A Method for Generating Plans for Retail Store Improvements Using Text Mining and Conjoint Analysis

Takumi Kaneko[1], Yuichiro Nakamura[1], Michiko Anse[1], Tsutomu Tabe[1], and Yumiko Taguchi[2]

[1] Graduate School of Science and Engineering, Aoyama Gakuin University
5-10-1, Fuchinobe, Sagamihara, Kanagawa, 229-0006, Japan
c5605046@cc.aoyama.ac.jp, c5605111@cc.aoyama.ac.jp,
anse@ise.aoyama.ac.jp, tabe@ise.aoyama.ac.jp
[2] Department of Business Administration and Communication, Shohoku College
428, Nurumizu, Atsugi, Kanagawa, 243-8501, Japan
taguchi@shohoku.ac.jp

Abstract. Sales at retail stores in Japan have been declining for various reasons. One important factor has been a steady diversification in the lifestyles and needs of customers. If a retail store is to sustain itself and continue developing, it must search for the latent demands of customers and adapt itself to accommodate those demands. A support system for store improvement capable of viewing specific improvement plans will prove useful as a tool for improving stores on a sustainable basis. In this research we develop a method for generating effective store-improvement plans to accommodate actual customer demands. The method employs both Text Mining and Conjoint Analysis techniques. We also demonstrate a sequence and a test run of a prototype.

Keywords: Customer-satisfaction measurement, Text Mining, Definition Method, Conjoint Analysis, Store-improvement plan.

1 Introduction

Sales at retail stores in Japan have been declining. The declines are attributable not only to the slump in the national economy, but also intensifying competition with other stores and a diversification of the needs and lifestyles of customers. For a retail store to sustain itself and continue developing, it must continue to search for the latent demands of customers and adapt itself to accommodate them in a huge and fluctuating market. The demands of individual customers are vague and divergent. A method that enables us to understand the latent demands of customers has yet to be established.

In an earlier study, researchers developed a Support System for Improving Stores based on customer-satisfaction measurement (B. Ives, 1983) (Y. Taguchi 2004). When they attempted to elucidate the demands of customers using a 5-point questionnaire (Semantic Differential), their method showed clues for improvement. It proved difficult, however, to connect the improvements with specific actions or to develop a specific plan for improvement. Thus, the method developed through this

M.J. Smith, G. Salvendy (Eds.): Human Interface, Part II, HCII 2007, LNCS 4558, pp. 910–917, 2007.

earlier research turned out to an imperfect as a strategy for learning store improvements tailored to customer demands.

The purpose of the current research is to demonstrate the sequence applied in a new method of generating store-improvement plans tailored to customer demands.

2 Approach

2.1 Combining Text Mining with Conjoint Analysis

Text Mining is a technique to search for hidden information, trends, and correlations within inventory databases and to discover new factoids (A. Hearst, 1999). With Text Mining, we can measure qualitative data from unstructured text as determinate data and thereby grasp relevant issues for the store based on the real thinking of the customers. The technique is useful only for extracting clues on the issues and trends, however. It cannot elucidate how effective it will be for the store when the issues are solved. Therefore, it is difficult to show specific improvement plans based solely on this data.

Conjoint Analysis is a technique to provide a quantitative measure of the relative importance of one attribute as opposed to another when asking about preference (D. Aaker, 1990). With Conjoint Analysis, we can measure the preference of each participant for each plan and ask each participant to estimate the effectiveness of each plan. If an issue for store improvement (i.e., Selection, Price and Quality) is set as an Attribute for Conjoint Analysis and a specific content of Attribute(i.e., Handles Alcohol, A lot of perishable foods) is set as an Level for Conjoint Analysis, the virtual plan formulated will become a candidate as a store-improvement plan. As we attempt to estimate each virtual plan, Conjoint Analysis lets us measure the frequency of effect for each plan when the plan is executed. When we take this approach, the plan output will be the best for improving the store. The method for making the Attribute and the Level has yet to be established.

Therefore, to combine Text Mining with Conjoint Analysis, and to take advantage of the benefits of each (① Text Mining, "To measure qualitative data as determinate data and grasp the real demands of customers"; ② Conjoint Analysis, "To measure the frequency of the effect of each plan when each plan is executed, and then show an effective improvement plan"), we develop the sequence for store improvement and examine the method.

