Reviewing The Effect of Business Intelligence on Decision Support Process: An Application on The Finance Sector

Araştırma Makalesi/Research Article

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Abstract— Nowadays, data warehouse (DWH) and the business intelligence enterprise solutions frequently used by companies blend the services of reporting, analysis and data mining by rich visual components and provide easy to interpret and meaningful information for decision makers. This study aims to summarize the bank profit loss and Balance in the corporate data warehouse model using the bottom up methodology at enterprise level. Building a data mart using the bottom up methodology allows; high flexibility and user friendliness, because it is based on the individual business department (finance) information needs. The other reason this methodology which was preferred, is that the fundamental concept of dimensional modelling, is the star schema and it also supported by data modelling architecture of Oracle OBIEE 11g .One of the main pillars of a bank's pricing policy is to control the profit and loss of branches. At the end of application of this concept's study, Corporate memory became more mature and dependency on people was removed in terms of reporting. In addition communication and sharing of information within the finance department increased, personal Productivity increased and cost advantage was ensured and the widespread use of structural data, the users' confidence on business intelligence solutions increased by new data mart.

Keywords— business intelligence, strategies, data warehouse, ETL, data mart, financial sector

İş Zekasının Karar Destek Sürecindeki Etkisi: Finans Sektörü Üzerine Bir Uygulama

Özet— Günümüzde, veri ambarı (VA) ve şirketler tarafından sıklıkla kullanılan iş zekası kurumsal çözümleri, zengin görsel bileşenler sayesinde raporlama, analiz ve veri madenciliği hizmetlerini sunmakta ve karar vericiler için kolay anlaşılır ve anlamlı bilgiler sağlamaktadır. Bu çalışmada banka gibi kurumsal veri ambarı modelinde kar zarar ve bakiyesini işletme düzeyinde aşağıdan yukarı metodoloji kullanarak özetleme işlemi amaçlanmıştır. Aşağıdan yukarıya metodolojisini kullanarak bir veri mart oluşturmak; bireysel iş departmanı (finans) bilgi gereksinimlerine dayandığı için yüksek esneklik ve kullanım kolaylığı sağlamaktadır. Bu metodolojinin tercih edilmesinin bir diğer nedeni, boyutsal modellemenin temel kavramının yıldız şeması olması ve Oracle OBIEE 11g veri modelleme mimarisi tarafından desteklenmesidir. Bir bankanın fiyatlandırma politikasının temel dayanaklarından biri şubelerin kar ve zararını kontrol etmektir. Banka üzerinde yapılan uygulamalı çalışma neticesinde, kurumsal hafızanın artması ve raporlama açısından insanlara olan bağımlık ortadan kaldırılmıştır. Çalışma sonucunda uygulamaya alınan bu yapı ile bankanın finans bölümünde iletişim ve bilgi paylaşımı, kişisel verimlilik artmış, maliyet avantajı sağlanmış, yapısal verilerin yaygın kullanımı arttırılmış ve kullanıcıların iş zekası çözümlerine olan güvenleri artmıştır.

Anahtar Kelimeler— iş zekası, stratejiler, veri ambarı, ETL, data mart, finans sektörü.

1. INTRODUCTION

Changing business needs and models cause the companies to make changes in their technology preferences and organizational structures. At this point, rapid access to information has a critical importance due to direct impact on the decision making processes of companies. Each aspect that would delay access to information is the main reason for customer loss and means staying behind in competition for the company managers. When considered from the organizational perspective, the long lasting meetings without any decisions are interpreted as the lack of common language of business units with different work discipline and culture. Bad definition of needs or misinterpretation of shared needs and generation of non-aimed solutions are among the top of obstructions for fast and effective decision making process. The changes in this scope have severely affected the organizational structures of institutions. By positioning temporary units that will act as a bridge between the business units and IT teams; significant enhancements were witnessed in the centralization of institutional goals and the accurate determination of needs. It is seen that radical investments are being made for the technology along with the changes implemented in organizational structure. The main focus of all the companies are product and service profitability, acquiring quality customers to the institution in short and long term and to support profitable sales by enhancing the customer relations. The results of analysis obtained after intense and long efforts constitute the starting point of decision making process [1].

