



CUSTOMER BEHAVIOR AND DECISION MAKING IN THE REFURBISHMENT INDUSTRY-A DATA MINING APPROACH

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Abstract. The study of consumer behavior in the refurbishment industry is crucial to the business operation of firms, but there is a lack of research in this regard. With reference to the EKB model specific to consumer behavior, this paper discusses the relationship among consumption characteristics, firm selection behavior and satisfaction degree of refurbishment customers. 242 valid questionnaire copies were collected from refurbishment customers, and analyzed using Decision Tree Analysis and Association Rules in Data Mining. The research results show that, over half of the customers tend to entrust the refurbishment to well-reputed firms. Moreover, the integrity of refurbishment equipment, response of refurbishment personnel, professionalism and confidence are key elements in service quality (SQ). The best marketing policy for the customers is one which provides more attractive services. These research findings may provide a useful reference for innovative refurbishment firms in their decision-making.

Keywords: refurbishment industry, datamining, consumer behavior, EKB model, service quality, business strategy.

1. Introduction

About 84% of Taiwan citizens own houses, with the refurbishment rate up to 26.2% according to the survey of population and housing state; and the refurbished households accounted for 44.3% according to the 2002 survey of family income and expenditure (Census Bureau 2002), showing that the housing refurbishment market will play a bigger role in the future.

As an emerging market, the building refurbishment is often underrated by the customers, who often arrange for refurbishment with a lack of relevant information about refurbishment firms. However, if improper firms are selected, the customers may often be vexed about the poor refurbishment quality and services. And, the customers without professional know-how will find it difficult to make decisions on building refurbishment. The refurbishment firms are often in a dilemma since they are not well aware of customer requirements and characteristics, and their new products or services are not recognized by the customers. In the new economic times with fast-growing information transfer and emergence of new competitors, many enterprises set business targets on “improving the quality of service and seeking customer satisfaction”. The relevant research indicates that, a customer who is satisfied about one company’s product or service may introduce 1~3 other customers, otherwise he/she may tell 11~13 relatives or friends about the negative assessment (Johns 1995). Thus, an important subject in the refurbishment market is how to create and transfer the real value required by the customers, and promote SQ to win customer satisfaction. For this reason, this paper

intends to analyze the customers’ recognition factors, decision behavior, consumption characteristics and satisfaction degree about refurbishment by employing relevant consumer behavior theories and two Data Mining methods: Decision Tree and Association Rules. While key factors recognized by customers are analyzed, this research helps the refurbishment firms to understand customer requirements and characteristics, thus providing a reference for business management and improvement of asymmetrical information problems between the customers and the refurbishment companies.

2. Literature review

This part will review the previous research on the refurbishment industry, consumer behavior, SQ, Data Mining, Decision Tree and Association Rules.

2.1. Relative research on refurbishment and overview of Taiwan’s refurbishment market

Buildings refurbishment supports excellent opportunities to reduce energy consumption in buildings as well as encourages other sustainable refurbishment principles implementation – citizens’ healthcare, environment protection, rational resources use, information about sustainable refurbishment dissemination and stakeholders groups’ awareness (Mickaitytė *et al.* 2008). There are many definitions of refurbishment by researchers, for example, Egbu *et al.* (1996) defined it as alteration, replacement, modernization and repair of buildings to meet diversified application characteristics, but not including

routine maintenance, regular painting and cleaning. In this paper, refurbishment is defined as: “the refurbishment behavior taken for the customers to extend the service life of buildings after completion of construction. It covers the following aspects: (1) maintenance and servicing of construction equipment, (2) breakdown maintenance, (3) improvement of indoor housing quality and space modification (Aikivuori 1996; Johnstone 2001; Huang and Wang 2005) Kaklauskas *et al.* (2005) pointed that a thorough building’s refurbishment evaluation was quite difficult to undertake, because a building and its environment were complex systems. They also applied the method of multivariate design and multiple criteria analysis of a building’s refurbishment and on that basis, developed a Decision Support System for building refurbishment.

Given the fact that existing households number over 7 million in Taiwan, the annual turnover of the refurbishment market is estimated to reach about NT\$ 100 billion (1 USD = 30.415 NTD, the rate of exchange on 13 July 2008), not including such relevant industries as: removers, furniture and cleaning companies. Investigation results from the Executive Yuan indicate that, about 26% of households conducted refurbishment every year in 1992-1995, and annual turnover of the refurbishment market was predicted to reach NT\$153.7 billion (Huang and Wang 2005).

There are over 10,000 refurbishment firms in Taiwan, meanwhile fierce competition and diversified business models make the industry fragmented. Taiwan’s refurbishment companies can be categorized into the following four types of business models (Huang and Wang 2005): (1) traditional companies, (2) companies with reinforced brands, (3) regular chain system companies and (4) franchise chain system companies. The business model of Type I is the most historical and has the most companies using it. Different from Type I companies, companies of the other three types have several innovations in their services and running their brands, therefore, they are called “branded companies” in this study. Companies of Types I and II adopt single-store operations while those of Types III and IV use chain-store operation systems.

