Incorporation Stuck Between Customer Relationship Management (CRM) and Data Warehousing for Data Mining Application

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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 India 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 Mining 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 fulfill 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 datawarehouse becomes the repository for all customer information from all sources including operational systems, 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. 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.
3. 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.

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."

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.

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

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 customersatisfaction improvement in IT systems with and without customer knowledge [3], as illustrated in figure 1.
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

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

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.

4. 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 amounts 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 offer 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 warehouses 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 immaturity level of the information, more value is added to the concerned organization.

5. Improving customer services and customer retention

6. 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 tangible sales performance [6].

7. Recommendations
Analysis of other companies from the telecom industry, medicine, IT industry, construction industry etc., whichever 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.
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