

## Application of Business Intelligence in the Financial Services Industry

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**ABSTRACT:** A highly dynamic market, violent competition, changing client demands, and the need of strict control and risk management are only some of the challenges of the business environment where modern financial companies conduct their operations. Factors such as mergers and acquisitions, deregulation, technological innovation, and competition, have forced financial companies to rethink their business. Business intelligence (BI) solutions for financial companies provide the decision makers with the ability to manage and take advantage of information resources, in order to solve the problems and make high-quality and timely decisions. The use of BI in financial services industry helps financial companies for creating a vision for financial managers, training the organization to determine realistic goals, and supporting optimal decision making. Business intelligence covers many areas of the financial services industry, and among the most important are: Relationship Marketing, Performance Management (PM), Risk Management (RM), Asset and Liability Management (ALM), and Compliance. Data warehouse (DW) and on-line analytical processes (OLAP) are the informational basis for the application of business intelligence. Data mining (DM) is important part of business intelligence and deal with complex statistical analysis, discovering hidden relationships between data and predicting the behavior trends of business systems. This paper is an attempt to straighten Economy Bank for Investment and Finance (EBIF) through business intelligence techniques to properly identify opportunities and trends in financial businesses. In this work, we propose a business intelligence system, developed on Microsoft SQL Server 2008 R2, for an Economy Bank for Investment and Finance based on the information which the company has. We utilized the business intelligence system in EBIF to accomplish complex processing and data analysis.

**KEYWORDS:** Data warehouse, Data Mining, On-Line Analytical Processing, Performance Management, Risk Management.

### 1 INTRODUCTION

Financial companies must respond to challenges such as globalization, process automation, aggressive competition, mergers and acquisitions, increased client expectations, and market segmentation. Also, financial companies must manage risks, make decisions. Decision making process must be efficient, timely, and based on reliable and accurate information derived from data. Financial data doubles every three year [1]; data are recorded for clients on their personal, property and financial features, in addition to their accounts, transactions per account, credit liabilities, loans etc.. This data is stored in transactional databases. Transactional databases are a source of rich information about a company's processes and its business environment that can be used for enhancing the business of any company, especially a financial companies. During the past few years, information-based services have become a critical part of business processes in the financial services industry (think about fraud protection and anti-money laundering) [2]. However, financial companies have a little information, and very little knowledge on many sides of their operations [3]. Let us suppose that a particular client go to a financial company and apply for a loan, financial company wants to determine the risk to the company based on client's financial history. The result of this information will aid the loan officer as to whether the company should make the decision to loan money. Such information can usually be requested from IT personnel at the financial company, who, in such cases, must spend a large amount of time to produce the requested report, so, it may be too late for decision making [4]. Therefore, having the foundation and feedback information available at the appropriate time is extremely important.

The development of technologies provides successful solution to the above-mentioned problems. A large subset of business information and knowledge management tools and applications denoted by "business intelligence" (BI). Business

intelligence can be described as "a set of techniques and tools for the transformation of data into meaningful and useful information for business analysis purposes. BI is the delivery of accurate, useful information to the decision makers within the necessary time frame to support effective daily decision making.

Business intelligence is regarded as a separate discipline encompassing elements of information technology, strategy, managerial accounting, corporate analysis and marketing. Business intelligence enables gathering, analyzing, and acting based on the business information, aimed to facilitating the resolution of problems and making the best business decisions. Financial companies are known to be among leaders in the area of using new technologies, such as BI, which is exactly why they are the fertile soil for implementing such an infrastructure [5].

