

Systematic Approach for Digital Marketing Strategy through Data Mining Technology

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Received 1 April 2014; Revised 1 May 2014; Accepted 13 July 2014

Abstract. Marketing does not involve only sales and advertising; rather, it helps the manager make good decisions pertaining to business, products, and services. Therefore, from the viewpoint of the business, how to meet market requirement has been an important issue. In order to meet market requirement and to develop different marketing strategies, the market segmentation proposes to explore the opportunities of the target market. The method of market segmentation generally includes “consumer preference,” “distribution channel,” “geographical analysis,” and so on. However, previous research on marketing only focused on some fixed point, and those were lack a set of systematic analysis process. In addition, the corporate decision-making analyses are mostly collected from the history data. An information system is used to obtain the factors and to conduct market research with those factors. However, the dynamic market requirements will either obstruct the decision-making or affect the appropriateness of the analysis results. In this study during the selection process of the marketing, the products information and previous marketing experience or data are used to first analyze and then to find useful, unobvious, or ineffective methods of marketing. Moreover, the results are selected, mixed, and saved in the marketing database. Finally, the information on marketing activities is presented. In addition, based on the market response, consumer behavior, click-through rate, and other feedback mechanisms, the related information on marketing activities is transferred to the required information that needs to be stored in the marketing database. The study provides not only an advantageous way of finding proper marketing strategies but also an effective method of transforming feedback mechanisms. It makes marketing more instantaneous and effective.

Keywords: digital marketing strategy, data mining, RFM, Apriori algorithm, ID3 algorithm

1 Introduction

Digital marketing is a method of marketing from the viewpoint of customers. Digital information is not only more easily integrated, sorted, and spread, but also enables providers and consumers to interact more quickly [1]. In the past, it usually took a long time for marketing to analyze and achieve effectiveness. Today, digital marketing enables marketing promotion to have a higher synergistic effect.

With the rapid changes in the business environment, technology progress, and digital transmission, the marketing of businesses should be changed rapidly. Similarly, the strategy of the market should be changed from the Red Sea Strategy to the Blue Ocean Strategy [2]. With the environment changing, not only market space continues to expand, but also the market environment becomes more tightened.

From traditional store sales, telephone marketing, and face-to-face marketing, to the development of Internet marketing, such as sale and purchase through the Website, keyword marketing, blog marketing, and so on, and with wireless network development, the ubiquitous Internet will be bringing the world [3]. It makes the development of

digital marketing communications seem increasingly important. The business is no longer limited by traditional ways such as time and space, but increases the opportunities of contact and interactions with customers.

As technology advances with time and information is constantly being discovered and updated, the traditional marketing model is also gradually developed along with the digital environment into the digital marketing mode. The way of marketing through the Internet to disseminate information is quite different from the traditional way. Furthermore, in the case of low consumer loyalty, rapid changes in the industry, and an intense and competing market environment, every business produces many kinds of products. Therefore, how to stand out in a highly competitive situation, in addition to the business's innovative, brands, quality, and other factors, how to combine marketing strategies with the product, and influence customers through advertising will be one of the key points.

Today, businesses use many marketing strategies to promote their products. Consumers no longer passively accept product information, so the industry needs to use positive interaction patterns to increase the impressions made on consumers. Therefore, how to master the market characteristics and how to select appropriate marketing strategies to make the marketing effort a good response or increase the purchase intention is the main purpose of any marketing research institute. Therefore, this study proposes a digital marketing framework that not only provides the marketing information for businesses but also allows the businesses to find the right kind of marketing strategies. In this study, the Apriori algorithm, ID3 algorithm (Iterative Dichotomiser 3), and other information technologies are combined to help businesses select different product-marketing promotion strategies for different consumer segmentation. The three main objectives of this study are as follows:

- (1) Apply data-mining technology in digital marketing to help businesses find proper marketing strategies for the right consumer group.
- (2) Use the history purchase information of consumers to segment customers, then to identify the major profit-contributed groups in order to make businesses with limited marketing resources accrue maximum benefits.
- (3) Get feedback quickly due to digital marketing as soon as the products are sold. Hence, real-time feedback can be obtained to avoid unnecessary waste of marketing cost.

The literature reviews in Section 2 include the definition of digital marketing, customer relationship management, and the technology of data mining. A new digital marketing framework is proposed in Section 3. Section 4, the framework operation is illustrated. Finally, the conclusions and future studies are discussed in Section 5.

2 Literature Review

In the past, traditional businesses carried out related marketing activities at higher costs to attract the attention of customers. Due to the traditional marketing process being too lengthy, businesses could not react to market change; so, the results of the marketing activities were not good enough. With the popularity of the Internet, the digital information era is emerging, and it enables marketing to adopt diverse strategies. Breaking the traditional marketing model to increase the interaction with customers, promoting customer-oriented products, and evolving and innovating with regard to the consumer channels, the development of marketing strategies are soaring. Therefore, the usage of IT in supporting marketing promotion is imperative in order to stand out in a highly competitive environment, to develop quick responses, and to satisfy market and customer needs. In this section, some relevant marketing literatures, customer relationship management, and the methods of analysis used in this article are discussed.

2.1 Digital Marketing

Marketing refers to a social and management process that creates and delivers value, and makes transactions with others to satisfy his/her/their needs and desires [4]. The purpose of marketing is to be fully aware and understand customers, to ensure that the products or services meet the needs of customers. Keegan et al. believe that marketing involves selling products, services, and ideas, leading to the exchange behavior between buyers and sellers in the planning and implementation process [5]. Armstrong et al. say that marketing is a process of social management [6]. In this process, individuals and groups create and exchange values with others to meet their own needs and desires. The discussion just conducted can sum up the fact that the main purpose of marketing is to promote the features of the product to persuade customers to buy with the aim of meeting their needs and desires, and then to make the products spread throughout the world.

Digital marketing is still a kind of marketing that integrates information technology, business activities, and business management [1]. It especially provides a customer-oriented sales model, which serves as a platform that enables customers and businesses to have an in depth knowledge of the true value of the brand, and make the brand's communication and interactions with customers [7].

The key consideration of our study is that the emergence of digital marketing can cause the following two changes in business marketing [8]:

- Reduce the cost of advertising: By using digital technology and the Internet, interactive advertising media enable marketing information to be more users friendly. The cost of digital advertising may be even lower than that of traditional ad-films.
- Shorten the distance between the consumers: Computer equipment can be used to make business closer with consumers, customer loyalty can be improved, and services of more value for consumers can be added. The digital channel intermediation provides more opportunities for new distributors or creates more marketing channels that touch consumers.

Overall, digital marketing is composed of various forms of relevant digital information packaging, such as e-mails, short messages from mobile phones, Website pages, social network services, blogs, chat rooms, digital interactive TV, and so on [9].

2.2 Customer Relationship Management

CRM (Customer Relationship Management) refers to the integration of marketing and high-quality services through information technology with the aim of increasing the customers' satisfaction and loyalty to achieve the purpose of increasing business efficiency [10]. Its purpose is mainly to attract customers and maintain or enhance the relationships between them.

In the study of Peppard and Rogers, the CRM is a marketing strategy through which many companies use the information of both existing and potential customers to plan their marketing strategies, and to predict and respond to the customer needs as quickly as possible [11]. In the study of Ronald, the CRM companions through meaningful communication to understand and influence customer behavior in order to increase the number of higher loyalty customers [12].

Luan et al. and their concept of loyal customers explain the spirit of CRM systematically; namely, the relationship between customers and businesses can be divided into three steps, as shown in Fig. 1 [13].

