

# MINING Restaurant Data

Know your customer.

At a time when really knowing customer preference is crucial to successful restaurant operations, data mining should be at the forefront of a manager's technology toolbox. Customer attraction, retention and prediction are important marketing concepts in the restaurant industry and central components of data mining. Foodservice establishments have long known there is a need to exceed customer expectations in order to stimulate current sales while creating the opportunity for repeat business. Until recently, eateries have captured and stored transactional data in a point of sale (POS) system in a manner that made it difficult to access, evaluate or apply to decision making. Recent developments in technology now provide a more structured collection area (data warehouse) that facilitates effective empirical analysis (data mining). The data mining process is designed to identify relationships, patterns and trends that may be present among data, but are not obvious.

The data mining process is intended to turn data into information and information into insight. For example, if a restaurant could sort through stored data to improve its customer relations, then the property is more likely to gain a competitive advantage. Important considerations of data mining include scalability, reliability and ease of operation. There are at least three factors influencing the adoption rate of data mining software within the restaurant industry. These factors are declining costs of computing power, availability of effective data mining techniques, and the increased knowledge of end users.

Data mining is simply the process used to derive useful information from transactional data that a restaurant has likely captured and stored about its clientele. Data mining software

is often described as the intersection of statistics, database technology and business decision making and is often referred to as "siftware." The objective of siftware is to change passive data into interactive data to enhance customer relationship management (CRM) while improving profitability. Together, data warehousing and data mining form a powerful base in support of a robust restaurant management information system. The concept of data mining isn't new; what is new is restaurant management's ability to quickly extract useful information from a large and complex data warehouse.

## **THE CONCEPT OF DATA MINING ISN'T NEW; WHAT IS NEW IS RESTAURANT MANAGEMENT'S ABILITY TO QUICKLY EXTRACT USEFUL INFORMATION FROM A LARGE AND COMPLEX DATA WAREHOUSE.**

### Data Warehousing

A data warehouse is a repository into which operational and transactional data are placed. The data can originate from within the restaurant (POS system functionality) or outside the establishment, such as environmental conditions. From a technical perspective, data mining is a customer-oriented collection of raw facts used to support managerial decision making. The data warehouse serves as the focal point in a restaurant information system and can provide facts otherwise unavailable through traditional database search routines. Unlike a legacy corporate reporting system, a data warehouse is created to serve as a facility for integrating data from a variety of internal and external sources. For example, a restaurant warehouse could integrate customer demographic profiles with visit frequency along with spending

## Data Mining Categories DM conclusions fall into three broad categories

**Associations and Sequences.** Data mining can uncover affinities between isolated events. For example, a guest purchasing the restaurant house specialty is likely to also purchase a small antipasto salad and glass of Chardonnay wine. Paired relationships provide a basis for bundling menu items into a cohesive meal that simplifies ordering while ensuring customer satisfaction. Menu design can also be manipulated to

feature such combinations as unique opportunities for customers. Data associations are often credited with a means for influencing customers to spend more than anticipated or upselling.

**Clusters.** The identification of repetitive purchase patterns (e.g. split tenders or individual checks) can also be important to customer profiling and advancement in CRM strategies.

Clustering can also alert a restaurant to the need for e-mail promotions, frequent diner programming, gift cards or other incentives.

**Forecasts.** Forecasting is one of the strengths of data mining and enables restaurants to better plan to exceed the needs of its clientele. Forecasting enables more efficient staffing, purchasing, preparation and menu planning.

pattern and geographic census information to develop a successful customer profile.

