INSODE 2011

Integration between Customer Relationship Management (CRM) and Data Warehousing

Abeer Khan[a], Dr. Nadeem Ehsan[b], Ebtisam Mirza[c], Sheikh Zahoor Sarwar[d*]

[a,b,c,d]*Center for Advanced Studies in Engineering, Ataturk Avenue, G-5/1, Islamabad, Pakistan.*

Abstract

The focus of CRM investment is to automate the sales force i.e., to build separate applications for CRM having their own databases. These are just like operational systems, from where the data has to move to data warehouses later on. But now the trend is changing and CRM applications are supported by the data from data warehouses. This research paper focuses on various organizations especially within Pakistan which have switched to data warehousing for CRM applications. As a result, they are getting various benefits, such as minimized ETL processing, more timely and high quality data, alignments ensured with business goals, reducing the operational cost, improving customer services and customer retention etc. These benefits have been measured through statistical data analysis to show the trends over the years.

Keywords: CRM (Customer Relationship Management); Data Warehouses; ETL; Quality data

1. Introduction

Customer relationship management (CRM) consists of guidelines, procedures, processes and strategies which provide organizations the ability to merge customer interactions and also keep track of all customer related information. Technologies are utilized to attract new and profitable customers, retain and strengthen ties with current ones.

CRM revolves around the concept of maintaining long-lasting, valuable relationships with customers. This becomes easier when an organization knows its customers very well. It aims at capitalizing on customer relationships to establish and sustain them over time, and also monitoring all business areas such as marketing, sales, operations, services, production and HR. This all can be accomplished by maintaining one integrated view of each customer.

Data warehouses consist of operational data, decision support data, and data external to organization's business units to offer reliable and submissive business intelligence. In spite of developing, maintaining and managing the warehouse environment, warehouse administrators also perform the tasks of analyzing and transforming the data.

Data warehouses which fulfil CRM's basic requirements of granular customer transaction data are termed as customer data repositories (CDR).

Effective CRM collect data at every customer interaction and then analyze it for future improvements. The data warehouse becomes the repository for all customer information from all sources including operational systems,

* Nadeem Ehsan. Tel.: +92518317545;
 E-mail address: m4nadeem@yahoo.com

interaction data (solicitations, call centres), demographic data, behavioural data and customer- provided bio data. The key focus of a data warehouse is to support enterprise decision support system and is not restricted to a specific LOB (Line of Business).

2. Literature review

A lot of research has been done on CRM applications and data warehousing. However, the benefits of the latest trend of applying data from data warehouses to CRM applications needs to be elaborated so that more organizations may move to this technique.

Feargal McDonnell, Business Intelligence Practice Manager, at System Dynamics [1], highlights the following Data Warehouse and ETL advantages:

- Provides a single source of trusted data for your business.
- Offers your business accurate, relevant and timely information to make effective business decisions.
- Architects a Data Warehouse solution that is scalable and extensible across the enterprise.
- Identifies and resolves data quality and data cleansing issues

Duane Sharp in his article "The Ultimate Benefits of CRM", states the tangible and intangible benefits of CRM. The use of data warehouses and knowledge extracting technologies like data mining provides tangible and intangible benefits both external and internal to the organization.

Employees acquire the satisfaction of having authority and being in charge of their jobs and careers. Further, problem avoidance can be achieved as employee capabilities and power can be diverted towards innovation and creativity rather than on keeping on doing monotonous and time-consuming tasks of data-accumulation and its processing.

External to the enterprise, stronger, long-lasting customer relationships can be built by improved customer services, along with succeeding enhancement of three critical consumer parameters: *satisfaction, loyalty, and retention.*

"Putting the customer at the center of the business is one of the key trends in the industry," said Stewart Meyer, telecommunications industry analyst for MicroStrategy [2]. "The best way to do this is through a data warehouse." He also realized the need to integrate customer information and feedback from several sources, including call centers and online transactions. Complete history and details of customer's interaction done with the enterprise should be available for use to service representatives.

