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Expert Systems with Applications 27 (2004) 521–532

Expert Systems
with Applications

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Mining customer knowledge for electronic catalog marketing

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Abstract

Direct marketing is the use of the telephone and non-personal media to communicate product and organizational information to customers, who then can purchase products via mail, telephone, or the Internet. In contrast, catalog marketing is a type of marketing in which an organization provides a catalog from which customers make selections and place orders by mail or telephone. However, most catalogs for retailing firms are presented to customers in the format of paper catalogs without strategic segmentation design and implementation. In this regard, electronic catalog design and marketing could be a method to integrate the Internet and catalog marketing using market segmentation in order to enhance the effectiveness of direct marketing and sales management in retailing. This paper uses data mining based on association rules from relational database design and implementation for mining customer knowledge. As result, marketing knowledge patterns and rules are extracted for the electronic catalog marketing and sales management of a retailing mall in Taiwan.

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Keywords: Data mining; Knowledge extraction; Relational database; Direct marketing; Electronic catalog marketing

1. Introduction

Direct marketing is the use of the telephone or non-personal media to communicate product and organizational information to customers, who then can purchase products via mail, telephone, or the Internet (Pride & Ferrell, 2000). This marketing includes a wide range of promotional and selling activities where businesses identify, target and directly contact potential customers (Roy, 2000). Various social, economic, and technological changes that have taken place over the last few decades have contributed to the growth of direct marketing, such as direct mail, computer-mediated communication, decision support systems, customer relationship management, personalized marketing, etc. (Albert, 2003; Bult, Scheer, & Wansbeek, 1997; Cheung, Kwok, Law, & Tsui, 2003; Morganosky & Fernie, 1999; Stevenson & Swayne, 1995; Tiwana, 1998; Wierenga & Oude Ophuis, 1997). Furthermore, the rapid changes in the retail industry are obvious to both consumers and retailers. Retailers involved in direct marketing emphasized quality standards and strategies for return on investment (Morganosky, 1997). For those from a retail background, it is fairly common to define the parameters of direct marketing in terms of non-store formats. In this regard, direct marketing is

simply marketing directly, without the necessity of a store to conduct exchanges (Timmermans & Morganosky, 1999).

In addition, catalog marketing is a type of marketing in which an organization provides a catalog from which customers make selections and place orders by mail or telephone (Pride & Ferrell, 2000). Catalog marketing began in 1872, when the Montgomery Ward Company issued its first catalog to rural families. The advantages of catalog retailing include efficiency and convenience for customers. The retailer can benefit by marketing in remote, low-cost areas, saving on expensive store fixtures, and reducing both personal selling and store operating expenses. On the other hand, catalog retailing is inflexible, provides limited service, and is most effective for a selected set of products due to the convenience of catalog shopping (Chase, 1997). In cognitive continuum theory, the effect of consumer shopping and retail information display properties on consumer perceptions of the Internet and of catalogs suggests that both Internet and catalog shopping have active dimensions of value on retail experiences (Mathwick, Malhotra, & Rigdon, 2002). However, most of the catalogs from retail firms are published for customers in the format of paper catalog without strategic segmentation for marketing and sales management. For example, there has been little discussion of which catalogs should be delivered to specific target groups of customers including different product collections and price discounts according to customers' historical transaction data and retail

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marketing strategy. In this regard, electronic catalog design and marketing could be a method to integrate Internet and catalog marketing using market segmentation in order to enhance customer relationship management and customized direct marketing in retailing.

Furthermore, data mining, also known as knowledge discovery in database, is a rapidly emerging research field (Ha & Park, 1998; Park, Piramuthu, & Shaw, 2001; Spiegler, 2003). This technology is motivated by the need of new techniques to help analyze, understand or even visualize the huge amounts of stored data gathered from business and scientific applications. It is the process of discovering knowledge, such as patterns, associations, changes, anomalies or significant structures from large amounts of data stored in database, data warehouse, or other information repositories (Hui & Jha, 2000). When transaction records (or data) are stored in a database, customers' behavior or patterns in relation to their purchases are used to specify certain knowledge for sales management and marketing. Recently, some data mining methodologies and applications have been developed to explore the practices and planning methods of sales and marketing management between customers and sellers in the market (Bloemer, Brijs, Vanhoof, & Swinnwn, 2003; Chen, Hsu, & Chou, 2003; Feelders, Daniels, & Holsheimer, 2000; Lee & Park, 2003; Rygielski, Wang, & Yen, 2002; Shaw, Subramaniam, Tan, & Welge, 2001; Song, Kim, & Kim, 2001). In addition, knowledge-based data mining systems are a process, which can obtain and maintain mining knowledge in order to support decision support or problem solving both before and after data mining techniques are implemented (Hong & Han, 2002; Park et al., 2001).

In this paper, data mining using association rules from relational database design and implementation is used to mine customer knowledge in order to generate cross-selling proposals for electronic catalog design and marketing for a retailing mall in Taiwan. Customer knowledge obtained from mining is designed and maintained to the knowledge base in order to provide knowledge management capabilities for the case firm on both sales management and catalog marketing. The rest of the paper is organized as follows. In Section 2, we present the background of the case firm and our discussions on the objective of this research project with executives of the case firm. Section 3 introduces the proposed data mining system, which includes system framework, and relational database design. Section 4 presents data mining process, result analysis and electronic catalog design. Discussions and future works are presented in Section 5; and Section 6 presents a brief conclusion.