2.2 Generating the Improvement Plan

This support prototype system consists of two parts and uses two types of customer satisfaction questionnaire to confirm the behavior of the prototype system. The first part of the survey uses a free form questionnaire to grasp the real demand (see Fig. 1), and this is analyzed by Text Mining. Next, the Attribute and Level for the second part of the survey are distilled so that the issues can be ranked. The result of the first survey is used with the second part of the questionnaire to compare the combination of Attributes and Levels, then the data of the second questionnaire is analyzed by Conjoint Analysis. Lastly, the effective improvement plan is shown.

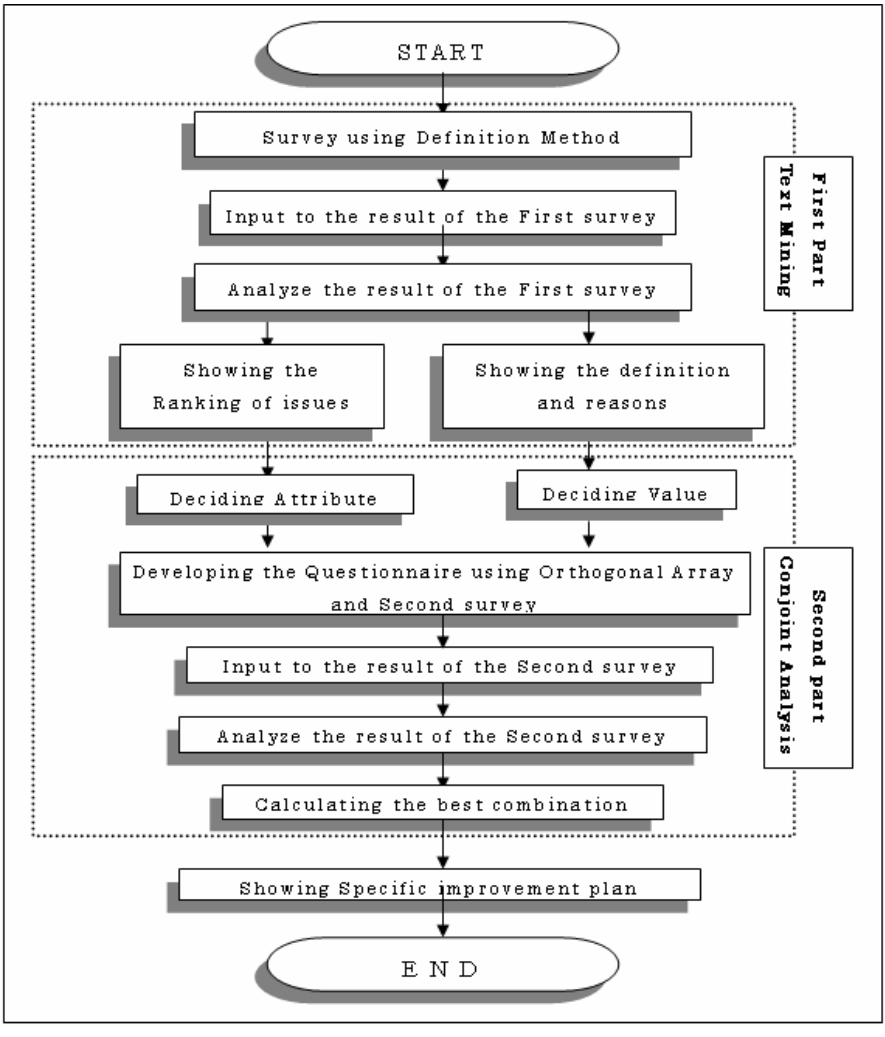


Fig. 1. Sequence leading to a specific improvement plan

3 Support System

3.1 Questionnaire of Definition Method

In the first survey, it is important to grasp the issues that combine the Attribute and Level, that is, the alternative improvement plan making use of the real demands of the customers. In the first survey we use a free-description type of questionnaire for Text Mining. The so-called Definition Method (T. Hayashi, 2001). The Definition Method has the questioner describe the store in a set format. The method is an efficient tool for deciding the Attributes for Conjoint Analysis, as it allows us to calculate the text

data, measure the essential propositions without losing the real description of the questioner, and grasp information efficiently. TOTO LTD., a manufacturer of ceramic equipment, uses a Definition Method questionnaire to collect data in its research and development works (Chino, 2005). With this method, however, it can be difficult to grasp the real demand for combining the Level for Conjoint Analysis based merely on the description of the definition. Thus, we need to add a question comprising the reason for the description of the definition next to the definition, in order to grasp the effective customer demand for deciding the Level. As shown in Fig. 2, this clarifies the causation between the definition and the reasons, that is, what the customers focus on and what customers really need. The customer demands are measured by the gap between reality and the ideal, thus the survey asks about the reality of the store relative to competitors, and about an ideal store. Once the survey answers are calculated, compared, and analyzed by Text Mining, the issues to be improved are grasped.

