A Study on Strategy for Improvement of Customer Purchasing Quantity to Realize Efficient Green Logistics in Home Delivery Business

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Abstract

The purpose of this research is to propose a strategy to attract excellent customers and evaluate the improvement of the green logistics system through improving the customer's order amount and purchase price. We analyze what kind of logistics service is attractive to excellent customers but unattractive to bad customers from the marketing viewpoints, and propose a way to improve the delivery efficiency by increasing the average amount of purchase price per order.
Key words: Environmental Logistics, Environmental Efficiency, CO2 Emission

Introduction

Recently, the home delivery business is growing in Japan as a result of social aging and access to high quality services. Japanese Cooperatives (COOPs) are regarded as one of the most well-known associations running a home delivery business. Although the customers (known as "Coop members") are increasing, the average quantity of each order per member is decreasing. The main reason for this is the tendency for new members to make small orders. This problem causes an inefficient logistics system for home delivery. This fact has been verified from the data of sales results in COOPs. In the home delivery business, drivers have to stop their trucks in front of each member's residence, unload the delivery goods, catalogs, and order sheet s and collect used containers and bottles for recycling. Therefore, the amount of energy consumed in the delivery is basically proportional to the number of contractors (customers). Thus, the lower the order and delivery quantities per member, the less efficient the delivery system is. Therefore, one of the most important goals for COOPs is to increase the order quantity per member, leading to a more efficient logistics.

In addition, most companies have to care about environmental issues these days. CO2 emissions are caused by the consumption of fuel or electric energy in the process of transportation, stock holding, loading, etc. COOPs also have been making efforts to reduce the environmental load caused by logistics activities. They are recognizing that improvement in the efficiency of home deliveries will lessen the environmental load. Currently, however, the influence of the decrease in the purchasing price is stronger than their efforts. In the logistics of COOPs, it is of critical importance to improve delivery efficiency by increasing the number of new excellent customers who will buy a lot of goods in a single order.

In this paper, we propose a sales and delivery system, in other words "a strategy", to reduce the CO2 emissions and to increase the sales amount. We analyze what kind of logistics service is attractive to excellent customers but unattractive to bad customers from the marketing viewpoints, and propose a way to improve the delivery efficiency by increasing the average amount of purchase price per order.

We analyze the difference in characteristics between excellent customers and other customers, based the Conjoint Analysis with stratification, and prove that services exist which give us the possibility to attract only the excellent customers. A delivery service system with incentives is proposed to discourage the participation of customers who make small orders leading to environmental inefficiency. In addition, we evaluate the impact of improving the purchase amount of price for efficiency of the home delivery system. By considering the results based on the Conjoint Analysis, it is efficacious to show the effect of reductions of the environmental load, i.e., CO2 emissions, quantitatively with its price.

Through this process, we propose a strategy to attract excellent customers and evaluate the improvement of the green logistics system through improving the customer's order amount and purchase price.

Customer Survey Questionnaire

In this paper, we analyze the home delivery services which are attractive to excellent customers through a customer survey using a questionnaire. The questionnaire contains both selective questions about customer characteristics and questions for the Conjoint Analysis. Here, the Conjoint Analysis is a statistical technique used in market research to evaluate how customers value different features of products or services. For the Conjoint Analysis, a virtual home delivery service is described in terms of a number of attributes. A list of the several prototypes of virtual home delivery services is shown to questionnaire respondents and they are asked to choose from and rank the virtual home delivery service in the order they like.

In this study, the difference of ranking between excellent and bad customers is examined and the services excellent customers like are revealed.

The process to make the questionnaire is as follows:

Step1. Developing items for the questionnaire for inquiry into the customers' attribution

Step2. Creating questions for the Conjoint Analysis

<1> Listing all the attributes of home delivery services

<2> Extracting important items from the list of all attributes.

<3> Deciding the level of extracted attributes.

<4> Profiles of virtual home delivery services are constructed by the Fractional factorial design.

Step3. Making the questionnaire by combining both questions of Step 1 and 2.

1) Making items of questionnaire about customers' attribution

In order to analyze the differences between excellent and bad customers, the expected purchase price per order should be evaluated for all questionnaire respondents. In this study, we use the following question to get this information: "How much would you purchase per week in case if you use home delivery service (having conditions similar to COOPs)?"