2. Case firm and catalog marketing

2.1. Case firm

Far Eastern Geant is a retailing corporation assembled by the Far East Group and the Casino Group from Taiwan

and France, respectively. In 2003, it had 18 chain malls operating, making it the third largest retailing corporation in Taiwan. The average turnover of Far Eastern Geant is approximately 4 million US dollars per month, making it a very competitive company. The JingMei branch mall is Far Eastern Geant chain mall located in the northern part of Taipei City, having about 300 full-time and part-time staff, and selling 8000 kinds of major commodities. In 2002, the JingMei mall was the most profitable branch of Far Eastern Geant.

2.2. Catalog design of case firm

From interviews with marketing managers of the case firm, the case firm's catalog design presented in three aspects below.

A. Catalog production. The catalog is designed and produced by the head office based on decisions from department meetings, and no branch store has the right to independently design. According to promotion schedule, approximately one month is required from head office meeting to completion of the final traditional catalog.

B. Catalog product layout. The head office's marketing personnel changes catalog layout according to seasonal factors, such as higher demand for beverages in the summer, so that there are more page space or beverages products in the catalog. Therefore, there might be eight kinds of beverages published in the catalog in the summer, but only three kinds in the winter.

C. Catalog delivery. After design by the head office, new catalogs will be dispatched to each branch 5 days before the new schedule becomes effective, and traditional paper catalogs are placed in sales location easily to access during promotion periods.

In addition, the case firm's catalog promotion modes are arranged as following.

(1) *Product promotion:* For purchase costs, there are two promotion modes, either the published catalog (DM) or without catalog but with the suppliers doing promotions on-site (MM). Furthermore, during the five major promotion schedules of the year, namely, Ghost Festival, Dragon Boat Festival, Branch Anniversary, Year-end Party and Chinese New Year, head office's marketing personnel will increase cable TV or newspaper advertisement.

(2) *Promotion method:* Appliance and Textiles of the Sundry Department and Fresh and Live Food Department promote different commodities based on seasonal consideration; For example, the Textile Section will consider the current fashion styles and colors; the Appliance Section will consider current popular topical subjects and promote suitable products, such as Plasma TV. The fresh and Live Food Department's promotion emphasis is on foreign fruits.

Marketing personnel consider that the best method to increase sales is the joint promotion, such as 'double purchase with one cost', 'Buy one and get a free extra smaller one', or 'buy A and get B free'.

(3) *Promotion basis*: This is made mainly according to each customer's transactions (for the case firm, there are 13 populations), in which average transactions per customer are more than 400 dollars, therefore, if each customer whose transactions are about more than 400 dollars, increases 1.2 purchase items, the shopping could be stimulate effectively. Furthermore, according to manager's response on case firm's sales data, in general, consumers have very low brand loyalty except a few products with indelible brand images, so consumers seldom consider whether the products are promotion ones or not. Therefore, mostly, all the marts are aiming to provide low price products.

(4) *Formation of promotion activity*: The mart holds a conference meeting with suppliers to discuss and negotiate product quantity, pricing, free gift mode, commission percentage, and promotion mode. Therefore, suppliers have rights to negotiate pricing.

(5) *Forming of promotion prices*: The Price Control Center investigates other marts' prices every week deepen their understanding of other mart's promotion methods and objects to adjust its own strategy.

2.3. What problems of catalog on case firm?

In view of the foregoing results, following problems are identified:

(1) The catalog is designed and completed by the head office, and each branch has no right to make decisions. This practice is based on mass marketing, and cannot follow trends or provide consumers with customer-oriented segmentation service.

(2) Because each branch has its local customs and practices, consumer habits or preferences, so, if the catalog is designed by the head office without each branch's policy decision, the marketing policy maker could not consider each branch's needs.

(3) It takes about one month to produce the traditional paper catalog. However, consumers' needs are changing daily, so the status of previous month merely not relevant after one week.

(4) From our interviews, we found that the case firm has not currently set up database until now.

(5) The traditional paper catalog promotion is still the only product promotion, no combination products or cross-selling.

(6) The paper format catalog is a generalized catalog, which means that no marketing segmentation has been considered to target customers interested in specific products, brands, and prices.

(7) On the other hand, printed catalogs are a traditional method of catalog marketing, which means difficult to extend the catalog functions through electronic commerce and to enlarge business capabilities on either the physical or the Internet market.

(8) In addition, customer knowledge is another source of competitive advantages if information technology, such as

database management, customer relationship management, or knowledge management, could be implemented for marketing and sales management decision-making process. Although the case firm has a good profit on its current catalog marketing and sales model, it could be more advantageous for business model if customer knowledge were properly and efficiently managed.

Some suggestions have been proposed based on the case firm's situation. Currently, the most urgent need for the case firm is the establishment of a database. Through the construction of database, marketing policy-makers could obtain more data and information for policy/decision making. At early stages, the head office could authorize marketing personnel of each branch to set up market segmental marketing strategy through each database's analysis results, in order to improve and the relatively insufficient mass marketing of the traditional paper catalog. To improve over the traditional catalog, it is recommended that the case firm adopt electronic catalog since is more flexible than the traditional catalog, and can be frequently updated according to customer and market knowledge.