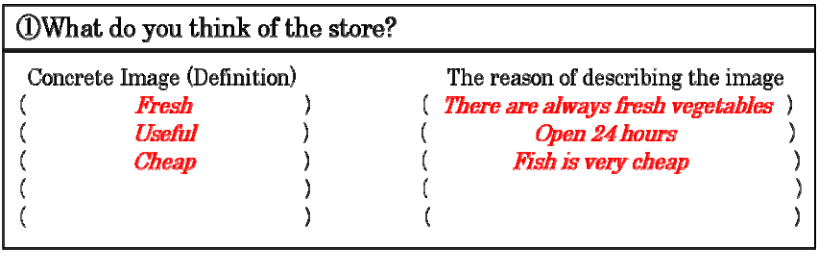


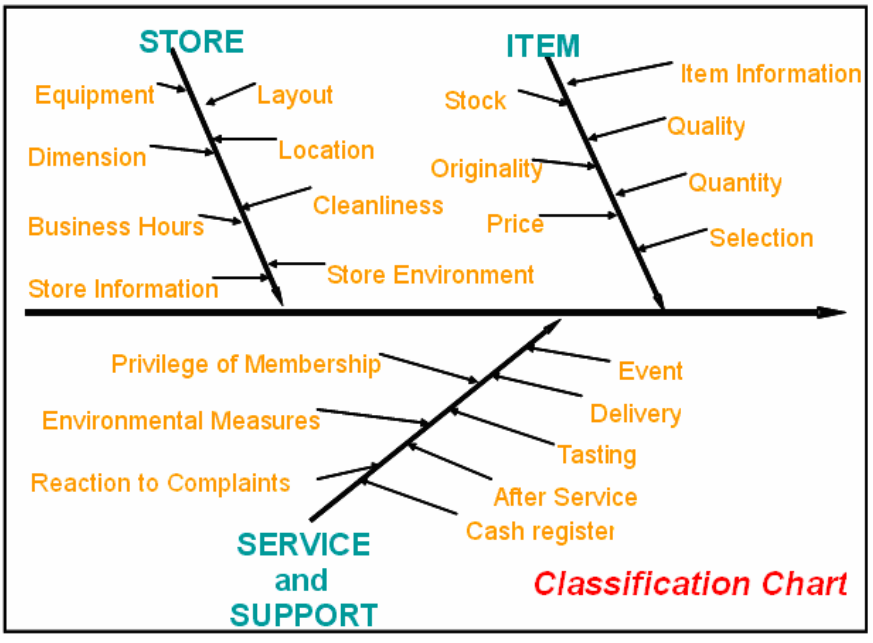
Fig. 2. The sample of first questionnaire

3.2 Process of Cleansing

To grasp the issues clearly and then smoothly apply the analysis to the second step, we have to analyze the result of the Definition Method by the same approach we would use to analyze determinate data. The definition described in the first survey is corrected and arranged into a common form (T. Nasukawa, 2001). The correction and arrangement of this common form collectively referred to as the "Process of Cleansing," and the sets of arranged words are referred to as "the Categories." To calculate the number of categories, the general trends and features are grasped.

There generally must be rules imposed on the Process of Cleansing, as the analytical results would diverge too widely from person to person without rules. Chart 1 below shows the formulation of a Classification Chart from a characteristic diagram, and how the chart is actually used. We can use the char if the definitions described for it are classifiable, whereas entirely new categories must be added for any definition which turns out to be unclassifiable (a no-category definition). If the questioner uses a negative word such as "expensive" to describe his or her own store or a competitor's store, the word is added as a descriptor for an ideal store, as the Category data is analyzed by the number of classified categories in the research.

Chart 1. Classification Chart from characteristic diagram



3.3 Developing the Ranking of Issues and Deciding Attributes

The classification of category is analyzed and the Ranking of issues is developed. The Ranking of issues calculates the frequency of each category described for each store (Own store, Competitor, Ideal store), measures the correspondence of the frequency of the category described for the customer's own store and for the competitor with the frequency of the same category for an ideal store, and then ranks the from the unfulfilled category. The frequency of each category is the rate at which each number of categories can be divided by the total number of categories (%). The Ranking of issues is helpful to evaluate the Attributes.

The interface is a method developed automatically by Excel VBA, to fill in the questionnaire results and support the Process of Cleansing and the Ranking (see Fig. 3). The interface is helpful for filling in the results without making mistakes, as it contains categories that have been already been entered. The person at the keyboard merely selects the category then the data is fed into the system automatically.

