GRADUATE ENTREPRENEUR ANALYTICAL REPORTS (GEAR) USING DATA WAREHOUSE MODEL: A CASE STUDY AT CEDI, UNIVERSITI UTARA MALAYSIA (UUM).

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ABSTRACT. Business Intelligence (BI) system using Data Warehouse (DW) technology is one of the important strategic management approaches in the organizations today. BI combines architectures, databases, analytical tools, and methodologies to enable interactive information access focused on analytical reports. Analytical reports, which affect the long-term direction of the entire company, are typically made by top managers. Decisions making in an organization is very difficult, especially if the organization has poor quality data and limited information. The management in the organization always depended on the past experiences and their instincts when making a decision making without support from the factual information. DW is a technology enable to integrate and transform enterprise data for strategic decision making. The organization, which is, responsible to manage entrepreneur activities need an analytical report for strategic decision making. This paper is focused how to design and develop Graduate Entrepreneur Analytical Reports called GEAR by using a DW model in Cooperative and Entrepreneur Development Institute (CEDI), Universiti Utara Malaysia (UUM) as a case study. This system has been tested through the system user feedback by using Computer System Usability Questionnaire (CSUQ), which measures satisfaction and consumer usability.

Keywords: Graduate Entrepreneur, Data Warehouse, Dimension Modeling, Business Intelligence, Analytical Report

INTRODUCTION

Cooperative and Entrepreneur Development Institute (CEDI) is a reference point for all aspects of entrepreneurship and cooperative development in Universiti Utara Malaysia (UUM). CEDI mission is to become a center to support the government's proactive and effective in their development and cooperation through innovative programs and creative. Furthermore, CEDI was also involved with the development of cooperatives as well as the need to generate revenue to the university. CEDI management needs a good strategic planning and decision making tools to archive their mission. Right now, CEDI doesn't have any analytical tools to monitor the channel of management, analysis, and monitoring the entrepreneur activities. Without analytical reports, it will be exhausted and difficult to manage a team to have a right picture about fundamental levels of information with the huge number of the operational database. The operational database lacks of effective organization, sorting of objective analysis, which is a very difficult use it to make a decision. The main problem for operational database that has not been able to meet the requirements of the manager that need an intelligent analysis tool (Tong et al., 2008). Turban et al., (2011) mentioned, the collection of data and the estimation of future data are among the most difficult step in the analysis for strategic information. Therefore, the management required concise, dependable information

about current operations, trends and changes in their organization. DW model is one of the BI technologies to extract, summarized, cleansing and transform data from various sources for developing the analytical report.

BACKGROUND

Business intelligence is a method of storing and presenting key enterprise data for the management easily can get the strategic and timely information. The process of BI is based on the transformation of data to information, then to decisions, and finally to actions (Turban et al., (2011). This technology collects the meaningful data from various sources in the given time and analyzes the data into meaningful and useful information by using data warehouse (DW) tools (Lida et al., 2007). One of the main functions of BI technology is the analytical report, which helps the management to take the right decisions in the organization. CEDI, UUM has a responsible to manage a graduate entrepreneur become an excellent business venture. An entrepreneur is the person who organizes, operates, and assumes the risk for a business venture. Furthermore, graduate entrepreneur refers to the university students or graduate students involved in a business venture. CEDI creates million bytes of data about all aspects of their business such as graduate profiles, business activities, course managements, and graduate entrepreneur funding. But for the most part, the data is locked up in the manual or computer system and exceedingly difficult to get. DW technology can help CEDI management to acquire meaningful information for CEDI management manages their activities and makes a good decision making. Therefore, CEDI management needs a system to manage graduate entrepreneur information for facilitating their management to make a decision making.

DATA WAREHOUSE MODEL

Inmon (2002) has defined DW as a database containing a subject oriented, integrated, time variant and non-volatile information used to support the decision making process. DW is a central managed and integrated database containing data from the operational sources in an organization. It may gather manual inputs from users determining criteria and parameters for grouping or classifying records. That database contains structured data for query analysis and can be accessed by users. The data warehouse can be created or updated at any time, with minimum disruption to operational systems. It is ensured by a strategy implemented in an ETL process. Data warehouse is a dedicated database which contains detailed, stable, non-volatile and consistent data, which can be analyzed in the time variant. Figure 1 below illustrates the software technologies and tools that are typically present or needed in the infrastructure of an end-to-end data warehousing solution. It also illustrates how the data flows from the sources to the targets in the process of creating and maintaining the data warehouse. DW repositories are available in different BI tools such as reporting service, dashboard, mashups, OLAP analysis, and data mining. The ETL tools are needed to automate the initial and periodic tasks of consolidating and summarizing data from the different data into the warehousing databases.

requirement gathering and analysis focused in developing CEDI analytical report. Table 1 shows the result of report requirements for GEAR prototype.