The traditional refurbishment-related businesses commonly found in the market include masonry stores, plumber/electrician shops and small contractors. Most of these firms adopt the business model of self-owned single stores characterized by high working flexibility and mobility. However, most of them are not active in or willing to build their brand images. The customers are often puzzled by their different charging standards, construction methods and SQ. Given the fact of asymmetrical information, the customers have to spend a lot of time on searching, bargaining and supervision, and also bear the risk of transaction and extra transaction cost (Williamson 1975).

In view of aforementioned shortcomings of traditional business models, many refurbishment companies have adjusted their operations. Type II companies are different from Type I counterparts in their awareness of brand

building through marketing. Establishing themselves as professional companies, they often market themselves by sending DMs or posting ads on the Internet. Some of them even provide free housing condition checkup services in order to promote their business concepts and locate business opportunities among potential clients. The enhanced brand credibility and information transparency can help lower transaction costs for consumers. However, they are still using single-store models and, therefore, they can not enjoy the benefit of economies of scale in effectively reducing procurement costs. When completely developed with sufficiently accumulated know-how, they might possibly develop into chain business systems.

There is a growing trend to chain operation in Taiwan’s refurbishment industry. The chain system is also divided into regular and franchise chain system. Induced by huge development opportunities, large-scale suppliers of refurbishment materials, for DIY such as the famous B&Q (like Homedepot in the U.S.), have started to get involved in the refurbishment business by merging some technical crews. In such a centralized chain system, the head office has absolute control and management powers over the branches, including their procedures, promotional activities and procurement. Also, such firms are well-positioned for unified image and purchasing advantages.

Among these four models, the franchise chain system, now prevalent in Taiwan, is the most innovative. Currently, a leading brand has nearly 200 franchise stores, and its head office is mainly liable for brand operation, awarding of franchises and offering necessary education & training as well as business know-how. As the requirements of customers and entrepreneurs of franchised firms are met, such a franchised business model is already widespread based on strong promotion of brands in Taiwan.

2.2. Consumer behavior model

Numerous studies have been devoted to consumer behavior, e.g. from the perspective of microeconomics or macroeconomics, or the social psychology including learning or cognition. The representative EKB model, initiated by Engel, Kollat and Blackwell, was taken as the analysis framework for this research (Engel *et al.* 2001). Juan (2008) stated that the refurbishment market had grown greatly in the last decade. Relevant projects were becoming increasingly more demanding in the construction industry due to the emphasis on sustainability. Since most refurbishment works, involving a higher level of risk and uncertainty, the characteristics are likely to cause asymmetric information between contractors and tenants in a refurbishment process and thus affect customers’ satisfaction and project performance. His study proposed a systematic decision support approach to solve refurbishment asymmetric information problems by employing case-based reasoning and data envelopment analysis (DEA). The PZB model of the service quality and fuzzy sets were applied to support the DEA operation. The proposed hybrid decision support approach was expected to be useful

for both tenants and contractors with high refurbishment needs when they face similar problems.

EKB model is primarily divided into information input & processing, decision variables (internal and external) and decision process, of which the decision process is the focus of research, and the others are influential factors in the decision process. The major concerns of the model include (1) information input: it refers to the marketing information of firms and relevant information received by the customers from interpersonal interaction; it's also divided into marketing and non-marketing sources; (2) information processing: this is divided into five phases: exposure, attention, understanding, agreement and retention; that's to say, the information is exposed to and received by the customers, who may acquire a long-lasting memory through processing, explanation, acceptance and retention; (3) decision process: the customers' decision process is a "troubleshooting" process, including perception of problems, searching for information, assessment of alternatives and purchase; (4) result of purchase: either satisfaction or dissatisfaction following from purchase behavior may also affect the consumers' purchase decisions; (5) decision process variable: the influential factors on the customers' decision process are categorized into personal and environmental factors (Engel *et al.* 2001).

It's thus learnt from the EKB model that, consumption behavior is a continuous process during which different personal attitudes and values take shape under external stimulation, and various variables are interrelated. This process will affect the decision procedure. The purchase decision is affected by many environmental factors, including: cultural criteria, social class, customers' motives, knowledge, attitude, personality, value system and life style.