The steps to be taken after the analysis are the results of service provided to the decision makers by the used technology. The rapid changes in business and the complex situations as a result of such changes force the businesses to make the right decision in the earliest convenience. This adventure has started with the use of decision support systems and with the changing business needs; they are replaced by business intelligence technologies. According to Oracle Europe Business Intelligence Solutions Consultancy Director Haaije Bruins: "Business intelligence basically gives a chance to view the last year's sales and see what has been done. Then, it provides clear hints about what to focus in the future and which processes to optimize. It guides the decisions of company for future periods" [2].

In order for companies to provide competitive advantage; decision makers have to adopt realistic approaches instead of their predictions and assumptions. With the implementation of business intelligence applications, centralized data sources have increased the data quality and control and this has prevented the decision makers to get lost in different data sources, thereby shortening their term to reach a conclusion and to act. Centralized data sources appear in front of decision makers sometimes as data warehouse and sometimes as data mart containing department of issue based solutions [3]. Strategic decisions are long lasting ones with huge impacts. Access to appropriate, accurate and complete information made

the decisions to be more structural [4]. Data warehouses store the continuously cleaned and updated data with ETL (Extract Transform Load) processes and they fulfill the aspect of quality data which is one of the important factors of decision making process. The software for executing the business intelligence process provide the visual tools, display panel, summary table or graphics to put all technical works into a ground where all decision makers can understand and contribute to the decision making process.

With the proliferation of business intelligence solutions in business world; significant developments were observed in the control and timing ability of decision support systems. With the centralization of data sources, the data quality and control and timing ability have increased; which provided the decision makers to make fast and accurate decisions in the developing competitive environment. The concept of business intelligence in the globalized world is an important tool for the strategic decision making and implementation. Recently, many research on the use of BI systems and the benefits that can be achieved from its use on an organizational level [5]. The aim of this study is to emphasize the impact of business intelligence solutions on company strategies in the finance sector which is directly related with money and to describe the advantages it will provide to companies in the process.

In this paper, in the second part, we have mentioned definition of decision making and types of decision making strategies. In the third part, we have focused on historical development of strategic decision making speed and factors which are affecting the speed of strategic decision making. In the fourth part, we have mentioned concept of business intelligence and benefits of business intelligence on strategic decision making. In implementation part, we have deeply explained data modelling architecture of OBIEE 11g and creating data mart on OBIEE 11g by using bottom up methodology. In the final part we have explained the benefits of the study outputs.

2. RELATED WORKS

2.1. Strategic Decision Making Process

Henry Mintzberg defines the strategic decision making process as a concept that can be expressed by the words innovation, complexity and indefiniteness [6]. This seems to suggest availability of information is critical to support the decision making process [7].

In this process, the organization is confronted with a new situation it has never faced before with unclear thoughts on solution and how any possible solution will be utilized. They have determined three basic strategic decision making stages and these are; definition, development and choice. The stage of definition consists of two phases. First one if the stage of "decision determination" where

the opportunities, problems and crises are recognized and the decision activities are triggered. Second one is the stage of "taboo" where the executives interpret the stimulants and determine the cause and effect relations to make a decision. The stage of development which is about bringing a solution to the exiting problem and crisis or to evaluate the recognized opportunity in detail and it is considered as the heart of strategic decision making process. This stage constitutes the fundamentals of strategic decision making process and it consists of two phases. First one is the research phase to find ready solutions and the second one is the design phase to adopt the ready solutions or create solution depending on case.

There are four research methods set hierarchically in the research phase, which constitutes the first phase of development stage of strategic decision making process. First one is the Memory Research Method that reviews the existing situation of business, second one is Passive Research Method where the alternatives are expected to appear, third one is Trap Research Method to activate the forces of research in order to generate alternatives and the final and the fourth one is Active Research System that covers the direct research of alternatives either by scanning a vast area or by focusing on a narrow space.

