Chapter 80
Business Process Improvement through Data Mining Techniques:
An Experimental Approach

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ABSTRACT

The chapter proposes a general methodology on how to use data mining techniques to support total quality management especially related to the quality tools. The effectiveness of the proposed general methodology is demonstrated through their application. The goal of this chapter is to build the 7 new quality tools based on the rules that are "hidden" in the raw data of a database and to propose solutions and actions that will lead the organization under study to improve its business processes by evaluating the results. Four popular data-mining approaches (rough sets, association rules, classification rules and Bayesian networks) were applied on a set of 12.477 case records concerning vehicles damages. The set of rules and patterns that was produced by each algorithm was used as input in order to dynamically form each of the quality tools. This would enable the creation of the quality tools starting from the raw data and passing through the stage of data mining, using automatic software was employed.

INTRODUCTION

Nowadays, a sudden increase of data that is stored in electronic form within an organization or an organisation is observed. This data constitutes the "historical files" of any process-activity that has taken place in the past and is digitally recorded and prompts each interested analyst to extract the useful information that is "hidden" inside. The application of mined knowledge in theoretical practices is capable of leading the analysts to a set of actions that will bring about the optimization of the organization's processes.

In the field of interest of the herein, the mined knowledge is represented by the data mining techniques while the theoretical practices are represented by the quality tools, as main components of Total Quality Management (T.Q.M.).

The present work intends to demonstrate the applicability of data mining techniques in the quality tools formation. More specifically, the aim is the implementation of an automatic application, which is based on their feed with a specific type of information and this comes from the results of data mining techniques upon raw data. The final goal is the emergence of the sources of the problems and the provision of the likely solutions that will lead to the improvement of the business processes.

The quality tools are chosen as a guide for the process improvement because they are powerful, easy to use and simple to be dynamically constructed. Furthermore, they offer a better frame of quality management from the others. Finally, they are suitable for pointing out the sources of a problem and its possible solutions (Kolarik, 1995).

At a brief, the 7 new quality tools and their main functions are:

- **Affinity Diagram:** It concerns the systematization of large quantities of data in groups, according to some form of affinity (Kanji and Asher, 1996). The regrouping adds structure in a big and complicated subject, categorises it and leads to the determination of a problem (Dahlgaard, et al, 1998).
- **Relationship Diagram:** Its aim is the recognition, comprehension and simplification of complex relations (Dale, 1994).
- **Systematic Diagram:** The systematic diagram is a hierarchical graphic representation of the requisite steps towards the achievement of a goal or project (tree diagram) (Dale, 1994). Its aim is the development of a sequence of steps, which compose the resolution of a problem (Mizuno, 1988). Also, it has the ability to deconstruct a general problem in more specific ones, helping to understand their causes.
- **Matrix Diagram:** The matrix diagram aims to seek the clarification of relations between causes and effects (Dale, 1994). Moreover, it detects the reasons behind problems during a productive process (Mizuno, 1988).
- **Arrow Diagram:** The arrow diagram is used for the improved development project planning and maintains suitable control so that its goals will be achieved (Kanji and Asher 1996). Furthermore, the arrow diagram visualises the sequence of tasks that should be done until the final goal is reached. (Lindsay and Petrick 1997).
- **Process Decision Program Chart - PDPC:** The process decision program chart helps to focus on the likely solutions that will lead to the solution of a problem (Kanji and Asher 1996). It is mainly used for the planning of new or renewed actions which are complicated and it determines the processes which should be used, taking into account the succession of the events and the likely consequences (Lindsay and Petrick 1997).
- **Matrix Data Analysis:** The aim of matrix data analysis is the quantification of the data of the matrix diagram using methodologies of data analysis.

On the other hand, the data mining techniques were selected as the most suitable solution to the problem when a vast amount of data has to be dealt within a database. The main result of the data mining techniques is the creation of rules and patterns based on the raw data. These rules will dynamically form the new quality tools.

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