2.3. Evaluation model of SQ

"Service" means a complex, abstract and non-quantifiable interpersonal behavior that features intangibility, heterogeneity, transiency, inseparability and non-ownership, making it difficult to measure SQ (Regan 1963). In the early stage, Parasuraman, Zeithaml and Berry (1988) developed the SERVQUAL scale, which contained 22 items, and was divided into tangibility, reliability, responsiveness, assurance and empathy. This scale aims at evaluating the gap between customers' expectations and their actual cognition about the service. Every item has two options for measuring separately the "expectation" and "actual cognition". Cronin and Taylor (Cronin and Taylor 1992) argued that previous literature about SQ focused more on performance-based measurement, they proposed SQ should be conceptual, an attitude. Hsieh *et al.* (2008) explored customer's expectations of service quality in hot spring hotels in Taiwan. Based on the five dimensions of PZB service quality and found the service quality evaluation framework and evaluation results can be used as a guide for hot spring hotel proprietors to review, improve, and enhance service planning and service qualities. Therefore, the SERVQUAL scale was shaped into the "SERVPERF" scale, from the original semantic

difference evaluation to direct measurement of service results. The "SERVPERF" scale was adopted in this research since it can improve the efficacy of questionnaire investigation. In this paper, Decision Tree Analysis and Association Rules in Data Mining, as well as the EKB model and the SERVPERF scale, were used to discuss the correlation of various items, and provide further insight into the customers' perceptions of the industry.

2.4. Data mining

Data Mining refers to a technique used to extract latent or implied trends, patterns and relationships from a big database (Thuraisingham 2000). It is also a process of discovering interesting knowledge, such as patterns, associations, changes, anomalies and significant structures from large amounts of data stored in a database, data warehouses, or other information repositories (Hui and Jha 2000; Chua and Lan 2005). Datamining is able to automatically analyze the information in a database and attempts to interpret irrational knowledge so as to achieve the goal of creating new knowledge (Lee *et al.* 2008). In consideration of the shortcomings of traditional statistics, that a basic hypothesis is first required and data analysis cannot be conducted through a database management system (Kleissner 1998), this technology is used to set up a complete data mining model by combining several artificial intelligence technologies and statistical methods, such as: database, machine learning, knowledge acquisition, pattern identification and information indexing visualization.

Amongst many Data Mining methods, Decision Tree Analysis and Association Rules are used as research methods in this study. Decision Tree Analysis is to set up a classification principle using a series of classifications or values, and infer the rules from historical data, namely, set up the classifications and rules from the object sets of known classification according to their attributes. The attributes represent the influential classification or judgment characteristics (represented by the branch points of tree), while the decisions represent the classification or judgment (represented by the leaves of a tree), so it's called a Decision Tree (Han and Kamber 2000). For example: the "compactness strength of concrete" is divided into high, medium and low strengths. The basis (objective attribute) of classification shall be first selected, so it's also referred to as a supervisory learning function. The purpose of Association Rule Mining is to find out if there are associated combinations in the database, e.g.: "80% of bread customers will also purchase milk", according to the association analysis from the purchase records of a supermarket. As mentioned above, if the enterprises can find similar association rules from existing transaction records, they can formulate marketing policies, and provide a reference for market planning, ads strategy or directory planning to further improve turnover and profit (Fayyad *et al.* 1996).

3. Research design

To further probe into consumer behavior in the refurbishment industry, the EKB model was introduced in this

study, and some basic elements from three constructs were extracted to analyze and verify the validity of the EKB model in the refurbishment industry, and also explore the connotations of business strategies in the refurbishment industry. In this paper, “decision process” was taken as a major dependent variable, while “information input and processing” and “decision process variable” were taken as independent variables. In addition, the customer satisfaction on the decisions was measured by the SERVPERF scale. This questionnaire contains four parts:

The first part involves the decision process variable, which aims at understanding the customers’ attitude toward and perception of the refurbishment, that’s to say, exploring their values and beliefs for enterprises or products. Here, price preference and brand recognition are two important research targets, and applied in this paper after slight modification by relevant scales (Moschis *et al.* 1978; Gaski and Micheal 1986). The second part involves information input and processing, which aims at learning how the customers gain an access to the relevant information of refurbishment firms and which promotion or marketing contents can attract customers. The third part discusses the decision-making behavior of refurbishment customers on selection of firms. Finally, the SERVPERF scale is introduced to ascertain customer satisfaction for overall services of the refurbishment firms and analyze the key elements to improve SQ. 800 questionnaire copies were distributed to families in Kaohsiung City, the second largest city in Taiwan, and 242 valid copies were collected.

4. Results

4.1. Selection modes of refurbishment customers and sources of information influential to decision-making

To learn the preferred choices of the customers, one item in the questionnaire is: “which is your first preference in the listed four business models under similar conditions?” As listed in Table 1, 49% of respondents chose traditional refurbishment companies, followed by 20% and 17% choosing companies with reinforced brands and regular-chain companies, and only 14% choosing branded franchise chain refurbishment companies; the latter three “branded refurbishment companies” win 51% customer support. According to the brand preference, 57% (14% very necessary, 43% necessary) of respondents consider it necessary to entrust the refurbishment works to the branded firms, only 8% think it unnecessary, and 35% are neutral.

The investigation shows that, there is room for brand development in the refurbishment industry. As the branded firms increase in number gradually with improvement of SQ, the trend for brand selection will possibly change structurally.