BI applications use data gathered from a financial data warehouse (DW) or from a data mart to getting useful information out of financial data. Data warehouses are a special type of database, where data is organized in manner suitable for analytical processes on large dataset. A data warehouse structured specifically for reports and analysis and contains a copy of data isolated from operational database. Data warehouses and On-Line Analytical Processing (OLAP) form the informational basis for applying business intelligence. OLAP is used to answering multi-dimensional analytical queries quickly. OLAP tools enable users to analyze multidimensional data interactively from multiple perspectives. OLAP consists of three basic analytical operations: roll-up (data aggregation), drill-down, slicing and dicing. OLAP is a part of the broader category of business intelligence, which also include relational database, data mining, report writing [6]. Data mining (DM) and knowledge discovery are important segments of business intelligence. Data mining is the computational process of discovering patterns in large data sets. DM dealing with complex statistical analyses and discovering hidden relationships between data and forecasting the behavior trends of financial systems[7].

## 2 BUSINESS INTELLIGENCE AND FINANCIAL INDUSTRY

Business intelligence solutions for financial services companies should provide the decision makers from all business segments of the financial company with the ability to manage and exploit the information potential of a huge amount of internal and external data resources.

With the conditions of growing competition, analyzing the total client relationships is vital for successful financial companies operations. Using BI solution to analyze organizational data, financial companies can improve and streamline operational efficiency, not only to enhance the sales and marketing strategies and develop better customer service programs, but also mitigate risk, through the development of risk management processes more convenient [8].

Business intelligence covers many areas of financial services, the most important being (Table 1):

- Relationship Marketing;
- Performance Management;
- Risk Management;
- Asset and Liability Management;
- Compliance.

*Table 1. Areas Covered by Business intelligence in Financial Services*

Focus Area	Analytical Requirements	
<b>Relationship Marketing</b>	<ul style="list-style-type: none"> <li>• Customer Interaction Analysis</li> <li>• Customer Investment Profile</li> <li>• Wallet Share Analysis</li> <li>• Customer Complaints</li> <li>• Delinquency Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Customer Loyalty</li> <li>• Market Analysis</li> <li>• Campaign Analysis</li> <li>• Cross sell Analysis</li> </ul>
<b>Performance Management</b>	<ul style="list-style-type: none"> <li>• Transaction Analysis</li> <li>• Activity Based Costing Analysis</li> <li>• Insurance Product Analysis</li> <li>• Investment Arrangement Analysis</li> <li>• Profitability Analysis</li> <li>• Channel Profitability</li> <li>• Customer Lifetime Value</li> </ul>	<ul style="list-style-type: none"> <li>• Customer Profitability</li> <li>• Location Profitability</li> <li>• Product Profitability</li> <li>• Product Analysis</li> <li>• Organization Unit Profitability</li> <li>• Performance Measurement</li> <li>• Business Procedure Performance</li> </ul>

<b>Risk Management</b>	<ul style="list-style-type: none"> <li>• Interest Rate Risk Analysis</li> <li>• Credit Risk Profile</li> <li>• Credit Risk Assessment</li> <li>• Credit Risk mitigation Assessment</li> <li>• Asset Securitization Analysis</li> <li>• Operational Risk Assessment</li> <li>• Outstanding Analysis</li> <li>• Portfolio Credit Exposure</li> <li>• Security Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Liquidity Risk</li> <li>• Collections Analysis</li> <li>• Insurance Risk Profile</li> <li>• Authority Profiling</li> <li>• Credit Risk Analysis</li> <li>• Debt Restructuring</li> <li>• Involved Party Exposure</li> <li>• Non-Performing Loan</li> <li>• Operational Risk Loss Analysis</li> </ul>
<b>Asset &amp; Liability Management</b>	<ul style="list-style-type: none"> <li>• Interest Rate Sensitivity</li> <li>• Liquidity Analysis</li> <li>• Short Term funding Management</li> <li>• Financial Management Accounting</li> <li>• Capital Allocation Analysis</li> <li>• Capital Procurement</li> <li>• Credit Loss Provision</li> </ul>	<ul style="list-style-type: none"> <li>• Funds Maturity Analysis</li> <li>• Income Analysis</li> <li>• Net Interest Margin Variance</li> <li>• Structured Finance Analysis</li> <li>• Equity Position Exposure</li> <li>• Position Valuation Analysis</li> </ul>
<b>Compliance</b>	<ul style="list-style-type: none"> <li>• Financial Capital Adequacy Analysis</li> <li>• Structure of Regulatory Analysis</li> <li>• Foreign Financial Account Analysis</li> <li>• Suspicious Activity Analysis</li> <li>• Transaction Activity Analysis</li> <li>• Balance Sheet Portfolio</li> <li>• Balance Sheet Classified Approach Analysis</li> <li>• Balance Sheet Order Of Liquidity Approach Analysis</li> <li>• Balance Sheet Net Assets Approach Analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Cash Flow Direct Analysis</li> <li>• Cash Flow Indirect Analysis</li> <li>• Cash Flow Direct Financial Institution Analysis</li> <li>• Cash Flow Indirect Financial Institution Analysis</li> <li>• Income Statement By Function Analysis</li> <li>• Income Statement By Nature Analysis</li> <li>• Income Statement Financial Institution Approach Analysis</li> <li>• Statement Of Changes in Equity Analysis</li> </ul>