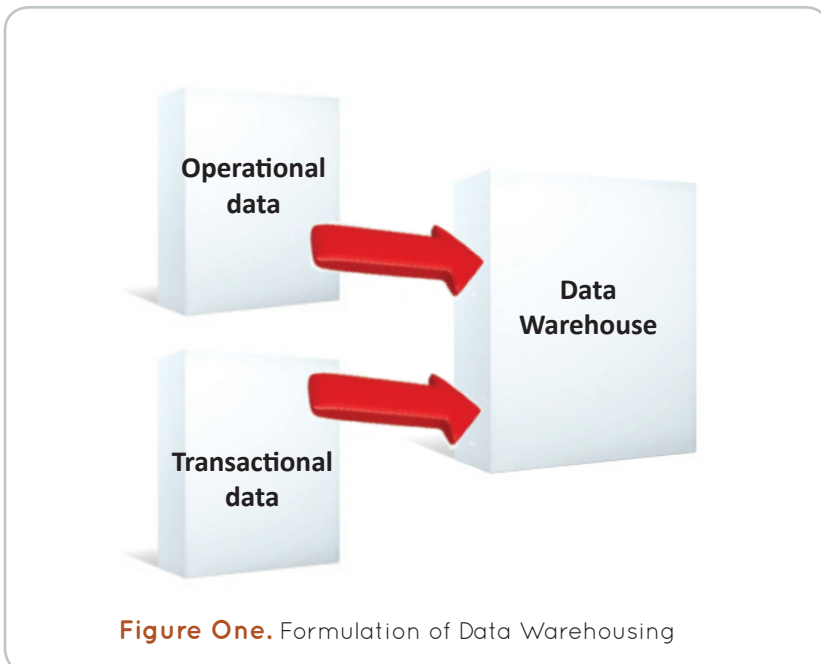
By design, a sophisticated data warehouse is composed of discrete customer-oriented fields. Each transaction is thereby assigned a unique data field into which relevant information can be stored. By contrast, traditional database systems are organized around restaurant operations, not customers. Data must be entered using standardized coding procedures and variable identification to ensure uniformity throughout the system, thus allowing management to better understand the content and structure of data analysis. The value of a data warehouse is its capacity to organize, store and process large amounts of data in a centralized location [see Exhibit 1].

### Data Modeling

Data warehousing is concerned with database design and eventual data modeling processes. Transactional data tends to be placed in a database management system to satisfy immediate business requirements (e.g. total revenues for a meal period and/or day part), while warehoused data usually contains more granularity or detailed data that can be analyzed for operational decision making. For example, an analysis of the volume of menu item transactions by meal period interval, gathered through a POS system, can prove helpful in the refinement of staff schedules and menu item preparation. Alternatively, a review of menu item sales correlated against wine purchases can help management identify if particular entrées are typically ordered in combination with specific wines. Such a determination can certainly have planning, purchasing, production, marketing and service staff implications. This sort of analysis is no different than the creation of a combination meal at a QSR that simplifies menu design and contributes to accelerated order entry.

### Restaurant Innovation

A few years ago NCR and Microsoft announced an agreement to link database technologies with advanced data warehousing concepts for restaurant companies. The alignment integrated Teradata's relational database management system with Microsoft's SQL server. While the initial goals dealt with data marting (warehouse segmentation), e-commerce, CRM, enterprise resource planning and other applications, an important outcome was the discovery of purchase patterns hidden within the data. More recently, several point of sale system vendors have also introduced data mining applications. Given that data mining is often defined simply



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## GOALS OF Data Mining

Over the past few years, many data mining tools have emerged that allow restaurant organizations to address simplistic levels of data mining, including relational databases, multi-dimensional analysis tools and statistical analysis packages. Some of these tools allow companies to perform the more complex levels of data mining which enable them to find patterns hidden in large corporate databases and make faster, more accurate proactive business decisions.

Many software packages employ a drill-down technique that enables analysis of relational databases or stand-alone automated pattern recognition. The more sophisticated data mining techniques integrate automated pattern discovery and recognition tools with widely accepted interface standards into a comprehensive, scalable, business prediction system.

The goals of most data mining software include:

- customer retention—promotion planning
- customer attraction—media planning
- customer cross selling—alliance planning
- customer upgrading—product planning
- customer audit—transaction planning
- customer bundling—purchase planning

as the development of an algorithm (formula) that enumerates patterns from data to modeling, there are several noteworthy restaurant applications.

Data mining in restaurants is most often applied to the areas of: customer profiling, site selection, forecasting, customer relationship management, menu engineering and productivity indexing.

**Customer Profiling.** Customer profiling is accomplished through in-depth analysis of guest demographics and lifestyle characteristics. Attributes such as income levels, family status, age and sports and cultural interests, if known, can be appended to model guests. Customer profiling can be used to create an e-mail listserv for targeted marketing of current as well as prospective clientele. Prospect profiles can be especially useful in identifying those folks most likely to respond to marketing and/or promotional offers. Profiling can also be important in determining which market segments are most productive and profitable.