The final stage of strategic decision making process is the process of choice and it consists of three phases. First one is the determination of criteria for choice, second one is the assessment of alternatives results according to criteria and the final one is making the choice [8].

2.2. Strategic Decision Making Speed

Strategic decision making speed is defined as giving the decisions in a short time. Strategic decision making and acting occurs after the simultaneous intervention of many factors. Considering the current circumstances, it is obvious that competition among companies is becoming harsher each day. Adding the developing technologies into the company is not sufficient in order exist in dynamic business life. Bringing these technologies with the well-designed analyses and the analysis results with competent decision makers are the keystones of fast and efficient strategic decision making and they also provide a significant competitive advantage for companies [9].

The data used is at the top of important factors for taking fast strategic decisions. Retaining the information and utilizing that in the future is not an idea put by the people of today. Even during the prehistorical ages, people have noticed this as a need and they kept records for that purpose. The utilization of computers has caused a great revolution for the storage of data. The bulk of information that appeared by changing technologies was not useful for the upper management. There was a need of management information systems providing summarized and integrated presentation of data. Decision support systems were developed for this purpose. However, the visual defects, problems of utilization and integration problems between

the applications have generated a need for a new system and this caused the appearance of Business Intelligence Systems [10].

The term of business intelligence was first used by Howard Dresner in 1989, who was employed in Gartner Group as an analyst and researcher. Howard Dresner considered the business intelligence as an umbrella that covers all methods and ideas developing the decision making skill for business by using the reality based decision support systems. We can easily say that decision support systems are on the basis of business intelligence. The idea of reporting and analysing the information has appeared in 1970s and it was first used without the two dimensional report analysis and in a static way. In 1980s, dynamic reports have started. Apart from determining the situation and functioning in that time, it was aimed to use the existing information in order to give decisions about the following processes and determining the critical goals. These studies have caused the appearance of Decision Support Systems. Decision support systems did not become sufficient for the growing information and smarter systems were needed. In 1990s, the concept of Business Intelligence appeared as a response for this need. Power uses the definition "Data guided decision support systems" for business intelligence systems [11]. Business intelligence application software is also considered as the latest point of development for decision support systems. Therefore, it has a wider scope than decision support systems. It contains more analysis ability and assumption algorithms. Besides, its strong visual tool support is an important factor for its widespread use today [2].

2.3. Business Intelligence

Today, modern organizations store the data in various sources such as operational systems, data warehouses, computer networks and personal computers. All these data retained in different sources are used to help for operational, tactical and strategic activities of companies. Many companies consider information as a strategic value, permanent management optimization and an important tool for competitive advantage and they shape their investments according to this perception. New economy is reshaped with the great impact of information sources on production chain and as the borders between products and services disappear, new business opportunities appear which are based on information technologies. The success of any company depends on how well it understands the work processes, how efficient it manages the operational activities and how good it knows its customers.

Companies need to determine their profitable customers, business trends, mostly sold product and the most efficient distribution chain in order to exist in the competitive environment. Companies have clearly understood that the company's future means analysis, report, estimation and real time data management. Information constitutes the basis of all activities in a

company. Information systems have to be used efficiently for proper production and management [12]. These systems provide the on time and proper information support for all users, the ability for the senior management to see the work processes and analysis via business intelligence technologies [13]. Business Intelligence has an open and flexible architecture and it integrates the innovative technologies to store them consistently, thereby transforming the data to information and including the information to decision making process in order to increase the competitive advantage [14]. In this study, business intelligence can be defined as a technological approach developed to support the decision making process and to increase the decision making efficiency of companies. The adoption of each new solution by masses cannot only be done through a well-designed technological infrastructure. Understanding the philosophy of solution and the meaning it accommodates is as important as solution itself. Different definitions of business intelligence were made in order to emphasize its contribution to decision making process and administrative decision making efficiency; "Business intelligence is the conveyance of accurate information to the right person (decision maker) on time" [14]. "It is the ability to comprehend the mutual relation of facts presented in a way to reach the aim" [2]. "These are the concepts and methods improving the decision making through the utilization of real time support systems" [15]. "Business intelligence is a board category of technologies, applications, and processes for gathering, storing, accessing and analysing data to help its users make better decisions" [16]. When we consider the starting point, we can say that business intelligence is he natural result of previous systems designed to support the decision making process. The visual inabilities noticed in decision support systems in time, and the incompetencies between the applications are the reasons of appearance of business intelligence technology [2].