To explore which information source affects the customers’ decision, the sources of information are grouped into 7 types according to the previous investigation (Huang and Wang 2005). Table 1 lists the result as to

whether the received information is attractive to the customers, showing that 71% of customers were influenced by word of mouth from friends and relatives. It shows that. Information from the refurbishment industry is not sufficient and/or transparent, so refurbishment firms should attend to word-of-mouth marketing.

Table 1. Selection preferences of Refurbishment Customers and Major Sources of Information

Item	Analytical results
Preferred selection if there are similar prices	(1) Traditional refurbishment companies: 49%; (2) companies with reinforced brands: 20%; (3) companies of regular chain systems: 17%; (4) companies of franchise chain systems: 14%
Is it necessary to entrust refurbishment to branded firms?	(1) very necessary: 14%; (2) necessary: 43%; (3) neutral: 35%; (4) unnecessary: 6%; (5) extremely unnecessary: 2%
Major source of influential information	(1) introduction of relatives and friends: 71%; (2) leaflets& ads: 8%; (3) magazines(medium): 6%; (4) signboards: 5%; (5) TV ads: 4%; (6) Internet: 3%; (7) others: 3%

Table 2. Attraction of Marketing Tools to Refurbishment Customers

No.	Marketing (promotion) contents	Percentage of attraction response
1	Warranty service	66.1%
2	Charging standard and content	45%
3	Free-of-charge design or consultancy	40.1%
4	Professional brand image	39.7%
5	Free or cheap housing diagnosis	33.5%
6	Cheap in charge	32.6%
7	Diversified options of products	26%
8	Toll-free hotline	23.1%
9	Lower price than peers	10.7%

In the fiercely competitive environment, the refurbishment firms face an issue of how to select promotion policies. The investigation results in this paper show that, 66.1% respondents agree that “warranty service” is an effectively attractive marketing tactic; among 9 commonly-used marketing tools, charging transparency, free-of-charge design consultancy and brand image take the 2nd–4th places, and two price-related options take the 6th and 9th place.

4.2. Relationship between brand & price preference and consumption decision

Prior to data analysis via Data Mining technologies, it’s necessary to find and eliminate abnormal data (outliers or noise) through outlier analysis, namely, remove data with

highly different characteristics and trends, so as to identify the abnormal ones for subsequent analysis of data sets and improve the accuracy and reliability of data analysis (Kiselev 1995). In this paper, “brand recognition”, “price preference” and “SQ satisfaction” are taken as objective variables for outlier analysis, and 155, 158 and 147 valid data sets were found separately.

Decision Tree and Association Rules are used to analyze, separately, the customers’ brand recognition and price preferences, with the major purpose of discussing their implied purchase inertia, namely, creating a Decision Tree for classifying and predicting the customers’ attitude towards brands, to understand the customers’ perception of and cognition about of the brands.

4.2.1. Analysis of refurbishment customers’ brand preference

There are 5 items (Q1~Q5) about “brand attitude” in the consumer behavior scale in this study, and the customers are required to fill in: highly disagree, disagree, neutral, agree or highly agree, yielding 1~5 scores. For each respondent, the sum of the five item scores represents his/her brand recognition.

The analytical results of the Decision Tree are judged based on classification probability and classification effectiveness. The classification probability indicates how much data can be correctly classified by the Decision Tree; and classification effectiveness indicates the classification efficiency and reliability of every leaf in the Decision Tree, a higher value means higher validity and reliability of Decision Tree. The overall classification probability is 95.48%, indicating 95.48% (148 out of 155) data can be correctly classified. In addition, the validity of every leaf on the Decision Tree is over 85%, indicating the validity of classification results up to 85%. The results show that the Decision Tree of this study presents high reliability and applicability.

The Decision Tree of the customers’ brand preference is illustrated in Fig. 1, wherein the classification node at the first layer is expressed as “Q2 (a famous company will produce top-quality products)”, indicating that “Q2” is most suited to classify “brand recognition” in many classification attributes. At the second layer of the Decision Tree, “Q3 (I prefer to purchase or use products of specific brands)” is a classification baseline, indicating that “Q3” is optimally suited to classify the objective variables in addition to “Q2”, followed by “Q1 (Products (or services) with ads are superior to those without ads)”, “Q5 (Products with ads are more attractive to me)” and “Q4 (Products with ads have better functions than those without ads)”. However, the rules contain different numbers of attributes, for example, the leftmost rule in Fig. 1 is composed of a single attribute, indicating that: if the respondents select “Q2 (a famous company will produce top-quality products)” to the extent of “highly disagree”, “disagree” or “neutral”, 97% of respondents have “low brand recognition”. Thus, if the customers tend to disagree with “Q2 (a famous company will produce top-quality products)”, the customers are judged as having low brand recognition. So, the decision-makers may, if

necessary, use different rules to formulate business operations or marketing packages. For example, if the refurbishment firms are targeting marketing activities in a specific range, they may judge the customers’ brand recognition based on the Decision Tree, then decide the marketing methods to realize efficiently the desired results. In addition, Table 3 lists 6 rules, each of which corresponds to a certain classified result. Thus, the results can be converted into “If ~ then” rule to provide a reference for clear and simple decision-making.

