

CRM PERFORMANCES ACCENTED WITH THE IMPLEMENTATION OF DATA WAREHOUSING AND DATA MINING TECHNOLOGIES

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General survey

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Abstract: Customer Relationship Management (CRM) has become more and more a key strategy for large and small businesses. It supports marketing, sales, services and involves direct and indirect customer interaction. Customers are put into the center of the business, because they represent an asset and profit for any company. Customers need to be satisfied in order to be loyal. A company can achieve that by meeting customer's needs and expectations. In order to perform both for the benefit of the customer and for itself, a company has to use all the positive advantages of IS technologies that support CRM including data warehouses and data mining, that are clearly presented in this paper

Key Words: Customer Relationship Management (CRM), Data Warehousing (DW), Data Mining (DM)

INTRODUCTION

New information technology systems have an impact on the trend of a global economy redesigning that causes the fast reduction of technological costs. Today's Web sites, e-mails, computers and other automation tools made feasible implementation of the cost efficient Customer Relationship Management (CRM) into the organizations. Because of that, Data Mining and Data Warehousing, as same of automated tools, are crucial for the company, because those tools help to get useful information (reports) about customers and their needs.

The organizations cannot escape this revolution, because it is present and it is *business-to-business (B2B)* marketing revolution. Each level of the company will be affected, but some of the company managers will follow new trends and some of them will refuse changes and the role of the new technology. However, to avoid misunderstanding, the implementation of the Customer Relationship Management (CRM) will not be an easy process, and the fact is that organizations that do not accept those changes will lose a competitive advantage.

DATA WAREHOUSING (DW)

A data warehousing "is a copy of transaction data specifically structured for querying, analysis, and reporting [5]." Data warehousing uses data from any type of database and analyses them, for example customer services such as complaints and compliments and give report, from which, company can easily see most common customers complaints or rewords. **Data warehouse database** "is a database that focuses primarily on the storage of data used to generate the information required to make tactical or strategic decisions [6]."

The unique form of a data warehouse is the **operational data store (ODS)**. This form is much smaller than the conventional data warehouse, because it stores only information about customer identity. The operational data store is structured for transactional performance. This kind of data warehouse is used for the front-office systems and for the purpose of establishing a single view of the customer.

The **data conversion** is constructed in a way that data is copied from tactical databases to the data

warehouse. In this way, the duplication of data is reduced and database inconsistencies are solved.

Selecting and combining technology options for CRM

The integration of the CRM approach will also be determined on the organization’s CRM strategy. In terms of data repository CRM strategy development is based on four broad alternative technologies, which are:

- a database
- data marts
- an enterprise data warehouse, and
- integrated CRM solutions

The graphical illustration of CRM applications is shown in Figure 1.

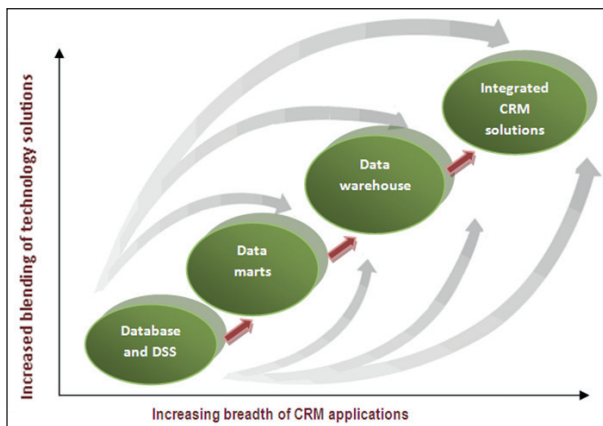


FIGURE 1. TECHNOLOGY LEVELS FOR CRM

(SOURCE: ADRIAN PAYNE, 2005, “HANDBOOK OF CRM: ACHIEVING EXCELLENCE IN CUSTOMER MANAGEMENT”, PAGE 236)

Data mart

Data mart “is the ability of computers to act as an enormous memory and capture all the information on a customer that has been the driving force behind the adoption of CRM IT applications [6].” In order to shift it from the product-based selling to a customer-based marketing, the company needs to have an advance CRM system. A data mart stands for the simplest form of the data warehouse.