Today, many companies store huge amount of data. The role of business intelligence is to distinguish the useful information and to process the data for the transformation of useful information to be utilized in administrative decision support process. The greatest benefit provided by these solutions to decision makers is the possibility to access updated and integrated information and to screen the business performance [17].

Today, companies meet their data requirements from different data sources in different formats, depending on their changing business needs. Data is retained and managed in different departments and systems. Business intelligence is the most efficient solution used for making the all data proper in a storage, thereby providing the chance to see the greater picture [18]. With the help of this methodology, all the departments within the company use the data from the same storage and write the data to the same place after updating. The information inconsistencies between the departments are prevented as such. Also, business intelligence has enhanced analysis options and it provides the user the chance to use a single

database and architecture and preparing the report and dashboard without the assistance of a technical expert [2].

Recent studies indicate that majority of companies could not efficiently utilize their corporate data in decision making processes. The information gathered increases on a daily basis and this means that the competition between companies increase proportionally. Well integrated information sources are important for efficient decision making process. At this point, business intelligence provides a strong, cost efficient, easy to use and shared resource [19].

Gartner provides services as the pioneering information technology and consultancy company in the world. As a result of the study they have conducted in 2009 with the participation of 1500 CIOs (Chief Information Officers), they have reached the conclusion that Business Intelligence technology is the top requirement for companies [20].

3. MATERIAL AND METHODS

3.1. Bottom up Methodology

The term Bottom Up Methodology refers to the architecture of a data warehouse. A data warehouse is a collection of information and data derived from operational systems and external data sources. A data warehouse is designed to support business decisions by allowing data consolidation, analysis and reporting at different aggregate levels [21]. Several approaches are using for data warehouse to building a data warehouse. The most well knows are top-down: and bottom-up.

The aim to prefer bottom-up is to deliver business value by deploying dimensional data marts as quickly as possible. Each data mart contains data on an atomic level as well as on a summarized level, representing all of todays and the future's information needs. In addition, each data mart is modelled in a star schema design to optimize usability and query performance [22].

Each data mart is integrated with others within a logical enterprise dimensional model. The connection of all data marts in current DWH, makes queries through all data possible for the user [23]. The use of a staging area also eliminates redundant extracts and overhead required to move source data into the dimensional data marts. Bottom-up approach is that it requires organizations to enforce the use of standard dimensions and facts to ensure integration and deliver a single version of the truth. One thing with we should pay attention, distributed, decentralized organization, it may be too much to ask departments and business units to adhere and reuse references and rules for calculating facts. There can be a tendency for organizations to create "independent" or non-integrated data marts [24].

3.2. Implementation

Building a data mart using the bottom up methodology allows; high flexibility, user friendliness and subject orientation. Especially for this study it was designed for the needs of the finance department. According to OBIEE 11g data modelling architecture fact table must be created and surrounded by many dimensions. The fact table has all the measures that are relevant to the subject area, and it also has the foreign keys from the different dimensions that surround the fact. The application with a strong visualization has a positive effect on the decision making process of the end users [24].

Implementing the drill-down feature on OBIEE 11g business intelligence application and obtaining the solid performance analyses of bank branches [25]. The implemented solutions are realized within the Aktifbank by using the already running business intelligence applications on its technical infrastructure and corporate data. The outputs of application are actively used by the finance group and constitute a source for senior management meetings. In the data modelling part of study Oracle Business Intelligence 11.1.1.7.140527 was used. With the help of BI (Business Intelligence) software provided by Oracle company; the data obtained from existing databases provide fast and consistent reports to the end user via the business models established within the framework of business needs on enterprise level.

