Management Studies, Mar.-Apr. 2018, Vol. 6, No. 2, 67-95
doi: 10.17265/2328-2185/2018.02.001

Purchase Analysis Based on the Relationship Between Customers and Service Providers

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Although the service industry takes up a large percentage in world economies and is situated in the center of all industries, it has been pointed out that its growth rate is smaller compared to the other industries, which is partly because of its characteristic features: "amorphousness", "simultaneity", and "heterogeneity". Service providers are therefore required to be experienced and have a good business sense to succeed in this field. The aim of this research is to support those who are not experienced or do not have a good business sense, using scientific approach. This research tries to present recommendation, taking customers' value and compatibilities with employees into account, and is based on the assumption that customers and employees have one-to-one contact over a period. A total of 3,447 customers and 133 employees were classified according to their philosophies, needs, and abilities. For each case, customers' purchase histories are first interrelated with the result of questionnaire, and put purchase behavior into marketing using Bayesian network. Then the HUB was examined and extracted features of the data of the questionnaire, and executed the stochastic inference to present the recommendation. This procedure enabled us to extract the features of customers' purchase behavior, and it is turned out that compatibilities of customers and employees are more important than the difference of their values and abilities.

Keywords: heterogeneous, customer values, recommendation, service science, purchase Bayesian network, stochastic reasoning

Introduction

The service sector's importance is increasing in the global economy; further, the number of countries is also increasing in which the ratio of their GDP involving the service sector has surpassed 70%.

A strategic frame work known as the Service Triangle shows the importance for long term succeeding to keep the balance between the Company (Management), Employees (Service providers), and Customers (Zeithaml, Bitner, & Gremler, 2010). The relationship between service providers and customers is called the interactive marketing. The interactive marketing is to deliver the company's services. That is why the interactive marketing is one of the most important factors to make the relationship better with customers.

The differences exist in not only customers, but also service providers (Zeithaml, Parasuraman, & Berry, 1985; Grönroos, 1990). Therefore, services' quality and productivity depend on the service providers' experiences and intuitions. Service providers' heterogeneity is a factor in the gap between previous

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expectations and the actual service provided (Zeithaml, Berry, & Parasuraman, 1993). The customisation and promotion of efficiency is a trade-off relationship (Anderson, Fornell, & Rust, 1997). Further, this tends to be stronger in the service industry than in the manufacturing industry.

This study aims the proposal of analytical method to promote the efficient purchases based on the heterogeneity between customers and service providers' in the interactive marketing.

Literature Review

As a study pointing to the interactive marketing in the service triangle, service marketing practices explain how value-creating interactions between service providers and customers are more transparent than usual (Hultman & Ek, 2011). However, they did not quantitatively analyse the interaction between customers and service providers. As a study focusing on the service providers in the service triangle, there is the paper which analyses service providers' motivations (Gąsior, Skowron, & Sak-Skowron, 2014). It is considered that service providers' motivation along with their satisfaction with work is one of the most significant factors determining functioning and the success of an organization on the market. The service providers' satisfaction must relate with customers. However, they did not analyse the relationship based on the heterogeneity between service providers and customers. These studies do not discuss whether customer satisfaction depends on service providers' heterogeneity in customisation.

Research Methods

This study comprehends the structure of customers' consumption and use through a factor analysis of questionnaire survey data regarding their sense of values, lifestyle, consumption, and use. Customers are then classified using factor scores. Furthermore, this study also interprets the structure of service providers' sales behaviours using a factor analysis of the questionnaire survey data regarding their sense of values, motivations, and abilities; service providers are then classified using factor scores. Additionally, a sales-purchase Bayesian network, which demonstrates the relationship between the questionnaire survey regarding their sense of values, needs, and so forth, and their purchase history, with products and services in each combination of customer and service provider types, is analysed. The study then investigates the significant gap in purchase probabilities, as conditioned by customers' positive and negative responses to each questionnaire in the purchase Bayesian network, as characteristics of the type's sales. The sales promotion support method is proposed by comparing the purchase probability predicted for all service providers in the type to the purchase probability predicted for a service provider in the type.

The 1st section of next chapter will provide an analysis of customer purchases and use, constructed through a factor analysis based on their sense of values, lives, purchase, and use. They will be classified using a factor score resulting from this factor analysis. The 2nd section of next chapter will analyse service providers' sales activities through a factor analysis based on their sense of values, motivation, and abilities, and will classify them by the factor score resulting from this factor analysis. Each type's characteristics will be investigated. In the 3rd section of next chapter, according to the combination of customer and service provider types resulting from the factor analysis, a sales-purchase Bayesian network model to further analyse the relationship between such questionnaire items as sense of values, needs, and feelings from lives, and service sales data, will be analysed. Then sales-purchase activities' characteristics based on combinations of customer and service provider types will be compared, and confirm that obvious differences exist when each

provider type corresponds to each consumer type. Then a sales and purchase analysis to improve the usage value, and promote sales by combining customer and service provider types, will be proposed, and verify its usefulness. Additionally, the chapter of conclusion will discuss each service provider's sales Bayesian network by calculating the differences between purchase probabilities using the stochastic reasoning predictive for customers who react to each questionnaire item positively, negatively, and respectively. Further, whether the questionnaire items with greater differences which are characteristic of service provider-type sales will be investigated. Subsequently, the Bayesian network for each service providers' sales, as included in the type, will be analysed, and the purchase probability will be calculated using similar stochastic reasoning. The combinations of questionnaire items and services that each provider does not sell, in spite of the result that other service providers in the type can sell to customers with positive reactions, will be focused on. Then a support system for service providers by listing the services that focus on the above-mentioned questionnaire items using the predicted purchase probabilities to improve their sales, will be proposed.

Analysis and Research Result

Classificaton of Customer Based on Their Sense of Values and Consuming and Use

Questionnaire survey for customers. Customers were surveyed using a questionnaire to understand the structure of their consumption and use based on such factors as their sense of values, their daily life, needs, and brand royalty. These survey items are based on (Watabe & Tsubaki, 2016) consumption and use hypothesis model.

