

# Data Warehousing for Decision Support

**John Wang**

*Montclair State University, USA*

**James Yao**

*Montclair State University, USA*

**Qiyang Chen**

*Montclair State University, USA*

## INTRODUCTION

Today's business environment is dynamic and uncertain. Competition among business organizations is becoming more intensified and globalized. These business organizations' demand for both internal and external information is growing rapidly. This rapidly growing demand to analyze business information has quickly led to the emergence of data warehousing (Finnegan, Murphy, & O'Riordan, 1999). The strategic use of information from data warehousing assures the solution of the negative effects of many of the challenges facing organizations (Love, 1996). When the data warehousing technologies are well positioned and properly implemented, they can assist organizations in reducing business complexity, discovering ways to leverage information for new sources of competitive advantage, realizing business opportunities, and providing a high level of information readiness to respond quickly and decisively under conditions of uncertainty (Love; Park, 1997).

A data warehouse (or smaller scale data mart) is a specially prepared repository of data created to support decision making. Data are extracted from source systems, cleaned and scrubbed, transformed, and placed in data stores (Gorla, 2003). A data warehouse has data suppliers who are responsible for delivering data to the ultimate end users of the warehouse, such as analysts, operational personnel, and managers. The data suppliers make data available to end users either through structured query language (SQL) queries or custom-built decision support applications, including decision support systems (DSSs) and executive information systems (EISs).

During the mid to late 1990s, data warehousing became one of the most important developments in the information systems field. It has been estimated that

about 95% of the *Fortune 1000* companies either have a data warehouse in place or are planning to develop one (Wixon & Watson, 2001). Data warehousing is a product of business need and technological advances. Since the business environment has become more global, competitive, complex, and volatile, customer relationship management (CRM) and e-commerce initiatives are creating requirements for large, integrated data repositories and advanced analytical capabilities. More data are captured by organizational systems or can be purchased from a third party. Therefore, organizational desirability of implementing data warehousing technology has been on the rise.

Even though there are many success stories, a data warehousing project is an expensive, risky undertaking (Beitler & Leary, 1997). Organizations are spending millions each year on data warehouse development, but the majority of initial data warehousing efforts fail (Chenoweth, Corral, & Demirkan, 2006). The most common reasons for failure include weak sponsorship and management support, insufficient funding, inadequate user involvement, and organizational politics (Watson, Gerard, Gonzalez, Haywood, & Fenton, 1999).

Conventional wisdom holds that having a management champion with a tightly focused (data mart) design and restrictive tools will lead to success. However, Chenoweth et al. (2006) found out that the reverse situation can be just as successful. If the users see the potential of the data warehouse to deliver value to the organization, they can be the champions and convince management to adopt the technology. Furthermore, if users understand both the technology and the organization's business processes, a single data repository may actually be more satisfying for them.

This article is organized into several sections. In the background section, what a data warehouse is, five major elements of a data warehouse, and fundamental concepts

of how a data warehouse works will be discussed. In the main-focus section, current issues that organizations are facing in implementing data warehouses, for example, the selection of data warehouse methodologies, management of data warehouse operational life cycles, and data warehouse security, will be discussed. Finally, the trends in data warehousing development, such as active data warehousing, integration of data warehousing, and CRM, will be discussed in the future-trends section.

## BACKGROUND

### Basic Concept of a Data Warehouse

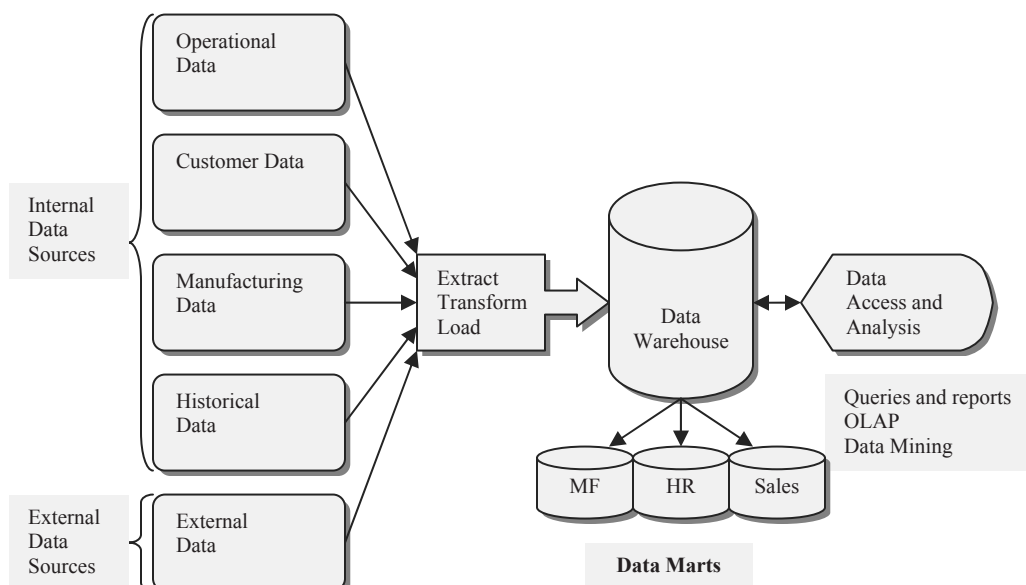
In today's business environment, every business owner dreams of having the ability to know what is happening in all aspects of his or her operation and of being able to use that information to optimize the market and increase profit. In order for an organization to achieve competitive advantage, voluminous data need to be managed, analyzed, and fed into the decision-making process. The introduction of data warehouses, which provide decision support to organizations with the help of analytical databases and analytical applications like online analytical processing (OLAP), answers this need (Gorla, 2003). The technical definition of a data

warehouse is a subject-oriented, integrated, time-variant, and nonvolatile collection of data that supports managerial decision making (Inmon, 2002). Typically, a data warehouse is housed on an enterprise's main-frame server, but it can reside with a storage service provider. Data in an OLAP data warehouse are extracted and loaded from various online transaction processing (OLTP) applications and other sources using extract, transfer, and load (ETL) tools. See Figure 1 for data warehouse architecture. Analytical applications such as OLAP tools, data mining, statistical modeling, geographical information systems (GISs), DSSs, and other user queries are then applied to the repository (Jones, 2001).

### Data Warehouse Elements

There are five major elements of data warehousing, including data acquisition, data modeling and schema, metadata, data management, and data analysis (Inmon, 2002; Jones, 2001). Data acquisition involves identifying, capturing, and transforming data in operational systems so that the data can be loaded into a data warehouse or data mart. Data acquisition is a complex, time-consuming, and costly phase of building and managing a data warehouse, but if this phase is not correctly carried through, the data warehouse will not be effective. During data acquisition, data are extracted,

*Figure 1. Data warehouse architecture (Adapted from Laudon & Laudon, 2007)*



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