Data warehouses along with analytical tools such as online analytical processing (OLAP), can give gains such as customer appeal and retention, cross-selling and up selling. For example, telecommunications firms can study the CDR to establish patterns and trends suggesting the significance of launching an additional service for the customers. The core purpose of these endeavors is to maximize customer satisfaction.
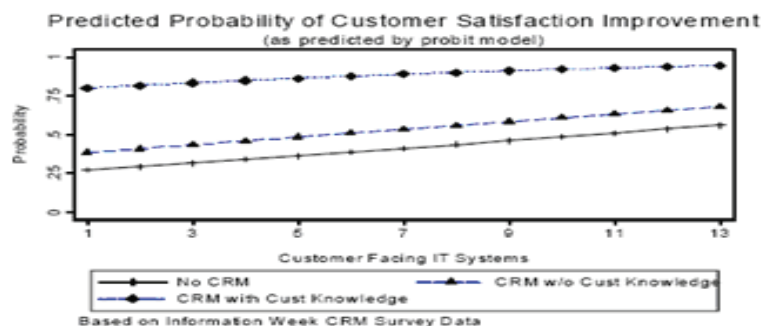

Fig. 1. Predicted Probability of customer satisfaction improvement [4]

IBM recommends data warehouses for benefits such as to improve strategic decision making with consistent views of data, improve regulatory compliance and help companies become more nimble. Companies of all sizes and stature need to make rapid, well-informed decisions to ensure overall competitiveness, expansion and development.

Data warehouses manage rapidly growing company-wide data efficiently and cost-effectively. With further help from online analytical processing (OLAP) and data mining tools, business strategies can be formulated based on patterns, trends and knowledge extraction rather than guess-work.

Data warehousing is considered a chief area in the field of IT. Sunil Mithas graphically demonstrated customer satisfaction improvement in IT systems with and without customer knowledge [3], as illustrated in figure1.

2. Research Methodology

Research methodology used in this paper is analytical research. Already available facts and information have been extracted and analyzed to make critical evaluation. The in-depth study and evaluation of available information has enabled to determine several benefits that integration of CRM and data warehousing can bring to the industry as well as customers.

4. Data Warehouse Framework

Data Warehouse Framework organizes all of the components of a data warehouse environment. The framework can be used as a communication tool with all of the parties involved with the data warehouse.

The data warehouse frame is designed to gather data from various operational data sources. The gathered data is then transformed to form the core data warehouse. This enterprise data warehouse is managed and on occasions replicated and propagated to form data marts, also known as, departmental warehouse.

This information within data warehouse, with the aid of knowledge discovery, data mining and information access tools, is used by business users to improve organizational processes.

5. Data Warehouse Architecture

Enterprise Data ware house is a centralized store of detailed data from all relevant source systems, which allows ad-hoc discovery and detailed focused analysis by several user groups.

All historical and transactional data resides within one centralized data warehousing. Based on data mining and information access tools, business users extract the pertinent facts and figures.

An Independent Data Mart is a specific distributed subset of operational data targeted at analysis by a specific user group. It is also known as a departmental data warehouse. This approach requires simpler data mining as data has already been divided.

Enterprise Data Warehouse with Dependent Data Mart: A Dependent Data Mart is a special purpose subset of a larger data warehouse in which data is selected and organized for pre-determined requirement sets.

Different companies have their own solutions; some recommend distributed approach for DW and some recommend centralized approach for DW.

IBM recommed distributed approach also known as Federated approach.

NCR Corporation recommend centralied approach.

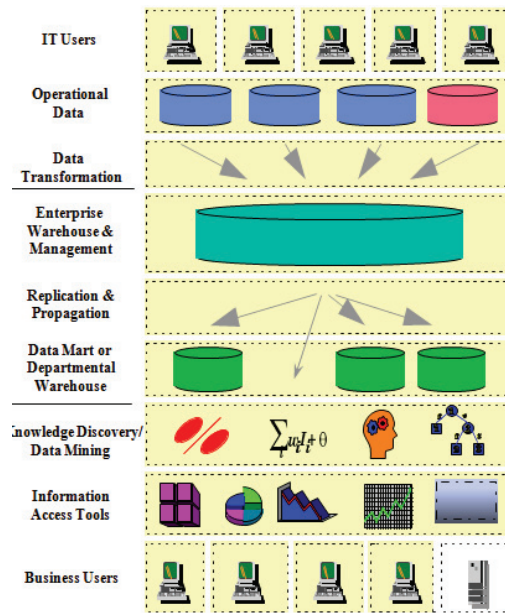Fig. 2. Data Warehouse Architecture [5]