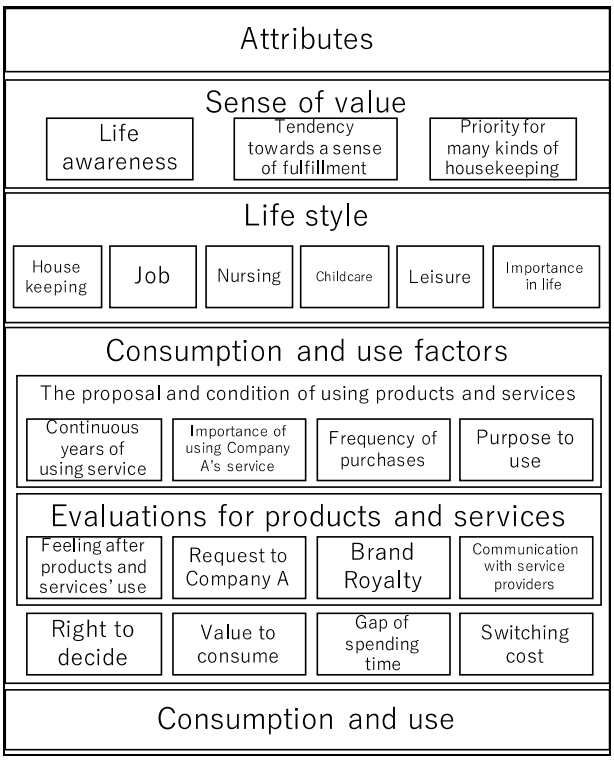


Figure 1. Hypothesis model of consumption and use.

According to Figure 1, "Attributes", such as a customer's age and families, act as a fundamental base for consumption and use. Next fundamental factor is assumed to be a "sense of value" that is determined by such

questions involving “life awareness”, “tendency towards a sense of fulfilment”, and “priority for many kinds of housekeeping”. Additionally, in their lives the ratios of five items, such as “housekeeping”, “job”, “nursing”, “childcare”, and “leisure”, are based on their sense of values; “importance in life” builds their “lifestyle”, and their “daily life” enables us to observe the customer’s condition. As consumption and use factors, “the proposal and condition of using products and services” should be measured by “continuous years of using the service”, “importance of using Company A’s service”, “frequency of purchases”, and “the purpose of use”. Further, “evaluations for products and services” should be measured by “feeling after products and services’ use”, “request to Company A”, “brand loyalty”, and “communication with service provider”. Finally, they consider “right to decide”, “value to consume”, “gap of spending time”, and “switching cost”. Finally, “purchase behaviour” will occur.

This survey targets customers with service providers at Office I in Company A.

The questionnaire is summarised as follows:

Target: Current customers, or 7,948 participants who live in City I and are purchasing products and services from Company A.

Effective answers: 3,447 (43.37%).

Purpose: To understand customers’ needs and sense of values, and confirm obvious factors regarding customer consumption and usage; to improve the quality of products and services; and to increase the numbers of both new and repeat customers.

Time period: 2015/07/09-2015/10/30.

Classification of customer based on the structure of consumption and use for each customer value type. The questionnaire survey data were analysed through factor analyses (using a principal factor method, promax rotation, and parallel analysis criteria) as the same conditions which are to reduce variables in which the factor loading is less than 0.4 and more than 0.4 in two factors, and repeat the factor analysis until each variable’s factor loading becomes more than 0.4 in one factor (Shinkawa, Shimada, Hayase, & Inui, 2009; Ono & Shoji, 2015; Watabe & Tsubaki, 2016). At the repeated fourth result, seven factor structures are adopted through parallel analysis criteria.

Table 1 illustrates the parallel analysis result, and Table 2 displays the factor loadings for seven factor structures.

Table 1

Units for Properties With Parallel Analysis

	Eigenvalue	Parallel analysis	Contribution Rate	Cumulative contribution ratio
1st factor	5.443	1.162	20.20	20.20
2nd factor	3.153	1.138	11.70	31.80
3rd factor	2.329	1.123	8.63	40.50
4th factor	2.029	1.111	7.52	48.00
5th factor	1.841	1.097	6.82	54.80
6th factor	1.432	1.083	5.30	60.10
7th factor	1.144	1.070	4.24	64.30
8th factor	0.942	1.058	3.49	67.80
9th factor	0.824	1.048	3.05	70.90
10th factor	0.761	1.037	2.82	73.70

Table 2

Factor Loadings (Customers' Questionnaire Data)

Category		Questionnaire outline	1st factor	2nd factor	3rd factor	4th factor	5th factor	6th factor	7th factor
Lifestyle		Time of raising children	0.001	0.003	1.330	0.058	0.003	0.069	0.011
Evaluation of housekeeping		Cooking	0.029	0.828	0.021	0.048	0.014	0.017	0.002
		Washing	0.016	0.874	0.008	0.028	0.001	0.022	0.018
		Cleaning up	0.019	0.827	0.002	0.034	0.005	0.023	0.031
		Shopping	0.007	0.742	0.012	0.040	0.009	0.016	0.038
Evaluation of products and services	Realisation of feeling	Spending time with better feeling	0.531	0.013	0.009	0.004	0.008	0.039	0.056
	Brand loyalty	Quality of products and services	0.490	-0.018	0.007	0.041	0.012	0.074	0.047
		Convenience	0.514	0.019	0.037	0.007	0.005	0.016	0.007
		Attachment to products and services	0.810	0.001	-0.038	0.025	0.052	0.045	0.021
		Trust of products and services	0.816	0.013	0.005	0.086	0.016	0.033	0.040
		Recommendation	0.698	0.010	0.026	0.101	0.016	0.063	0.018
		Evaluation from close people	0.693	0.007	0.025	0.003	0.000	0.042	0.043
		Good products, although expensive	0.720	0.026	0.004	0.036	0.012	0.079	0.005
Consumption value		Focus on convenience	0.009	0.016	0.057	0.020	0.014	0.816	0.037
		Focus on after service	0.047	0.003	0.066	0.034	0.022	0.891	0.043
Decision right		Decision right to low price	0.052	0.034	0.021	0.026	0.038	0.041	0.786
		Decision right to high price	0.017	0.024	0.008	0.001	0.051	0.049	0.640
Demand for Company A		Enjoy with family	0.082	0.005	0.030	0.612	0.017	0.028	0.014
		Explaining how to use products and services	0.042	0.013	0.126	0.569	0.072	0.073	0.001
		Delivery service	0.015	0.003	0.054	0.647	0.044	0.031	0.041
		One-point lesson	0.073	0.021	0.059	0.736	0.022	0.009	0.054
		Organisation lecture	0.091	0.006	0.098	0.699	0.046	0.059	0.014
Communication		Communication based on daily conversation	0.079	0.016	0.021	0.022	0.446	0.022	0.005
		Communication based on sales products	0.030	0.005	0.001	0.011	0.980	0.014	0.009
		Communication based on new products	-0.021	-0.005	-0.007	-0.007	0.945	-0.003	0.004
Attributes		Number of preschool children	0.031	0.052	0.442	0.087	0.009	0.046	0.006
		Number of elementary and junior high school students	0.003	0.057	0.464	0.092	0.018	0.105	0.010