3.2.1. Physical Layer

Data model architecture of OBIEE 11g consists of three main parts. Physical layer basically holds Physical tables which would be modeled in new repository. New data model is designed according to business needs and physical layer become a first step of this process. The tables in this layer are exactly equivalent metadata in source database. Tables which are used in the first stage of data mart design will be fed daily ETL jobs. Figure1 illustrates the tables that will be the source for the new data model.

Figure 1. Physical Tables.

Data control on the related tables might be reassuring for the accuracy of the work. Figure 2 illustrates content of table and data pattern. Join types and join directions, which are the cornerstone of the new data model, are designed according to business needs. The physical layer design constitutes the framework of the model desired to be created [26]. Figure 3 shows the fundamental data model of physical layer.
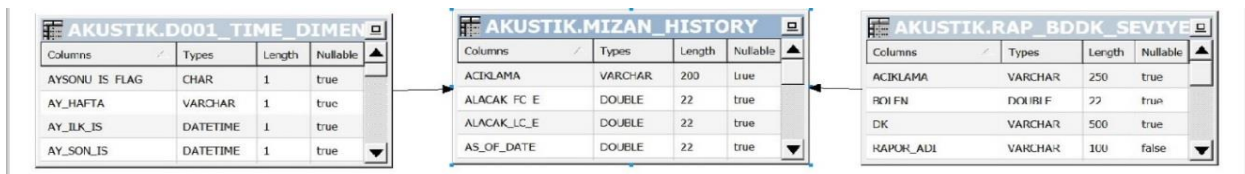

Figure 2. Data visualization.

Figure 3. Physical layer table design.

3.2.2. Business Model Mapping Layer

Business Model and Mapping Layer is the layer where business model or logical model is defined and the relation with physical layer is established through this layer. More attention is on business problems and come up with a dynamic design. In this phase of data warehouse schema design, conceptual design is converted to logical data warehouse schema [27]. The business model object establishes the definition of business model, logical tables and the relation between the physical tables. Star schema is designed in this layer. The main purpose of the business model is to design the physical diagram and mappings in accordance with the purposes of user and business rules and to access the source. A logical column may use more than one physical objects as source. Business model uses two main table types; these are Fact and dimension tables. According to data model architecture of OBIEE 11g, dimension tables, which are surrounding

the fact table, must be created in this layer. Star scheme was preferred due to availability of both the Oracle 11g data model architecture and the bottom up methodology. Logical fact tables retain the key areas of definition tables it will establish relation with and the numerical