3.4 Deciding the Level

The Attributes for Conjoint Analysis are decided by the Ranking of the issues developed by Text Mining and the Level for Conjoint Analysis, as decided by the reasons given in the first part of the questionnaire.

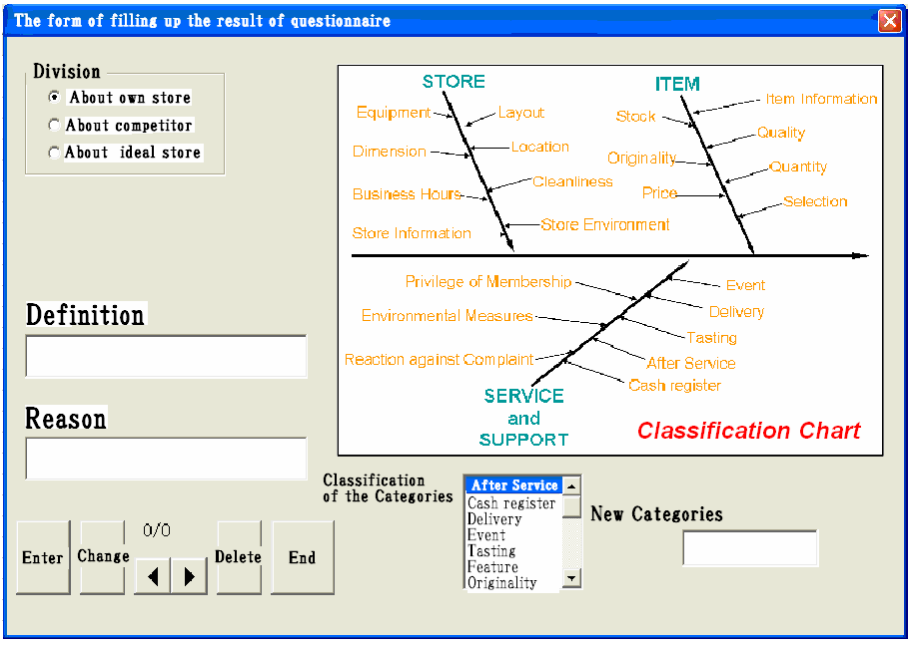


Fig. 3. Form for filling in the questionnaire results

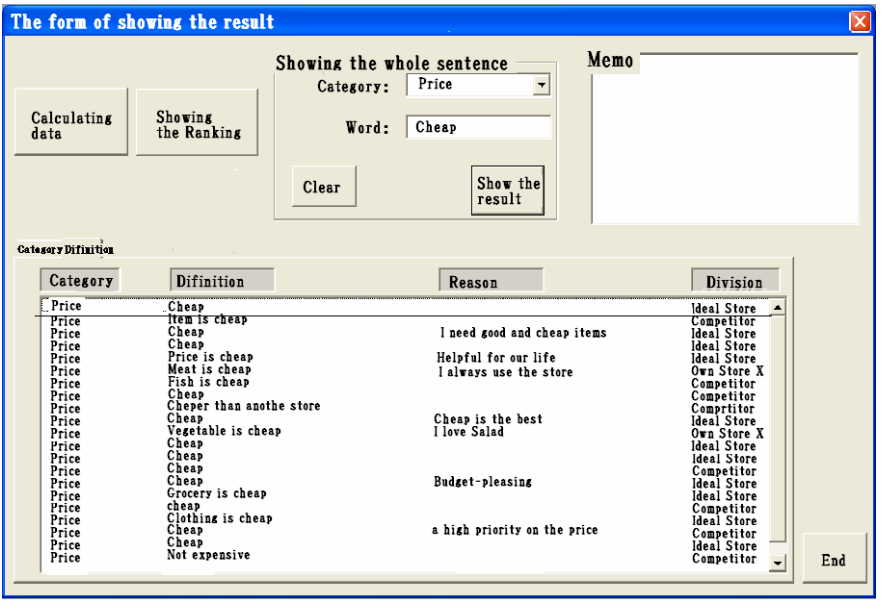


Fig. 4. Table of Definitions and Reasons

A great deal of text data has to be collected accurately in order to decide the effective Level to be adapted for the Attribute. The developed form (see Fig. 4) shows the definition and the reason for each category, and thus enables us to easily find the reason for each definition and decide the Level.