The extracted seven factor structures were then interpreted, and their names were investigated. The first factor was named "loyalty caused by realising the feeling from using products and services" due to high factor loadings for "feeling and satisfaction" and "brand loyalty". The second factor was named "the families' evaluation for housekeeping" because "life awareness" expressed a high factor loading in families' evaluation for housekeeping. The third factor was named "time pressure by childcare" because there were high factor loadings for childcare time in "priority for housekeeping" and the numbers of preschool, primary, and junior high school students in "attributes" are high. The fourth factor is constructed only as "request for Company A", and named "request for housekeeping products and services". The fifth factor is constructed using only "communication with service providers", and named "communication to promote customers' consumption". The sixth factor is constructed using only "a sense of values for consumption" and named "selection criterion of housekeeping products and services". The seventh factor is constructed using only the "right to decide", and named "right to decide". Table 3 states the results.

Table 3

Factor's Name (Customer Questionnaire)

1st Factor (Contribution Rate: 20.2%)

1st factor		
Loyalty caused by realising feelings from using products and services		Factor loadings
Spend time with better feelings	Realise feeling	0.531
Quality of products and service	Realise feeling	0.490
Convenience	Brand loyalty	0.514
Attachment to products and services	Brand loyalty	0.810
Trust of products and services	Brand loyalty	0.816
Recommendation	Brand loyalty	0.698
Evaluation from close people	Brand loyalty	0.693
Good products, even expensive	Brand loyalty	0.720

2nd Factor (Contribution Rate: 11.7%)

2nd factor		
The families' housekeeping evaluation		Factor loadings
Cooking	Housekeeping evaluation	0.828
Washing	Housekeeping evaluation	0.874
Cleaning up	Housekeeping evaluation	0.827
Shopping	Housekeeping evaluation	0.742

3rd Factor (Contribution Rate: 8.63%)

3rd factor		
Time pressure by childcare		Factor loadings
Time in raising children	Priority for housekeeping	1.33
The number of preschool children	Attribute	0.442
The number of elementary, junior high school students	Attribute	0.464

4th Factor (Contribution Rate: 7.52%)

4th factor		
Request for housekeeping products and services		Factor loadings
Enjoy with family	Demand to Company A	0.612
Explaining how to use products and services	Demand to Company A	0.569
Delivery service	Demand to Company A	0.647
One point lesson	Demand to Company A	0.736
Organisation lecture	Demand to Company A	0.699

5th Factor (Contribution Rate: 6.82%)

5th factor		
Communication to promote customer consumption		Factor loadings
Communication based on daily conversation	Communication	0.446
Communication based on sales products	Communication	0.98
Communication based on new products	Communication	0.945

6th Factor (Contribution Rate: 5.30%)

6th factor		
Selection criterion of housekeeping products and services		Factor loadings
Focus on convenience	Sense of values for consumption	0.816
Focus on after service	Sense of values for Consumption	0.891

7th Factor (Contribution Rate: 4.24%)

7th factor		
Right to decide		Factor loadings
Right to decide on low price	Decision right	0.786
Right to decide on high price	Decision right	0.64

Customers are then classified into types by Ward's clustering method, based on the factor analysis scores. Table 4 illustrates the number and average of each type's factor scores, with five to seven cluster members, which are compared to determine the number of types.

Table 4

The Result of Customer Clustering (the Number of Clusters 5-7)

5 Clusters

Factor	Group 1	Group 2	Group 3	Group 4	Group 5
1st factor	0.404	-0.703	0.011	0.256	-0.393
2nd factor	0.618	0.002	-0.091	-0.969	0.020
3rd factor	-0.606	-0.503	3.164	-0.725	-0.454
4th factor	0.045	-0.580	0.510	0.278	-0.271
5th factor	0.440	-0.229	0.187	0.226	-2.217
6th factor	0.433	-0.716	-0.379	0.390	-0.040
7th factor	0.224	-0.484	-0.172	0.263	0.104
Number of people	1,161	779	544	696	267

6 Clusters

Factor	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
1st factor	0.973	-0.703	0.011	0.256	-0.058	-0.393
2nd factor	0.572	0.002	-0.091	-0.969	0.656	0.020
3rd factor	-0.615	-0.503	3.164	-0.725	-0.599	-0.454
4th factor	0.559	-0.580	0.510	0.278	-0.372	-0.271
5th factor	0.455	-0.229	0.187	0.226	0.427	-2.217
6th factor	0.785	-0.716	-0.379	0.390	0.149	-0.040
7th factor	0.241	-0.484	-0.172	0.263	0.210	0.104
Number of people	520	779	544	696	641	267

7 Clusters

Factor	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
1st factor	0.973	-0.703	-0.026	0.256	0.048	-0.058	-0.393
2nd factor	0.572	0.002	-0.106	-0.969	-0.076	0.656	0.020
3rd factor	-0.615	-0.503	4.485	-0.725	1.833	-0.599	-0.454
4th factor	0.559	-0.580	0.572	0.278	0.447	-0.372	-0.271
5th factor	0.455	-0.229	0.087	0.226	0.288	0.427	-2.217
6th factor	0.785	-0.716	-0.499	0.390	-0.257	0.149	-0.040
7th factor	0.241	-0.484	-0.111	0.263	-0.232	0.210	0.104
Number of people	520	779	273	696	271	641	267

Table 4 divides types 1 of 5 clusters into types 1 and 5 of 6 clusters. Table 5 compares their characteristics of types 1 and 5. The first, fourth, and sixth factors are then divided into high and middle characteristics;

therefore, it is appropriate to divide them into six clusters. Additionally, type 3 of 6 clusters is divided into type 3 and 5 of 7 clusters. These are divided into high and middle-high in the fourth factor, and middle-low and middle in the sixth factor, but they are similar conclusions. There should be six clusters then decided. Table 6 shows the detailed characteristics in the case of six clusters, which comprehensively evaluate the averages of factor scores for each type (factor scores are distributed with standard normal distribution, and are then evaluated as averages: less than -0.5 is low, greater than 0.5 is high, and in between is middle), median of factor score for each type (the same criteria, with using averages), the ratio of the number of people (evaluated as low when the ratio of less than -0.5 is the largest, and high when the ratio of greater than 0.5 is the largest, and middle when the ratio in between is the largest). These are then comprehensively evaluated in five grades: high, middle-high, middle, low-middle, and low. For example, if the average, median, and ratio of the number of people are high, middle, middle, its evaluation is middle-high.

