

Application of Business Intelligence in Insurance Industry (Iraq)

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ABSTRACT

The insurance industry faces increasing competitive environment and many challenges. The insurance industry needs to operate ever more efficiently, manage risk, and to increase revenue through using effective tools. Insurance companies handle huge amounts of information every day. To effectively perform their job, insurance companies need simple, fast, powerful tools to access and analysis their information. Additionally, the threats the industry faces require insurance companies to ensure their financial security through proactive risk management. The current information technology allows insurance companies to gain better business decisions and to better performance goals. Business intelligence (BI) supports these companies for obtaining insight and competitive advantages using a set of techniques such as data warehouse (DW), on-line analytical processing (OLAP), data mining (DM), advanced reporting, etc. This paper is an attempt to straighten Iraqi Insurance Company (IIC) analysis through business intelligence techniques to properly identify opportunities and trends in insurance businesses. In this work, we propose a business intelligence system, developed on Microsoft SQL Server 2008 R2, for an Iraqi Insurance Company based on the information which the company has. We utilized the business intelligence system in IIC for complex processing and data analysis.

KEYWORDS: Business Intelligence, Data warehouse, Data Mining, On-Line Analytical Processing.

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I. INTRODUCTION

Business intelligence is a broad category of applications and technologies for gathering, access to, and analyzing data for the purpose of helping organization's employees, partners, and suppliers to make better business decisions [1]. Business intelligence is very important to measure current state of business, as well as all parts that represent the whole of the business together to find out where funds are needed, what part of a business is strong and what parts of the business is weak [2].

Business intelligence technology allows planners to perform what-if analyses, run budgets through predictive and profitability analyses, and create scorecards and dashboards to help enhance corporate performance and management practices. BI not only speeds up these processes, it also gives the finance department far more confidence in the numbers themselves [3].

The insurance industry is totally dependent on the ability to translate raw data into intelligence - intelligence about customers, competitors, markets, and business environment. Over the years data processing technology has progressed dramatically and tools like data warehousing, OLAP and data mining, which constitute the cornerstone of an effective business intelligence environment, have been widely accepted across industries. However, insurance companies have been relatively slow in adopting these tools, primarily because of lack of competition due to protective regulations. But now, they can no longer afford to be complacent as the Internet, deregulation, consolidation, and convergence of insurance with other financial services are fast changing the basic structure of the industry [4].

II. TRADITIONAL REPORTING

A traditional paper report of the business is not dynamic (static). Therefore, the report will always be presented in the same way each time it is printed. This report will often give us either too little or too much information. And most likely, when produce this type of reports and test the numbers, new questions will arise but the printed report cannot answer. This type of report cannot keep pace with the today's fast developing business, so, when print this report it could be out of date.

A traditional report usually requires a great deal of hand holding, support, and explanation for the receiving person to get any good use out of it. The generation of traditional report often leads to more questions which entail more work to answer [5].

Business intelligence is a dynamic, constantly updated and can provide a birds-eye view of the business, so that insurance companies know the whole picture, and can drill down to a particular transaction line in

seconds. And unlike traditional paper reporting, BI is also intuitive. Its advanced “What-If” analysis that can assist insurance companies answer some of the questions that may arise faster than they can think of them. “What-if” giving insurance companies the ability to access to answers that previously might have taken months of forecasting to reach. “What-if” easily analyses many questions such as how costs, price and volume affects company's margins[6].

III. BUSINESS ANALYTIC VERSUS BUSINESS INTELLIGENCE

Business analysis is the process of analyzing trusted data with the goal of discovering insights, supporting decision making, improving business processes, suggesting solutions to business problems [7]. Business analytics aims to focus on the analytical part.

Analytic applications are focused on immediacy of information, its broad deployment and its direct applicability across the entire enterprise value chain from office operations to supply chain, Web channel, customer relationship management, sales and marketing, and other critical functions [8].