## 2.1 RELATIONSHIP MARKETING

The American Marketing Association's definition of marketing indicates that "marketing is an organizational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders". Thus, the overall definition of marketing identifies the process of managing relationships as one of its key charters, parallel to more traditional marketing-mix factors. Relationship management is defined as the identification, establishment, maintenance, enhancement, modification and termination of relationships with customers to create value for customers and profit for organization by a series of relational exchanges that have both a history and a future. Relational exchanges can be viewed under transaction cost analysis and social exchange theories depending on the context[9].

Relationship marketing (RM) is the process of identifying, developing, maintaining, and terminating relational exchanges with the purpose of enhancing performance. Relationship marketing be implemented to improve customer loyalty and seller's sales and profits[10].

## 2.2 PERFORMANCE MANAGEMENT

Performance management enable managers to monitor key performance indicators (KPIs) through scorecard reports. KPI used for continuous monitoring of the current balance with defined objectives. The users (especially managers) should be provided with ability to rapid and efficient access to scorecards that showing the key performance indicator values, alert them when these values exceed the allowed limits, and facilitate drill-down. The requirements of performance management methodology requires providing an infrastructure to support the planning and budgeting process. This means that the system should support the possibility of defining the target values across of all dimensions of business operations (clients, services and organizational units), considering the time dimension[11].

### **2.3 RISK MANAGEMENT**

Risk management is a process of identification, analysis, measurement, control and reporting posing a threat to the achievement of its goals and individual business activities, so that the achieved risk level should not endanger the financial company's safe and stable operation. Some of this risks include credit risks, market risks, interest rate risks, foreign change risks, liquidity risks, operational risks, reputational risks, etc.

The purpose of risk management is to enable the financial company to monitor and control the sizes and concentrations of risks resulting from its activities. The risk management process take place in several interconnected stages: risk exposure identification, risk evaluation and assessment, risk control, risk financing and risk management. The risk management process implies identifying and analyzing all risks within the company, defining appropriate risk limits, and monitoring risk limits via contemporary information systems in a controlled manner[12].

### **2.4 ASSET AND LIABILITY MANAGEMENT**

Asset and liability management (ALM) is a process of managing policies and procedures that address financial risks associated with changing foreign exchange rates, interest rates and other factors that can affect a company's liquidity which is one of the fundamental principles of doing business in financial company and denotes the company's ability to meet its current financial obligations continuously. ALM seeks to limit risk to acceptable levels by monitoring and anticipating possible pricing differences between a company's assets and liabilities. The fundamental task of the ALM concept is to establish the correlation between the risk and profitability of individual financial company transactions. This is a method of preventing high risks, which can lead to losses in companies.

Business intelligence solutions for ALM should enable generating a complete set of internal reports – starting from balance sheets, liquidity analysis and cash flow, down to maturity and interest rate structure[5].