6. Use of Data Warehouse to process customer information

Operational and analytical requirements are both a path of CRM. CRM works by collecting customer information at each transaction and from each customer activity. This data is analyzed to achieve quality in business processes. Here, data warehouse comes into role, as it is a repository for all customer related information: operational or transactional data, interaction data, customer-profile data and demographic and behavioral data.

The table below shows differences in Transaction processing systems (TPS) which make use of databases, and Decision Support Systems which make use of data warehouses.

Table 1. Differences between TPS and DSS

	TPS	DSS
Users	Front-line workers	Management
Purpose	Supports day-to-day operations	Supports strategic decisions
Data	Raw data (entered by users)	Filtered and transformed data
Source of data	Internal sources only	Internal and external sources
Time horizon	Current data	Historical data
Level of detail	Only detail data	Detail and summary data
Data structure	3NF	De-normalized tables
Design goal	Maximum update efficiency	Maximum query efficiency

Analytic CRM shows the best use of data extracted from data warehouses to better understand customers. Analytic CRM utilized the accurate, integrated and accessible data in the warehouse. Customer data is controlled to

identify selling opportunities, point inefficiencies, increase product demand within customers and improve retention of existing customers.
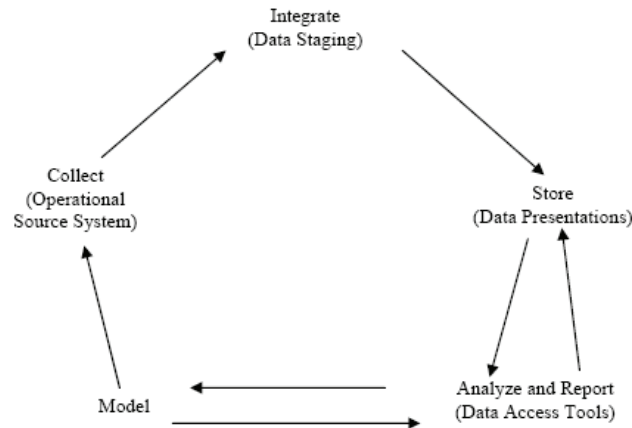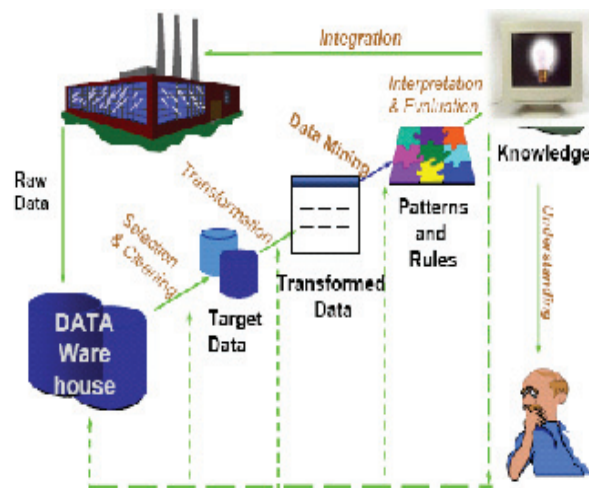

Fig. 3. Analytic CRM

Fig. 4. Knowledge Discovery Process

7. Minimized ETL Processing

ETL, abbreviation for Extract, Transform, Load, is the main activity for data warehousing. Extraction refers to extraction of data from various sources. Transformation includes activities such as refining, reformatting, standardizing, aggregation and inclusion of multiple business rules. Finally, the formatted data is loaded into end systems or file formats.

When organizations switch to data warehouses from data bases, the number of ETL processing is significantly minimized.