Data warehouse systems provide some data analysis capabilities, collectively referred to as online analytical processing. Analytical processing supports basic OLAP operations, including slice-and-dice, drill-down, roll-up, and pivoting. Data warehouses provide online analytical processing tools for the interactive analysis of multidimensional data at varying granularity levels, which facilitates effective data generalization and data mining. Data warehouses and online analytical processing tools are based on a multidimensional data model. This model views data in the form of a data *cube* [9].

Business intelligence helps organizations and business users move from manual to automated business analysis [7]. Business intelligence tools deliver powerful analysis and knowledge discovery capabilities into the hands of a specialist who familiar with their use. Therefore, with BI tools, analysis should performed in integrated with management functions rather than separated from them. Otherwise, the resulting reports and forecasts are not always understandable and, sometimes, represent after-the-fact knowledge.

IV. STRATEGIC OR TACTICAL

BI applications can be used either strategically (across functional department) or tactically (within a functional department).

4.1. Strategic

Strategic business intelligence can give managers a birds-eye view of the company and can identify opportunities and trends for growth. Strategic business intelligence can also be used for monitoring the Key Performance Indicators (KPI) of the company. It encourages collaborative working in the organization that because it goes across departmental boundaries.

4.2. Tactical

Applied to the areas of business where the extra knowledge and insight that business intelligence can bring will bring quick and irrefutable results. Tactical business intelligence is a good place to start if the organization have had no previous experience in business intelligence. An example of tactical BI might be to look at product yield from a manufacturing phase, we might want to record inputs, output, expenditure [8].

V. ANALYSIS PROCEDURES IN BUSINESS INTELLIGENCE

There are two families of analysis procedures can be performed in BI. The first one consists in analyzing data collected from external data sources, called real data, using business intelligence applications (OLAP, data-mining, etc.). The second one of analysis tries to illuminate the decision process by evaluating the impact of alternative hypothetical strategic decisions, using for example what-if analysis. What-if analysis means providing the ability to use BI applications, not only on real data, but also on hypothetical computed data. For example, in an insurance DW devoted to insurance transactions, decision makers may need to investigate the impact on profits, if during the last three months a promotion campaign for a new type of insurance have taken place. First, hypothetical sales are generated by computation as versions of real sales that should have been impacted by the promotion. Next, the outcomes of the promotion are explored by OLAP queries. The data generated for such hypothetical decision can be implemented as a version of the DW, partly composed of real data unconcerned with the promotion and partly composed of hypothetical data impacted by the promotion. As several such scenarios can be studied, the DW can be transformed, by inclusion of hypothetical data, as follows: (1) the real data constitute the so called real data warehouse version; (2) a hypothetical DW version with the same content as the real DW version is created. Such a data warehouse version is called alternative data warehouse version; (3) in the alternative data warehouse version, hypothetical data generated by replacing the corresponding real data [10].

VI. BENEFIT OF BI

Business intelligence provides many benefits to and improves the overall performance of companies utilizing it. It can eliminate a lot of the guesswork within an organization, enhance communication among departments, and enable companies to respond quickly to changes in customer preferences, financial conditions, and supply chain operations.

Information is often considered as the second most important resource a company has (the most valuable assets are its people). So, having access to timely and accurate information when making decisions can improve the performance of the company, improve customer experience, and allowing for the timely and suitable response to customer priorities and problems. Business intelligence expedites decision-making, as acting quickly and correctly on information before competing businesses do can often result in competitively superior performance.

The company cannot exist without their customers who are considered the most critical aspect to a company's success. So, it is very important that companies have information on the customer's preferences and quickly adapt to their changing demands. Business intelligence enables insurance companies to collect information on the trends in the marketplace and reach innovative services or products in case of customer's changing demands.

Competitors can be a huge obstacle on the insurance company's way to success. Their objectives are the same objectives of other companies and that is to maximize profits and customer satisfaction. In order to be successful insurance companies must stay one step ahead of the competitors. Business intelligence tells what actions our competitors are taking, so one can make better informed decisions.