Table 5

Customers' Characteristics Based on Each Cluster Number

5 Clusters

	Type 1	Type 2	Type 3	Type 4	Type 5
1st factor	Middle	Low	Middle	Middle	Low-middle
2nd factor	High	Middle	Middle	Low	Middle
3rd factor	Low	Low	High	Low	Middle
4th factor	Middle	Low	High	Middle	Middle
5th factor	Middle-high	Middle	Middle-high	Middle	Low
6th factor	Middle-high	Low	Middle	Middle-high	Middle
7th factor	Middle	Middle	Middle	Middle	Middle

6 Clusters

	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1st factor	High	Low	Middle	Middle	Middle	Low-middle
2nd factor	High	Middle	Middle	Low	High	Middle
3rd factor	Low	Low	High	Low	Low	Middle
4th factor	High	Low	High	Middle	Middle	Middle
5th factor	Middle-high	Middle	Middle-high	Middle	Middle-high	Low
6th factor	High	Low	Middle	Middle-high	Middle	Middle
7th factor	Middle	Middle	Middle	Middle	Middle	Middle

7 Clusters

	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
1st factor	High	Low	Middle	Middle	Middle	Middle	Low-middle
2nd factor	High	Middle	Middle	Low	Middle	High	Middle
3rd factor	Low	Low	High	Low	High	Low	Middle
4th factor	High	Low	High	Middle	Middle-high	Middle	Middle
5th factor	Middle-high	Middle	Middle-high	Middle	Middle-high	Middle-high	Low
6th factor	High	Low	Low-middle	Middle-high	Middle	Middle	Middle
7th factor	Middle	Middle	Middle	Middle	Middle	Middle	Middle

The characteristics resulting from the comprehensive evaluation of type in 6 clusters are displayed.

Table 6

Characteristics of Customer Types From Comprehensive Evaluation

6 clusters	Factor's name	Contribution rate	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1st factor	Royalty caused by realizing feelings from using products and services	20.20	High	Low	Middle	Middle	Middle	Low-middle
2nd factor	The families' housekeeping evaluation	11.70	High	Middle	Middle	Low	High	Middle
3rd factor	Time pressure by childcare	8.63	Low	Low	High	Low	Low	Middle
4th factor	Request for housekeeping products and service	7.52	High	Low	High	Middle	Middle	Middle
5th factor	Communication to promote customer consumption	6.82	Middle-high	Middle	Middle-high	Middle	Middle-high	Low
6th factor	Selection criterion of housekeeping products and service	5.30	High	Low	Middle	Middle-high	Middle	Middle
7th factor	Right to decide	4.24	Middle	Middle	Middle	Middle	Middle	Middle
Number of people			520	779	544	696	641	267

Figure 2 shows histograms for attributes (age, condition of youngest child, childcare duration, and usage period of the products or services) for each type.

Each type through Table 6 and Figure 2 is interpreted, and reveals this interpretation in Table 7.

This suggests that if customer's service provider loyalty or communication is high, they will purchase Company A's products or services. These are verified as the hypothesis.

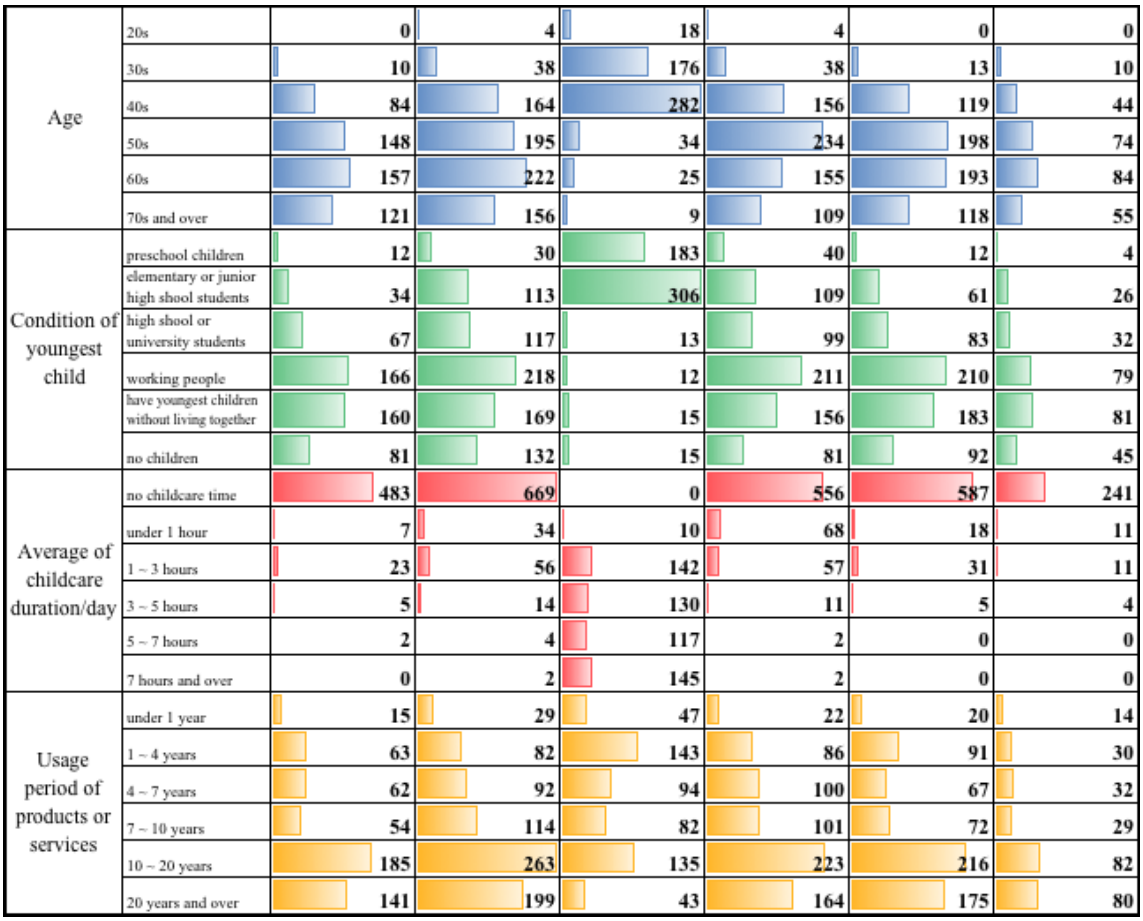


Figure 2. Histograms of attributes on each type.