Advantages of the Data Mart

Data mart is a tool that will be placed on a department server technology rather than on a PC and will enable numerous of users to connect and use information from it.

It is useful for the businesses that have many departments and would like to respond faster to a business opportunity.

Disadvantages of the Data Mart

The aim of each company that has CRM is to collect needed information about customers and due to that, data warehousing need to be able to store this information. From the beginning, data marts need to be developed as data warehouses. In order to get information based on the best customers and their profitability, product sales and financial data need to be offered. This does not enable companies to develop a consolidated single view of the customer; in that case each department in the business sees the same picture.

Enterprise Data Warehouse

The business that focuses its strategy on the customers will need many databases and data marts. In that case better solution is to have one repository for data. After developing the data warehousing and establishing clean data, analysis on data and data mining software can be applied, and understanding of customers’ manners can start as well as building more advanced CRM strategy.

In addition, data is collected from multiple part of the data warehouse into departments systems. It includes collection of data from databases or department data marts. The data warehouse can track customer relations over the entire customer’s lifetime.

The Figure 2 represents the data warehouse for the CRM systems.

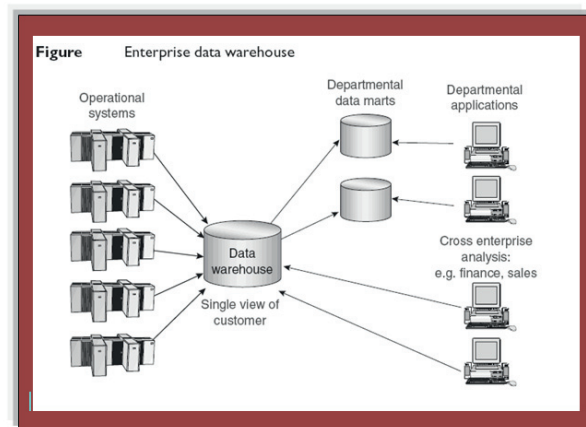


FIGURE 2. ENTERPRISE DATA WAREHOUSE

(SOURCE: ADRIAN PAYNE, 2005, “HANDBOOK OF CRM: ACHIEVING EXCELLENCE IN CUSTOMER MANAGEMENT”, PAGE 242)

Advantages of the Data Warehouse Enterprise

Usage of the data warehouse is beneficial in many cases, such as removing a demand on larger databases. Data that is stored in data warehouse is up to date and periodical (i.e. every 24 hours). In that case, analysis done in different periods will give different results. Also the company can direct analysis in one direction and it can then feed numerous data marts with consistent data.

Disadvantages of the Data Warehouse Enterprise

Enterprise data warehouses are huge and complex IT systems that require continuous implementation for a longer period time. And because of that, businesses are willing to implement cheaper and faster versions for the implementation solutions. Here are some costs and benefits that data warehousing has:

Costs

- Hardware, software, development personnel and consultant costs
- Operational costs such as continuing maintenance of the system

Benefits can be divided into two categories such as:

Added Revenue

- Will the new business objective gather new customers?
- Will the new business objective increase current customer tendency to buy?
- Is the new process necessary to make sure that the competition will not offer a demanded service that you cannot match?

Reduced Costs

- What costs of existing systems will be removed?
- Does the new process have the ability to make some operation more efficient in the future?

DATA MINING (DM)

Data mining, “also known as Knowledge Discovery in Databases (KDD) refers to the efficient process of searching through large volumes of raw data in databases to discover things (e.g. about a customer) that are not easily seen or noticed. The process of searching large amounts of data for patterns is based

on the following methods: clustering, classification and association rules [2].” Data within the data warehousing and data mining can be used to answer some questions related to the organization that a decision maker had not thought to ask before, such as:

- Decision on which products to offer to a current customer?
- Determining the probability that a certain customer will react to a planned promotion?
- Deciding which security will be more profitable to buy or sell during the next trading session?
- What is the probability that a certain customer will try non-payment or pay back on schedule?
- Determining the appropriate medical diagnose for the particular patient?