The insurance companies have recognized the importance of business intelligence. Some of them are listed below [1].

- With BI tools, employees can easily convert their business knowledge by using the analytical intelligence to solve many business issues, for example, increase response rates from direct mail, e-mail, telephone, and marketing campaigns delivered by Internet.
- With the BI tools, companies can identify the most profitable customers and the essential reasons for those customer's loyalty, as well as identify future customers.
- Companies can improve e-commerce strategies by analyzing click-stream data.
- Quickly discover problems to minimize the impact of service deficiencies.
- Discover money-laundering criminal activities.
- Analyze potential growth customer profitability and determine financial risk through more accurate financial credit scoring of their customers.
- Detect and prevent fraud behaviors.
- Determine what combinations of services and service lines customers are likely to purchase and when.
- Set more profitable rates for insurance premiums.
- Reduce equipment downtime by applying predictive maintenance.

By using business intelligence technology, insurance companies can quickly understand complex information so that they can make better and faster decisions and thus efficiently achieve business goals. The main benefits that business intelligence aims to are the increase the efficiency and effectiveness of the organization. Some business intelligence solutions enable organizations to have a faster flow of and easier access to information (for example, by facilitating creating, modifying and distributing reports). Some other advanced solutions are based on a more aggressive approach that in certain cases requires a redefinition of existing processes and their optimization, which can create new, previously unknown possibilities and opportunities.

By using BI, users can drill down into the content of the original report and thus come to the smallest and most detailed information in order to reveal the underlying causes of individual events or the current situation. Once they know the cause, they can take effective action in the opposite direction either to correct problems or to maintain good practice and maybe extend it to other areas [11].

VII. BUSINESS INTELLIGENCE INFRASTRUCTURE

Well-designed business intelligence infrastructure gives business organizations sustainable competitive advantage and may regard such intelligence as a valuable core competence in some instances. BI infrastructure is a set of layers that begin with the operational systems information and metadata and end in the delivery of business intelligence to various business user communities [12]. Fig. 1 shows the layers of business intelligence.

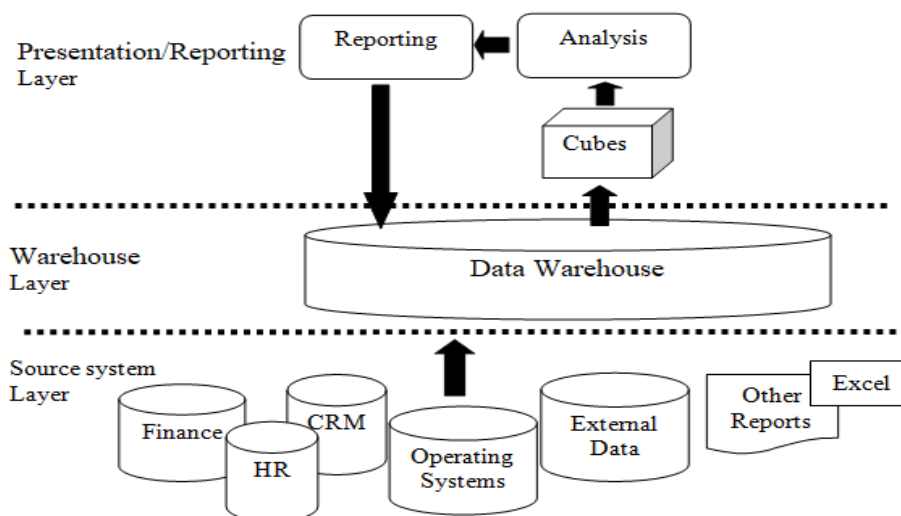


Figure 1: Business intelligence layers

7.1 Data Source Layer

Data source layer represents the various data sources that feed data into the data warehouse. This data source may be in any format, it may be relational database, plain text file, other types of database, Excel file, etc. Many different types of data that can be collected from the various data sources such as:

- Operations such as claims data, premium data, investment revenue data, human resources data, systems data.
- Internal marketing data.
- Web server logs with user browsing data and click-stream data.
- Third-party data, such as census data, or survey data, demographic data.