Table 7

Interpretation of Each Type

Type	Interpretation
Type 1	In this type, "the families' evaluation for housekeeping", is high, with a strong "sense of consumption values", loyalty to Company A is high, as well as communicating with service providers; having "request for Company A", and "time pressures from children" are low, and their age mode is in the 60s.
Type 2	This type does not have "a sense of consumption values", and loyalty to Company A is low. Therefore, "request for Company A" is low; their age mode is in the 60s, including various ages.
Type 3	This type has a high "request for Company A", communicates well with service providers, has nearly grown children, and their age mode is in the 40s.
Type 4	This type has low "families' evaluation for housekeeping", "time pressure by childcare", and their age mode is in the 50s.
Type 5	This type has high "families' evaluation for housekeeping", communicates fairly well with service providers, "time pressure by childcare" is low, and their age mode is in the 50s and 60s.
Type 6	The type has middle-low loyalty for Company A's products and services, and does not communicate with service providers at all.

Table 8

Ranking of Evaluation Based on Each Customer's Characteristics and Ranking of Average of Purchase by Customer Type

	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Ranking of evaluation based on each customer's characteristics	1	6	3	4	2	5
Average of purchase (yen)	23,395.15	16,911.90	18,557.98	20,735.75	21,105.18	16,195.95
Ranking of average of purchase on the customer type	1	5	4	3	2	6

Table 8 notes the ranked evaluation based on each customer's characteristics is similar to the ranking of average purchase by the customer type, but on types 3 and 4, and types 2 and 6, this is reversed.

Regarding types 3 and 4, Figure 2 illustrates that type 3 includes customers who have young children and limited money. Additionally, the first factor's type characteristics are evaluated as middle. However, the average of the first factor score is 0.028 for type 3 and 0.24 for type 4; therefore, type 4 is somewhat higher. Thus, one consideration includes that type 4 would be higher on average for customers' purchases.

Regarding types 2 and 6, type 2 is evaluated lower than type 6 in almost all factors. However, type 6 is evaluated as less than 2 in the fifth factor. Therefore, another consideration exists, in that consumers' communication influences their purchasing and customers' average purchase is lower.

Classificaton of Service Providers Based on Their Sense of Values and Sales

Questionnaire survey for service providers. A questionnaire survey of service providers was conducted to understand the structure of sales-action based on a sense of career values and skills. Those survey items are based on sales actions hypothesis model (Watabe & Tsubaki, 2016).

Figure 3 illustrates that service providers first understand consumption and use based on customers' lifestyle. They improve the fundamental competencies for workers, and acquire the specialised knowledge and skills for their products and services based on their own sense of carrier value. They then more deeply understand customers and their needs through this specialised knowledge and skills, to promote customers' consumption and improve their usage value.

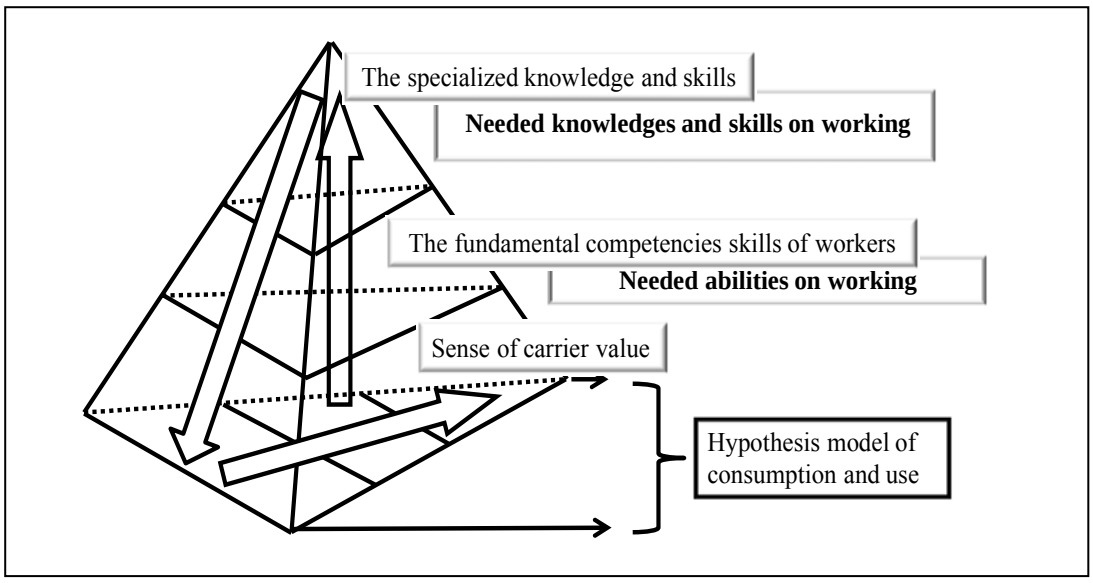


Figure 3. Sales actions hypothesis model for service providers.

The questionnaire is summarised as follows:

Target: Current service providers; 163 employees working for customers living in City I at Company A;

Effective answers: 133 participants (81.59%);

Purpose: To confirm the important factors for service providers to understand customers' needs and sense of values, to understand service providers' sense of values and carrier values to improve the quality of use of products and services, and to increase the numbers of both new and repeat customers;

Period: 2015/07/09-2015/10/30;

Survey method: Survey by post.

Service providers' classification based on the structure of sales action. The questionnaire survey data were analysed, using the same factor analysis method and criteria as in the previous chapter, for all 91 items. Seven factor structures by parallel analysis criteria are adopted at the repeated third result. Table 9 illustrates the factor loadings for the seven factor structurers.

Table 9

Factor Loadings (Service Providers' Questionnaire Data)

Category	Questionnaire outline	1st factor	2nd factor	3rd factor	4th factor	5th factor	6th factor	7th factor
Lifestyle	Time of raising children	0.071	0.109	0.106	-0.048	-0.104	0.083	1.050
Life awareness	Knowledge of cooking techniques	-0.080	-0.056	0.085	0.825	-0.026	-0.003	-0.125
	Knowledge of washing techniques	0.043	0.011	-0.014	0.794	-0.060	0.007	0.031
	Knowledge of cleaning techniques	-0.057	0.182	-0.066	0.817	0.074	-0.032	0.012
	Knowledge of shopping techniques	-0.027	-0.092	0.035	0.741	0.006	-0.009	0.016
	Effective cleaning, even when busy	-0.022	-0.024	0.122	0.556	0.078	0.108	-0.034
	Self-evaluation	-0.009	-0.252	0.193	0.062	0.152	0.453	-0.130
Importance in life	Fashion and jewellery goods	0.154	-0.161	-0.165	0.181	-0.109	0.570	0.223
	Cosmetic items for women	0.041	0.036	-0.162	0.002	0.070	0.543	0.225
	Interior	-0.067	-0.063	-0.043	0.014	0.076	0.600	0.026