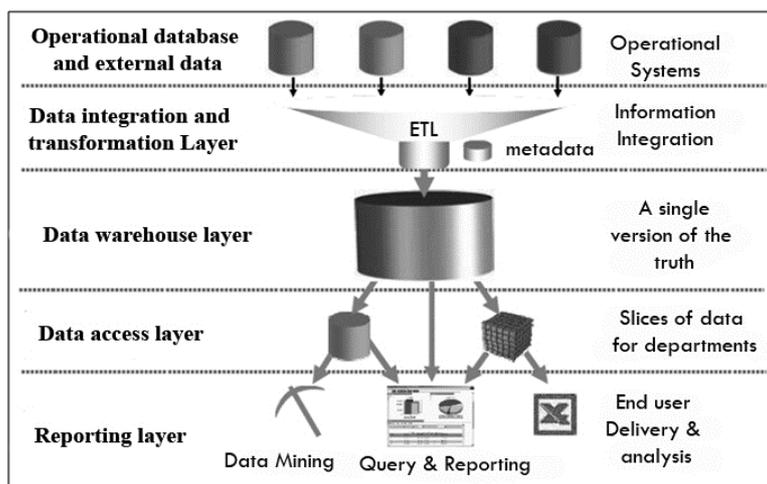
## **3 BUSINESS INTELLIGENCE SYSTEM ARCHITECTURE IN THE FINANCIAL INDUSTRY**

The architecture of a financial business intelligence system is very heterogeneous and include several layers (figure 1):

- Operational database and external data;
- The data integration and transformation layers;
- The data warehouse layer;
- The data access layer (application, OLAP, data mining, etc); and
- The front end (reporting layer).

Operational (transactional) databases are created to meet the needs of daily operations. The financial transactional data processing system, i.e. On-line Transaction processing (OLTP) is the company's basic information system. It's used to support day-to-day business transaction activities (entering and processing accounts, savings, deposit and loan contracts, overdrafts, card services, electronic financial services, recording transactions, commission processing and interest rate transaction, etc.) [5].

The data integration and transformation layer is a process of transforming data (operational and external) into a form suitable for database storage. They are referred to as Extract Transform and Load (ETL) processes. During the ETL process, data is extracted from an OLTP database, transformed to match the data warehouse schema, and loaded into the data warehouse database [13].



**Fig. 1. Business intelligence architecture in the financial services industry**

A data warehouse (DW) is an analytical database used as the basis for business intelligence systems. The data warehouse essentially holds the business intelligence for the enterprise to enable strategic decision making. The data warehouse based on the data extracted from operational systems. The data warehouse is an informational environment that:

- Provides an integrated and total view of the enterprise.
- Makes the enterprise's current and historical information easily available for decision making.
- Makes decision-support transactions possible without hindering operational systems.
- Renders the organization's information consistent.
- Presents a flexible and interactive source of strategic information

Data warehouse systems provide some data analysis capabilities, collectively referred to as OLAP. OLAP operations include drill-down, roll-up, and pivot. The term OLAP (On-Line Analytical Processing) refers to the category of software technology enabling users (such as analysts, managers etc.) to gain insight into data in a consistent, interactive, and quick. The major strength of on-line analytical processing over information processing is the multidimensional data analysis of data warehouse data. Multidimensional analysis enables users to look at a large number of interdependent factors involved in a business problem and to view the data in complex relationships. End users are interested in exploring the data at different levels of details, which is determined dynamically. OLAP is the database's interface and a form of data processing which enables end user to extract data easily and quickly, and translate them into information in unlimited number of ways [14].

OLAP technology has the ability to query and analyze multidimensional data through exploration, while data mining is known for its ability to discover knowledge from data [15]. Data mining is a process of evaluating large volumes of data to identify patterns and relationships. Data Mining encompass the use of sophisticated data analysis tools to discover previously unknown, valid patterns and relationships in large datasets. These tools can involve statistical models, mathematical algorithms, and machine learning methods. Consequently, data mining consists of more than collecting and managing data, it's includes analysis and prediction [16]. The term data mining refers to tasks such as classification, clustering, association rule mining, sequential pattern mining, and so forth.