7.2 Warehouse layer

Warehouses are collections of information assembled for users to meet their practical business needs. It is not about theory, and it is not about computer systems. It is about business needs and the survival of the corporation in a competitive environment [13].

The data sources connect into the data warehouse through a set of processes commonly referred to as *ETL*, or *Extract, Transform, and Load*. These processes do exactly what they say; first they grab relevant data from the operational databases, then they change it into a single, unified format so all data are significantly similar. After the data is *clean*, it's loaded into the data warehouse [3].

7.2.1 Knowledge Discovery

There are seven function/tool types to access area of the data warehouse [13]:

1. Query and reporting: Traditional query managers and report writers.
2. Agents: Software that schedules, runs, evaluates, or searches for things for the user.
3. OLAP (online analytical processing) /Cubes: Multidimensional analysis tools.
4. Statistical analysis: Traditional SPSS/SAS and other stats packages.
5. Data discovery: Neural networks, CART, CHAID, and other advanced artificial intelligence and knowledge-generating software.
6. Visualization: Systems that graphically or geographically display complex data relationships.
7. Web tools: Software that performs search, query, and agency work in the WWW environment.

BI gives companies the ability to peer into the past, slicing and dicing historical data. In addition, BI enabled companies from dig through yesterday's information to form predictions about what the future will be like. Coupled with data warehouses, BI tools gives users access to snapshots of information from the organization's operational and transaction-based systems. The capability to do a complex drill-downs into this historical record is where the system provides its unique value for reporting purposes. On the other hand, some BI software focus on predictive-analysis tools. This software uses advanced statistical techniques to create tomorrow's forecasts based on yesterday's data [3].

In the business world, corporate and customer data are becoming recognized as a strategic asset. The ability to extract useful knowledge hidden in these data and to act on that knowledge is becoming increasingly

important in today's competitive world. The entire process of applying a computer-based methodology, including new techniques, for discovering knowledge from data is called data mining [14].

While the data warehousing revolution addresses the needs of business people by making data conveniently accessible, the complementary revolution, the data mining revolution, makes it possible for them to do much more with that data [13].

Many people treat data mining as a synonym for another popularly used term, Knowledge Discovery from Data, or KDD. Alternatively, others view data mining as simply an essential step in the process of knowledge discovery [9]. Knowledge discovery as a process is depicted in Fig. 2.

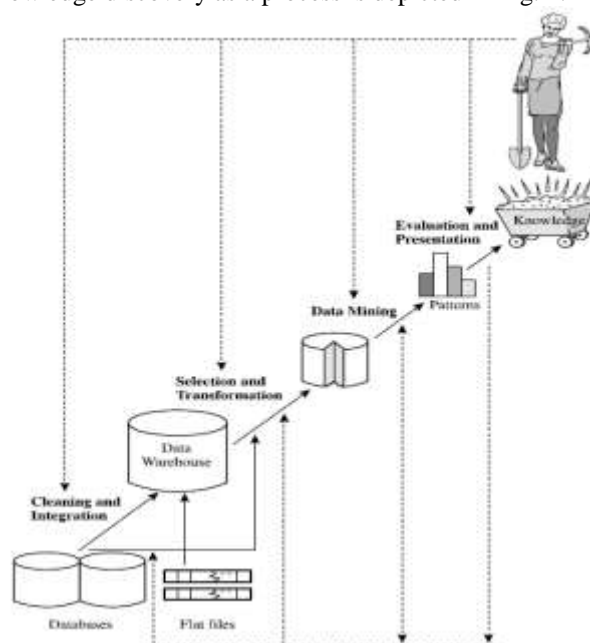


Figure 2: Knowledge discovery process [9]

7.2.2 Reporting/presentation

BI tools meet the companies needs because the knowledge workers can easily design and deploy ad-hoc queries and reports. They can do it with minimal knowledge of SQL (or other programming languages), in the same way most employees in a business can operate an Excel spreadsheet.