- (1) To obtain new customers: namely, marketing concepts, that is, businesses create customers in various ways, including low-cost promotion, differentiation, personal selling, and so on. First, we have to create a customer in order to proceed with the next action. Before we have CRM, we should have customers; the customer should know that the company's products and services are good, so, this is the first step.
- (2) To establish better customer relationships: This step is the core of CRM; whether the future benefits are successful or not depends on whether this step is working or not. Right from the beginning, with the aim of getting new customers, businesses enhance their relationships with these customers, thus not only forming a link by the product, but also requiring a deeper interaction. Businesses should go through proper channels, at the right time, for providing different services to various customers.
- (3) To recommend others: This role is played by customers. Most of the CRM benefits are obtained from this step. Inferring from the 80/20 rule, assuming that 20% of the customers as we expected, after he/she used our products not only continue to use, but also recommend our products for others to use, as long as one person on an average recommends another person, then corporate earnings will be a full one-time growth. This is the reason behind loyal customers resulting in huge benefits.

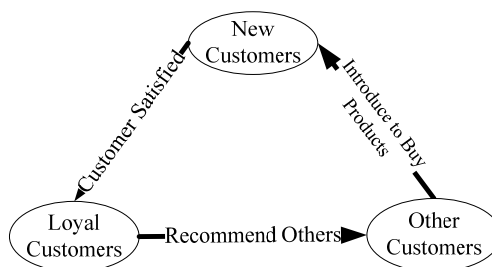


Fig. 1. The concept structure of CRM [13]

However, many of the businesses are aware of the huge databases, which is a key point for making decisions in many organizations, especially the information on customer databases are critical for businesses to formulate a marketing strategy. However, the most useful knowledge is either hidden or not carefully used. On the other hand, fierce competition provides customers with more convenient choices, creates new pressure for decision makers, and comes up with the urgency of long-term customer relationship management. This new phenomenon

is called customer relationship management; under this circumstance, the products/services may not be produced for all public [14], but the company should provide tailor-made products and services. When the company moves its focus to customer relationship management, then interactions with the customers would first determine the success of customer relationship management. These changes cause the greatest impact for businesses.

However, finding an effective marketing model underlying the huge customer database to meet customers' satisfaction is really a big deal. Underlying the era of the raising of consumer awareness, the factor of affecting consumption is very wide. Prices and brands are not the most important factors for customers to affect consumer behavior. All these are in the place of service attitude or are the merits of the product after-sales service. Overall, service is one of the elements of customer relationship management that cannot be ignored. However, to quantify the quality of customer service is difficult, and it is more difficult to know exactly the customer needs and customer preferences. If the business can really discover the importance of service quality to customers, and have a more in-depth understanding of customers, then the best price can be developed to meet customer satisfaction. The competitiveness of businesses can be improved, in addition to getting profits and helping businesses obtain high-loyalty customers.

In the past, the related researches in customer relationship management, there already have been many ways to help businesses understand their customer information and use this information to understand consumer behavior and to develop the marketing strategies that meet the customers' needs [15]. Kahan advocates the RFM (Recency, Frequency, Monetary) data analysis technique, because it provides customer transaction information for businesses, and it is a behavior analysis technology that is more useful than cognitive analysis [16]. In customer-related information, the RFM data analysis technique is most widely used in order to understand the methods.

In 1994, Hughes defined the RFM data analysis technique to analyze and measure consumer behavior [17]. The customers are segmented by past information on the customers' transactions on the basis of measuring customer loyalty and contribution. The RFM data analysis technique is consistent in assessing the importance of a customer. It uses relative grading; the R, F, or M can be divided into five equal portions; 1 to 5 are used for the distinction; the higher the value, the larger the number represents, that is, each of them would be 20% of the entire database. Therefore, there is three numbers in the record of each user. The composition will be 555, 554, 553 ... to 111. Totally, there are 125 compositions. The 555 represents the customer who had purchased the product most recently, purchased the product most frequently, and spent the most of money on it. In addition, the record 111 represents the customer who had never purchased the product or purchased it at a long time ago, purchased the product once or never, and spent no money or a little money on it [17].

In addition, the average purchase interval, which literatures have followed since a long time, is the easiest way to calculate purchase period. Goodman used the concept of MLE (Maximum Likelihood Estimation) to calculate the customer's average purchase interval, where t_1 refers to the time interval between the first purchase to the second purchase, t_2 refers to the time interval between the second purchase to the third purchase, and so on [18].

$$\begin{aligned} \text{MLE} &= (t_1+t_2+t_3+\dots+t_n)/n, \\ \text{or MLE} &= \sum_{i=1}^n t_i / n \end{aligned} \tag{1}$$

Due to the older purchase experience, the lesser influences of making purchase decision for customer. Each purchase means different consumer experience, should be given different weight. Based on the maximum likelihood estimates for customers of purchase interval, the weighted average purchase interval can be referred to as WMLE (Weighted Maximum Likelihood Estimation) as (2).

$$\begin{aligned} \text{WMLE} &= (t_1+2t_2+3t_3+\dots+nt_n)/(1+2+3+\dots+n), \\ \text{or WMLE} &= \sum_{i=1}^n it_i / \sum_{i=1}^n i \end{aligned} \tag{2}$$

According to the description just given, the difference between MLE and WMLE can be used to determine the customer value and the classification of the customer as shown in Table 1 [18].

Table 1. Trends analysis of the customer value with (MLE –WMLE) [18]

Trends analysis	
(MLE-WMLE) > 0	It means that customers' purchase interval is shorter and shorter. The customers are the high value customers and the main benefits providers for the business.
(MLE-WMLE) = 0	It means that customers' purchase interval is stable. The customers are loyal customers for the business.
(MLE-WMLE) < 0	It means that customers' purchase interval is longer and longer. The customers loss their patience and loyalty, and provide less benefits for the business. Their customer value is low.

Since $(MLE-WMLE)/MLE$ represents the slope of the customers' shopping frequency, $(MLE-WMLE)/MLE > 0$ means the customer is more and more likely to buy the products. On the other hand, $(MLE-WMLE)/MLE < 0$ means the customer less and less likely to buy the products. Let Φ be the threshold of purchase frequency and θ be the threshold of monetary, both are set by the product manager based on the selling experience of the product. If the purchase frequency of a customer is higher than Φ , the times of the customer buy the products is more than expected. In addition, if the average monetary of the customer is higher than θ , the monetary of the customer buy the product is more than expected value. The trends of the customer value can also be analyzed as shown in Table 2.

The study uses the data analysis techniques RFM to create the customer market segment; enable businesses to find out the key customer with a higher benefit contribution; understand the customer consumer behavior, characteristics, or loyalty; provide the product combination to meet customers' needs; and effectively raise customer purchase intentions and interests.

Table 2. Trends analysis of the customer value with average shopping behavior [18]

	$(MLE-WMLE)/MLE > 0$	$(MLE-WMLE)/MLE < 0$
Purchase Frequency $-\Phi > 0$	Loyal Customers	Passive Customers
Purchase Frequency $-\Phi < 0$	Potential Customers	Lost Customers
Average Monetary $-\theta > 0$	Loyal Customers	Passive Customers
Average Monetary $-\theta < 0$	Potential Customers	Lost Customers

2.2.1 Data Mining

Data mining is a way of discovering new patterns, characteristics, or associations from large data sets [19]. The mining results can be provided valuable reference information and can also be used as the businesses engaged in the mix of marketing and the forecasting activities of market [20]. Data mining is one of the steps involved in the Knowledge Discovery in Databases. The purpose of data mining is identifying cost-effective, novel, potentially useful information data and understanding the patterns of information [7,21].

However, data mining technology is already quite mature and extensive. Those industries with valuable and analyzable data warehouses or databases can use data mining technology to analyze. The common applications are retail, direct marketing, finance insurance, medical services, and others. According to the difference between analysis methods and discover results, mining techniques can be divided into Link Analysis, Clustering Analysis, Sequential Pattern Analysis, Association Rule Analysis, and Classification Analysis [20]. In this study, the Apriori algorithm is used to discover the association rules and the ID3 algorithm is used to classification analysis. Detailed discussions are given next.

2.2.2 Apriori Algorithm

In 1994, the Apriori algorithm was proposed by Agrawal and Srikan [22]. It is a classic algorithm for learning association rules. Apriori is designed to operate on databases containing transactions (for example, collections of items bought by customers, or details of commerce website frequentation). As is common in association rule mining, given a set of item sets (for instance, sets of retail transactions, each listing individual items purchased), the algorithm attempts to find subsets which are common to at least a minimum number of the item sets. Apriori uses a "bottom up" approach, where frequent subsets are extended one item at a time (a step known as candidate generation), and groups of candidates are tested against the data. The algorithm terminates when no further successful extensions are found.