3. Data mining system—relational database approach

3.1. System framework

This study used a designed questionnaire with research data collected from shoppers in the JingMei mall from May 2002 to August 2002. There were three major parts to the questionnaire: (1) customer's personal data; (2) purchased product data and the case mall's data; and (3) investigation of consumer attitudes, including catalog promotion and price sensitivity, as well as product combination. In order to develop the data mining system, a relational database management system framework was developed, as shown in Fig. 1.

3.2. Relational database

The concept of relational database was first developed in the 1970s by Codd, representing interrelated data in the form of a table. The representation of data in the interrelated table hence becomes the main characteristic of the relational database (Codd, 1970). Relational databases organize data as a collection of tables in which all data relationships are represented by common values in related tables. It can relate data stored in one table to data in another, as long as the two tables share a common data element. The tables appear similar to flat files, but the information in more than one file can be easily extracted and combined with Structured Query Language (SQL), which is the standard data manipulation language for relational database management system (Laudon & Laudon, 2003). Many organizations maintain relational databases, and as relational patterns reliably portray patterns embedded within database, relational

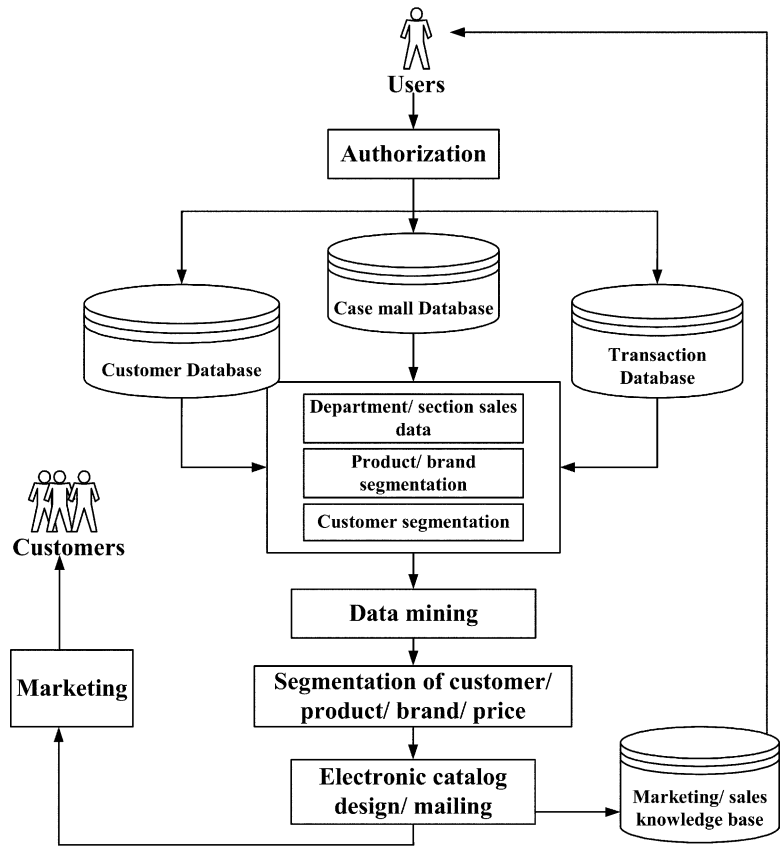


Fig. 1. System framework.

patterns can be beneficially utilized by organizations to support a variety of efforts on building their database management systems (Tsechansky, Pilskin, Rabinowitz, & Porath, 1999). Some research articles have shown that association rules of relational database can provide a useful method for mining knowledge on different application areas (Anand, Bell, & Hughes, 1996; Berzal, Cubero, Marín, & Serrano, 2001; Breault, Goodall, & Fos, 2002; Dabbas, & Chen, 2001; Lin, Li, & Tsang, 1999).

In this paper, relational database management system is the systems development approach in order to implement system integration by designing and constructing a relational database, and using SQL in a web-based system environment. The case mall’s relational database system is divided into three data functions, containing eight data tables, based on database functions, as shown in Table 1.

3.2.1. Conceptual database design—E–R model

Usually, there are three main data design models in relational database design, the conceptual database, the logical database design, and the physical database design. Conceptual database design is the first step for designing a relational database, and it is used to describe conceptual summary of database application by a concept model. Fig. 2 is the Entity and Relationship (E–R) diagram of conceptual database diagram, which provides a conceptual data model

for the case firm’s relational database design. It is important to check the quality of such a design with users who will use the database after it is implemented. An important type of quality check is to determine whether the E–R model can easily satisfy user requests for data and/or information. At this stage, we discuss the E–R model and its functions with the CEO, financial manager, and chief of the MIS department in order to confirm that they satisfied with information requirements of E–R model design. The E–R model includes 10 entities, nine relationships and 68 attributes, as shown in Fig. 2.