Moreover, in order to investigate customers attributes related to the purchase unit price per order, we also ask the following profiles of the respondents in the questionnaire:

- Age
- Sex
- Occupation
- Resident status
- Family
- Experience of home delivery service

2) Making questions for the Conjoint Analysis

As the result of investigation of important attributes of home delivery services, we reached the conclusion that interim services are important because they lead new customers to participate in COOPs. Thus, the following four attributes are extracted:

1. A free delivery service

The delivery charge is a very important attribute in the home delivery service. Two types of charge free service can be showed to new customers.

- In case of ordering items more than 5000yen, the delivery charge is free.
- If a new customer joins the home delivery service, free charge service will be available for an initial 8 weeks.

2. A trial service

Many companies which is running the home delivery business are using marketing strategies using the services of supply of trial goods to customers. In this study, the following two trial goods are considered by investigation of real cases in practice:

- Vegetables in season
- Frozen food

3. Discount and point services

Discount service is popular for consumers and it is used as an important price strategy in marketing to get many customers. On the other hand, the point service is also attractive to Japanese people. Customers can get various services by accumulating points they get proportional to the purchase price. The answer for the question, "Which service prefer to excellent customers?" is interesting for marketers and the following two services are considered as service attributes.

- In the case of ordering more than 5000yen, 5% OFF of the price ordered.
- In the case of ordering more than 5000yen, the points are increases by 20 times.

4. Penalty of stopping the catalog distribution

In order to remove bad customers making very small orders, some penalty for customer members may be introduced as a possibility. In this study, we evaluate the penalty of catalog distribution as a way to stop the bad customers.

- In the case of ordering less than 1000yen, the next catalog delivery is stopped
- No penalty.

Here, the eight interim services can be made by combining the above-mentioned four attributes with two levels based on the orthogonal table L_8. However, it is difficult for respondents to rank eight virtual services. Therefore, the above four attributes are divided into two portions with three attributes each in this study and we make two sets of 4 interim services by using the orthogonal table L_4 of three attributed with two levels.

The four virtual services from services A to D are made by using attributes 1, 2, and 3 in the above list as shown in Table 1. The other four virtual services from services E to H are made by including the penalty of catalog distribution instead of the discount or point services as shown in Table 2. Then, we analyze the two sets of four virtual services by the Conjoint Analysis.

【3 attributes combined in the virtual services A, B, C, and D】

- The free service of the delivery charge.
- Trial service
- Discount or point services

【3 attributes combined in the virtual services E, F, G, and H】

- The free service of the delivery charge.
- Trial service
- Penalty of catalog distribution

Table1 Virtual services A,B,C, and D

	A free delivery service	**Trial service**	**In case of ordering more than 5000 yen**
A	In case of ordering items more than 5000yen	Vegetable in season	5% OFF of the price ordered.
B	In case of ordering items more than 5000yen	Frozen food	The points are increases by 20 times.
C	Anyone can receive free delivery service for the initial 8 weeks.	Vegetable in season	The points are increases by 20 times.
D	Anyone can receive free delivery service for the initial 8 weeks.	Frozen food	5%OFF of the price ordered.

Table2　Virtual services E, F, G, and H

	The delivery charge is free.	Trial service	The penalty
E	In case of ordering items more than 5000yen	Vegetable in season	The case of ordering less than1000yen, the catalog delivery is stopped.
F	In case of ordering items more than 5000yen	Frozen food	No penalty.
G	Anyone can receive free delivery service for the initial 8 weeks.	Vegetable in season	No penalty.
H	Anyone can receive free delivery service for the initial 8 weeks.	Frozen food	The case of ordering less than1000yen, the catalog delivery is stopped.

3) Making and distribution of the questionnaire

- Execution period: January, 2008
- Target: Men and women from teenage years to seventies
- Number of distributions: 330 people
- Distribution method: Handing or E-mail
- Number of collections: 267 people (rate 81%)
- Collection method: Handing, E-mail, or mailing

Result of questionnaire

1) Attributes of respondents

At first, we show the attributes of respondents.