The purpose of the Apriori Algorithm is to find associations between different sets of data. It is sometimes referred to as "Market Basket Analysis". There are a number of items in each set, and is called a transaction. The output of Apriori is sets of rules that tell us how often items are contained in sets of data. Following the original definition by Agrawal et al. [22] the problem of association rule mining is defined as:

- (1) $I = \{i_1, i_2, \dots, i_n\}$, I is the set of n binary attributes called items.
- (2) $D = \{t_1, t_2, \dots, t_m\}$, D is the database set of transaction records. Each transaction in D has a unique transaction ID and contains a subset of the items in I .
- (3) Association rules $X \Rightarrow Y$ expresses the customers purchase X and may purchase Y at the same time, where X, Y are subsets of I and $X \cap Y = \emptyset$.
- (4) $Support(X) = (\text{the number of the item set } X \text{ appears in the database } D) / (\text{the total number of transactions in database } D)$, is defined as the proportion of transactions in the data set which contain the itemset X .

- (5) $Confidence(X \Rightarrow Y) = Support(X \cup Y) / Support(X)$, or (the number of times both X and Y appears in the database D)/(the total number of X appears in the database D). It refers to the ratio of the conditions when the X appears, the Y will also appear.

In the steps of the Apriori algorithm, the minimum *Support* and the minimum *Confidence* threshold to filter rules need to be developed first. Then, according to the minimum *Support* that scans the database, the set of single item which appearance is higher than the minimum *Support* can be found. By using the same method, a set with two items may be produced. The data are scanned repeatedly, until there are no new set with multi-items can be found out.

2.2.3 ID3 Algorithm

In 1986, the ID3 (Iterative Dichotomiser 3) algorithm was proposed by Ross Quinlan; it is one of the most representative ways in the classification [23]. This algorithm in the classification process is based on the entropy and information gain that classify the data according to attributes. The aim is to select the best attributes as a node/class in order to construct the most simple decision state or one that is close to the simple state. The best node/class is determined by the entropy generated by the respective node/class. The calculated steps are as follows [23,24]:

(Step 1) Calculate the set of objects of the entropy $E(C)$:

$$E(C) = -\sum_{i=1}^c P_i * \log_2 P_i \quad (3)$$

- C : the set of all objects.
- i : denotation of a category from 1 to n .
- c : the number of categories in C .
- P_i = (the number of objects in category i)/(the number of objects in C).

(Step 2) Calculate the sub-entropy $E^+(A)$ that the node with attribute A generated:

$$E^+(A) = \sum_{j=1}^k (n_j / n) * E(C_j) \quad (4)$$

- C_j : the subset of C with the same object attribute j .
- $E(C_j)$: the entropy of C_j .
- n : the total number of the objects in C .
- n_j : the number of objects in subset C_j .
- k : the total number of subsets in C .

(Step 3) Calculate the information gain $G(A)$:

$$G(A) = E(C) - E^+(A) \quad (5)$$

The greater the information gain of generating the node with the attribute A , the more attributes does the class contain.

Due to the digital related media can be integrated, classified, and spread quickly, thus not only reducing the amount of time and the cost spent in the past, but also improving the relationship between consumers, improving customer loyalty, or providing more value-added services to consumers. During traditional marketing, since we cannot monitor the process of consumers, we do not know the full behavior of consumers. However, through the recorded digital marketing's characteristics of feedback, the consumers can be influenced and verified.

With the rapid development of information technology, information and media explosion, and the rise of the consciousness of consumers, improving customer relationship management has become increasingly important. Therefore, meeting consumer demand and establishing the high loyalty customers will be one of the key factors of business success. Therefore, in order to understand the consumer behavior, characteristics, or loyalty, RFM is used to segment customer markets by our study. Then, the required products combination is provided by the Apriori algorithm. In addition, the marketing platform and marketing methods for the target consumers are selected by the ID3 algorithm. However, a high degree of customer purchase intentions and interests can be effectively obtained.

3. Proposed Digital Marketing Framework

Currently, business lives in a rapidly changing environment. The external environment is changed by the national economic, government regulations, consumer preferences, and industry development. The change of the internal environment comprises the business itself, the production, marketing, finance, research & development,

and personnel moves, etc. So that business cannot ignore the impact brought to the company by the environment changes. Businesses want to develop in a sustainable manner; one should change along with the environment, continuously adjust the major strategy for businesses, and develop goals that cause an environmental change. In business strategy, consumer demand has been an area of focus for market researchers. As early as 1988, Hauser and Clausing used a Japanese business as an example [25]. They placed products in public, and the designer hid in the shadows to listen to the views of consumers regarding products to find out the requirements of consumers. However, this approach does not appropriately apply to most industries. There should be a systematic approach by using information technology that is business expected.

Under traditional marketing, since the purchase process of consumers cannot be monitored, their entire behavior cannot be known. However, through the digital marketing's characteristics of feedback and it can be recorded, the consumer's behavior can be influenced and verified. Through the channel we designed, consumers behavior can be converted from passive onto active to complete the purchasing process that we expected. Since the process can be controlled, the manner of getting profit can be designed and organized. Therefore, this study aimed at finding a proper marketing approach for the product in the marketing process proposing a digital marketing framework.

The marketing framework proposed in our study provides not only the related information for the business to formulate marketing strategies, control of the market characteristics, and consumer preferences to select the appropriate marketing strategies for the product, but also through the digital marketing's characteristics of feedback and it can be recorded, real-time feedback is provided during the product selling. Therefore, the unnecessary waste of marketing costs can be avoided. In addition, in order to grasp the needs of its consumers, we segment the marketing for consumers to attract and increase the consumers' attention and purchase intention.

Three major phases involved in the framework of the digital marketing proposed in this study. They are analysis, selection/combination, and marketing/feedback, as shown in Fig. 2. At first, according to the products information, previous marketing experience or data, the study analyzes the marketing strategy during the selection process of the marketing; then, finds the useful, unobvious, or ineffective methods of marketing. Moreover, the results are selected, combined, and saved in the marketing database; then, the information on marketing activities is presented. Finally, the research bases on market response, consumer behavior, click-through rate, and other feedback mechanisms transform that information into the required information; then, they store the information to the database through data pre-processing. The digital marketing framework operation process is described in detail in the next sections.

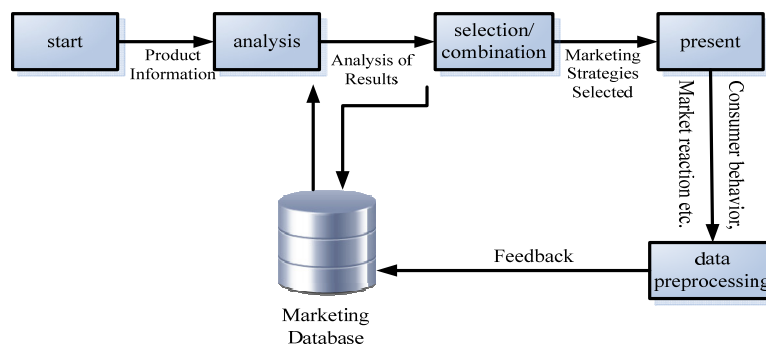


Fig. 2. The proposed digital marketing frameworks

3.1 Analysis Phase

During the analysis phase, the product information, history record, consumer behavior, and other information are used to conduct the first-stage analysis. The analytical framework is shown in Fig. 3.

- (1) Product Information: the type, price, selling channels, and promotions information of the product.
- (2) History Record: the previous marketing experiences, strategies, and market reactions are used to assess and explore the influential factors of potential marketing.
- (3) Customer Behavior: in the marketing process, different characteristics of the consumer behavior, the marketing methods will be different. Therefore, consumer behavior and relative information will be one of the decision factors of marketing methods, such as the age and gender in population statistics, the socio-economic variables and income in professionals, and the need and interest in lifestyle.