values. Dimension tables retain the definition and description fields that make the numerical values meaningful [28]. Figure 4 illustrates the data model of star schema and types of Business model mapping.
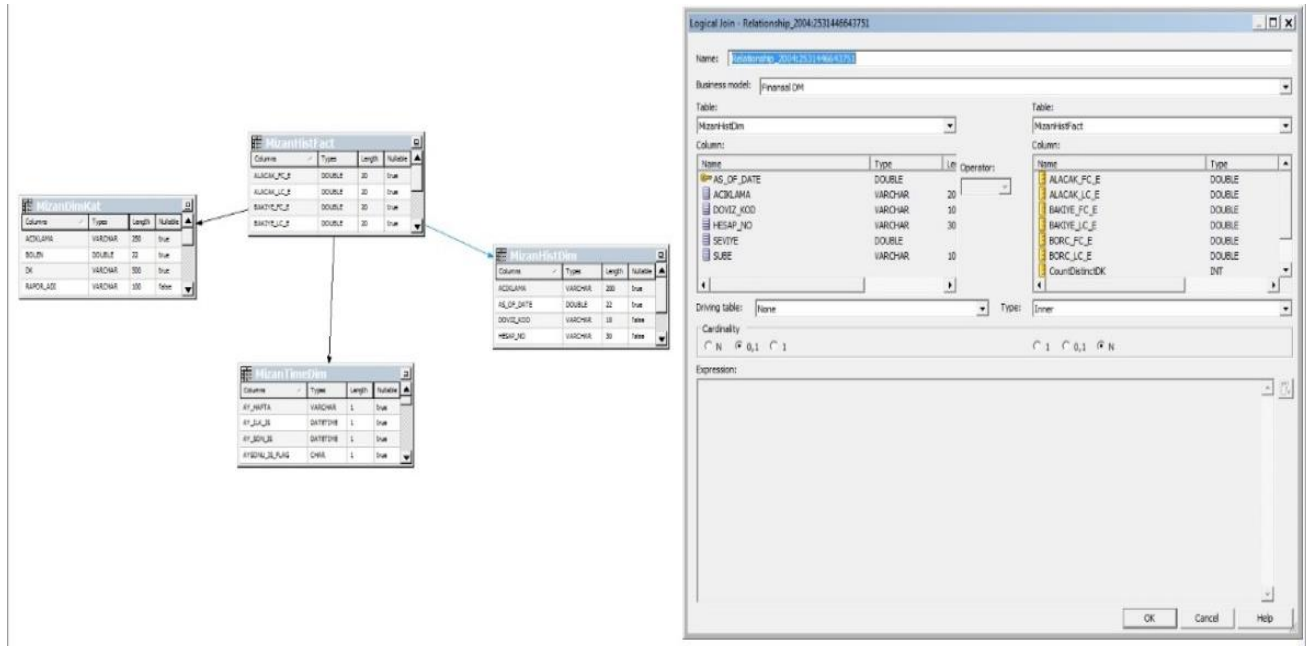

Figure 4. View of Business Model.

3.2.3. Dimension Hierarchy

Feature of Dimension hierarchy includes the rules defined in the report and the needs of the organization. Oracle BI users obtain their drill down report based on the format of data requests for reporting needs at a basic level and it meets at a detailed level. Developed Branch and branch profit and loss account balance sheet trial balance by reference to the numbers in the reports, the definitions of business intelligence solutions were created by using alternative hierarchical relationships with each other. This development is designed with Dimension Hierarchy which is the feature of oracle 11g. Figure 5 illustrates the final state of dimension hierarchy.

3.2.4. Presentation Layer

Presentation Layer is created after added to Business model and mapping layer model. Presentation Layer is the layer where objects are stored, which end users see while they use the BI reporting interface [25].

The subject title is created under the name of Finance DM at Business Model and Mapping Layer and it is

dragged by using drag and drop method from the business model and dropped to Presentation Layer; and it is created automatically as a new subject title. Under the subject title created inside the Presentation Layer; the previously designed hierarchy levels will be dragged and dropped to the Business Model and Mapping layer and the same column names and hierarchy ranks are automatically created. Figure 6 illustrates the objects which end users use while they are creating their own reports.

3.2.5. Business Intelligence Report Production

Oracle Business Intelligence web interface provide access for end users to the data in different data sources in a fast, consolidated and consistent way in accordance with business needs and targets and serves them to report their analyses with visual richness. After the completion of first phase of the study, designing the Data model, we will move to the reporting phase of the environment by using Oracle BI web interface. Figure 7 shows report items and filters. After the work is completed, report will be executed. Figure 8 illustrates the result of selected objects.
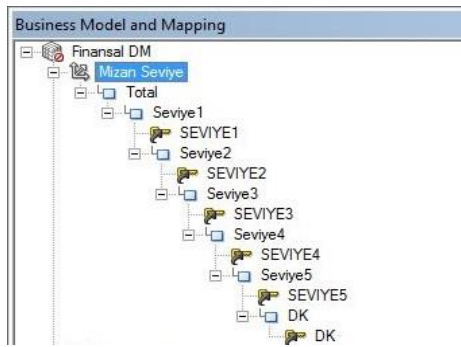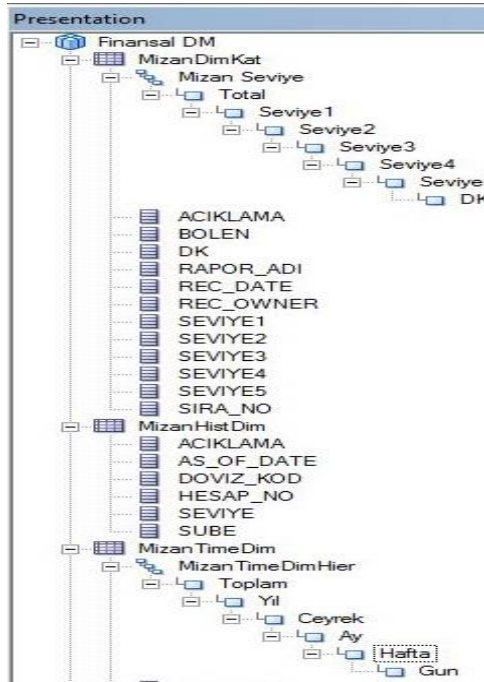
Figure 5. List of hierarchy (Parent-Child).