Data mining can be very useful in the financial industry and there are many instances of their application. Data mining can help analyze patterns to help with cross-selling, risk management, fraud detection, customer segmentation, customer retention. For example, based on the clients characteristics, the financial company can predict loan payment, analyzing customer credit policy, classification and clustering of customers for targeted marketing, and detection of money laundering and other financial frauds. In addition, based on historic data, financial company may define characteristics of clients who could use additional services, as well as methods of detecting potential bad debtors [5].

The reporting layer contains tools and applications that interacts directly with end users. These tools tend to become increasingly sophisticated and offer numerous opportunities for manipulating, analyzing and presenting information visually. The reporting layer use the following forms of accessing and presenting information:

- Reports are the basic and static form of presentation that have minimum analytic requirements. Reports can answer classical financial queries generated with classical SQL queries. such as, "How many outstanding loans are and what is their total value?"
- Analytics meet much more complex queries demands (related to time, customers, services, distribution channels, etc.). Multi-dimensional analysis has become a popular way to expand the query and reporting capabilities. It enables users to look at a large number of interrelated factors involved in the business problem and view the data in complex relationships. End-user are interested in exploring the data at different levels of detail, which is determined dynamically. Multi-dimensional analysis can analyze complex relationships through an iterative process involving drilling down to the lower levels of detail or rolling up to higher levels of aggregation and summarization.
- Scorecard shows the progress over time in a graphical representation. Scorecard enable monitoring of key performance indicators (KPIs), which can be used for comparing and controlling the match between the current state and the previously defined target performances or goals.
- Dashboards is a data visualization tool that displays the current status of metrics and (KPIs) for an enterprise at a specific point in time. Dashboards combine all information required for decision making in one place, it allows the decision makers to view instant results into the live performance state of business or data analytics.

#### **4 EBIF – A BI IMPLEMENTATION**

EBIF (Economy Bank for Investment and Finance), a special Iraqi bank, provides financial services to small and medium enterprises. EBIF offers banking services for companies include (commercial estate services, loans for construction, credit services, and trade finance). In addition, EBIF provides services to individual customers, which includes a full range of deposit accounts, loans, housing loans, personal loans, and car loans. EBIF comprises of 18 branches distributed across Iraq. EBIF is a member of a group of projects company and has a presence in the middle east and north Africa. It is a group of seven banks partners.

EBIF maintains with the borrowing information related to each person, company, and/or group of companies. It maintains this information by frequently fetching borrowing's related information from various departments and branches over Iraq.

When the bank want to granting a loan above a particular amount to a customer, it prepares the credit worthiness report for the customer. This report is prepared manually by the bank staff and delivered to the requesting institution on the following days. Unfortunately, EBIF can't analyze the reasons for customer attrition. It can't manage well its loans and improve the effectiveness of underwriting functions. EBIF can't detect accurately fraudulent loans attempts. In addition, the current practice of obtaining a report of some of these needs is prepared manually by the EBIF staff and delivered to the requesting branch or institution on the next day, if not the next week!.

##### **4.1 PROBLEM STATEMENT**

EBIF must be able to provide fast, accurate, and dynamic analysis. Currently, EBIF gets financial information through the regular mail and E-mail. If any branch or department wants to ask about the information of a certain borrower (for example) it will write to EBIF and then after 3-7 days the information is provided to the department/branch. The process is fairly slow. EBIF provides information about borrowing of a particular borrower, also if the borrower belongs to a particular branch, then the borrower also needs to be identified. Currently, EBIF provides static reports and inaccurate enough, furthermore, it cannot provide predictive analytics any way.

##### **4.2 EXISTING REPOSITORY**

Currently the database is running on MS Access 2007 contains information related to financial services.