Table 1
Database functions and data tables of the case mall’s relational database

Database functions	Data tables
Customer data	Personal information Purchasing tendencies Purchasing data
Transaction data	Product information Brand Price
Case mall data	Section data Department data

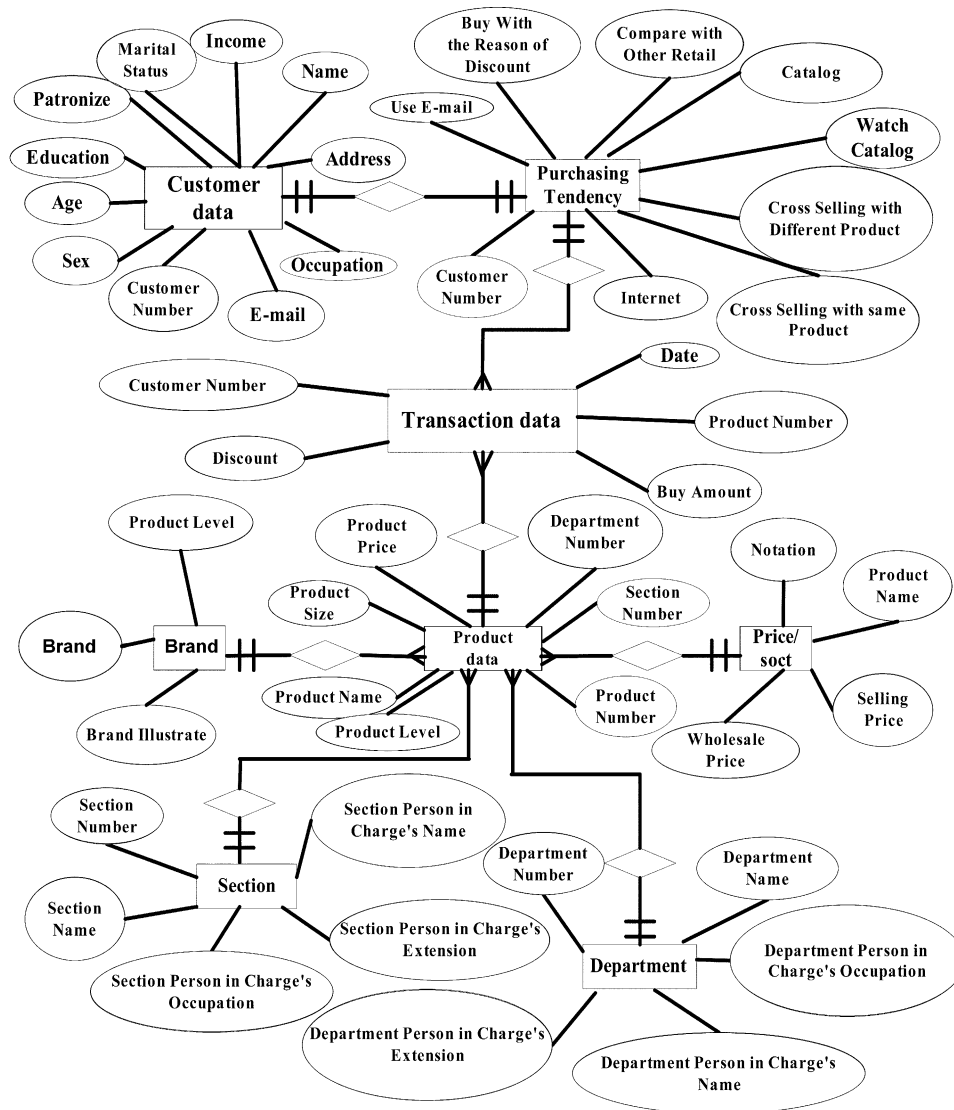


Fig. 2. Conceptual database design: E–R model.

3.2.2. Logic database design

Logical database design is the process of transforming the conceptual data model into a logical data model that can be implemented on a chosen database management system. Although there are other data models for database design, there are two aspects for emphasizing the importance of logical database design in relational database. First, the relational data model is most commonly used in contemporary database applications. Second, some of the principles of logical database design for the relational model apply to the other logical models as well (McFadden, Hoffer, & Prescott, 1999). Fig. 3 is a logical database design, which provides a logical data model in order to implement the relational database design.

The logical database design includes Logical Database Model, Entity, Data Attribute, and Relationship between entities that are used to describe events and messages occurred within an enterprise. Every entity is employed to

describe the enterprise's important internal Object, Event and Concept; whereas, Data Attribute is used to describe the entity's characteristics and Relationship between entities is used to explain relationships between different Objects and Events inside the enterprise. The logical data model enhances 'logic', which is a readable method to understand enterprise requirements and data structure, using a logical model to discover valuable information and provide it clearly to the enterprise. A relational database is the data model currently the most frequently used because it only needs to establish a simple form for each relation and for many-to-many relationships. Database functions and data tables of the case firm are described below:

A. Customer data: Customer data consists of a customer personal information table, a customer shopping tendency table and a customer shopping data table.