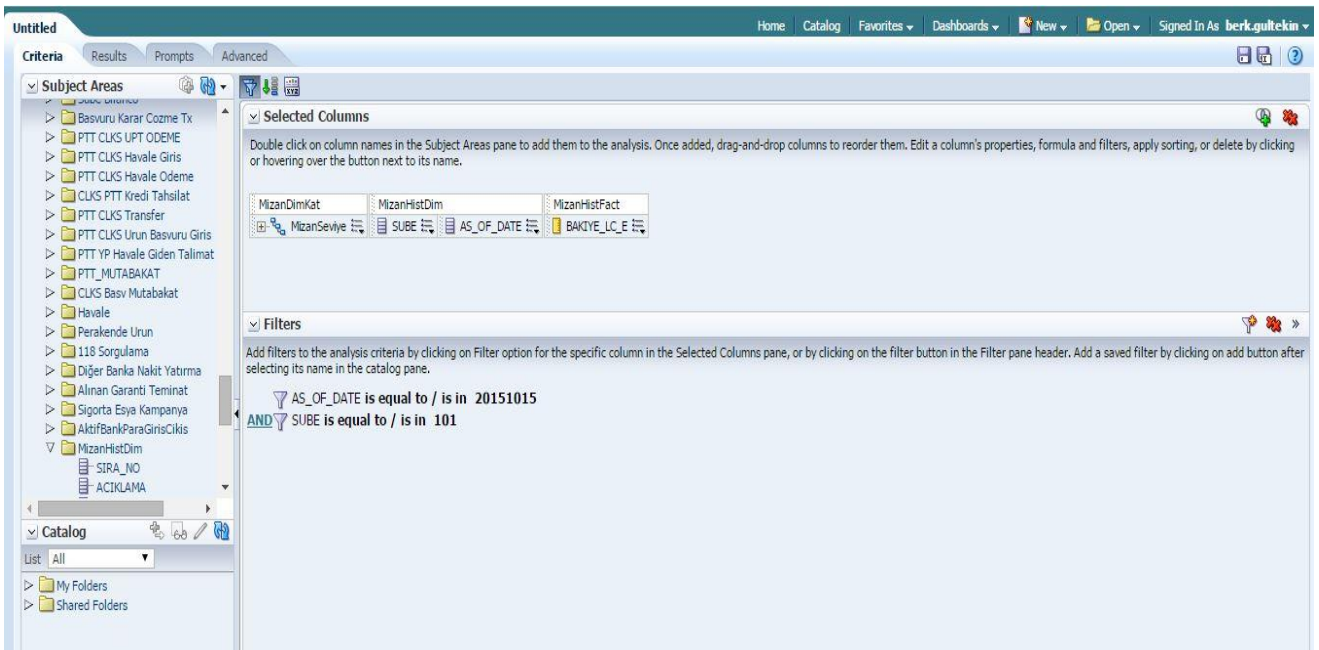Figure 6. Hierarchy levels in presentation layer.

Figure 7. Report design.