Querying and reporting tools sit astride the data warehouse. They act as the abstraction layer between the user and the *really* confusing, complex code that pulls just the right data from the database and puts it on somebody's desktop in a readable format. Newer querying and reporting tools offer a Web interface that allows users to access the tool *as a service* through a common Web browser.

Business dashboards provide what is essentially a control panel for monitoring the vital functions of the business. They supply immediate information and indicate when and where performance is lagging. Dashboards are only designed for ongoing monitoring of specific activities. Dashboards are not meant to convey information about how close operations match the intent of the business and associated targets.

Scorecards are designed to measure progress toward meeting strategic business goals. A scorecard usually appears as a graphical list of specific, attainable strategic milestones, combined with metrics that serve as benchmarks. Measurements of how well the company actually executes specified activities are linked to the scorecard; the resulting display is the status of each goal, often with some kind of graphic indicator. For example, a scorecard might display green when a given profit margin is meeting or exceeding company expectations. But once the bloom is off the rose and profits sag, the scorecard fill color turns to red indicating that attention is needed to shore up the business. Like a dashboard, the scorecard gives a consolidated at-a-glance view of key information [3].

VIII. BUSINESS INTELLIGENCE AND INSURANCE INDUSTRY

Insurance is a contract that indemnifies financially another, fully or partially, against the loss or damage caused by event(s) beyond the control of the insured party. Under this contract, a party (the insurer) indemnifies the other party (the insured) against a specified amount of loss, occurring from specified eventualities within a specified period, provided a fee called premium is paid.

The insurance industry is quite diverse in terms of portfolio of products provided by different companies. The products can be broadly classified into two product lines: property and casualty (P&C) and life insurance. Life insurance product line can be further sub-divided into life insurance, health insurance and annuity products [15].

Business intelligence solutions have played a significant part in the strategy of many of insurance companies, to quickly adapt to market changes. With easy access to large amounts of complex data from disperse sources, companies are able to manage costs and performance, and acquire and increase the profitability of customers [8].

Business intelligence solutions provide the decision makers from all business segments of an insurance with the ability to manage and exploit information resources, in order to solve the problems and make timely and high-quality decisions. Business intelligence covers many areas of the insurance, and among the most important are: Customer Relationship Management (CRM), Performance Management (PM), Risk Management (RM), Asset and Liability Management (ALM), and Compliance [16].

IX. IIC – A BI IMPLEMENTATION

IIC (Iraqi insurance company), a public subsidiary of the ministry of finance engaged in insurance business on the property (cars, marine / cargo, fire, theft, accident, engineering). IIC comprises of 15 departments and it has 19 branches distributed across Iraq. The company participates in developing economics through providing insurance protection to the customers, encouraging them to save money which used in investment.

IIC maintains with the insurance information related to each person, company, and/or group of companies. It maintains this information by frequently fetching insurance's related information from various departments and branches throughout Iraq. Unfortunately, IIC can't identify the right customers for target marketing and analyze the reasons for customer attrition. It can't manage well its agents and sales force and improve the effectiveness of underwriting functions. IIC can't detect accurately fraudulent claims attempts and claims assessment. In addition, the current practice of obtaining a report of some of these needs is prepared manually by the IIC staff and handed over to the requesting institution on the next day, if not the next week!.

9.1. Problem Statement

IIC must be able to provide fast, accurate, and dynamic analysis. Currently, IIC gets insurance information through E- mail, synchronizes with the regular mail, and if any department or branch wants to inquire about the information of a certain insurer (for example) it will contact IIC and then after 7-14 days the information is provided to the department/branch. The process is quite slow. IIC provides information about insurance of a particular insurer, also if the insurer belongs to a particular branch, then the insurer also needs to be identified.