B. Product data: Of the case mall's product types, food sundries make up more than 50% of the total structure.

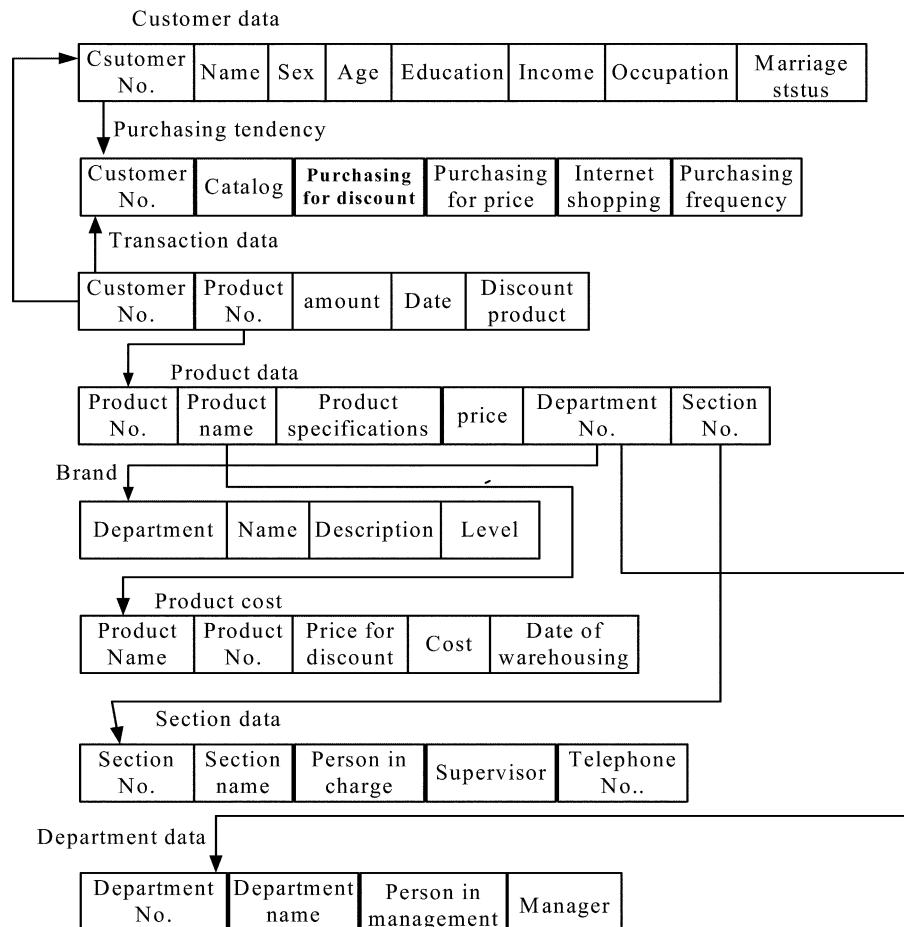


Fig. 3. Logical database design.

Furthermore, based on manager interviews, the Dry Food Department is the major sales department in the case mall; therefore, this research focused on the Dry Food Department's products when setting up product data. The product database consists of a product basic information table, a product price table and a brand table.

C. Case mall data: The case mall data is made up by department list and section list. Furthermore, based on different user purposes, Information Department personnel can change the linking between data tables based on different requirements, enabling high-level managers to make further inquiries for greater database utility and convenience.

3.2.3. Physical database design

The primary goal of the physical database design is to translate the logical description into the technical specifications for storing and retrieving data. It thus should create a design for storing data that will provide adequate performance and insure database integrity, security and recoverability. Once the physical database design is completed, the standards for operating systems, database management

systems, and the data access languages are reached for the final decision to implement it for the organization. The structure of physical database design in this paper is described in Fig. 4. In the relational database, data integrity and security are maintained by employees who are authorized to use, update, and delete. Once relational database design has been completed, this paper starts to mine customer knowledge by using association rules.

4. Data mining

4.1. Data mining process

Data mining processes generally consist of database establishment, data mining function, segmentation analysis, knowledge acquisition, catalog marketing, and sales promotion. The data mining process in this research is divided into the following steps (Fig. 5).

A. Database establishment: The data used in this research was collected from the case mall from May 2002 to August 2002 in the three different sampling time periods

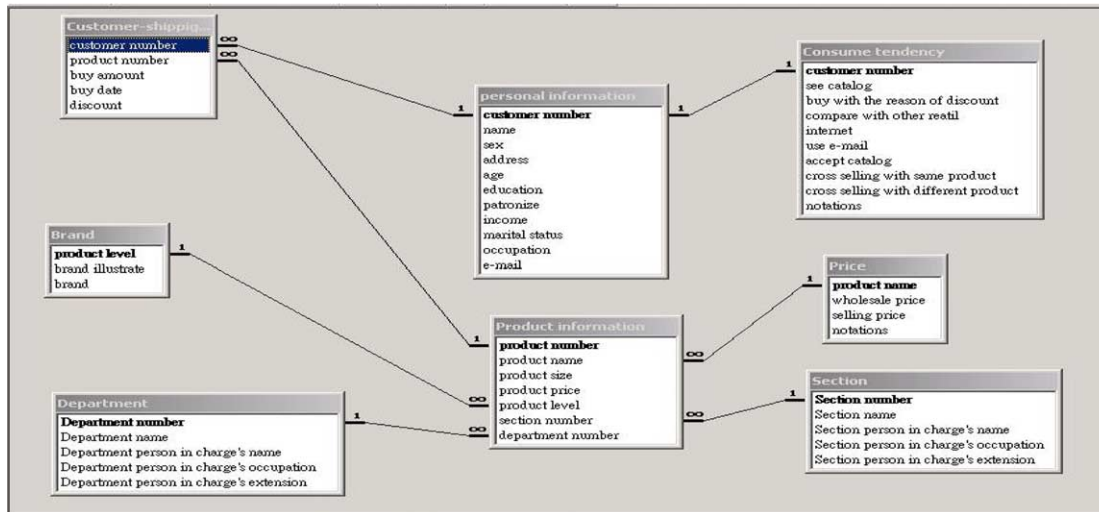


Fig. 4. Physical database design.