Through product information, history record, and consumer behavior, the proposed framework conducts the product value analysis, market positioning, and market segmentation.

3.2 Selection/Combination Phase

To select proper marketing platform for each product is the main purpose performed in the analysis phase. Using the platform that has been selected, the proper combination of suitable marketing strategies for the product is conducted. The selection of proper marketing platform is based on the media of receiving the promotion information, personal characteristics, and past consumer behavior to classify the marketing platform and marketing strategies; then, a proper marketing platform for this consumer segmentation is found; and finally, with the marketing platform, appropriate promotional practices are selected and found. Through two-stage approach, the digital marketing method obtains marketing strategies that meet consumers' needs, as shown in Fig. 4.

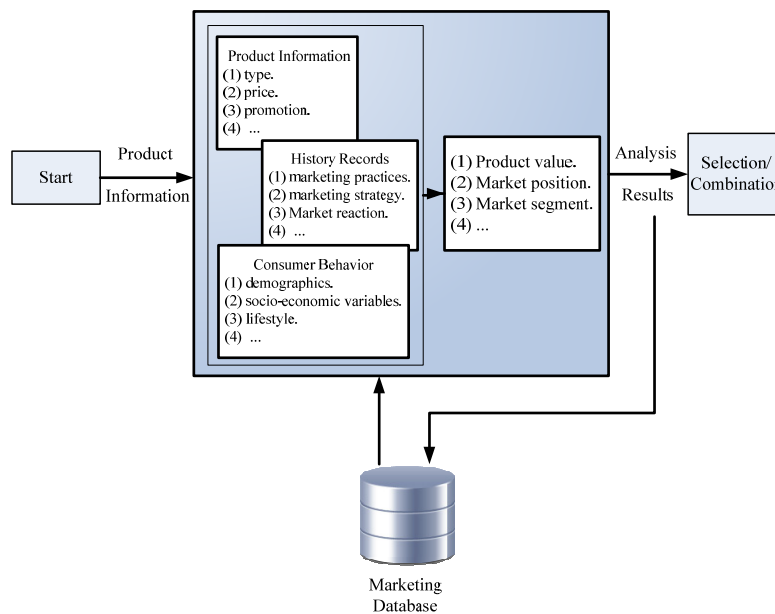


Fig. 3. The analytical framework

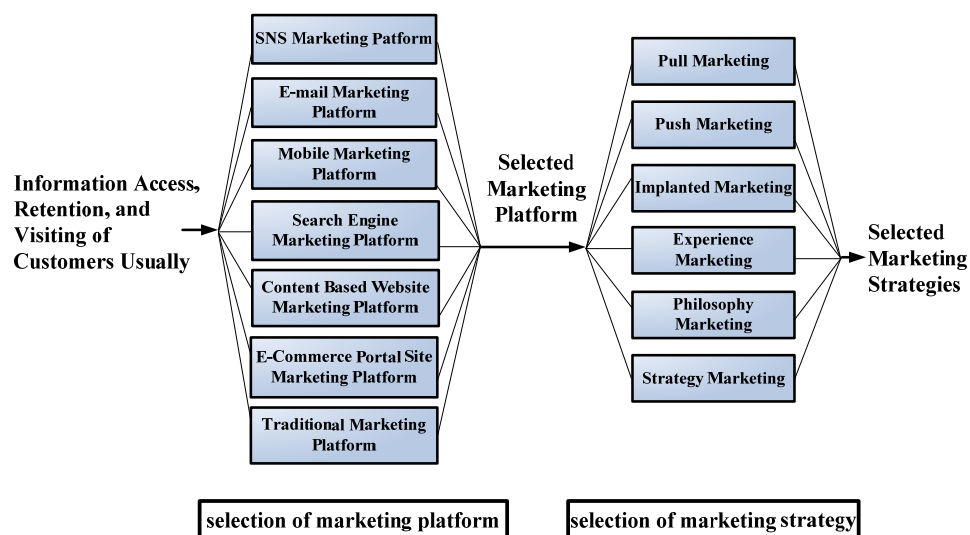


Fig. 4. Two-stage selection of digital marketing strategies

3.2.1 Marketing Platform Selection

The marketing platform refers to the communication channel interface, which the marketing activities are required to touch the consumers. Based on the digital environment of the consumer usually used for information access, retention, and visiting, various marketing platforms the study proposed are shown in Fig. 5.

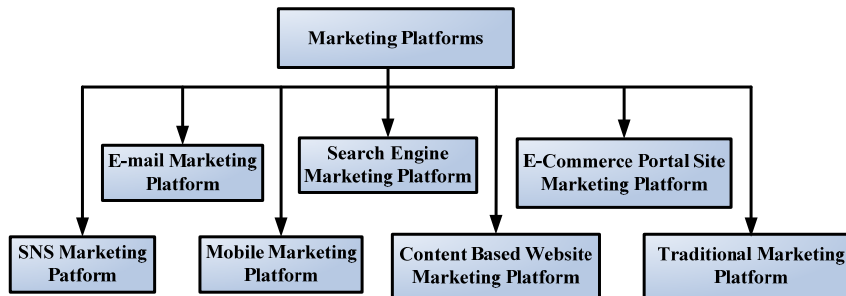


Fig. 5. The marketing platform proposed of the study

(1) SNS Platform: The so-called SNS (Social Networking Services) refers to the patterns formed through the exchange of messages between people [26]. According to the theory of the Six Degrees of Separation, a chain of "a friend of a friend" statements can be made, on average, to connect any two people in six steps or fewer. On the Internet, the messages pass quickly from mouth to mouth. Therefore, in today's environment Web 2.0, the interpersonal network has become a new channel for brand marketing. Users can share views, experiences, and viewpoints to interact with others, such as instant messaging (Information Messenger), video sharing, social groups, music sharing, and so on.

(2) E-mail Marketing Platform: E-mail marketing platform refers to sending advertisements to the consumer's mailbox via a network to achieve advertising publicity. However, we are faced with the era of information explosion, E-mail marketing platforms due to the influx of a large number of ads, thus causing the most troubling problems of spam for most people today. Therefore, before sending marketing messages, one should obtain the consumers' consent, and based on consumer preference, adjust the advertisement. Finally, regardless of delivering the messages by push-marketing strategies or causing participants' interest by pull-marketing strategies, people will be linked together naturally by sharing the messages [19].

(3) Mobile Platform: However, the mobile phone has become a universally popular communication tool [6]. The so-called mobile marketing platform means marketing tools to disseminate information by using the mobile device (such as mobile phones, PDA, etc.), including mobile e-mails, text messages, multimedia messages, and so on; for example, using the mobile phone text messaging to do marketing, such as mobile e-coupons, short-message service advertising, events, and other activities.

(4) Search Engines Platform: By using search engines to find the desired information not only deletes unwanted information by the search engine to reduce the time of looking for information, but also becomes an important channel through which businesses do advertising marketing, such as keyword ranking, SEO (Search Engine Optimization), and so on [6].

(5) Content-Based Website Platform: Content-based Website means that the Website itself provides some information or integrates itself into information and then generates value-added content for consumers to use; for example, subscriptions or searches, such as electronic newspapers, and other types of professional messages [5].

(6) E-commerce Portal Site: E-commerce portal site means businesses or stores in direct contact with consumers by Websites for online marketing, ordering, payment, customer interaction, and other services, such as open auctions; for example, Amazon online bookstores. The e-commerce portal site platform is able via the Internet to conduct product purchase, sale, and other commercial activities. The Website provides a trading platform for both buyers and sellers [5].

(7) Traditional Marketing Platform: Traditional marketing means the product information through the existing sales practices is used to conduct traditional promotional activities, such as television advertising, DM, telemarketing, and so on. It is a marketing way mainly used for those consumers who infrequently use or never use the Internet. However, in the digital age environment, information technology progresses, thereby changing traditional marketing patterns, such as from passive viewers by the cable, into the IPTV interaction model. Traditional marketing platform is no longer limited by time, and one can also vote and search online.