Currently, IIC provides static reports and inaccurate enough, furthermore, it cannot provide predictive analytics any way.

9.2. Existing Repository

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

9.3. Entities Summary

The operational data store contains the following:

- Billing systems.
- Claims records.
- Premium records.
- Investment revenues.
- Technical reserves.

9.4. The Solution

Business intelligence solution consists of several layers. Starting from OLTP, to ETL, generation of multidimensional data store, and finally a reporting/presentation that providing reports and Drill-down and Roll-up facilities. We convert the insurance's related MS Access database to SQL database by using the Upsizing Wizard in Access 2007.

Data in IIC came from a several data sources (e.g. transaction files, claims files, premium 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.

Table 1: The tools/technologies used in implementing BI layers

| Layer | Tool/Technology |
|--|---|
| Operational Database (OLTP) | SQL |
| Data Extraction/Transformation/Loading | Microsoft SQL Server Integration Services |
| Data Staging Area | Microsoft SQL Server 2008 R2 |
| OLAP & Data Mining | Microsoft SQL Server Analysis Services |
| Presentation/Reporting | Microsoft SQL Server Reporting Services |

9.5. The Schema Design

Data warehouse was designed by using Star schema. The data warehouse has five dimensions tables for Branches, Stock Companies, Insurance Claims, Reinsurance Claims, Insurer, Employees related information. The data warehouse has also five fact tables for Insurance Premium, Reinsurance Premiums, Investment Revenues, Technical Reserves, Administrative expenses information. Fig. 3 shows the database schema and the fact and dimension tables.

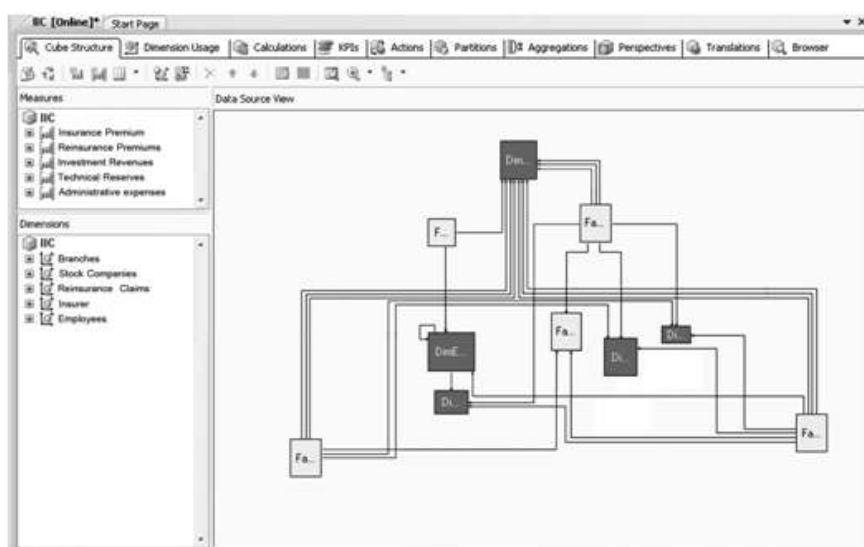


Figure 3: The database schema

9.6. Presentation /Reporting

Data can be visualized or delivered to business owners and other users in the community to help them to know business trends and usability of the system, including other benefits. The reports may have different layouts to present the data, such as Chart, Metrics, Gauge, Funnel reports, and so on. All these kinds of data layouts can be considered, based on the targeted spectators.