of morning, afternoon and evening. The sampling objects were consumers who shopped in the case mall during these periods. There were 188 consumer data collected, of which 175 data were valid. At the same time, a simplified questionnaire survey was administrated to consumers, with a male to female ratio of 1:2. The occupational distribution

was other service industries 24%, house keeping 21%, general manufacturing industry 17%, financial 21%, unemployed 6%, public officials and teacher 5%, computer information industry, self-employed and retired 2%, respectively. Because the case mall had not previously construct a database, data were collected and input into data

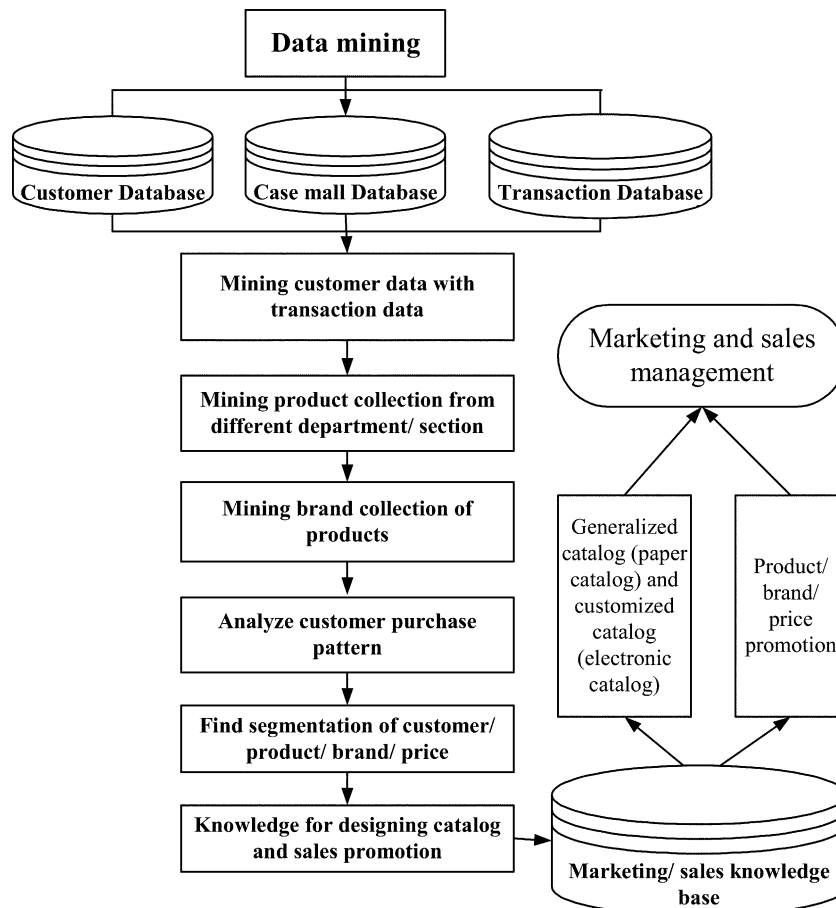


Fig. 5. Data mining processes.

customer number	product number	buy amount	buy date	discount
m59	ab3070300			
m7	aa1010400			
m7	aa2010100			
m7	ab3011900			
m7	ab3011500			
m7	ab3010400			
m7	ab3112200			
m7	ad9010100			
m8	ab3020100			
m8	ac6010100			
m9	aa4020200			
m9	aa2010200			
m9	ad8010400			
w1	aa1010400			
w1	aa1020100			
w1	ab3030200			
w1	ad8010500			
w10	aa1040300			
w100	aa2010600			
w100	ad7010500			
w100	ad8010900			
w101	aa1010500			
w101	aa3010100			
w101	aa4020200			

Fig. 6. Customer–shopping information.

tables from fieldwork in order to build the relational database, including case mall database, customer database, and transaction database. To search for relationships between data tables from different data functions, the relational data in data functions could be associated from different data tables for data mining.

B. Data mining: Data mining step implements association queries according to decision variables in order to analyze consumer behaviors so that the marketing/sales department can plan strategies and tactics for target consumers. The objective of database mining includes mining customer transaction data, mining purchased product collection, and mining brand collection of purchased products.

C. Segmentation analysis: After database mining was implemented, customers purchasing patterns and their segmentation of product, brand, and price from the database were obtained. By doing so, mining results from different relational tables can generate business information and knowledge.

D. Knowledge acquisition: Some specific knowledge patterns or rules from mining results are acquired for building and maintaining a knowledge base. These knowledge patterns or rules could be a knowledge basis in terms of customer relationship and knowledge management for marketing and sales management.

E. Catalog design and sales promotion: With knowledge of their customer, the case mall therefore started to design catalog content, including generalized format (paper catalog) and customized format (electronic catalog). By doing so, collections of target customers, target products, target brands, and target prices (discount) were designed and mailed to all customers or specific segmentation groups in order to implement catalog marketing. In addition, sales promotion of the case mall was also built according to mining knowledge so that marketing and sales management could be integrated.

In addition, quantitative analysis was used to analyze problems in finding relational rules, such as customer–shopping information, as shown in Fig. 6. For example, m7 indicates that customers purchase beverages in the Beverage

Department and ice cream in the Daily Distribution Department; and w1 indicates that customers purchase biscuits in the Sundry Department, beverages in the Beverage Department and Yogurt in the Daily Distribution Department.