3.2.2 Marketing Strategies Proposed

Marketing strategies means the various activities that are undertaken for making every customer know the products, promote the advantages of products, and convince himself/herself to buy the product. The focus of marketing strategy is on communication: trying to create consumers' awareness, understanding, affection, and buying products. In addition, the product's popularity, image, and sales will be improved. The marketing strategies proposed in this study are shown in Fig. 6.

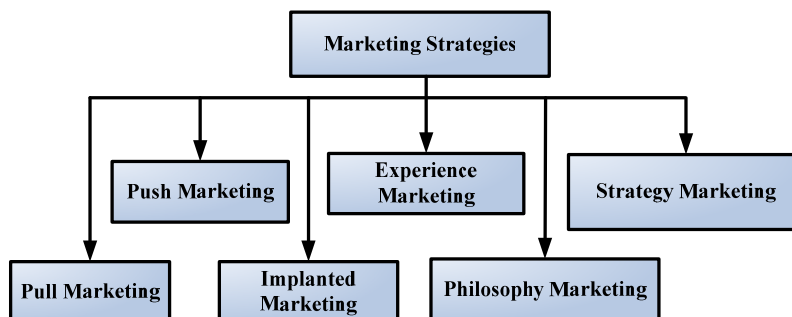


Fig. 6. The marketing strategies proposed of the study

(1) **Push Marketing:** Push marketing is a strategy that cannot be modified according to consumers' personal preference, but it is rather one-way receiving information or services. It passes information to the target groups initially in order to achieve publicity such as e-mail marketing, Internet telemarketing, printing, radio, and television.

(2) **Pull Marketing:** Pull marketing is a strategy through which consumers actively search or receive information about products. Through an attractive way, the consumers actively search the information they need and provide the service mechanism according to personal preferences, selective use, formed and subscription, such as the SEO keyword ranking, search keyword advertising, and Website marketing.

(3) **Placement Marketing:** Placement marketing is a strategy that strategically places products or brand names on TV, in movies, games, and other entertainment media to achieve advertising effectiveness [27]. It not only reduces the resistance of advertising, but also increases the preference and understanding for certain products under an unconscious condition, such as public-praise marketing, game marketing, and video marketing.

(4) **Experiential Marketing:** Experiential marketing is a strategy that uses the past experience of consumers, history records, experiences, and other ways to conduct product marketing strategies, such as blog marketing, social marketing, story marketing, database marketing, public-praise marketing, and so on. For example, it enables them to write their own personal web log by blogs, using text, music, images, colors, and so on to create and for full self-expression. These spontaneous expressions rapidly get feedback, identity, and make enthusiasts in the network by links, quotes interactive feedback, and so on. Furthermore, it can use sensory marketing experience to create a new, unique emotional or perceptual experience. Through the stimuli of vision, hearing, touch, taste, and smell, it triggers customers' motivations and needs, and encourages consumers to buy the products to achieve marketing purposes.

(5) **Idea Marketing:** Philosophy (or idea) is the intellectual foundation of any human activity. People reflect their own experiences and understand problems by constantly absorbing new information, such as event marketing, social marketing, and green marketing.

(6) **Strategy Marketing:** Strategy marketing means through inter-businesses, marketing strategies, and other cooperation relationships to conduct products marketing promotion, such as affiliate marketing, integrated marketing, independent marketing, cross-marketing, and so on.

3.3 Implement and Feedback Phase

After finding out a suitable combination of marketing platforms and strategies for the product, we show up the products to customers. In the meanwhile, we have not only present advertising but also present related activities information, as shown in Fig. 7. Finally, based on market response, consumer behavior, or click-through rate, and other feedback mechanisms, the pre-processing data of marketing applications, results, and other information are transformed. However, the information is transformed into the same format with databases and required information, and then resent to databases for storage and use, in order to improve data reliability.

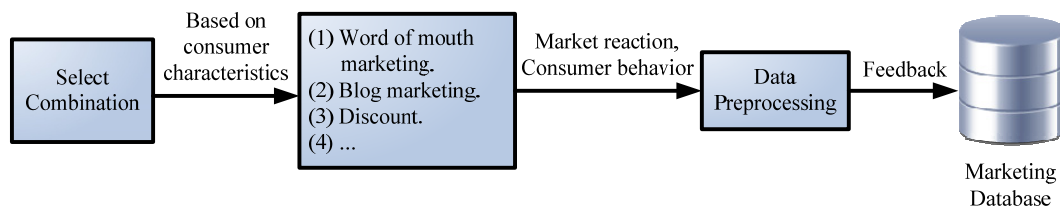


Fig. 7. The flow of Implement/Feedback phase

4. Examples Explanation

In this section, the examples are used to explain how the proposed framework provides an effective marketing combination, masters the market characteristics and consumer preferences by the digital marketing strategies. The “Food Mart 2000 database [28]” is used to run the example. At first stage, the Apriori algorithm, RFM analysis, and ID3 algorithms compose the analysis phase. In this study, the Apriori algorithm is used to analyze the association relation of the related products in order to find out the most appropriate product combination to increase the sales revenue. Then, the customer value is analyzed by RFM to find out the high-contribution customer groups for the business. Finally, the ID3 algorithm analyzes the history record of past marketing strategies and summarizes the experience rule of success and failure, thereby reducing the risk of businesses marketing.

At the second stage, in the selection/combination phase, the results of the analysis phase is used, such as product characteristics, market segmentation, and so on, to find out the proper marketing strategies combination. In this example, the Internet market platform is selected to be used to integrate the Website most commonly used and the cluster by the ID3 algorithms to find the best-suited marketing combination. Moreover, in the analysis phase, if it has generalized the experience of success and failure, then it will be based on marketing experience to screen the combination in order to reduce marketing risks.

Finally, in the implement/feedback stage, the product via the suggested marketing platform and strategies is depicted to the customer. Then, the information of marketing activities, market response, consumer behavior, and click-through rate will be transformed and stored into the database by data pre-processing. The feedback mechanism is used to improve the reliability of the data of consumer purchase behavior. The all steps of the example are shown in Fig. 8.

4.1 Data source and Experimental Tools

The “Food Mart 2000 database” provided by Microsoft [28] is used in example discussed. This type of database is found in multinational retail chain stores. There are 1560 kinds of 47 categories of products, and more than 180,000 records of customer transactions. Among 47 categories of products, the study picks packaged vegetables as an example product.

The experimental tools used in this study are shown in Table 3. First, the Apriori algorithm in R Statistical Software is used to analyze the association of products. This is in order to find the association between attributes and bestseller products by generating rules and inducing consumers to complete the purchase behavior. Furthermore, SPSS is used to analyze the calculation of five equal portions of RFM, PHP and the MySQL database are used to calculate the interval of customer buying time, and Microsoft Office Excel 2007 is used to convert the data and analyze the statistics charts. This is in order to find out high-contribution customer groups for businesses by customers’ purchase information and maximize the benefits with limited marketing resources. Finally, the DMAS (Data Mining Assistant System) is used to analyze product value and select a marketing combination.

4.2 Use Apriori Algorithm to Analyze Products

The Apriori algorithm is used to analyze the association of the product. First of all, the purchase frequency of product items should be calculated and the *Support* should be found out which products are most often purchased by consumers. Fig. 9 shows that the overall *Support* distribution of product items ranges between 0 and 0.021.

Therefore, the most popular products by the level of product support can be found. When the *Support* is set to 0.02, 1 product meets the association rules; when the *Support* is set to 0.015, there are 363 products found. The study uses the *Support* 0.019 as an example, as shown in Table 4, to find the top eight popular products in food retail.