**Site Selection.** Data mining can also be essential to determining sound criteria for restaurant site selection given an index derived from an analysis of high-volume, successful units. Such items as demographics (customer profile) and psychographic (buying patterns), and related customer descriptors are used to delineate highly probable factors for site modeling. As a result, evaluation data and analytical profiling qualify companies to be better able to identify candidate sites. *Nation's Restaurant News* has cited the following restaurant companies as active data mining site selection participants: Dunkin' Brands, Logan's Roadhouse, Buffalo Wild Wings, McAlister's Deli, Papa Murphy's Take 'n' Bake Pizza, IHOP and Cereality. These companies, and others, are credited with correlating customer segmentation with statistical modeling and sales forecasting of demographic characteristics with local business intelligence to identify sites.

**Forecasting.** Customer transactional data (segmented by menu item and day part) can be useful in the development of a forecasting model

that accurately produces meaningful expectations. Regardless of whether a restaurant company relies on moving average or time series forecasting algorithms, data mining can improve the statistical reliability of forecast modeling. Estimating in advance how much and when menu items will need to be prepared is critical to efficient food production management. Data mining can provide a prognostication of product usage by day part given available sales data. In addition, knowing how much product was sold during any meal period can also be helpful in supporting an effective inventory replenishment system that minimizes the amount of capital tied up in stored products.

**Customer Relationship Management.** An effective CRM program can be a direct outcome of data mining applications. The ability to enhance CRM given rapid accessibility of more comprehensive management information should lead to satisfied clientele and improved sales performance. The ability to anticipate and affect consumer behavior (influence menu item sales and other promotions) can provide the restaurant with a competitive advantage. Having a signature item, for example, can be found to be a driver of improved relations while providing a product that customers do not perceive as having an equivalent elsewhere.

**Menu Engineering.** An analysis of menu item sales and contribution margins can be helpful to continuous, successful restaurant operations. While menu engineering deals with menu content decisions, data mining can produce reports to indicate menu item selections, by customer segment, as a basis for operational refinement. For example, Applebee's has been described as employing data mining expressly for the purpose of determining ingredient replenishment quantities based on a menu optimization quadrant analysis that summarizes menu item sales. Through such analysis the company then decides which menu items to promote.

**Productivity Indexing.** By correlating order entry time (POS time stamped) with settlement time, data

mining is able to provide a reliable estimate of elapsed production and service times. This data provides insight into average service time relative to

**SIMPLY STATED DATA MINING INVOLVES THE DISCOVERY OF NEW INFORMATION THROUGH AN IDENTIFICATION AND UNDERSTANDING OF TRENDS, PATTERNS AND VARIABLE CORRELATION.**

customer turnover as well as waiting line statistics. While productivity data is difficult to ascertain, this analysis provides factual data to assist management in fine tuning operations (heart of the house and

dining room staff).

**DM Categories**

According to skilled researchers, data mining conclusions fall into three broad categories: associations and sequences, clusters and forecasts.

**Associations and Sequences.**

Data mining can uncover affinities between isolated events. For example, a guest purchasing the restaurant house specialty is likely to also purchase a small antipasto salad and glass of Chardonnay. Paired relationships provide a basis for bundling menu items into a cohesive meal that simplifies ordering

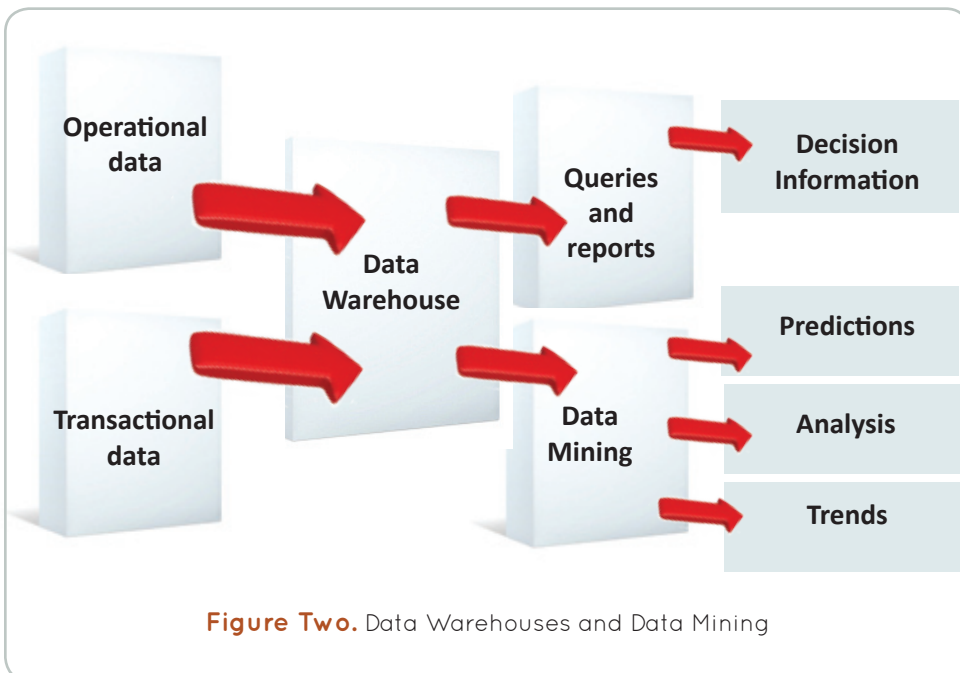
while ensuring customer satisfaction. Menu design can also be manipulated to feature such combinations as unique opportunities for customers. Data associations are often credited with a means for influencing customers to spend more than anticipated or upselling.