4.2. Data mining and result analysis

The first level of data mining uses product department and section classification as decision variables, for example:

$$P(aa \cap ab = \text{Type1}|T)$$

or

$$P(aa \cap ac = \text{Type2}|T)$$

and, etc.

T indicates all consumers, aa indicates Grocery section, ac indicates Beauty appliance section and ad indicates Daily distribution section. See Table 2 for results.

The decision variable in the second level data mining is product category, for example: $P(aa1 \cap ab1|\text{Type1})$ or $P(aa1 \cap ac1|\text{Type2})$, etc. Table 3 illustrates data mining results. Here, four product categories are selected in the Grocery category (biscuits are coded $aa1$, instant noodles are $aa2$, canned food is $aa3$, and $aa4$ is for rice), $ab3$ is the code for beverages in the beverage section, and the daily distribution section selects three products (which are milk with code $ad7$, yogurt with code $ad8$ and ice cream with

Table 2
Results of section classification as the decision variable (first level)

Product combination code	Product combination (%)	Rank
aa&ab	33.1	1
aa &ad	19.4	2
ab&ad	16	3
ab&ac	11.4	4
aa&ac	10.9	5
ac&ad	6.9	6

Table 3
Results of product classification as the decision variable (second level)

Product combination code	Product combination (%)	Rank
aa3&ad9	53.6	1
aa2&ab3	53.4	2
aa1&ab3	51.7	3
ab3&ad8	39.3	4
aa1&ad9	26.5	5

code ad9), each product category selected above was obtained from manager interviews and the market survey.

The decision variable in the third level of data mining is product name (Table 4).

The data mining results show that, although beverages and the daily distribution section's ice cream are the most frequently purchased commodity collection, there is no significant product brand. Thus, the results are attributed to daily distribution section's ice cream because there is no significant merchandizing difference compared with other

Table 4
Results of product name as the decision variable (third level)

Decision variable	Product combination name	Rank
<i>No. 1</i>		
Beverages and daily distribution section's ice cream	The beverages, HeySong carbonated drink, Supau, Vitalon soda-water and CocaCola; as well as the ice cream brands Shomi, Duroyal, Yaa Fang, I Mei Hei Shun Feng all have many consumer purchases, however, the collections are more scattered, so they are classified as cross-selling commodities	
<i>No. 2</i>		
Grocery section's instant noodles and beverages	Uni-President Noodle paired with Vitalon soda-water (16.13%)	1
Grocery section's instant noodles and beverages	HsinChu Rice Noodle paired with Supau (12.9%)	2
Grocery section's instant noodles and beverages	Grocery's One More Cup together with beverages' AGV's wheat tea, Apple Cidra and CocaCola are purchased by many consumers', however, the collections are more scattered, so they are classified as cross-selling commodities	
<i>No. 3</i>		
Grocery section's biscuits and beverages	Want Want Senbei paired with Vitalon soda water (15.63%)	1
Grocery section's biscuits and beverages	Want Want Senbei paired with Supau (15.63%)	1
Grocery section's biscuits and beverages	Want Want Senbei paired with HeySong carbonated drink (12.5%)	2
Grocery section's biscuits and beverages	Want Want Senbei paired with Apple Cidra (12.5%)	2

retailers such as convenience stores. Moreover, the prices are not high and product differences are small, so consumers purchase with little brand loyalty. Furthermore, instant noodles and beverages in the Grocery section are considered to promote Uni-President Noodle paired with Vitalon soda water and HsinChu Rice Noodle paired with Supau so that sales of these four commodities' could be increased. Finally, the biscuits and beverages of the Grocery section are considered. Apparently, all customers purchase Want Want Senbei, and the top two beverages together purchased are Vitalon soda water and Supau, which are both ranked No. 2. Therefore, the best selling biscuits are Want Want Senbei, and Nos 1 and 2 beverages are Vitalon soda water and Supau, respectively.

4.3. Mining knowledge for electronic catalog design

According to data mining results, this paper illustrates the followings knowledge patterns of cross-selling and brand collections for electronic catalog design to the case mall.

Pattern A: Product-oriented catalog promotion.

Combine ordinarily purchased commodities in combination by consumers from two types to three types, aiming at the customers who have purchased two out of the three products, and encouraging the customers who have not purchased this particular commodity combination purchase the designed products in collection by using more discounts and increased turnover. The cross-selling collection commodities/price with specific customers for electronic catalog design is those such as Rules 1 and 2.

Rule 1: Want Want Senbei paired with Vitalon soda water and Uni-President Noodle with 10% discount to customers who are listed on transaction records.

Rule 2: Want Want Senbei paired with Supau and HsinChu Rice Noodle with 15% discount to customers who have not yet been listed on transaction records.

Pattern B: Self-owned brands-oriented catalog promotion.

When the high-selling Want Want Senbei is paired with self-owned brand commodities, consumers can have new choices. In order to conservatively apply this strategy, the ice cream of lowest price brand of in the daily distribution section has been selected. This is because consumers have lower brand loyalty for ice cream. The promotion strategy is to try to gain consumer confidence and promote self-owned brands. The customers targeted are those who have and have not purchased biscuits in the sundry section and ice cream in the daily distribution section. The cross-selling commodities/price collection with specific customers for electronic catalog design is Rule 3.