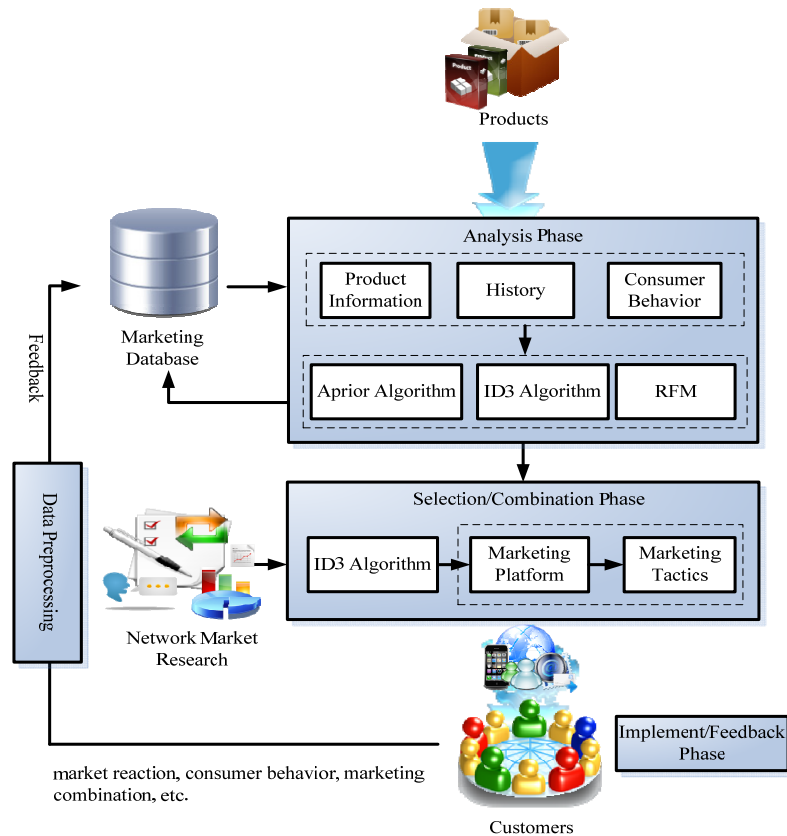


Fig. 8. The progressions of example execution

Table 3. Experimental tools and applications

Experimental tools	Application
R Statistical Software	Use the Apriori algorithm to analyze the association among products.
SPSS	Use RFM to analyze customer loyalty.
DMAS	Use the ID3 algorithm to analyze product value and marketing strategies combination.
Microsoft Office Excel 2007	The experimental results storing, data conversion, and generate statistical charts.
Microsoft office Access 2007	Food Mart 2000 database recording.
PHP and MySQL	Use PHP to program RFM underlying MySQL.

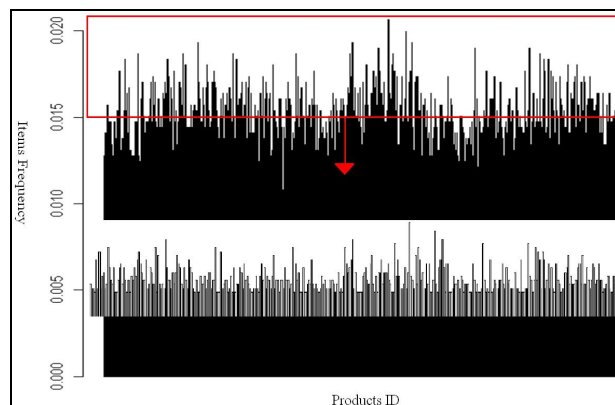


Fig. 9. The overall frequency distribution of product item sets

Table 4. The maximum frequency of product item sets

	Items	Support
1	{376}	0.02064220
2	{423}	0.01998689
3	{1257}	0.01933159
4	{440}	0.01933159
5	{277}	0.01933159
6	{762}	0.01900393
7	{612}	0.01900393
8	{348}	0.01900393

Second, the *Support* and *Confidence* are used to find the association between products. However, when *Support* is set to 9.002, no product meets the association rules; when *Support* is set to 0.0015, there are 108 products found. Therefore, we can find that when the *Support* threshold is set too high, it is not easy or we cannot find the association rules and thereby miss important association rules; on the other hand, when the threshold of *Support* is set too low, we cannot find useful and reliable association rules. Therefore, the *Support* should be set to 0.0019 and the *Confidence* should be set to 0.8 to generate the relationship between the products, as shown in Table 5, and the top four most correlation products should be removed by comparison.

The study uses {1230, 177} => {876} as an example. It means the customer purchases the product {1230} and {177}, he/she will purchase the product {876} at the same time. It equals to If ({1230} and {177}) then {876}. Thus, the relationship attributes in generating many condition rules can be found. Customers can be made to complete consumer behaviors by the path we designed, and product sales rate can be increased.

Table 5. Association product Item sets

	Items	Support	Confidence
1	{1230,177} => {876}	0.001965924	1
2	{1230,876} => {177}	0.001965924	1
3	{177,653} => {876}	0.001965924	1
4	{1230,653} => {420}	0.001965924	0.8571429

4.3 Use RFM to Analyze Customer Loyalty

The customer loyalty is analyzed by RFM. The Recency, Frequency, and Monetary are divided into five equal portions; each portion is 20%, respectively. Based on the R, F, and M values they belong to, RFM score can be calculated individually. As shown in Fig. 10, the RFM score distribution of each customer is obtained and the value of each customer can be found. The higher scores he/she gets the higher value he/she is.

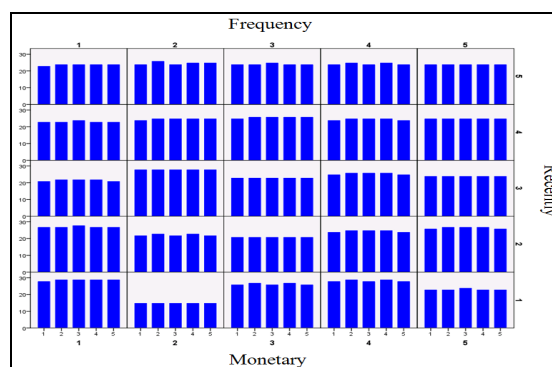


Fig. 10. Overall RFM score distribution of customers

Second, the MLE and WMLE are used to analyze the trends in customer value. In the computing analysis, the customer with only a one-time purchase record is eliminated, and the analysis results are shown in Fig. 11. The 89.48% customers whose trends of the customer value are greater than 0 are high value customers; the 0.08% customers whose trends of the customer value are equal to 0 are stabilized value customers; and the 10.44%

customers whose trends of the customer value are less than 0 are lower value customers. In addition, the trends of customer value and the average determination value can be used to analyze the customer purchase behaviors, then the characteristics of customer consumption can be found and the customer loyalty is measured, as shown in Fig. 12.

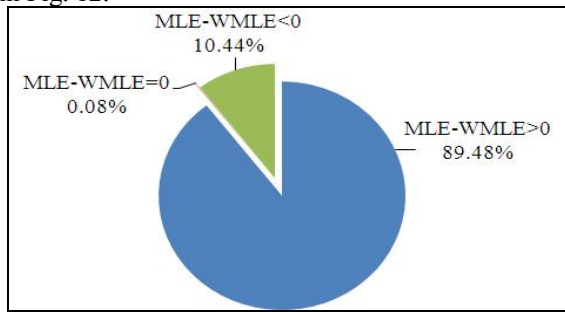


Fig. 11. Distribution of customer value analysis

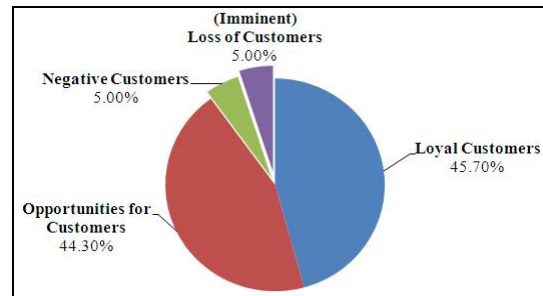


Fig. 12. The ratio of trends in customer value and average determination value analysis

4.4 Use ID3 Algorithm to Analyze Product Value

The ID3 algorithm is used to analyze the product value. This is done in order to understand the price perception of products and to help the businesses set prices and places in the future. As Fig. 13 shows, one can find that customers in different areas and of different age groups have different perspectives about product price. Take packaged vegetables as an example; in Mexico, the average price of consumption is \$6.79, in the United States, it is \$7.03, and in Canada, it is \$6.43. Different ages have also different perceptions of price. Therefore, to analyze the reference price for customers will be used to influence customer perception for a fair price and provide related information for businesses to formulate marketing strategies.