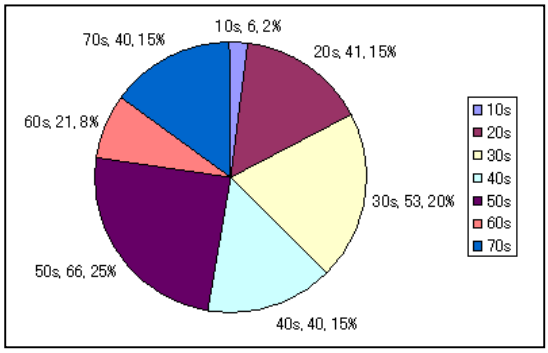

Figure 1 Composition ratio of age layer

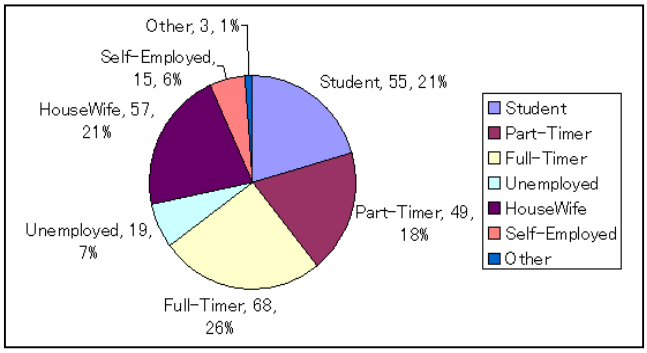

Figure 2 Composition ratio of occupation

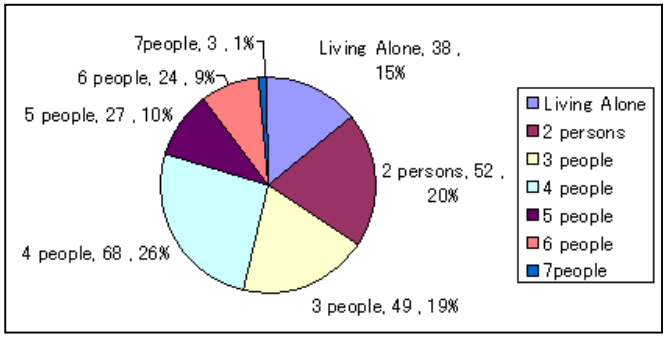

Figure 3 Composition ratio of number of families

2) Relation between respondent's attributes and the purchase price

It is important to pay attention to the purchase unit price and the answer result of the selection order of the virtual service in order to find the home delivery service

that excellent customers like.

Then, we use the question "How much would you purchase per week in the case of using home delivery service (having conditions similar to COOPs),?" and using the answer for this question as the base of judgment for purchase price per order.

Then, the choices in the 12 question concerning the purchase unit price are classified into 3 layers.

- "Less than 3000 yen"
- "From 3000 yen to less than 7000 yen"
- "More than 7000 yen "

【About the purchase unit price and age layer】

Table 3 shows the relation between ages and purchase price per order of respondents.

Table 3 Purchase unit price ratio of each age layer

Unit price / Age	Less than 3000 yen	3000 - 7000 yen	More than 7000 yen	Total
10's	0.667	0.333	0.000	1.000
20's	0.591	0.273	0.136	1.000
30's	0.550	0.325	0.125	1.000
40's	0.340	0.453	0.208	1.000
50's	0.195	0.512	0.293	1.000
60's	0.350	0.450	0.200	1.000
70's	0.381	0.286	0.333	1.000
Total	0.423	0.382	0.195	1.000

From Table 3, the purchase price per order by the ages from 40's to 60's is higher than other ages. On the other hand, the purchase price per order of the ages from 10's to 30's is the lowest.

As mentioned above, people from 40's to 60's years by age may be excellent customers who will buy a lot of goods in a single order. Perhaps their incomes are higher than other ages and they have many family members including their growing children.

【About purchase price per order and the number of family members】

Table 4 shows the relation between the number of family members and purchase price per order of respondents.

Table 4 Ratio of the purchase price per number of family members

Unit Price / Number	Less than 3000 yen	3000 - 7000yen	More than 7000yen	Total
1	0.684	0.211	0.105	1.000
2	0.423	0.423	0.154	1.000
3	0.388	0.531	0.082	1.000
4	0.279	0.426	0.294	1.000
5	0.481	0.259	0.259	1.000
6	0.417	0.292	0.292	1.000
7	0.667	0.000	0.333	1.000
Total	0.425	0.380	0.195	1.000

This table shows the tendency for the customers with the highest purchase price per order having 3 or 4 family members on average. On the other hand, purchase price per order of people living alone is the lowest of all ages.