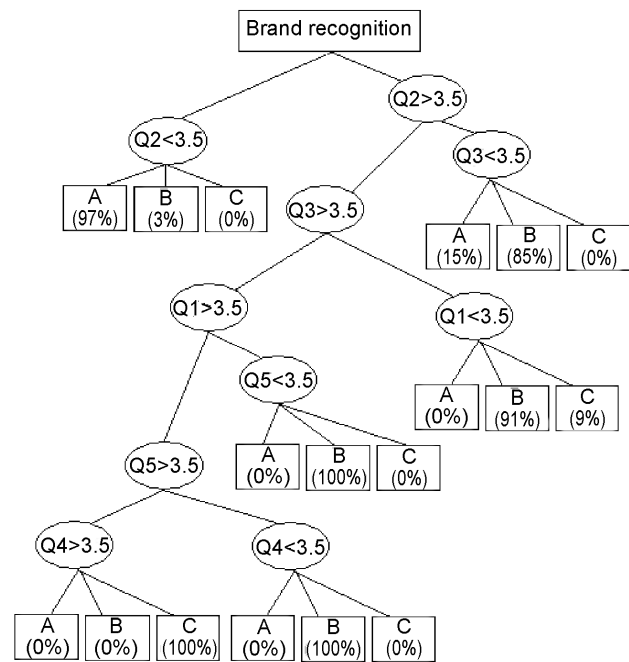


Fig. 1. A Decision Tree with “brand recognition” as objective variable

- Note: Q1: “products (or services) with ads are superior to those without ads”
- Q2: “a famous company will produce top-quality products”
- Q3: “I prefer to purchase or use products of specific brands”
- Q4: “products with ads have better functions than those without ads”
- Q5: “products with ads are more attractive to me”
- <3.5: highly disagree, disagree and neutral
- >3.5: agree and highly agree
- A: “low brand attitude”
- B: “medium brand attitude”
- C: “high brand attitude”

Basket Analysis is also used in this paper to discuss the correlation among the questions. As it’s primarily used for correlation analysis of researched items, the results (1~5 scores) selected by the respondents are converted via Boolean Algebra into 0 and 1 data type to represent the consumption decision. For example, if the respondents select “highly agree”, the data is represented by “1” in the field of “highly agree”, and the others represented by “0”. Two parameters are used to measure the performance of the rule, of which Support indicates the probability of events, and Confidence indicates the probability of an event

Table 3. Customer Brand Recognition Rules

Rule No.	If	Then	Classification effectiveness (%)
1	The agreement degree with “a famous company will produce top-quality products” “<3.5” (highly disagree, disagree, neutral)	Brand recognition belongs to “low”	97% (60 out of 62 data are correctly classified)
2	The agreement degree with “a famous company will produce top-quality products” “>3.5” (agree, highly agree) and “I prefer to purchase or use products of specific brands” “<3.5” (highly disagree, disagree, neutral)	Brand recognition belongs to “medium”	85% (22 out of 26 data are correctly classified)
3	The agreement degree with “a famous company will produce top-quality products” “>3.5” (agree, highly agree) and, “I prefer to purchase or use products of specific brands” “>3.5” (highly disagree, disagree, neutral) and, “Products (or services) with ads are superior to those without ads” “<3.5” (highly disagree, disagree, neutral)	Brand recognition belongs to “medium”	91% (19 out of 21 are correctly classified)
4	The agreement degree with “a famous company will produce top-quality products” “>3.5” (agree, highly agree) and, “I prefer to purchase or use products of specific brands” “>3.5” (highly disagree, disagree, neutral) and, “Products (or services) with ads are superior to those without ads” and “>3.5” (agree, highly agree) and, “Products with ads are more attractive to me” “<3.5” (highly disagree, disagree, neutral)	Brand recognition belongs to “medium”	100% (7 data are correctly classified)
5	The agreement degree with “a famous company will produce top-quality products” “>3.5” (agree, highly agree) and, “I prefer to purchase or use products of specific brands” “>3.5” (highly disagree, disagree, neutral) and, “Products (or services) with ads are superior to those without ads” “>3.5” (agree, highly agree) and, “Products with ads are more attractive to me” “>3.5” (agree, highly agree) and, “the refurbishment firms’ equipments can match their services” “>3.5” (agree, highly agree)	Brand recognition belongs to “high”	100% (35 data are correctly classified)
6	The agreement degree with “a famous company will produce top-quality products” “>3.5” (agree, highly agree) and, “I prefer to purchase or use products of specific brands” “>3.5” (highly disagree, disagree, neutral) and, “Products (or services) with ads are superior to those without ads” “>3.5” (agree, highly agree) and, “Products with ads are more attractive to me” “>3.5” (agree, highly agree) and, “the refurbishment firms’ equipments can match their services” “<3.5” (highly disagree, disagree, neutral)	Brand recognition belongs to “medium”	100% (4 data are correctly classified)

in the occurrence of another event, or the confidence level or reliability. The Support and Confidence rely on the nature and features of decision issues, but no optimum level has been confirmed (Han and Kamber 2000). So, support of 15% and confidence of 60% are set as the thresholds to analyze Association Rules in this study.