Data for CRM can come from various heterogeneous sources and in various formats. Data such as structured or unstructured data, XML documents, web services,

RFID systems, and packaged applications like SAP or PeopleSoft, need to be extracted from databases such as relational, hierarchical and object. Performing ETL activities on multiple databases lead to increase in number of

transactions. However, in enterprise data warehousing, data from all these sources is integrated at a single location. So instead of multiple processing, lesser ETL transactions can help in achieving the desired output. Customer profile data, behavior and topography analysis required ample effort when using databases, whereas, use of data warehouses reduces all the effort.

Meredith Publishing Group's marketing group in the United States, before having access to CDB (customer database) , could only perform analysis of about 1% of the entire customer data residing in external databases. However, with all customer data loaded into the enterprise data warehouse and directly accessible, marketing group were able to analyze almost 100% of the entire available customer data – more than 70 million customers – in only a few minutes.
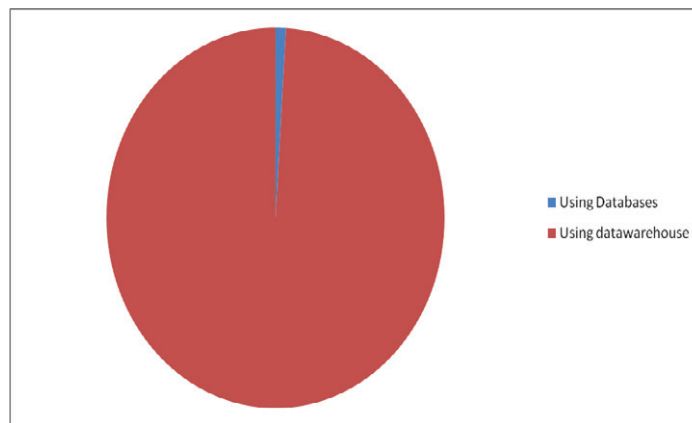

Fig. 5. Comparison of percentage of customer data analyzed using databases and datawarehouses

8. Timely and high quality data

80% of the time spent in data analysis is usually taken up by the data transformation process. So using the correct data warehouse architecture (enterprise, data marts), ETL tools and automated transfer, can dramatically reduce the 80% of the time.

As already mentioned, organizations collect data from various sources: legacy, databases, external providers, the Web, and so on. However, quality is compromised due to inconsistent data and several heterogeneous data sources. All these endeavors to collect enormous amount of data become an overhead for the enterprise as resources, time and money are spent without quality assurance.

Data quality often refers to cleansed data, which makes sense to the organization. ETL (extract, transform, and load) data warehousing process and data quality offers the ability to easily manage complex data integration ensuring data integrity and accuracy. Further, data warehouse quality depends on its accessibility, interpretability, usefulness, believability and validation [4].