Data mining can easily help CRM to analyze the largest databases for the purpose of solving business problems. But to make clear, DM is not a business solution, it is a technology same as statistics. On the other hand, CRM transfers information in a database into business decision that establishes a relation with customers. One example where DM helps when we are talking about CRM is deciding on to whom seller needs to send a catalog about the new product. CRM contains a historical database about the earlier connections with customers and all data about the customers. DM uses this data from the historical database and develops a model about the customer behavior that could be used to see which customer will be interested for the new product. This kind of knowledge can be used to send offer to the right customer.

Developing profitable customer relationship using data mining

After developing customer data warehouse, the major issue is how to use all information it contains. As mentioned before, CRM is used in order to increase the profit of the firm via customers' relations. Successful CRM has focused on building a customer database that presents a picture of the customer's relationship with the company.

However, the large amount of customer information as well as ever more complex relations with customers has pushed data mining to the leading po-

sition when we talk about making customer relationships profitable. Data mining is used in discovering patterns by using different methods and a variety of data analysis. Furthermore, it is used to understand what your customers want and predict what they will do. By using data mining, it is easier to determine the right customer, offer the additional products to current customers, such as determining the best customers that can leave the company. CRM applications that use data mining are called analytic CRM.

In CRM, data mining is often used to give a score to a specific customer or prospect where the individual behaves the way we want (i.e. Customer response to a specific product or ability to visit competitors' store and buy products there; segmentation into groups of the customers according to their behaviors, such as buying certain products). Classification can be used in order to determine similar interests held by groups of customers. Another name for classification is collaborative filtering. There are three methods used in data mining:

Classification "builds a classification model by using a given data set, and then classifies them according to their similarities [2]." "An **artificial neural network** is defined as constructing a network of artificial neurons [2]."

Clustering "is dividing data records in a given data set into groups (clusters) according to their similarity [2]."

The association rule "finds a strong association between items using the values of support and confidence, two complex concepts that focus on the similarity between the individual occurrences of the two items, as well as on their co-occurrence [2]."

Three phrases of the customer life cycle:

1. Attracting customers
2. Increasing the value of customers
3. Keeping a good customers

In all three stages of CRM, data mining can help. In addition we will see how.

1. Attracting customers

Building a predictive model, data mining will show who would respond to the company offers (using a decision tree) and using a neural network. In a credit card company, if we know: if customer earns between £20,000 and £40,000 and customer has a house, then the customer risk factor is low. Then, we can issue a credit card to the customer with confidence.

2. Increasing the value of customers

a) Cross-selling via data mining

In order to better understand customers' needs, the company uses data mining methods. When the data mining models are included in a typical cross-selling CRM campaign, then that models help company increase its profit.

b) Personalization via data mining

In order to see which products are grouped into the same group (cluster), the company uses data mining clustering method. After the analysis is done, some clusters are obvious (i.e. in a supermarket, if we know: 98% of customers who purchase orange juice also purchase nappies. Then, we can locate orange juice and nappies together to increase the customer throughput), but some results are unexpected (i.e. A customer who buys books about desert hiking and also buys snakebite kits). These patterns are used in order to group these products together and increase customer purchase.

3. Keeping good customers

For many companies, the costs of attracting new customers go above the costs of keeping good ones. This was the challenge for KnowService that it tries to solve and it consists of three models. One model determines potential customers, the next model picks out the profitable potential customers and the third model matches the potential customers with the most suitable offer. KnowService discovered that the investment given to data mining was beneficial, because it improved customer relationships and increased profitability.

Applying Data Mining to CRM

Some phases have to be included and followed in order to develop a good CRM system. The essential steps of data mining used for successful CRM are:

1. Identify business problem

The essential fact is the need to define business goals, because each CRM application deals with the goals for which, the company needs to develop an appropriate model.