Only four meaningful rules are validated in this paper, with the analytical results listed in Table 4, wherein Support indicates which percentage of data forms this rule, e.g. the support of rule 1 is 25.62%, indicating this rule is established by 25.62% of data. In addition, the confidence of 4 meaningful association rules is 100%, indicating that 4 association rules have extremely high reliability. For example, customers with high brand recognition are highly susceptible to advertisement, that's to say, the customers of high brand recognition will be motivated by professional brand image. Thus, branded firms should enhance customers' cognition of brand images.

Table 4. Results of Association Rules for Brand Recognition

Association Rule	IF	Then	Support (%)	Confidence (%)
1	You agree with “Products (or services) with ads are superior to those without ads”	“High brand recognition”	25.62% (63/242)	100.00%
2	You disagree with “Products with ads have better functions than those without ads”			
3	You disagree with “Products (or services) with ads are superior to those without ads”			
4	You disagree with “a famous company will produce top-quality products”			
		“Low brand recognition”		

Note: Support is 15%, Confidence is 60%

Furthermore, Decision Tree is used to analyze how the marketing policies of firms affect customers' selection behavior. The analytical results show that, 66.45% data (103 out of 155) could be correctly classified by the Decision Tree. As shown in Fig. 2, nine marketing tools commonly used by refurbishment firms listed in Table 2 are analyzed by Decision Tree. The Decision Tree has only one valid node, there isn't a significant relationship between the attraction of other the 8 marketing tools and selection behavior. This node indicates that, selection of “attracted by professional brand image” or not will affect the selection behavior. When selecting “attracted by professional brand image”, 75% of the respondent customers will simultaneously show their prior decision to select “branded refurbishment companies” to service them; and the other respondents who do not pick up the option, 62% of them will select unbranded firms, i.e. traditional firms.

In other words, the promotion or marketing models with brand image will yield good effect for customers with brand awareness, rather than those without brand awareness. Given the fact of similar marketing models without segmentation of customers, a marketing mode with customer segmentation is suggested for creating better efficiency.

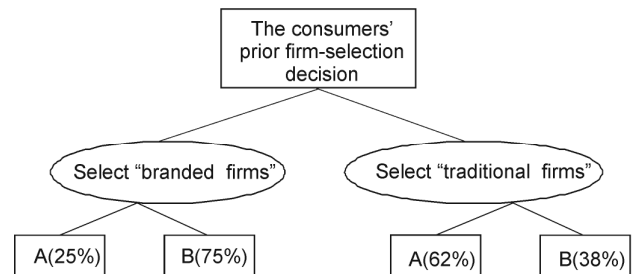


Fig. 2. Analytical Results of Decision Tree for selecting firms with brand image

Note: A: the ones who pick “attracted by professional brand image”
 B: the one who do not pick “attracted by professional brand image”

4.2.2. Analysis of price preference of refurbishment customers

The “price preference” is taken as an objective variable in this part. 158 data sets are selected after outlier is removed, then “price preference” is measured by a five-item scale (Q6~Q10). The summed scores of 5 questions are defined as “price preference”, and Decision Tree Analysis is used to establish the price preference decision tree in order to identify key elements influential to the customers' price preference. In this questionnaire, five questions about price preference are inclined toward low price, so a higher total score indicates a lower price preference. The analytical results indicate the classification probability of Decision Tree is 94.3%, showing that 94.3% of 158 data can be correctly classified by the Decision Tree.

As shown in Fig. 3, “Q7 (I'd prefer to select low price rather than high quality)” is most suited to judge the customers' price preference, followed by “Q8 (discount is particularly attractive to me)”, “Q10 (competition among firms leads to more appropriate price)” and “Q6 (I think most products on the market are excessively expensive)”. In other words, the customers' price preference could be acquired by Q7 effectively. However, “Q9 (the firms can also win profit by means of price reduction)” isn't covered in the classification rule of Decision Tree, since “Q9” and “Q6” are of isomorphic pattern and only one rule is required by Decision Tree for classification. Finally, the Decision Tree is composed of 9 rules, following the same analytic logic the brand-attitude Decision Tree does. The firms may judge the customers' sensitivity to price according to the analytical results of the decision tree, while the customers are grouped into high, middle and low price preferences in order to design marketing tools for different customer groups.