3) Conjoint Analysis: the relation between purchase price and popular service

The respondents make the orders they like for both two sets of the virtual delivery services, ABCD and EFGH. Figure 4 shows the result of the Conjoint Analysis for services

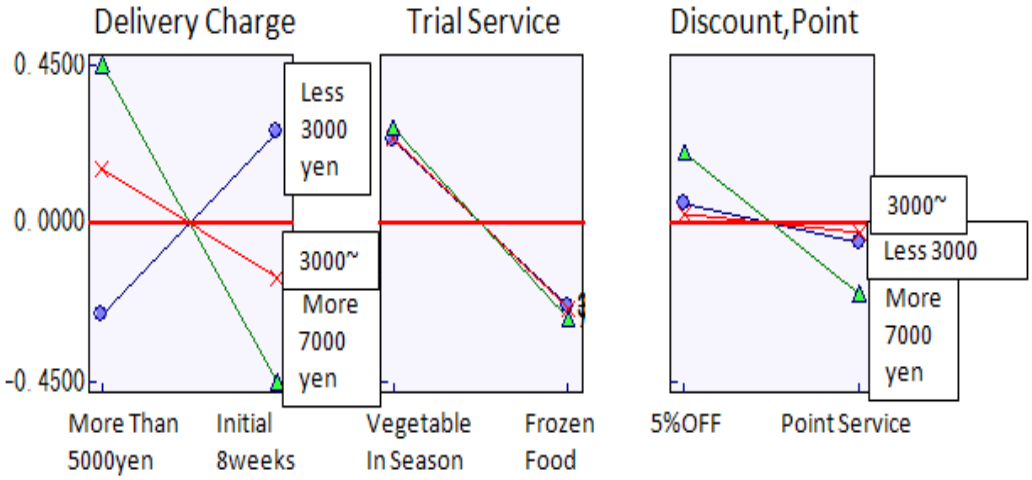

Figure4 Part effect of value per purchase price in the services ABCD

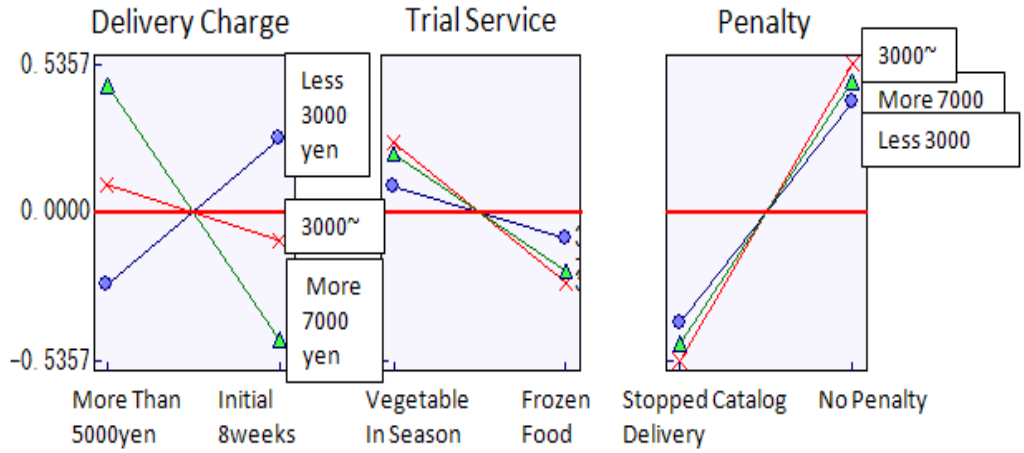

Figure5 Part effect of value per purchase price in the services EFGH

From Figure 4 which is the result for ABCD, the respondents with the highest purchase price per order (many of whom are in their 40s and 50s) tend to like the free delivery charge service in case of ordering items more than 5000yen. On the other hand, people with lower purchase price per order (many of whom are in their 20s and 30s) tend to prefer to receive the free delivery charge service for the initial 8 weeks. Therefore, the free delivery charge services are important to attract the excellent customers. This tendency is the same in the result of Figure 5. This result shows that excellent customers and bad customers tend to like different delivery services. Because the excellent customers often buy many items and spend a lot of money, they tend to like the services which can be received whenever they order items more than 5000yen. On the other hand, the bad customers tend to like the free services that anyone can receive. The free delivery charge service for the initial 8 weeks is attractive not only to the excellent customers, but also to the bad customers.

However in the result in EFGH, it is proved that the penalty has a strong influence on choice in comparison with the other service. That is to say, regardless of purchase price per order, all customers attach most importance to the penalty of stopping the catalog distribution. Although the penalty is the way to remove the bad customers who make small orders, it may disturb the excellent customers who are going to join as a COOP member.

Moreover, the customers tend to like the "Vegetable in season" more than "Frozen food" as the "Trial service", regardless of the purchase price. The fact may be useful to get new customers in Japanese market.