##### **4.3 ENTITIES SUMMARY**

The operational data store contains the following:

- Deposit accounts.
- Customers records.
- Loan records.

- Investment revenues.
- Commercial estate records
- Technical reserves.

#### 4.4 THE SOLUTION

Business intelligence solution consists of several layers. Starting from OLTP, to ETL, generation of multidimensional data store (OLAP), data mining, and finally a reporting/presentation that providing reports and drill-down and roll-up facilities. We convert the financial related MS Access database to SQL database by using the Upsizing Wizard in Access 2007.

Data in EBIF came from a several data sources (e.g. transaction files, loan files, deposit files, external data sources). Some data is incomplete, and some may contain some errors. We use the ETL process for accessing the data, staging, cleansing and validating the data, and linking data from various sources. Table 1 illustrates the tools/technologies used in implementing each layer.

Tool/Technology	Tools/Technologies
SQL	Operational Database (OLTP)
Microsoft SQL Server Integration Services (SSIS)	Data Extraction/Transformation/Loading
Microsoft SQL Server 2008 R2	Data Staging Area
Microsoft SQL Server Analysis Services (SSAS)	OLAP & Data Mining
Microsoft SQL Server Reporting Services (SSRS)	Presentation/Reporting

#### 4.5 THE SCHEMA DESIGN

Star schema was used to design the data warehouse. The data warehouse has six dimensions tables for Bank branches, Borrower, Stock Companies, Customers, Employees, Time related information. Also, we have five fact table for Current balance, Borrowing detail information, interest earned, Transaction count, and Profit Margin. Fig. 2 shows the database schema and the dimension and fact tables.