9.6.1 OLAP Analysis

Fig. 4 shown the drilldown report that browses the premiums of each branch in IIC through the portfolios.

| Branches | Portfolio | Premiums |
|--------------------|--------------------------|------------|
| Al-Karkh | Total | 416140000 |
| | | |
| Sadoun | Total | 186600000 |
| | | |
| Babel | Motor | 35416400 |
| | Marine cargo | 13281150 |
| | Individual Life Assur... | 194790200 |
| | Group Life Assurance | 354164000 |
| | Fire | 61978700 |
| | Reinsurance Revenues | 22135250 |
| | Public Accidents | 70832800 |
| | Engineering | 132811500 |
| | Total | 885410000 |
| | | |
| Rusafa | Total | 545950000 |
| Baghdad Al-Jadeeda | Total | 772500000 |
| Al-Najaf | Total | 2210000000 |
| Diyala | Total | 183500000 |
| Karbala | Total | 357500000 |
| Al-Qadisiya | Total | 386000000 |
| Ninawah | Total | 203950000 |

Figure 4: The premiums of branches through portfolio

9.6.2 The Reporting

We create a report to illustrate the distribution of claims in the country, Fig. 5. In this report, we used the Linear Gauge to show the count of claims.

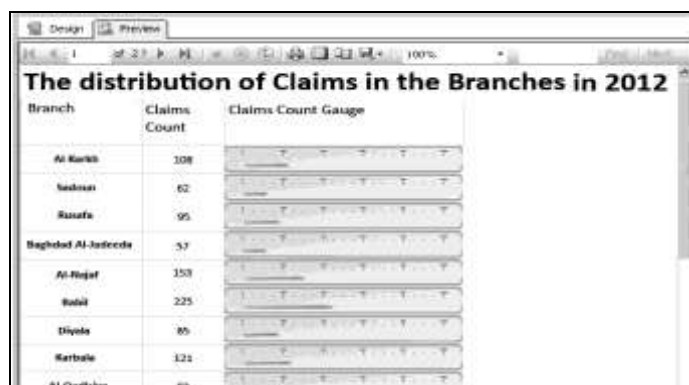


Figure 5: The distribution of claims in the branches in 2012

The report in Fig. 6 shows the earned premiums in 2011.

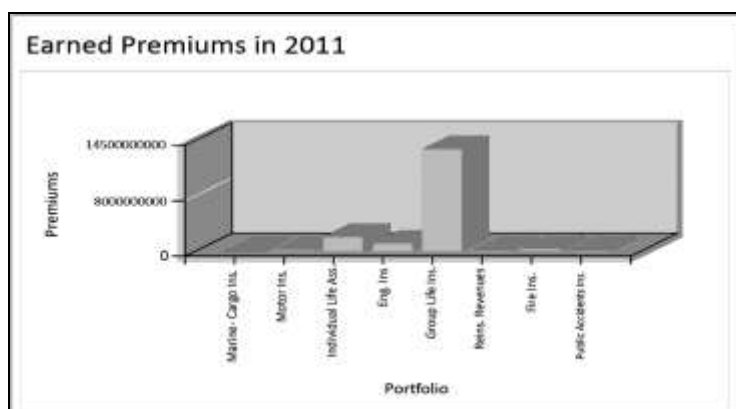


Figure 6: The earned premiums in 2011

X.CONCLUSION

Insurance industry in the country faces many challenges and constraints in a business environment. BI technologies can help insurance companies to manage risk, detect fraud, gain visibility into their profitability, and leverage customer insights. However, until recent times, there are no insurance companies in Iraq are adept business intelligence environment for gaining these competitive advantages and insights. In this study, we created a business intelligence system to help the Iraqi insurance company to improve its performance, determine business trends, manage risk, and make better and faster business decisions. We converted the MS Access database of the IIC to SQL database, then we used the ETL process to accessing, staging, cleaning, linking data from various company's sources using Microsoft SQL Server Integration Services. The business intelligence system is designed and implemented using Microsoft SQL Server 2008 R2. The business intelligence system being reported in this study is capable of analyzing and reporting data easily and quickly.

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