Table 1. Analytical Reports Requirement

No	Requirements	Priority
1	The system user needs **to determine the** BUSINESS PROFIT (RM) **categorized by business type and business category accordingly to time dimensions.**	High
2	The system user needs **to determine the** BUSINESS PROFIT (RM) **categorized by race, genders and states accordingly to time dimensions.**	High
3	The system user needs **to determine the** PERCENTAGE PROFIT (%) **categorized by business type and business category accordingly to time dimensions.**	Medium
4	The system user needs **to determine the** PERCENTAGE PROFIT (%) **categorized by race, genders and states accordingly to time dimensions.**	Medium
5	The system user needs **to determine the** TOTAL ENTREPRENEURS **categorized by business type and business category accordingly to time dimensions.**	High
6	The system user needs **to determine the** TOTAL ENTREPRENEURS **categorized by race, genders and states accordingly to time dimensions.**	High
7	The system user needs **to determine the** ENTREPRENEURS PERCENTAGE (%) **categorized by business type and business category accordingly to time dimensions.**	Medium
8	The system user needs **to determine the** ENTREPRENEURS PERCENTAGE (%) **categorized by race, genders and states accordingly to time dimensions.**	Medium
9	The system user needs to determine **TOTAL NUMBER** of Graduate Entrepreneur Status (Active, Non-Active and KIV)	High
10	The system user needs to determine **TOTAL NUMBER** of Graduate Entrepreneur Type (Siswaniaga and Graduate Entrepreneur)	High

CEDI management requires multiple data sources to build an analytical report. However, the data are not integrated and located in different locations. GEAR, using DW model for developing analytical reports consists of data sources, integration services, DW layer, analysis services, and presentation layer. The ETL tools such as SQL Server Integration Service (SSIS) was used to integrating, cleansing, aggregate, and summarize the data. This process involves to extract, transfer and loading the data from several data sources to DW. Dimensional model is used to design GEAR DW based on a Star Schema which is consisting of dimension and fact tables. The fact table contains business facts, measures and surrogate keys, which are referring to primary keys in the dimension tables. Dimension tables hold descriptive data that reflects the dimensions, or attributes, of a business domain in entrepreneur profile such as a business type, business category, gender, state, race, and time dimensions. With the large number of the reports' requirements, the Online Analytical Processing (OLAP) was appeared to provide CEDI management with deeper understanding and knowledge about many aspects of their organization data through fast, consistent, interactive access to a wide variety of possible view of the data. Figure 4 shows the star schema and OLAP of a data warehouse model for GEAR prototype.

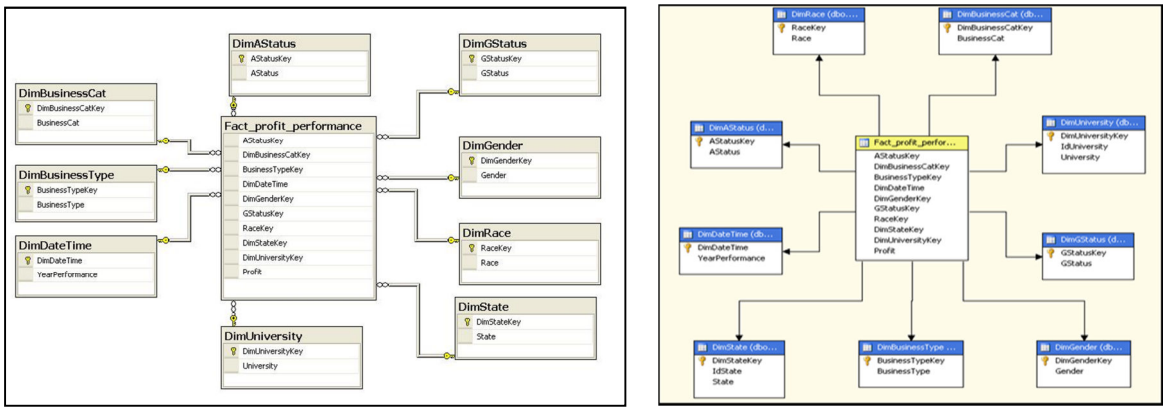


Figure 4. Star Schema and OLAP for GEAR

SQL Server Analysis Services (SSAS) was used to create the GEAR OLAP cube. OLAP cube is defined as the capability of manipulating and analyzing data from multiple perspectives due to some limitations of relational databases (Mundy et al., 2011). For a presentation layer, SQL Server Reporting Services (SSRS) was used to create GEAR analytical reports. SSRS is a server-based reporting platform that provides comprehensive reporting functionality for a variety of data sources. It used to determine the data set, type of chart for each report and create flexible analytical reports. Figure 5 shows the examples of GEAR analytical reports and presenting in the web based application.