2. Develop database marketing

The essence of this step is data preparation. These two first steps take more time and effort than all the other steps. The data preparation can be done in iterations as well as model building. These data preparation steps may take 50 to 90 percent of the time and effort for the entire data mining process.

The company will need to develop a marketing database, because operational databases and corporate data warehouse do not have the data needed in the form company needs it. Besides, CRM applications could meddle with the quick and effective implementation of these systems.

Clean data, which is needed after the development of the marketing database, is important because of a model developing. That data can be stored in multiple places, and because of that, the company is sometimes in a situation where it needs to integrate and consolidate the data into a single marketing database. The major fact why data quality represents a problem is that the same data are defined in different ways in two databases.

3. Discover data

The first thing that needs to be done before developing a predictive model is to comprehend data that company keeps. The starting point should be collecting numeric summaries, such as descriptive statistics i.e. average, standard deviations etc. Furthermore, continue with the process of analyzing description of the data. In some cases, company wants to develop pivot tables for multidimensional data. In a data preparation phase, the main role plays the tool for creating graphs and data visualization.

4. Prepare data for modeling

In this step, the company finally prepares the data before developing models. This final touch consists of four steps, which are: doing selection on the data that will be used to develop the model. The ideal way

to do this is by putting data into the data mining tool and let the data mining tool find those that are the best predictors.

The next step is to build new predictors resulting from the raw data. After that, the company can decide to choose a subset or sample of data on which to build models. The large amount of available data can cause problems, because it takes more time or in some cases requires buying a better computer.

When samples are selected randomly, it usually results in no loss of information for most CRM problems. So, the company has to change variables according to the requirements of the algorithm based on which it chooses to build the model.

5. Build model

The step in which company constructs the model is an iterative process, in order to find the one that is most useful in solving business problems. What company learns through searching for a good model, may even guide it to go back and make some changes to use the data or modify problem statement. Supervised learning is known protocol on which each CRM application is based. The company starts by using information about customers for which the desired result is known.

6. Evaluate model

Correctness is not important as a good metric for the evaluation of your results. Another measure that is often used is a lift, which measures the improvement attained by a predictive model. This measure does not take into account cost and revenue and due to that it is more suitable and preferable to look at the profit or ROI.

7. Organize model and results

Data mining developed in CRM application is a tiny and dangerous part of the final product. The way data mining is developed in the application is determined by the nature of your customer interaction, which can be done in two ways such that customer contacts company (inbound, i.e. telephone order, Internet order) or company contacts them (outbound, i.e. through advertising or direct mail).

CONCLUSION

While many companies are present in today's marketplace and want to be ahead of these competitors, the implementation of a Customer Relationship Management is crucial in order to compete effectively. Nowadays, CRM is a necessary part of a modern business that puts the customer in the center of its business activities to get long-term satisfaction and loyalty. Today, customers are actually the most important asset of each firm so they should get the full attention of the company's management. Satisfied and loyal customers lead to profitable customers. Customer satisfaction and loyalty are the results of meeting customers' needs and expectations as well as the results of good customer relationships. Companies need to attract new customers and retain current ones by offering good quality products and services. Furthermore, they need to make sure there is a low customer defection rate. A lower defection rate means higher company performance.

In addition to being one step ahead of the competition, companies need to use IS technologies that will support CRM. Through IS technologies companies can get closer to their customers by being able to collect useful information about them as well as being able to satisfy their needs and expectations. Using a data warehouse and data mining, a company can analyze data and get reports with meaningful knowledge that can be further used to improve or change some of their business performances. These technologies are very powerful tools that each leading company should use. All these IS technologies need to be used in a company in order to have a good CRM solution that will support their business strategy.

Authorship statement

Author(s) confirms that the above named article is an original work, did not previously published or is currently under consideration for any other publication.

Conflicts of interest

We declare that we have no conflicts of interest.

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