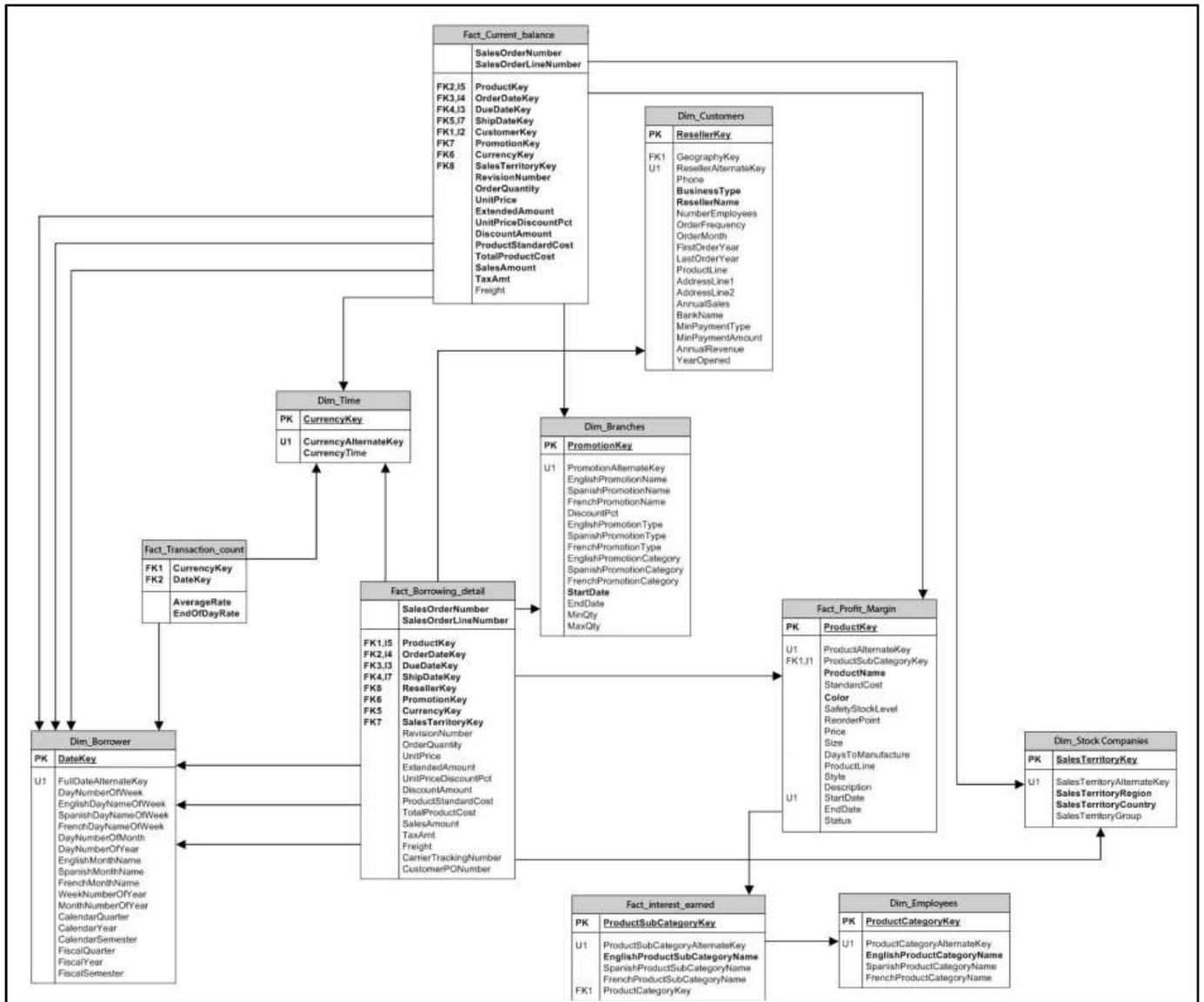


Fig. 2. Data warehouse schema

#### 4.6 PRESENTATION /REPORTING

Business intelligence reporting tools used to see risks and find opportunities so companies can stay in the know and push their business further. The reports may have different layouts to present the data, such as Chart, Gauge, Metrics, Funnel reports, and so on. All these kinds of data layouts can be considered, based on the targeted viewers.

##### 4.6.1 OLAP ANALYSIS

We used OLAP cube analysis capability to drill down through the EBIF data to shows the loans profit margin by years, Fig. 3.

Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			
Drop Filter Fields Here			
Drop Column Fields Here			
Calendar Year	Current balance	Loans	Profit Margin
2004	376768 \$	4880 \$	4880 \$
2005	487687 \$	5730 \$	5730 \$
2006	512331 \$	14320 \$	14320 \$
2007	586998 \$	34245 \$	34245 \$
2008	612213 \$	34980 \$	34980 \$
2009	679834 \$	39870 \$	39870 \$
Grand Total	3255331 \$	134024 \$	134024 \$

Fig. 3. The loans profit margin by years in the EBIF

#### 4.6.2 THE REPORTING

We can illustrate the volume of transactions by creating the report such as in fig. 4. In this report, we used the pie chart to show the volume of transactions in the bank for one year.

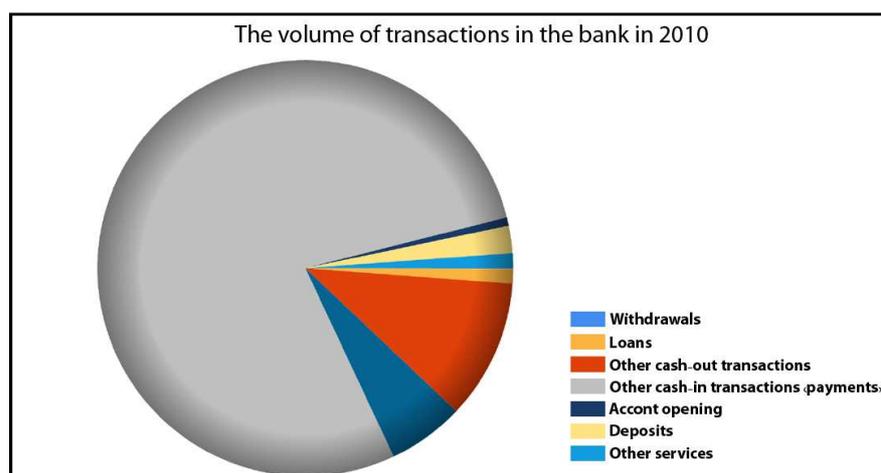


Fig. 4. The volume of transactions in the bank in 2010

Figure below shows the loans amount per services type in 2009.