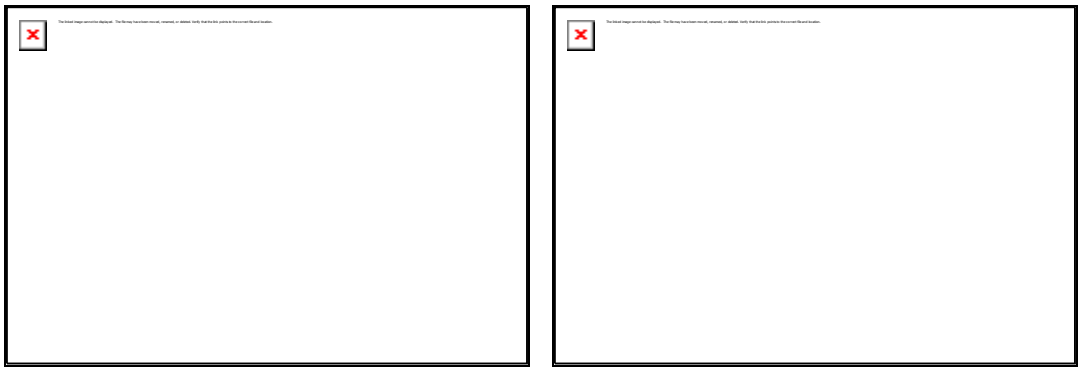


Figure 5. Analytical Reports for CEDI

The process to develop CEDI analytical reports started with identifying data sources, ETL process, build DW and OLAP storage, create report services and present the information. Figure 6 below illustrates the process to develop analytical reports in CEDI. GEAR assisted CEDI management to make better decision making and provide more understanding about the graduate entrepreneur profile. The important task in GEAR is to integrate data sources from multiple sources and transform to DW model, which is, enable to present an analytical report from many dimensions.

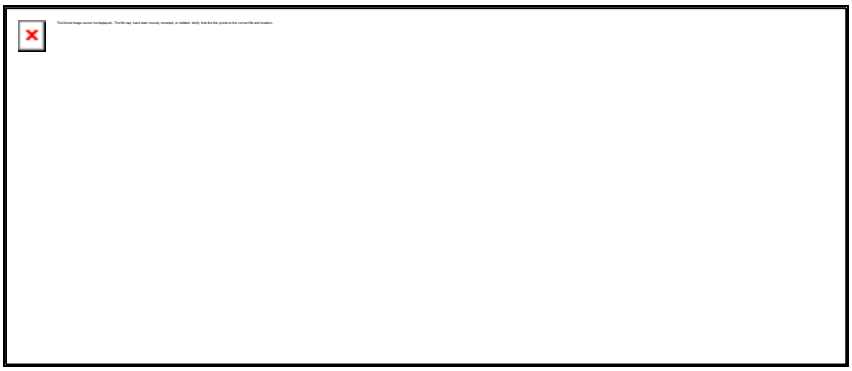
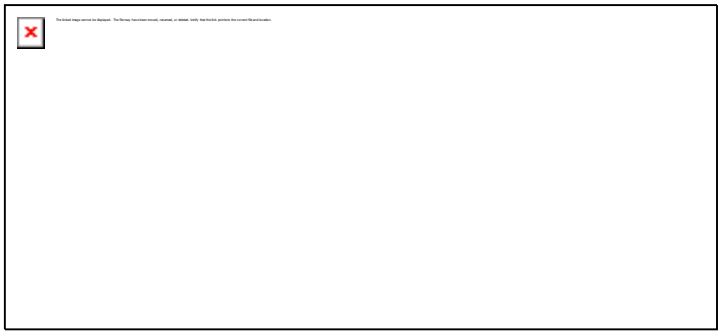


Figure 6. The process to develop GEAR for Analytical Reports

EVALUATION

GEAR prototype has been tested through the system user feedback by using Computer System Usability Questionnaire (CSUQ), which measures satisfaction and system usability. The questionnaire is adopted from Lewis (1995), contains of 19 questions and 7 degrees of likert scale (1-strongly disagree – 7-strongly agree). Descriptive mean statistics for GEAR evaluation result shows in Table 2.

Table 2. Descriptive Mean Statistics



CONCLUSION

In conclusion, DW model is a solution for CEDI management to build an analytical report for their organization. In graduate entrepreneur subject area, the information is concerning about graduate profile, business type, business performance, seminars, funding, and business transaction history. The CEDI operational data is integrated from various data sources and transform into analytical data storage to become a quality and meaningful information. The raw data in the operational system is clean, aggregate and summarize by using ETL process. Then, the data is the transfer to the DW and convert to the OLAP cube. Finally, CEDI management can access a strategic and analytical report based on report requirements without referring to the operational system. In additional, graduate entrepreneur analytical reports developed in CEDI are about entrepreneur profile, business profile and business performance. The reports are presenting in periodical time, using an analytical format and can be select by numerous dimensions. This paper shows the process how to design and develop analytical reports by using DW and BI applications in entrepreneur subject area. This process also can be a guideline to develop other analytical reports in a different domain. DW is an appropriate and excellent technology to develop analytical reports for the management in the organizations. The case study in CEDI, UUM shows that by using DW model to develop analytical reports is satisfactory for the users and useful for their management.

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