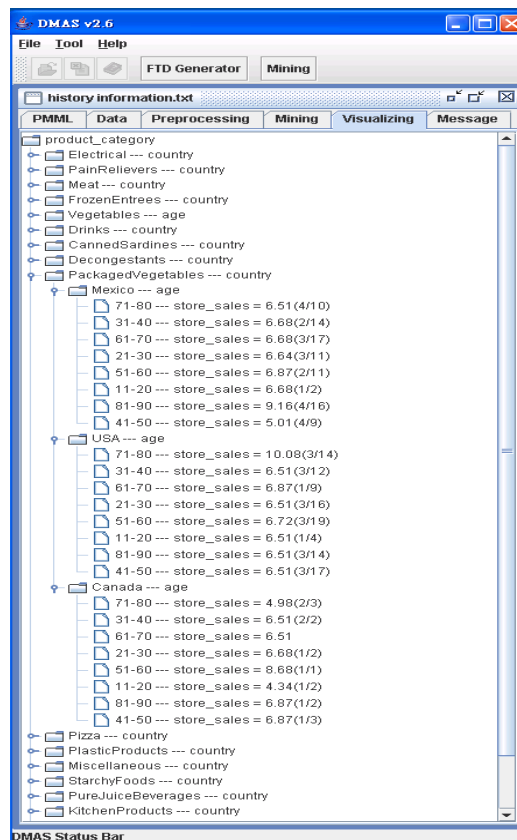


Fig. 13. Customer product value

4.5 Use ID3 Algorithms to Classify Marketing Platform and Marketing Strategies

The ID3 algorithm is also used to classify the marketing platform and marketing strategies. Table 6 shows the information of the marketing platform or the media_type of the customer used from the example database Food Mart 2000. Then, the ID3 algorithm is used to analysis. The analysis result is shown in Fig. 14. Finally, based on marketing platform classification and the characteristics of target groups, the marketing strategies can be selected that meet the needs of consumers and achieve publicity as shown in Fig. 15.

From the results in Fig. 14, we can observe that the source of purchasing packaged vegetables is almost from a content-based Website. Therefore, the content-based website platform is chosen to promote products. At the second stage, relied on the classification of marketing strategies with the selection of the first phase, a combination can be drawn that suits the content-based Website platform, as shown in Fig. 15.

In push marketing, the network telemarketing is chosen to provide customers with consulting services or to provide customers with customized marketing projects, and then, from passive to active, effectively to enhance product sales. In pull marketing, the customers try to find out the desired product information in search engines, we can make products be easily found in the content-based Website platform by SEO keyword ranking promotion. In placement, public-praise marketing is used informally to affect the behavior of others in the platform. The customers can reduce their risks and uncertainties when they make the decision of purchasing by public-praise information between each other. In experiential marketing, we analyze the preferences of each customer for a typical type of products, and then recommend related products for customers, such as Amazon.com book recommendations. In cause-related marketing, we focus on today's hottest environment protection issues, such as the green marketing by environmental friendly packaging to reduce the waste of resources.

Finally, in strategy marketing, the strategic alliances will be built by cross-marketing of cooperating with the contents of the major food website in order to improve product exposure and to increase the visibility of the product.

As an example in the study, the marketing strategies of purchasing packaged vegetables are analyzed. As shown in Fig. 16, in the content-based website, the consumers have been receiving media information over the past years that the strategy "Price Winners" is the most attractive method for consumers, in which the consumers will be stimulated to purchase a product by giving them a discount. It means to "pull" consumers to buy the products.

Table 6. The data source of customers purchase

customer_id	product_category	age	marital_status	gender	media_type	promotion_name
6461	Vegetables	81-90	M	F	E-CommercePortal Site	ShelfEmptiers
6461	PureJuiceBeverages	81-90	M	F	E-CommercePortal Site	ShelfEmptiers
6461	Bread	81-90	M	F	E-CommercePortal Site	ShelfEmptiers
6461	Hygiene	81-90	M	F	E-CommercePortal Site	ShelfEmptiers
6461	BreakfastFoods	81-90	M	F	E-CommercePortal Site	ShelfEmptiers
6461	SnackFoods	81-90	M	F	E-CommercePortal Site	CouponSpectacular
6461	BeerandWine	81-90	M	F	E-CommercePortal Site	CouponSpectacular
6461	Candy	81-90	M	F	E-CommercePortal Site	CouponSpectacular
6461	Dairy	81-90	M	F	Mail	PriceDestroyers
6461	BakingGoods	81-90	M	F	E-CommercePortal Site	CouponSpectacular
6461	SnackFoods	81-90	M	F	Mail	PriceDestroyers
6461	Hygiene	81-90	M	F	E-CommercePortal Site	CouponSpectacular
6461	Magazines	81-90	M	F	Mail	PriceDestroyers
6461	Candy	81-90	M	F	Mail	PriceDestroyers
6461	CannedSoup	81-90	M	F	Mail	PriceDestroyers
6462	Drinks	31-40	S	M	ContentBasedWebsite	BagStuffers
6464	SnackFoods	21-30	S	M	ContentBasedWebsite	ShelfClearingDays
6464	Electrical	21-30	S	M	ContentBasedWebsite	ShelfClearingDays
6464	CannedTuna	21-30	S	M	ContentBasedWebsite	TwoDaySale
6464	SnackFoods	21-30	S	M	ContentBasedWebsite	TwoDaySale
6464	Vegetables	21-30	S	M	ContentBasedWebsite	ShelfClearingDays
6464	Dairy	21-30	S	M	ContentBasedWebsite	TwoDaySale
6464	Vegetables	21-30	S	M	ContentBasedWebsite	TwoDaySale