The trend in the above diagram illustrates how information maturity improves with enhancement of data collection and representation tools. As data analysis tools move from tabular forms to ware houses and Executive Information Systems (EIS), information matures i.e. the data collection becomes more integral, accurate, consistent, reliable, meaningful and last but not the least, this data is available to all in a timely fashion. With increase in maturity level of the information, more value is added to the concerned organization.
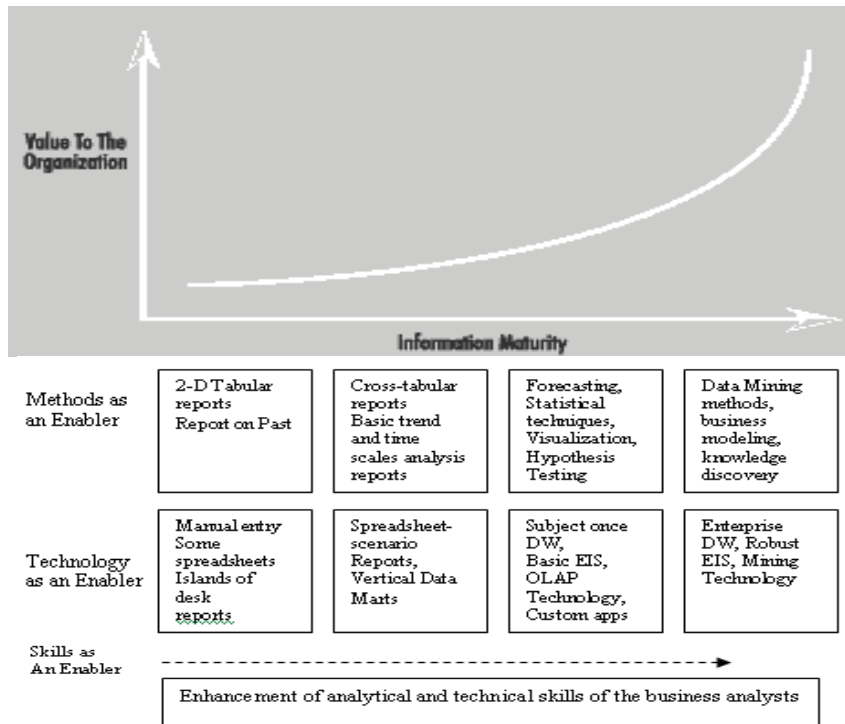
Methods as an Enabler	2-D Tabular reports Report on Past	Cross-tabular reports Basic trend and time scales analysis reports	Forecasting, Statistical techniques, Visualization, Hypothesis Testing	Data Mining methods, business modeling, knowledge discovery
Technology as an Enabler	Manual entry Some spreadsheets Islands of desk reports	Spreadsheet-scenario Reports, Vertical Data Marts	Subject once DW, Basic EIS, OLAP Technology, Custom apps	Enterprise DW, Robust EIS, Mining Technology

Skills as An Enabler

Enhancement of analytical and technical skills of the business analysts

Fig.6. Information maturity trends and value to the organization [6]

9. Reduction in operational cost and increase in revenues

Reduced cost in ETL processing, and availability of data in a timely fashion, eventually results in reduced business cost and increased revenue. Blue Martini software was able to increase their revenues by making use of enterprise data warehouse and data mining to analyze their website capabilities. The company analyzed information such a web traffic, days when customer purchases were high, number of visitors, number of clicks, demographics, customer income, searched items, visit statistics and visit durations. Imagine reviewing all this data from multiple databases. However, with the aid of enterprise data warehouse containing historical customer data and data mining, Blue Martini modified their website design to attract more visitors and customers. Eventually, the company was able to increase nearly 30% in overall revenue from the site.
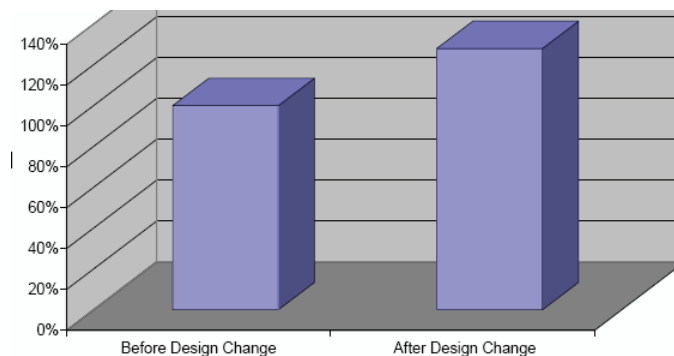

Fig.7. Increase in revenue before and after design change [7]

First American Corporation (FAC) is an all-inclusive financial services holding company based in the United States. In 1990, FAC lost $60 million to their competitors. While formulating new strategies the company realized that hey can gain sustainable competitive advantage by knowing their customers inside out and utilizing the knowledge obtained to design new banking products, creating new distribution channels and methodologies for improved interaction with customers.

To hold the amalgamated customer information, product profitability information, and revenues and costs, FAC setup a data warehouse called VISION.

Marketing and finance analysts used warehouse data directly to identify top revenue producers, profitability information, and send reported results and recommendations to management. Moreover, hundreds of indirect users received and used VISION generated reports.