Consideration of result of the survey

1) Relationship of purchase price and customer attribute

When ages are compared from the viewpoint of purchase price per order, it is shown that those in their 40's and 50's have a high average. This result may be dependent on family structure.

People in their 40's could have families with parents, school children, junior high school students, or high school students. For people in their 50's, there exists the tendency that most of the family members are adults. Therefore, it is thought that purchase price tends to be high because they need to buy a lot of food.

2) The results of the Conjoint Analysis

The customers tend to like the "Vegetable in season" more than the "Frozen food". This tendency is not depending on the segment of customers by the purchase price.

In Japan, people look for safety in food as they grow older. The trial service is not directly related to the price, it is especially popular to housewives. The fact is useful to get new customers in Japanese market. Because the trial service depends on customers' selection, it is meaningful to investigate what kind of trial service is attractive to customers.

3) The differences of favorite service between excellent and bad customers

From the results of stratification in the Conjoint Analysis, the interesting result was obtained in free delivery service. Several types of the discount delivery charge service can be introduced in home delivery service. We evaluated two types of the free delivery charge services from the viewpoint of the difference of conditions when customers can receive the free delivery charge.

As for the discount service of delivery charge, favorite services are greatly different by the purchase price per order between the high (40's and 50's groups) and low (20's and 30's groups).

People with a high purchase price per order tend to like the delivery free service they can receive in the case of ordering items more than 5000yen. The customers with the low purchase price tend to like the delivery free service that anyone can receive for the initial 8 weeks. The bad customers tend to prefer only their profit in the viewpoint of price. The reason of this result can be considered as follows: Usually, the customers with low purchase price cannot receive the benefits of the delivery free service in the case of ordering more than 5000yen because their purchase price per order is under 5000yen. On the other hand, the excellent customer with a high purchase price per order can usually receive the free delivery charge. The advantage for the excellent customers and the disadvantage for the bad customers might be influenced by their choice. The bad customers tend to like the services that they can receive even if they make small orders.

Then it is necessary to provide the free delivery charge in the case of ordering over some amount of purchase price (for example 5000yen) to guarantee the excellent customers. By the introduction of the delivery charge free service that customers can receive when they order many items, we can have the delivery service which is attractive for the excellent customers but unattractive to the bad customers. If the business company can get only the excellent new customers, the average delivery amount per member increases and the efficiency of home delivery can be improved.

In addition, it has been shown that people with high purchase price per order tend to like the discount service of "5% OFF of the price ordered" more than "the point service which is increased by 20 times in the case of ordering more than 5000yen". This fact is also meaningful to work out a strategy to get the excellent customers.

4) The point customers attach importance

The service that greatly influences all categories of customers is a penalty item of "In case of ordering less than 1000yen, the catalog delivery is stopped" without relation to the unit price. Therefore, the advantages of home delivery services with high quality services may be canceled in the case of combining the penalty condition even if the service quality is so attractive. Though the penalty may be effective to remove the bad customers, it is thought that the excellent customers are also kept away. Therefore, if the penalty is considered as a strategy to stop the delivery for bad customers and improve the efficiency of distribution, its influence has to be examined closely carefully.

Conclusion

In this research, the relation between preferable delivery services and the purchase price per order is examined. Regarding the purchase price per order as the amount of materials, the possibility of increase of purchase price of new customers is studied.

As a result, we clarified the delivery service the excellent customers like by analyzing from the marketing viewpoint. In COOPs, the initial (free service of delivery charge) − free delivery service is being introduced for the initial eight weeks for every new customer as a joining privilege. However, the result in this study suggests the need of a careful reexamination because it is also attractive to bad customers.

Moreover, it is effective to introduce the free delivery service (service of delivery charge) in the case of ordering over some amount of the purchase price. This service gives good customers the advantage. The service which is attractive to only excellent consumers with a high purchase price can be introduced from the result and consideration. Because the excellent customers also dislike the penalty as "in the case of ordering less than 1000yen, the catalog delivery is stopped", it is necessary to carefully examine the disadvantage of the penalty.

By considering the results based on the Conjoint Analysis, it is efficacious to show the effect of the reduction of the environmental load, i.e., CO2 emissions, quantitatively with its price. Therefore, we have to identify the CO2 emissions correctly. In this paper, this evaluation cannot be addressed. The future work is to present the calculation method of CO2 emissions exhausted by all processes of logistics, show the impact of the customer's order unit price for CO2 emissions by using this CO2 model, and discuss the effectiveness of the strategy.

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