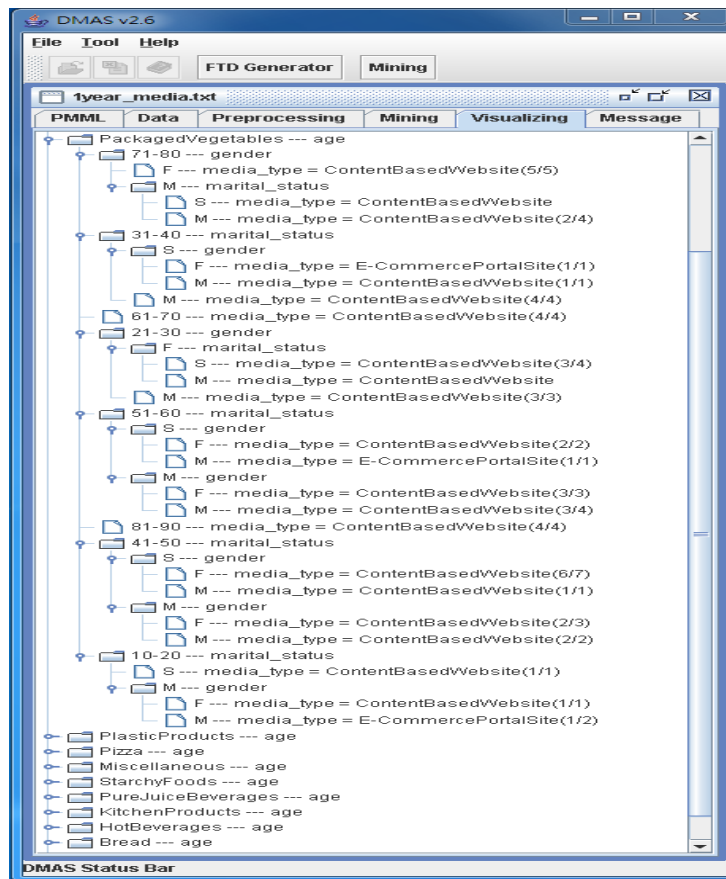


Fig. 14. The first step of marketing platform classification

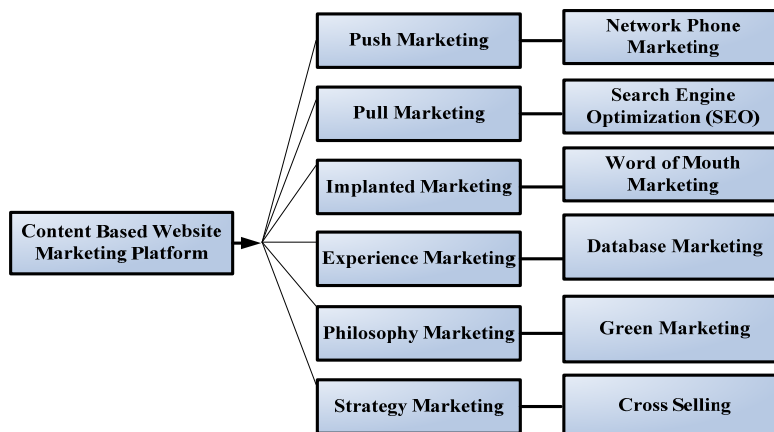


Fig. 15. The second step of marketing platform classification

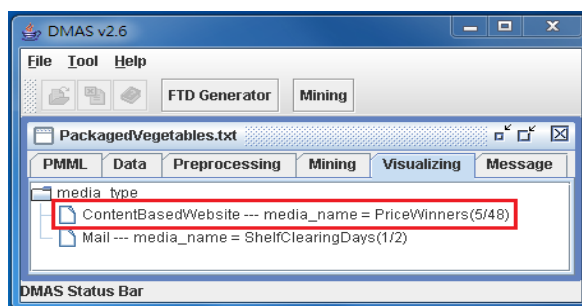


Fig. 16. The induction of media information strategy

If the businesses have extra marketing resources, more than one marketing strategies can be found by going back to selection/combination phase again as shown in Fig. 17. When a company chooses public praise as their first marketing strategy, they can analyze the information on the results of public praise, market response, consumer behavior, or click-through rate and other feedback mechanisms. The marketing strategy is verified as being suitable or not. If the marketing results are not as expected, fails, we will adjust the analysis phase. On the other hand, based on the resources of the business, we choose whether to continue marketing the product.

osCommerce is an open source e-commerce solution that offers a wide range of out-of-the-box features that allows online stores to be setup fairly quickly with ease, and is available for free [29]. The study uses osCommerce as our experimental tools to build the content-based Website platform on which the fruits and vegetables are available as an example for analyzing the performance of the website marketing, as shown in Fig. 18. The Google Analytics [30] is used to analyze the site traffic, marketing effectiveness, and other feedback mechanisms, and then to verify the combination of the marketing strategies the framework suggested being appropriate or not.

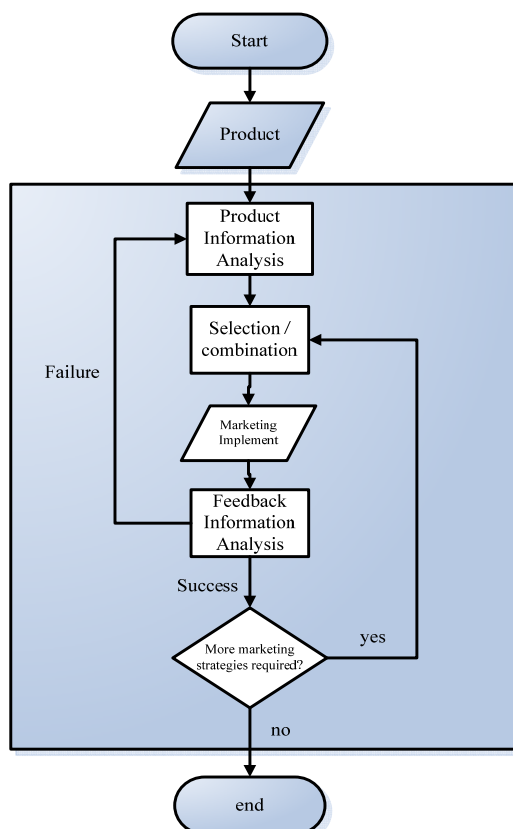


Fig. 17. The processes of marketing

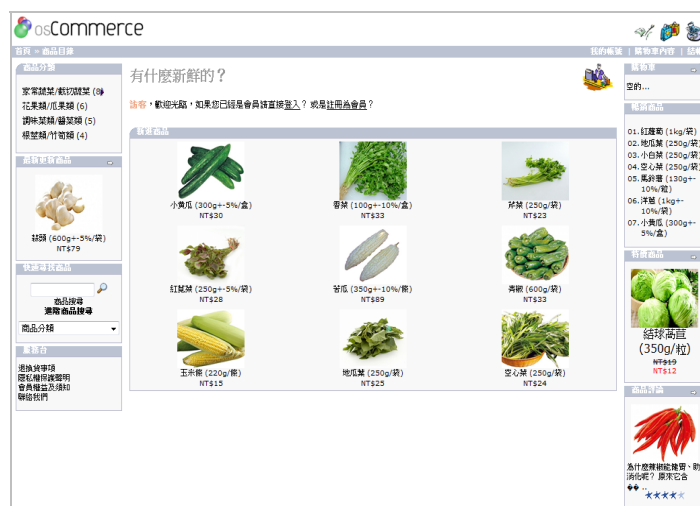


Fig. 18. Fruits and vegetables store website

5. Conclusion and Future Study

With the popularity of broadband Internet and the booming development of network technology recently, traditional marketing is also gradually moving toward digital marketing. Digital marketing should become more and more popular, and it is vastly different from the traditional marketing. Furthermore, e-commerce companies change the traditional business and marketing model, so companies need a different point of view to observe the contact and interaction between business and consumers is an important foundation for network marketing.

In today's competitive market, since every business produces many products, standing out in a competitive market is a great issue to be solved for businesses. The advantage of operating businesses in addition to their innovative products, brands, quality, etc., how to combine marketing strategies with products, make everyone know the product, and increase customers' purchase intention and interests is one of the key success factors of operating a business.

Overall, the digital marketing framework that the study proposed will suggest a proper communication method with consumers based on analyzing the marketing information of the product, history records, and purchase behavior of consumers. Among them, the product information includes the type, price, place, and promotion of the product. History records contain the previous marketing strategies, practices and market reactions to estimate, consult, and explore the potential or unknown influence factors of marketing. In terms of consumer behavior, 5W & 2H (what, when, where, which, why, how long and how much) of purchasing will help businesses to know what kind of platform and communication can touch the target customer. Different characteristics of consumer behavior, the marketing strategy should be ingratiated with the different of consumer's age, sex, occupation, income, lifestyle, interests. In other words, product information, history record, and consumer purchase behavior will affect the business to formulate the marketing strategy for different products.

After the analysis phase, the characteristics of products are summarized to include product value (such as function, quality, innovation, etc.), market segmentation (such as consumer characteristics), and market position (such as business image). Then, based on the characteristics of products during the selection/combination phase, the marketing platform and marketing strategy, the complete the marketing strategies combination is selected to the businesses. Finally, the selected marketing combination is used to marketing the products to customers. During marketing process, the digital market platform presents not just advertising but also providing related information, including discount activities, games contests, etc.

With the popularity of broadband Internet and the booming development of network technology in recently, traditional marketing is also gradually moving toward digital marketing. The dissemination of information through the Internet is different from traditional marketing. Therefore, in the study, a framework for digital marketing is proposed. It not only provides the related information for business in the marketing process but also finds a proper marketing strategy and increases customers' purchase intention and interest.

In addition to these ongoing studies, next, we can increase product recommendation, the establishment of knowledge rules, so as to provide more customized marketing strategies. Furthermore, the study analyzes explicit information to find out the needs of consumers. In the future, the study can further analyze tacit information to provide personalized marketing services.

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