(Table 9 continued)

Realizing of feeling	Realizing of feeling	Like to clean up	-0.024	0.198	0.680	0.047	-0.066	0.000	0.025
		Cleaning up, even when busy	-0.041	0.076	0.827	0.022	-0.179	-0.051	0.076
		Becoming peaceful	-0.020	-0.025	0.691	0.043	0.094	0.025	0.170
		Cleaning up soon	-0.009	-0.161	0.651	0.005	0.088	0.027	-0.036
		Spending time with better feeling	0.004	0.103	0.693	-0.007	0.050	-0.091	-0.015
		Improving health conditions	0.162	0.040	0.594	-0.080	-0.019	0.090	0.002
	Brand loyalty	Attachment to products and services	-0.125	0.716	0.239	0.036	0.087	0.011	-0.079
		Trust of products and services	0.010	0.628	0.044	0.036	0.099	0.004	-0.021
		Recommendation	0.114	0.673	-0.060	-0.041	0.183	-0.058	0.143
		Good products, although expensive	-0.147	0.771	-0.065	-0.035	0.019	0.005	0.111
		Product variety	-0.042	0.557	0.084	-0.231	0.172	-0.097	0.195
Sense of values	Consumption	Focus on quality of products and services	0.039	0.241	0.043	-0.155	0.058	0.563	-0.168
		Focus on convenience	-0.006	0.260	0.089	-0.136	-0.084	0.457	-0.198
		Focus on lifestyle	-0.134	0.069	0.124	-0.071	-0.051	0.589	0.039
Job about Company A	Motivation	Motivation based on appreciative comments	0.041	0.483	-0.055	0.085	-0.080	0.135	0.085
		Motivation based on communication among service providers	0.034	0.497	-0.095	0.099	0.059	0.077	-0.017
		Motivation based on chance for growth	0.045	0.434	0.079	0.171	0.317	-0.070	0.123
		Motivation based on expanding own knowledge	0.191	0.428	0.013	0.150	-0.174	0.044	-0.037
	Sense of job in Company A	Given position	0.045	-0.014	0.155	-0.002	0.595	0.029	-0.016
		Feeling attachment to Company A	0.056	0.317	0.039	0.079	0.613	-0.077	-0.079
		Stable work in a company	0.007	0.216	-0.131	0.008	0.759	0.038	-0.138
		Work in a highly visible company	0.006	0.028	-0.050	-0.083	0.665	0.034	0.035
	Ability	Ability based on building a smooth relationship with customers	0.528	0.111	0.075	0.018	-0.173	0.026	-0.213
		Ability based on discovering needs by analysing information	0.738	-0.076	0.089	-0.027	-0.193	0.055	0.043
		Ability based on recommendation to help customers solve troubles	0.780	-0.025	-0.091	-0.103	0.066	0.106	0.032
		Ability based on creating actions of interest	0.710	0.041	-0.006	0.020	0.103	-0.042	0.031
		Ability based on handling data	0.721	-0.234	0.080	-0.058	0.153	-0.050	0.180
		Ability based on logical analysis	0.682	-0.209	0.105	-0.086	0.133	0.057	0.155
		Ability based on actions to fit policy	0.470	0.032	-0.158	0.118	0.337	0.143	0.007
		Ability based on sales	0.783	-0.036	-0.098	0.006	0.089	0.047	0.013
		Ability based on communication with customers	0.707	0.193	0.011	-0.011	-0.182	-0.161	0.040
		Ability based on complying with customers' requests	0.653	0.054	0.102	0.062	-0.058	-0.152	-0.163
	Knowledge	Knowledge of Company A's products and services	0.485	0.126	-0.099	0.021	0.021	-0.058	-0.173
Attributes		Number of preschool children	-0.119	0.024	0.058	0.036	0.050	-0.078	0.516
		Number of elementary and junior high school students	0.017	0.077	0.066	0.060	-0.297	0.146	0.478

Next, extracted seven factor structures were interpreted and their names were investigated. The first factor was named as "the ability to effectively recommend products and services based on customers' needs" because this is constructed through variables that relate to abilities that understand customers' needs, sense of values, and knowledge. The second factor was named as "motivation from brand loyalty" because it is constructed using variables related to "brand loyalty" and "motivation". The third factor is named and constructed only

with variables related to "realising feelings and satisfaction by using Company A's products and services". The fourth factor was named as "motivation to learn housekeeping techniques" because it is constructed with many variables related to learning about housekeeping in life awareness. The fifth factor was named and constructed regarding the "sense of job and motivation in company A". The sixth factor was named as "taste into home and going out" because it is constructed regarding self-evaluation even in life awareness, importance, and their sense of consumption values. The seventh factor was constructed using childcare time and the number of preschool children, primary and junior high school students andwas named as "time pressure by childcare".

Next, service providers were classified into types by Ward's clustering method, based on their factor scores.

Table 10

Factor's Name (Questionnaire by Service Providers)

1st Factor (Contribution Rate 20.60%)

1st factor		
The ability to effectively recommend products and service based on customers' needs		Factor loadings
Ability based on building a smooth relationship with customers	Ability	0.528
Ability based on discovering needs with analysing information	Ability	0.738
Ability based on recommendation to help customers solve troubles	Ability	0.780
Ability based on creating actions of interested	Ability	0.710
Ability based on handling data	Ability	0.721
Ability based on logical analysis	Ability	0.682
Ability based on actions to fit policy	Ability	0.470
Ability based on sales	Ability	0.783
Ability based on communication with customers' requests	Ability	0.707
Ability based on complying with requests of customers	Ability	0.653
Knowledges of Company A' products and services	Knowledge	0.485

2nd Factor (Contribution Rate 10.40%)

2nd factor		
Motivation from brand loyalty		Factor loadings
Attachment to products and services	Brand loyalty	0.716
Trust to products and services	Brand loyalty	0.628
Recommendation	Brand loyalty	0.673
Good products, although expensive	Brand loyalty	0.771
Product variety	Brand loyalty	0.557
Motivation based on appreciative comments	Motivation	0.483
Motivation based on communication among service providers	Motivation	0.497
Motivation based on chance of growth	Motivation	0.434
Motivation based on expanding own knowledge	Motivation	0.428

3rd Factor (Contribution Rate 6.92%)