3.5 Second questionnaire and Conjoint Analysis Based on Orthogonal Array

In the second survey and Conjoint Analysis, we apply an Orthogonal Array developed by SPSS Conjoint. The Orthogonal Array is used to decide the combination of the Attribute and Level compared and evaluated in the second questionnaire, then the questionnaire itself is developed. As shown in Fig. 5, the results of the second survey are analyzed by SPSS Conjoint. The frequency of effect for each plan is measured when each plan is executed, and an effective improvement plan is displayed.

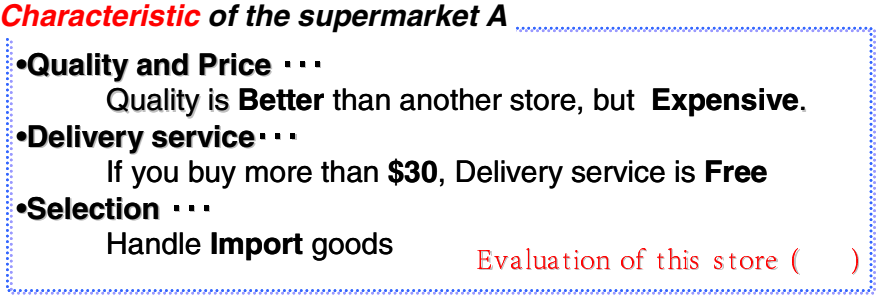


Fig. 5. Second questionnaire

4 Examine the Effectiveness

This prototype system was carried out in a real supermarket to show an effective improvement plan. The support system, method, and results were evaluated by the store owner, in order to examine the effectiveness of the system.

The manager provided the following comments.

1) On the questionnaire used for the Definition Method, and the method used for developing the Ranking of issues.

"I can easily grasp the issues by looking at the Ranking"

"The Text Mining raised new and interesting opinions that I hadn't thought about."

2) On the display of the Table of Definitions and reasons, and on the flow of the improvement plan.

"With earlier support systems my employees had to think about the actual approaches. This support system, on the other hand, outputs an effective improvement plan and shows the frequency of effects. This simplifies the task of improvement and lets me clearly show my employees the reasons for the improvements we make. It helps us act with greater confidence."

3) On the method of combining Text Mining and Conjoint Analysis to show the store-improvement plan

"It raises surprising and unexpected issues and shows an effective improvement plan. If we follow this plan, our improvement activities will differ from those of other stores."

These comments from the store owner attest to the utility of the method developed as a tool for store improvement.

5 Results

In conclusion, we have demonstrated a sequence in which "the issues arising from the actual demands of customers are elucidated using Text Mining and an effective improvement plan is output with indications of the frequency of influence using Conjoint Analysis." Further, we have conducted a pilot study of a constructed prototype. The results of this research confirm that our method outputs effective store-improvement plans tailored to actual customer demands.

Three important tasks lie before us:

1) The prototype system should be capable of supporting improvement plans not only for one's own store, but also other stores. This is vital for grasping the demands of customers more comprehensively.
2) The territory of the store survey in this study was the whole store. The territory should be narrowed to enhance the efficiency of the store improvements.
3) The survey and analysis should be stratified and a consistent system should be constructed.

References

1. Aaker, D.A, Day, G.S: Marketing Research, 4th edn. Wiley, Chichester (1990)
2. Ives, B., Olson, M., Baroudi, J.: The measurement of user information satisfaction. Communications of the ACM 26(10), 785–793 (1983)
3. Luce, R.D., Turkey, J.W.: Simultaneous Conjoint Measurement: A New Type of Fundamental Measurement. Journal of Mathematical Psychology 1, 1–27 (1964)
4. Marti, A.: Hearst: Untangling Text Data Mining. In: ACL'99, pp.3–10 (1999)
5. Chino, M.: How to utilize the customer's voice in the business, Marketing Research with Text Mining, Kodansha Scientific, pp. 58–80 (2005)
6. Chiba, S., Iwamoto, T., Okamoto, S.: A Study on the Conjoint Analysis. Journal of Tokyo University of Information Science 1(2), 137–154 (1997)
7. Okamoto, S.: Conjoint Analysis Marketing research by SPSS Nakanishiya LTD (1999)
8. Hayashi, T.: Approach to Text Mining by Excel, Omusha,Ltd (2002)
9. Hayashi, T.: Customer Value measurement of Wine. In: Practice of Preference-based Design, Kaibundo, pp.81–100 (2001)
10. Nasukawa, T., Kawano, H., Arimura, H.: Base Technology for Text Mining. Journal of JSAI 16(2), 201–211 (2001)
11. Taguchi, Y., Tabe, T.: Trial Development of a Task Support System for Improving Supermarket Branches with the Use of Perceptual Maps. Journal of Japan