Where FAC faced losses of $60million in 1990, use of warehouse data for CRM shifted the company to $211 million profitability in 1998 [5].
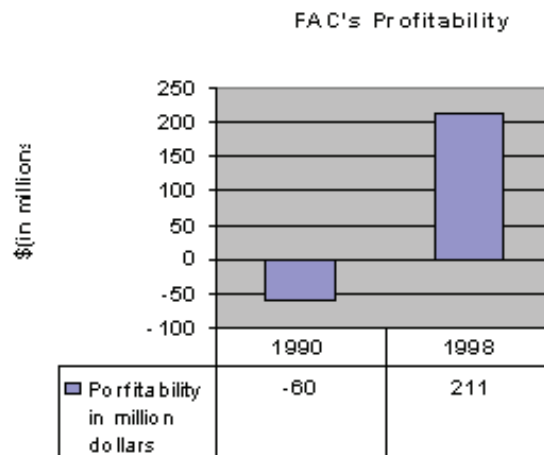

Fig.8. FAC's Profitability

10. Improving customer services and customer retention

Source: Cooley as referenced by "How to Hug Your Customers, and Get Value with Every Squeeze" CustomerThink Corporation 2004

Fig. 9. Why customers leave [9]

With 100% low-level, detailed customer data available for analysis, more descriptive analytical models can be created. These can further be used to promote customers to different segments by targeting new variables. With more customer data available such as their buying habits, gender differences, customer segmentation etc. data mining and extraction tools can be utilized to achieve best results.

Figure 9 shows percentage reasons why customers leave. With data warehousing data mining and knowledge discovery techniques, an organization can analyze reasons for service problems within itself.

These problems can be minimized too ensure customer retention. Track of customer call logs and maintaining history would give trend of services provided and customer's reaction to these services. Based on customer satisfaction, service quality can be maintained or improved.

Data warehousing and business intelligence solutions are the key to customer identification. Companies plan to enhance the ability to better understand their customers. Better customer identification can aid in profiling best customers and the rate at which they are buying products. Trend information gathered can eventually lead to making better business rules, marketing strategies and trained sales forces. Another benefit data warehouses tries to accomplish is to understand customer profitability. When a customer gets benefited, the company gets profits automatically. In short, availability of ERP-driven information provides enhanced customer relationships, identification of new products and services and improved market segmentation.

In November 2008, 200 plus retail companies were surveyed. Of the companies surveyed, 67 percent indicated they have already implemented and use BI (Business Intelligence – CRM and data warehousing), and 26 percent showed interest in adopting a BI solution. The best-in-class retail companies make use of CRM integrated with CRM to help make more accurate business decisions and improve customer retention and loyalty.
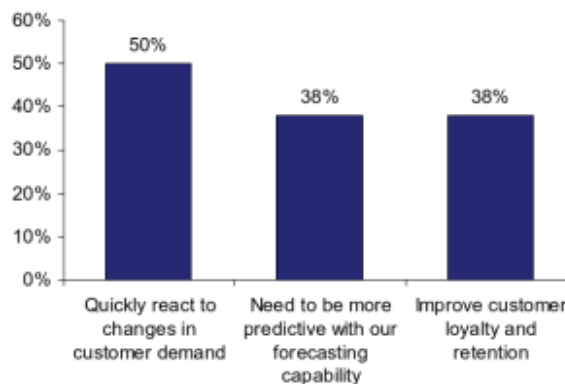

Fig. 10. Best-in-Class Pressures Driving Business Intelligence Use [10]

Within Pakistan, several organizations have switched to data warehouses for better data handling and improved CRM.

NADRA (National Database and Registration Authority) in Pakistan established the National Database Organization (NDO) under the Ministry of Interior to commence the task of handling the data being collected through National Data Forms during the Population Census in 1998. With enterprise data warehouses and knowledge discovery tools, NADRA has become one of the most successful organizations of the 21st century.