3rd factor		
Realizing feelings and satisfaction by using Company A's products and services		Factor loadings
Like to clean up	Realizing of feeling	0.680
Cleaning up, even when busy	Realizing of feeling	0.827
Becoming peaceful	Realizing of feeling	0.691
Cleaning up soon	Realizing of feeling	0.651
Spending time with better feeling	Realizing of feeling	0.693
Improving health conditions	Realizing of feeling	0.594

4th Factor (Contribution Rate 5.52%)

4th factor		
Motivation to learn housekeeping techniques		Factor loadings
Knowledge of cooking techniques	Life awareness	0.825
Knowledge of washing techniques	Life awareness	0.794
Knowledge of cleaning techniques	Life awareness	0.817
Knowledge of shopping techniques	Life awareness	0.741
Effective cleaning, even when busy	Life awareness	0.556

5th Factor (Contribution Rate 20.6%)

5th factor		
Sense of job and motivation in Company A		Factor loadings
Given position	A sense of job in Company A	0.595
Feeling attachment to Company A	A sense of job in Company A	0.613
Stable work in a company	A sense of job in Company A	0.759
Work in a highly visible company	A sense of job in Company A	0.665

6th Factor (Contribution Rate 20.6%)

6th factor		
Taste into home and going out		Factor loadings
Self-evaluation	Life awareness	0.453
Fashion and jewelry goods	Importance in life	0.57
Cosmetic items for women	Importance in life	0.543
Interior	Importance in life	0.6
Focus on quality of products and services	Sense of consumption value	0.563
Focus on convenience	Sense of consumption value	0.457
Focus on lifestyle	Sense of consumption value	0.589

7th Factor (Contribution Rate 20.6%)

7th factor		
Time pressure by child care		Factor loadings
Time of raising children	Lifestyle	1.05
Number of preschool children	Attributes	0.516
Number of elementary and junior high school students	Attributes	0.478

Table 11 shows the number and their average of factor scores of each type, on the case of 3-5 cluster members, and their clusters are compared and the number of type is determined.

Table 11

The Result of Clustering of Service Providers (the Number of Clusters 3-5)

3 Clusters

3 Clusters	Group 1	Group 2	Group 3
1st factor	0.558	-0.580	-0.244
2nd factor	0.639	-0.688	-0.229
3rd factor	0.356	-0.538	0.201
4th factor	0.033	-0.264	0.474
5th factor	0.285	-0.497	0.302
6th factor	0.263	-0.424	0.205
7th factor	-0.597	-0.193	1.994
Number of people	61	49	23

4 Clusters

4 Clusters	Group 1	Group 2	Group 3	Group 4
1st factor	0.551	0.564	-0.580	-0.244
2nd factor	0.776	0.506	-0.688	-0.229
3rd factor	0.045	0.657	-0.538	0.201
4th factor	-0.597	0.642	-0.264	0.474
5th factor	-0.030	0.591	-0.497	0.302
6th factor	-0.158	0.670	-0.424	0.205
7th factor	-0.710	-0.488	-0.193	1.994
Number of people	30	31	49	23

5 Clusters

5 Clusters	Group 1	Group 2	Group 3	Group 4	Group 5
1st factor	0.551	0.564	-0.572	-0.598	-0.244
2nd factor	0.776	0.506	-0.678	-0.709	-0.229
3rd factor	0.045	0.657	-0.632	-0.325	0.201
4th factor	-0.597	0.642	-0.556	0.399	0.474
5th factor	-0.030	0.591	-0.176	-1.223	0.302
6th factor	-0.158	0.670	-0.843	0.527	0.205
7th factor	-0.710	-0.488	-0.268	-0.021	1.994
Number of people	30	31	34	15	23

Table 12

Service Providers' Characteristic Based on Each Number of Cluster

3 Clusters

	Type 1	Type 2	Type 3
1st factor	High	Low	Middle
2nd factor	High	Low	Middle
3rd factor	Middle	Low	Middle
4th factor	Middle	Middle	Middle-high
5th factor	Middle-high	Middle	Middle
6th factor	Middle	Low-middle	Middle
7th factor	Low	Middle	High

4 Clusters

	Type 1	Type 2	Type 3	Type 4
1st factor	High	High	Low	Middle
2nd factor	High	Middle-high	Low	Middle
3rd factor	Middle	High	Low	Middle
4th factor	Low	Middle-high	Middle	Middle-high
5th factor	Middle	High	Middle	Middle
6th factor	Middle	High	Low-middle	Middle
7th factor	Low	Low-middle	Middle	High

5 Clusters

	Type 1	Type 2	Type 3	Type 4	Type 5
1st factor	High	High	Low	Low	Middle
2nd factor	High	Middle-high	Low	Low	Middle
3rd factor	Middle	High	Low	Middle	Middle
4th factor	Low	Middle-high	Low	Middle	Middle-high

(Table 12 continued)

5th factor	Middle	High	Middle	Low	Middle
6th factor	Middle	High	Low	High	Middle
7th factor	Low	Low-middle	Middle	Middle	High

From Table 11, type 1 of cluster 3 is divided into types 1 and 2 of cluster 4.

From Table 12, their characteristics are compared, 2nd-7th factors are evaluated differently, and it is appropriate to divide them into four clusters. In addition, type 3 of four clusters is divided into clusters 3 and 4 of five clusters. However, it is few that group 4 has only 15 people, and then the analysis could not be continued. Therefore, the number of clusters is adapted as four. Table 13 shows detailed characteristics in the case of four clusters. Table 14 shows characteristics by comprehensive evaluation in the case of four clusters.