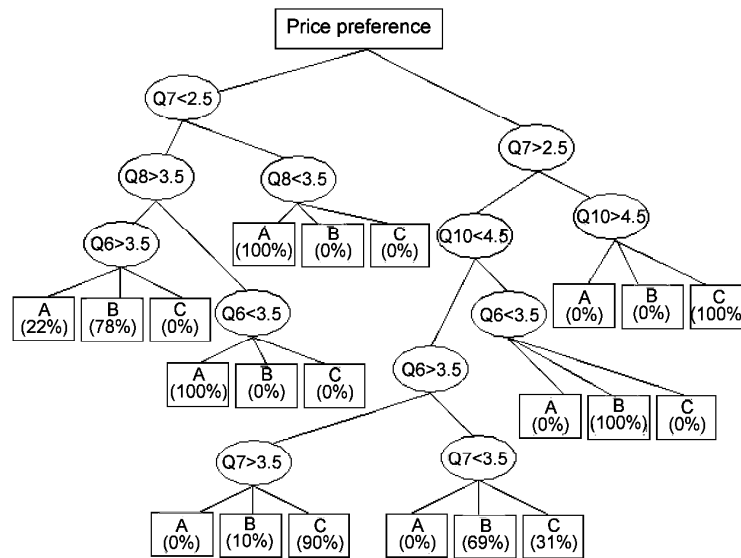


Fig. 3. A Decision Tree with “price preference” as objective variable

Note: Q6: “I think most of products on the market are excessively expensive)”

Q7: “I’d prefer to select low price rather than high quality”

Q8: “discount is particularly attractive to me”

Q10: “competition among firms leads to more appropriate price”

<2.5: highly disagree and disagree; >2.5: neutral, agree and highly agree

<3.5: highly disagree, disagree and neutral; >3.5: agree and highly agree

<4.5: highly disagree, disagree, neutral and agree; >4.5: highly agree

A: “high price preference”; B: “medium price preference”; C: “low price preference”

4.3. Overall SQ satisfaction

The final part of this paper intends to discuss overall SQ of the firms in the refurbishment industry, and analyze the comments of customers on existing refurbishment industry firms for future business operations. 22 items (S1~S22) in the SERVPERF scale are summed up and defined as “overall SQ satisfaction”, and then divided into very bad, bad, good and very good. Moreover, “overall SQ satisfaction” is taken as an objective variable for outlier analysis based on 147 data. The analytical results show that, the classification probability of the Decision Tree is 83%, indicating that 122 out of 147 sets of data can be correctly classified.

The node at the first layer of the Decision Tree is “S4 (the refurbishment firms’ equipments can match their services)”, showing that the customers consider “S4” as a key element to affect SQ satisfaction. Next, “S11 (you can enjoy real-time, rapid services from refurbishment personnel)” and “S20 (the refurbishment personnel are not aware of your real requirements)” are also important keys which show providing real-time services to meet customer requirements efficiently is the key to satisfy consumers. Moreover, “S6 (when you meet refurbishment issues, the refurbishment firms will give their concern and relieve your worry)” is another key decision node for decision makers in the industry. The original SERVPERF scale contains five constructs: entity, reliability, responsiveness, guarantee and care. Four classification rules of the Decision Tree in this paper— “S4”, “S11”, “S20” and “S6” separately belong to entity, responsiveness, care and reliability, respectively, only “gua-

rantee” isn’t incorporated into the classification rule. It’s thus clear that, the results of the Decision Tree are consistent with the spirit of SERVPERF questionnaire design, thus providing a useful reference.

So, these four items in the service process should be strengthened to improve SQ satisfaction. In other words, the firms should upgrade their hardware facilities, and also learn the real customer requirements and lay emphasis on the judgement of solution to improve the overall service level.

In addition to Decision Tree Analysis, this part also applied Basket Analysis to analyze “overall SQ satisfaction”. To find out more applicable Association Rules, “very bad” and “bad” in “overall SQ satisfaction” are reduced to “bad”, and “good” and “very good” reduced to “good”, which are conducive to explore key elements influential to satisfy with the customers’ SQ. The analytical results are listed in Table 5, wherein 6 association rules are influential factors showing a tendency to dissatisfaction. For example, rule 3 shows that, if the customers tend to disagree with item: “refurbishment personnel wear clothes tidily”, their overall satisfaction with SQ will be “dissatisfaction”. Similarly, the other 5 association rules are key elements in the tendency to dissatisfaction. Thus, these 6 influential elements should be strengthened to improve SQ. It’s found that the former three rules belong to “entity”, and can be reduced to “equipment (rule 1 and 2)” and “working uniforms (rule 3)”, showing that customers attach great importance to equipment and working uniforms. In addition, rule 4 and 5 belong to “reliability”, and it’s worthwhile to note that, rule 5 indicates, if “the refurbishment firms will keep

accurate records” is disagreed with, it will reduce SQ satisfaction, showing that the customers think it necessary for the refurbishment firms to document and analyze the consumption records and characteristics, and also enhance customer relationship management (CRM) and customize marketing to provide more value-added interactive models. Finally, rule 6 belongs to “responsiveness”, showing that the customers pay much attention to professional, value-added and timely services in a fast-changing and competitive era. In other words, the refurbishment firms should not only strengthen their professional services, but also meet the customers’ requirements with fast services. Three branded firms in this paper are making efforts to renovate their images, for example, requiring their employees or even technicians, to wear working uniforms, pay attention to telephoning etiquette and updating equipment.