**Clusters.** The identification of repetitive purchase patterns (e.g. split tenders or individual checks) can also be important to customer profiling and advancement in CRM strategies. Clustering can also alert a restaurant to the need for e-mail promotions, frequent diner programming, gift cards or other incentives.

**Forecasts.** As mentioned previously, forecasting is one of the strengths of data mining and enables restaurants to better plan to exceed the needs of its clientele. Forecasting enables more efficient staffing, purchasing, preparation and menu planning.


**Data Marting**

A data warehouse contains a cache of data that may be useful to the overall restaurant company. Each operational unit contributing to a data warehouse is often referred to as a data mart. Since data warehouses tend to grow large quickly, the data in a comprehensive warehouse may not be



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optimal for operating department managers. Application software capable of segmenting unit-level data into departmental components can be effective. Data in a data mart does not need to service an entire organization, only the department, and therefore can be streamlined, summarized and structured as appropriate. With a data mart the user can conduct data analyses with less concern for its impact on resource utilization elsewhere in the data warehouse scheme. A kitchen manager, for example, may rely upon a department-specific data mart to provide relevant information for production staff scheduling at a single location. A data mart scheme is a natural companion to a data warehouse. [see Exhibit 2, previous page]

### DM Limitations

As researchers are quick to point out, there are some restrictions related to data mining applications; each provides insight into possible shortcomings for restaurant analysis. Considerations include that fact that data is collected primarily from an existing customer base. Since findings are tied to the contents contained in stored operational and transactional data, the generated results may not be as forthcoming about future projections as customer population samples continuously change. This is a matter of revolving data and is not unique to data mining.

A second limitation often cited centers on the fact that results tend to be brand specific and may not be applicable to non-brand usage. Concern in this area focuses on the fact that a restaurant company may have multiple brands but

rely on one vast data warehouse to yield marketing strategies, forecasts or menu engineering changes. This limitation can be addressed by constructing the warehouse with each brand serving as an independent data mart. By doing so, management can analyze each product line individually as well as aggregate all marts to produce a company-specific analysis. Finally, data mining is often criticized for assuming a greater breadth of information than actually stored in the data warehouse. Transactions may not accurately reveal demographic characteristics (e.g. personality and lifestyle) or decision processes (including emotions) of the consumer. Data mining has been shown to be effective in projecting demand trends, and regardless of shortcomings can be invaluable in providing marketing intelligence to foodservice operators.

### Summary

Data mining can be defined as the extraction process used to derive information from a data warehouse or data mart. The key to successful data mining is to take disparate data sources and extract information for enhanced decision making. Simply stated, data mining involves the discovery of new information through an identification and understanding of trends, patterns and variable correlation.

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**Data Mart** – a database, or collection of databases, focused on a particular subject, department or operational function; tends to be a subset of a data warehouse.

**Data Mining** – process of using statistical techniques to discover subtle relationships between data items and the construction of predictive models based on them.

**Decision Support System/DSS**  
– application for analyzing large quantities of data and performing a wide variety of calculations and projections.

**Database Management System/DBMS**  
– used to store, process, extract and manage data in a systematic way.

**Data Warehouse** – collection of diverse data designed to support managerial decision making; includes development of a system to extract data from operating systems and installation of a warehouse database.

**Online Analytical Processing/OLAP** – technology for collecting, managing, processing and presenting multidimensional data for decision making; e.g. time series and trend analysis views.

**Query** – a stylized question requesting records meeting specified criteria from a database; rules for constructing queries conform to standardized query language.