Figure 8. Report result.

Report results can be supported by images in accordance with the needs. Complex analyses and reports become more meaningful and easy to interpret for end users as they are supported by graphics. When the prepared reports are requested, a report is created by Analysis Import button and provides the user with Excel, PDF, Power Point or Text format.

4. RESULTS AND CONCLUSIONS

How useful will the Branch profit-loss and Balance report will be on strategic decision making? One of the most necessary components for the management of an organization is the ability to monitor the numerical data about the activities related with the organization. This becomes more important in the banking sector, which mainly deals with managing the money and competing with time at the same time. There are two main indicators in banking that necessitate constant monitoring. One of them is size of balance and the other one is profitability. These two items must be monitored at bank and branches level.

Branch is the showcase of a bank and one of the main units through which it conducts the marketing activities for customers. The success of branches depends on the number and variety of products and services being sold and the profitability from such products. One of the most important criteria to purchase product and services for customers is the price of the product. The price to be requested for a product or service can be determined by the stand alone analysis, outputs and the internal dynamics of a bank. The price to be offered must be in compliance with bank policy and should not deviate from the similar products and prices in the market.

One of the main pillars of a bank's pricing policy is to control the profit and loss of branches. In this scope, the facility of monitoring the branch loss and profit reports through the system within the bank in general is very important. The ability of branches to monitor their profitability from the daily activities and transactions is significant in terms of understanding the performance they have reached in terms of net pricing and the level of realization of the determined budgets within the scope of bank strategies. Branch has items at interest income and expenditures and the commission income in terms of profitability. The monitoring of the profitability indicators of a branch will help to determine the strategies to strengthen other items when compared with the low item and to reach the targeted profitability level.

The continuity of profitability will be ensured with the continuity of services and products provided. Thus, the monitoring of balance data of the branches, which are the points of sale of products, is very important. The balance data in the banks are monitored continuously and their compliance with the targets created within the scope of Bank strategies are examined. The branches' ability to reach the determined targets is of utmost importance for the profit and loss numbers occurred. This data is controlled and monitored through the routine reports created in the bank and in the branches on a daily, weekly, monthly and periodical basis. Assessments will be done for the items behind the target and they are compared with market data. The reasons of this setback are investigated and steps will be taken for target revision or extra measures to reach the goal. Also, the reason for the excessive numbers beyond the targets will also be examined and target revisions may be done in terms of profitability.

For instance, in order to reach the end of the year profit number aimed for the Bank, credit volume and price are set (16 % for 1 million TRY volume). The profitability from these numbers is monitored annually. If the numbers are below this profitability due to conjuncture changes, there might be an increase in the volume

(increasing the volume to 2 million) or in the price (17 %); or the cost of funding source can be reduced (deposit interest can be reduced to 10 from 12).

Before the application is implemented, the profit and loss reports of branches which have an important place to deter-mine the bank strategies are distinguished from other reports also in terms of preparation. Reports are controlled for various times and by various people before being submitted for senior management and they are prepared as a result of long term efforts of personnel with a significant experience. Manual studies within Excel files sometimes last for days and they are known and used by a few people due to their importance. This business method puts a barrier for the development of corporate memory. On the other hand, the experienced manpower for this job had negative impacts on personal capacity and efficiency and also created a significant cost for company.

Cloud computing has become one of the revolutionary technologies for future prospects of BI.BI in the Cloud is a game changing phase of IT, as it makes BI finally affordable and accessible as compared to traditional BI. Application in global finance and economy reporting, and global monitoring of industries and sectors are few such areas where BI or BI like systems possess tremendous potential on Cloud computing. the size, scale, dynamism, and scope of data marts and data warehouses on Clouds contain important advantages [29].

At the end of application;
•	Corporate memory became more mature,
•	Dependency on people was removed in terms of reporting,
•	Communication and sharing of information within the finance department increased,
•	Personal Productivity increased and cost advantage was ensured,
•	With the widespread use of structural data, the users' confidence on business intelligence solutions increased.

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