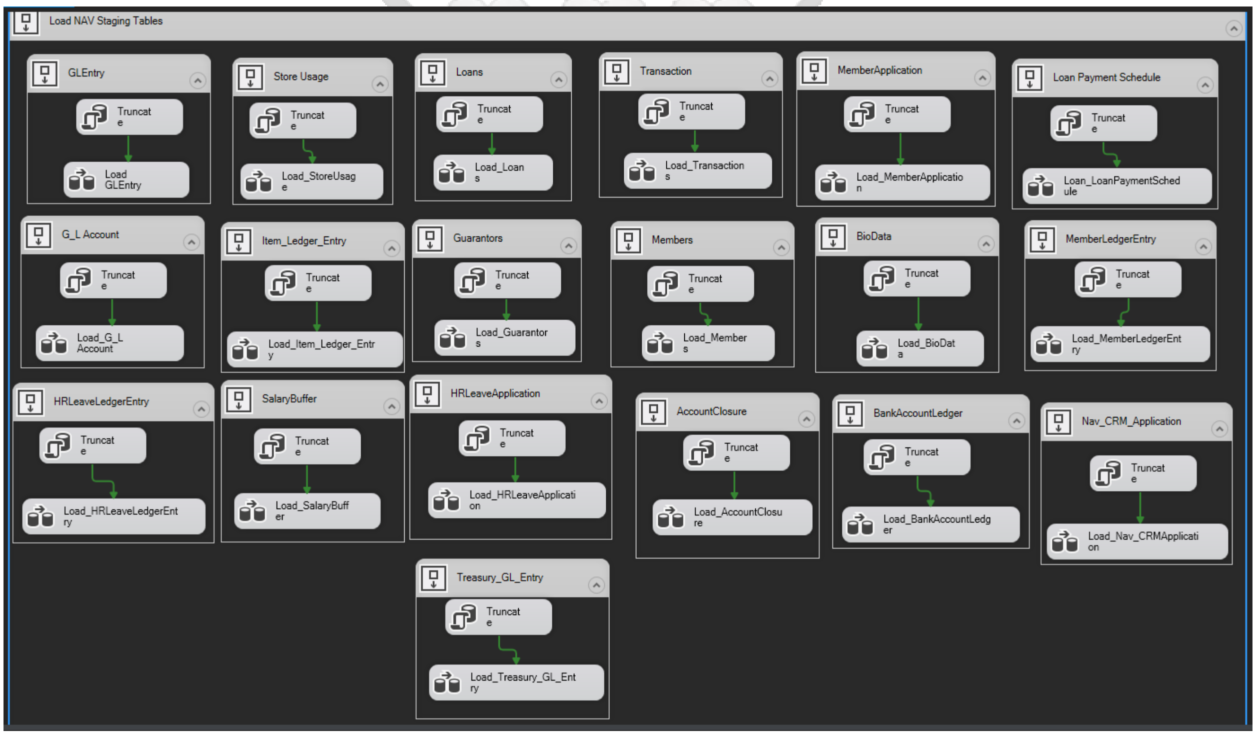
ETL to Loading Flat Files Data into the fact Table in SQL SERVER

ETL Package to Load CRM Data to Staging Area



ETL Package to Load Flat File Data to Staging Area

ETL Package to Load Navision Source Data to Staging Area



Appendix E: Originality Report

Document Information

Analyzed document	Design of Data Warehouse and Business Intelligence Systems for Decision Making Within a DT-SACCO Ecosystem_proposal_137022.docx (D135596535)
Submitted	2022-05-05T23:05:00.0000000
Submitted by	
Submitter email	John.Olaoye@strathmore.edu
Similarity	7%
Analysis address	library.strath@analysis.urkund.com

Appendix F: Ethical Review Certificate

Strathmore
UNIVERSITY

9th May 2022

Mr Olaoye John Adeyemi,
john.olaoye@strathmore.edu

Dear Mr Olaoye,

RE: Design of Data Warehouse and Business Intelligence Systems for Decision Making Within a SACCO Ecosystem

This is to inform you that SU-IERC has reviewed and **approved** your above **SU Masters'** research proposal. Your application reference number is **SU-IERC1327/22.** The approval period is **9th May 2022 to 8th May 2023.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-IERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 48 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 48 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

for: **Dr Ben Ngoye,**
Secretary; SU-IERC

Cc: Prof Fred Were,
Chairperson; SU-IERC

STRATHMORE UNIVERSITY INSTITUTIONAL ETHICS REVIEW COMMITTEE
(SU-IERC)
09 May 2022
Email:ethicsreview@strathmore.edu
P.O BOX 59857-00200
NAIROBI-KENYA

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