Telenor Pakistan is the world's seventh largest mobile operator, with 164 million mobile subscriptions in 13 countries. Telenor's Enterprise Data warehouse is based on the Teradata Communication Logical Data Model; information is integrated from all major networks and IT sources (call detail records from all months, customer data, billing and payment information, customer interactions, and more) to build a 360-degree view around the customer. With this state-of-the art EDW, the company became the fastest-growing mobile operator in Pakistan within just 4 years – "Growth comes from truly understanding the needs of people to drive relevant change".
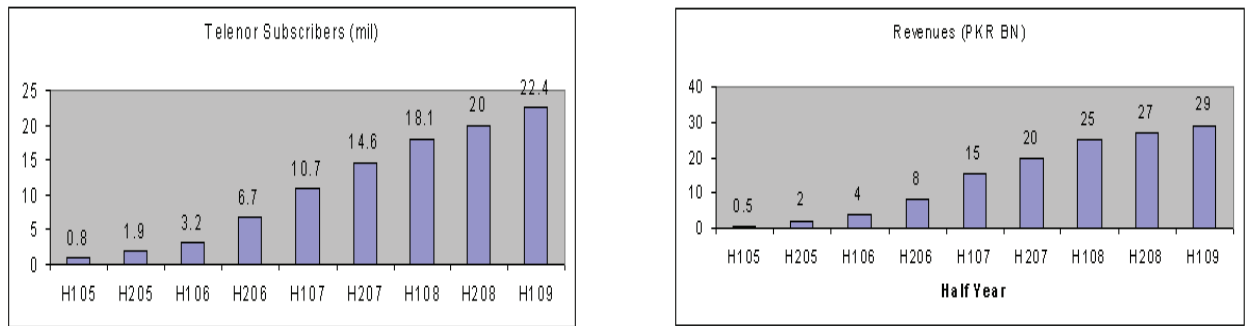
Fig. 11. a) Telenor Subscribers (in millions) (b). Telenor Revenues (in PKR Bn)

11. Conclusion

With all the benefits outlined, it is concluded that integration of CRM with data warehousing can provide the following corporate renaissance; reduction in cost to acquire customers, reduction in cost to sell, reduction in cost to serve and reduction in time to serve. Similarly, CRM enhances the following: customer satisfaction, relationship returns, competitive advantage, number of customers, customer retention rate, collection of analytic assessment to measure customer's value, revenue per customer and influence of order fulfillment, returns and call center goings-on on tangible sales performance [6].

12. Recommendations

Analysis of other companies from the telecom industry, medicine, IT industry, construction industry etc., which over the years have switched from databases to data warehouses, can further highlight the benefits achieved in CRM. However, one cannot ignore the overhead or cost incurred in the transition from switching to data warehouses. Break-even analysis can be performed to determine the average time taken by any enterprise to break-even with the initial switching cost incurred, after which the actual profits can be determined.

References

1. Feargal McDonnell, Data Warehouse and ETL(System Dynamics).
2. Judith Lamont, Data warehousing in the telecommunications industry. Posted Jan 1, 2000.
3. Sunil Mithas, Effect of Information Technology on Customer Satisfaction by- January 8, 2005.
4. Effect of Information Technology on Customer Satisfaction by Sunil Mithas (January 8, 2005) [Online]. Available: http://www.stern.nyu.edu/ciio/WorkOnline/IS20042005/0303.pdf.
5. Data Warehouse Glossary [Online]. Available: http://hubpages.com/hub/Data_Warehouse_Glossary.
6. DWQ, Foundation of Data warehouse Quality, by Matthias Jarke, Yannis Vassiliou, Data Warehouse Quality: A Review of the DWQ Project. Invited Paper, Proc. 2nd Conference on Information Quality. Massachusetts Institute of Technology, Cambridge, 1997.
7. eTail CRM Summit: Mining Customer Data By Ronny Kohavi, Ph.D. Senior Director and Chief Evangelist of Business Intelligence.
8. Wixom (McIntire School of Commerce), Hugh J. Watson (Terry College of Business) - MIS QUARTERLY EXECUTIVE, JUNE 2002, PP. 79-94.
9. crmTrends [Online]. Available: www.crmtrends.com/crm.html.
10. Drawing a Business Intelligence Road Map for E-Tailers by By Jeanette Keene and David Hatch CRM Buyer.
11. Customer Relationship Management (CRM) and Corporate Renaissance by M.L Agarwal . Journal of Services Research Volume 3, Number 2 (October 2003-March 2004) . 2003 by Institute for International Management and Technology.