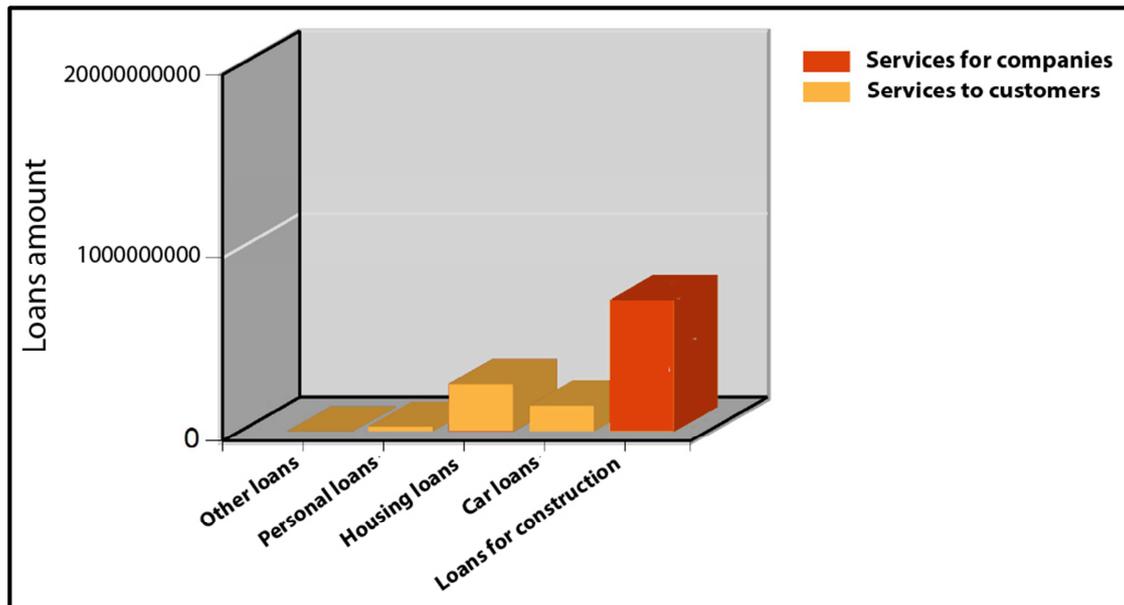


Fig. 5. The loans amount per service type in year 2009

## 5 CONCLUSION

Financial services industry faces many challenges in a business environment. BI systems can help financial companies to manage risk, detect fraud, gain visibility into their profitability, and leverage customer insights. BI systems also enable financial companies to expect future behavior of the company and their business indicators. They also enable financial companies to expect client behavior in terms of using new services and alarm the company to a possible risks. BI system support the financial companies to make high-quality and timely decision making. However, until recent times, there are no financial company in Iraq was adept business intelligence environment for gaining these competitive advantages and insights. In this study, we created a business intelligence system to help the "Economy Bank for Investment and Finance" to determine business trends, manage risk, improve its performance, and make better and faster business decisions. We converted the MS Access database of the EBIF to SQL database, then we used the ETL process to accessing, staging, cleaning, linking data from various branch's sources using Microsoft SQL Server Integration Services. BI system was designed and implemented using Microsoft SQL Server 2008 R2. This BI system that reported in this study is give power to EBIF to make projecting and calculating the future values of portfolios, cash flows, liquidity, and determine profit-and-loss accounts easily and quickly.

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