Table 5. Analytical Results of Association Rules for SQ satisfaction

Association Rule	IF	Then	Support (%)	Confidence (%)
1	You disagree with “the refurbishment firms have novel and perfect equipments”	Overall SQ is “dissatisfactory”	18.18% (44/242)	100%
2	You disagree with “the refurbishment firms’ equipments are extremely attractive”			
3	You disagree with “refurbishment personnel wear clothes tidily”			
4	You disagree with “the refurbishment firms are credible”			
5	You disagree with “the refurbishment firms will keep accurate records”			
6	You disagree with “you can enjoy real-time, rapid services from refurbishment personnel”			

Note: support is 15%, confidence is 60%

5. Conclusions and suggestions

This paper analyzed the customers’ behavior with regard to the refurbishment industry using representative marketing research scales along with Data Mining technology. The research results show that, over half of the customers tend to entrust refurbishment to branded firms. So, there is plenty of room for establishment of brand images in the refurbishment industry. Moreover, the empirical analysis indicates that, the customers who are attracted to “professional brand image” tend to select branded firms, indicating that a refurbishment firm may segment the customers into some specific groups in lieu of blind distribution of DMs and advertisement.

A key element in the refurbishment industry is how to learn efficiently the customer requirements. The SQ analysis shows that, the equipment, real-time services and reputations of refurbishment firms are crucial influential factors in SQ. According to our survey, warranty service, transparent in influencing consumer behavior charging standards & contents and free-of-charge design consultancy take the 1st~3rd place.

In spite of current innovations by many firms in their business models, there is still shortage of research on consumer behavior. This paper explores the characteristics of consumer behavior with relevant theories and methods, and provides an access to customers’ perceptions, thinking and requirements. By the information offered by this article, the firms can adjust their marketing policies and models to meet customers’ expectations. It’s suggested that refurbishment firms should make in-depth studies of consumer behavior, attach importance to the details of services and seek innovative methods and creating a Blue-ocean strategy in order to make better profits in the competitive market.

By combining EKB models and relevant influential factors, the questionnaire investigation proves that a small number of key questions are helpful to measure customers’ attitudes, reduce response time and increase collection rate. As the EKB model covers a wide range of influential factors, and these factors cannot be fully considered in the research design, so other variables in the EKB model are suggested for consideration to analyze consumer behavior and SQ with a more complete research structure. Since most refurbishment firms are small-scaled and the market is still fragmented, the firms in the industry emphasize more on technology and maintaining business, but less on the concept of “marketing” and how to satisfy the consumers. This study shows that the consumers in the old industry are ever sophisticated and they do need more considerate and delicate service which is ignored by the traditional refurbishment firms. If the companies in the industry want to have some breakthrough in their business, they can try to make much endeavor discovering what the consumers really want by deep investigation.

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VARTOTOJŲ ELGSENA IR SPRENDIMO PRIĖMIMAS ATNAUJINIMO SRITYJE DUOMENŲ GAVIMO POŽIŪRIU

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S a n t r a u k a

Vartotojų elgsena, tiriant atnaujinimą, yra labai svarbi verslo įmonių veiklai, tačiau stinga šiuo klausimu atliktų tyrimų. Remiantis EKB (*Engel-Kollat-Blackwell*) konkrečių vartotojų elgsenos modelių, straipsnyje aptariami ryšiai tarp vartojimo charakteristikų, įmonės pasirinkimo elgsenos ir atnaujinimo vartotojų įvertinimo laipsnio. Surinktos 242 galiojančios atsinaujinančių vartotojų apklausos, kurios buvo nagrinėjamos taikant sprendimų priėmimo medį ir ryšių taisyklės gaunant duomenis. Tyrimų rezultatai rodo, kad daugiau kaip pusė vartotojų yra linkę patikėti atnaujinimą žinomoms įmonėms. Dar daugiau, pagrindiniai elementai, užtikrinantys paslaugų kokybę (PK) ir atnaujinimo vientisumą, yra atnaujinančio personalo reakcija, jo profesionalumas ir pasitikėjimas juo. Geriausia vartotojų rinkodaros politika ta, kuri suteikia daugiau patrauklių paslaugų. Šių tyrimų rezultatai gali suteikti naudingos informacijos novatoriškoms atnaujinimo įmonėms ir jų sprendimams.

Reikšminiai žodžiai: atnaujinimas, duomenų gavimas, vartotojų elgsena, EKB modelis, paslaugų kokybė, verslo strategijos.

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