Rule 3: Want Want Senbei paired with Leader Price Ice Cream with 10% discount to customers who have and have not purchased on transaction records.

With customers listed from the customer database who have recently purchased Want Want Senbei paired with



Fig. 7. Electronic catalog marketing.

Vitalon soda water and Uni-President Noodle, we designed an electronic catalog with knowledge Rule 1 and e-mailed this electronic catalog to these customers according to their characteristics of segmentation in order to implement catalog and direct marketing.

After electronic catalog marketing implemented, new knowledge patterns and rules are updated to marketing/sales knowledge base while the data mining system continues to operate, observe, and modify the effects of electronic catalog marketing. By doing so, the marketing/sales knowledge base is not only the source of customer knowledge acquisition, but also provides the power of learning customer knowledge (Fig. 7).

5. Discussions and future works

The increased use of the Internet as a business mechanism over the past few years has further developed the meaning of electronic commerce. Electronic commerce (EC) describes sales in which transactions take place over computer networks. It is the process of electronically buying and selling goods, services and information, mostly on the Internet. This trend of electronic commerce is already having significant international impact on government, business, technology, society and individuals. The Internet has emerged as the primary database technology platform for electronic business (EB) (Liao, Chern, & Liao, 2004). In this paper, mining customer knowledge for electronic catalog marketing is an example of implementing a database marketing approach for increased connectivity and use of information technology, thus creating internal data mining capability for analysis and support of catalog marketing.

Sales management is increasingly being used to meet the needs of both customers and marketing. The goal of sales management is to have an inter-organizational coordination effect in inventory control, return and clearance sales policies for a distribution channel consisting of suppliers and

retailers as a part of supply chain management (Lee, 2001; Mohebbi & Posner, 2002). Precise planning for market demand can contribute to optimal planning and control between the supply chain and marketing (Chen & Chu, 2003). In addition, marketing strategies have evolved from the manufacturing-oriented approach previously used earlier in the 20th century to a market-oriented approach (Wedel & Kamakura, 2000). This market-oriented approach, including market segmentation, is attained through identifying specific needs of groups of customers and developing appropriate offers to certain groups of customers or market segments. This paper presents a case study where mining customer knowledge can determine specific needs of groups of customer from the database in order to determine specific customer patterns and rules on sales management.

On the other hand, direct selling continues to be a successful part of direct marketing for businesses, such as Avon and Amway. This marketing approaches end consumers through face-to-face sales presentations at home or in the workplace. Although, there are differences between direct marketing and selling according to their natures and approaches, could electronic catalog marketing could become one kind of direct selling approach for marketers or salespersons when their groups of customers and needs of product are targeted! Or direct selling could help direct marketing to increase sales capabilities through network relationships using segmentation electronic catalog marketing! Thus, electronic catalog can play the role of marketing and sales for both direct marketing and selling.

In addition, with traditional catalog marketing, printed-catalogs are the marketing method for marketers and salespersons to present their products, brands, and prices to customers. However, most of time, catalog marketing is a blind marketing way to generalized customers without segmentation strategy or tactics. This means that neither catalog content nor customer needs are designed, and put together in order to fit customer needs and save marketing

budget on printing many catalogs or advertising flyers with little effect. This paper does not exclude the importance of paper catalogs; but electronic catalogs might be an alternative approach for direct marketing, either independently or integrated with paper catalogs, using mining segmentation approach.

Knowledge management is an example of database implementation by an organization in order to enhance its competitive advantages (Davenport, Jarvenpaa, & Beers, 1996; Liao, 2002, 2003; Lorentzos, Yialouris, & Sideridis, 1999; Nonaka, 1994; Weber, Aha, & Becerra-Fernandez, 2001). Knowledge collection, verification, distribution, storage, and re-use are all essential elements in retailing for decision-making or problem-solving with expert consultant functions or to accumulate knowledge from customers and the market to be used by managers in sales problems.

Does this data mining approach work? Indeed, the case firm is actually doing the catalog marketing segmentation and promotion method proposed in this paper. For example, mining specific groups of customers who can have special services for shopping when their purchase amount reaches certain transaction levels in a specific period. In addition, discounts for products from the electronic catalog are dynamically designed, depending on customers' transaction frequency, spent amount, and purchase patterns. Electronic catalogs are mailed to customers according to customer and market segmentation and paper catalogs are mailed to new customers or presented to general customers in the shopping mall. In addition, electronic catalogs may become another kind of mobile marketing method for the case firm to mine customer knowledge regarding specific groups of customers who are accepting catalogs and coupons from their mobile phones and computers. Thus, this is not only the practical development of a data mining system, but also an academic study to explore retailing through direct marketing and sales management based on database technology.

6. Conclusion

This paper presents a case study on the development and implementation of a data mining system in order to mine customer knowledge for electronic catalog marketing. Thus, this research has begun to design and implement a data mining system using the relational database approach, including conceptual, logical, and physical database design as a data mining methodology. The data mining results and electronic catalog design from customer knowledge are presented. In addition, discussion and future research are described. Thus, this is an academic study to explore retailing direct marketing and sales management using database technology, based on the practical development of a data mining system development.

Acknowledgements

This research was funded by the National Science Council, Taiwan, Republic of China, under contract No. NSC-92-2416-H-032-017.

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