Table 13

Detailed Characteristics in the Case of 4 Clusters

Type	Factor	Average of factor scores	Evaluation of average	Median of factor scores	Evaluation of median	Percentage of people: ~-0.5 (low)	Percentage of people: -0.5~0.5 (middle)	Percentage of people: 0.5~(high)	Evaluation from percentage of people	Total evaluation
Type A	1st factor	0.551	High	0.551	High	10.0	33.3	56.7	High	High
	2nd factor	0.776	High	0.776	High	0.0	36.7	63.3	High	High
	3rd factor	0.045	Hiddle	0.045	Middle	23.3	50.0	26.7	Middle	Middle
	4th factor	-0.597	Low	-0.597	Low	56.7	43.3	0.0	Low	Low
	5th factor	-0.030	Middle	-0.030	Middle	23.3	53.3	23.3	Middle	Middle
	6th factor	-0.158	Middle	-0.158	Middle	26.7	60.0	13.3	Middle	Middle
	7th factor	-0.710	Low	-0.710	Low	73.3	26.7	0.0	Low	Low
Type B	1st factor	0.564	High	0.564	High	16.1	29.0	54.8	High	High
	2nd factor	0.506	High	0.506	High	0.0	54.8	45.2	Middle	Middle-high
	3rd factor	0.657	High	0.657	High	0.0	41.9	58.1	High	High
	4th factor	0.642	High	0.642	High	3.2	48.4	48.4	Middle	Middle-high
	5th factor	0.591	High	0.591	High	0.0	32.3	67.7	High	High
	6th factor	0.670	High	0.670	High	0.0	32.3	67.7	High	High
	7th factor	-0.488	Middle	-0.488	Middle	51.6	45.2	3.2	Low	Low-middle
Type C	1st factor	-0.580	Low	-0.580	Low	61.2	36.7	2.0	Low	Low
	2nd factor	-0.688	Low	-0.688	Low	57.1	34.7	8.2	Low	Low
	3rd factor	-0.538	Low	-0.538	Low	46.9	46.9	6.1	Low	Low
	4th factor	-0.264	Middle	-0.264	Middle	36.7	44.9	18.4	Middle	Middle
	5th factor	-0.497	Middle	-0.497	Middle	36.7	51.0	12.2	Middle	Middle
	6th factor	-0.424	Middle	-0.424	Middle	51.0	28.6	20.4	Low	Low-middle
	7th factor	-0.193	Middle	-0.193	Middle	22.4	67.3	10.2	Middle	Middle
Type D	1st factor	-0.244	Middle	-0.244	Middle	34.8	39.1	26.1	Middle	Middle
	2nd factor	-0.229	Middle	-0.229	Middle	34.8	47.8	17.4	Middle	Middle
	3rd factor	0.201	Middle	0.201	Middle	13.0	60.9	26.1	Middle	Middle
	4th factor	0.474	Middle	0.474	Middle	13.0	30.4	56.5	High	Middle-high
	5th factor	0.302	Middle	0.302	Middle	13.0	52.2	34.8	Middle	Middle
	6th factor	0.205	Middle	0.205	Middle	17.4	43.5	39.1	Middle	Middle
	7th factor	1.994	High	1.994	High	0.0	0.0	100.0	High	High

Table 14

Characteristics of Service Provider Types by Comprehensive Evaluation

4 Clusters	Factor's name	Contribution rate	Type A	Type B	Type C	Type D
1st factor	The ability to effectively recommend Products and service based on customers' needs	20.60%	High	High	Low	Middle
2nd factor	Motivation from brand loyalty	10.40%	High	Middle-High	Low	Middle
3rd factor	Realizing feelings and satisfaction by using company a's products and services	6.92%	Middle	High	Low	Middle
4th factor	Motivation to learn housekeeping techniques	5.52%	Low	High	Middle	Middle-high
5th factor	Sense of job and motivation in Company A	5.13%	Middle	High	Middle	Middle
6th factor	Taste into home and going out	4.70%	Middle	High	Low-middle	Middle
7th factor	Time pressure by childcare	3.84%	Low	Low-middle	Middle	High
Number of people			30	31	49	23

Figure 4. Histograms of attributes on each type.

Figure 4 illustrates the histograms regarding attributes (age, condition of youngest child, childcare duration, and usage period of products or service) of each service provider.

Table 15 reveals the interpretations of each service provider's type, based on Table 14 and Figure 4.

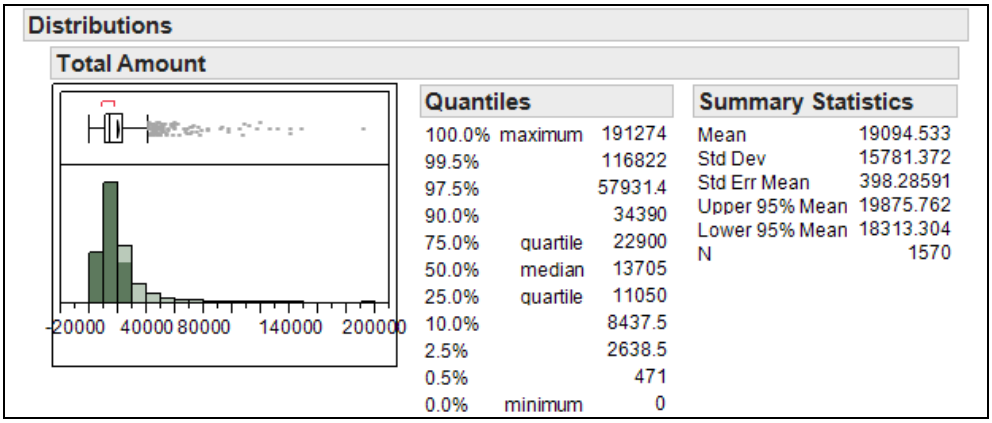
Table 15

Interpretation of Each Type

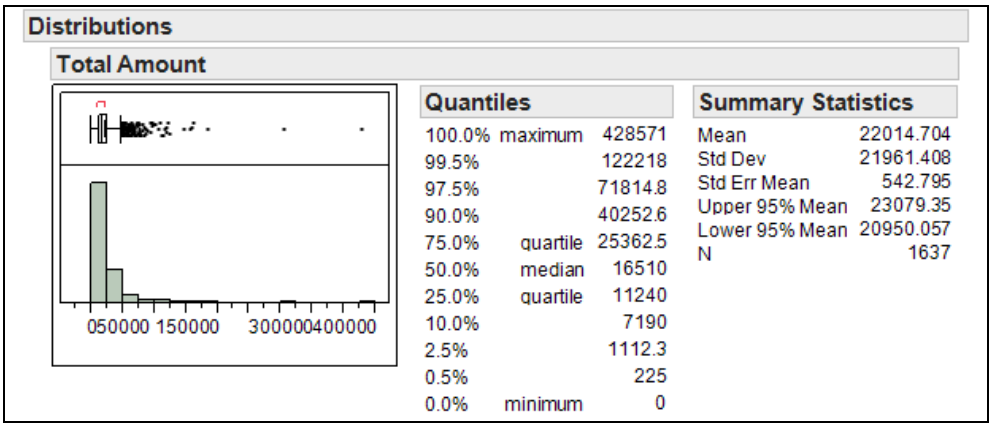
Type	Interpretation
Type A	This type has high confidence in products and services. Therefore, they have a high ability to recommend products and services, but low "motivation to learn housekeeping knowledge and techniques" and "time pressure by childcare". Their age mode is in the 50s.
Type B	This type is highly "concerned with home and going out", which is why they use Company A's products and services. Realizing feelings that "motivate learning housekeeping knowledge and techniques", a strong sense of job value and motivation, and an increasing "trust in products and services" and high "abilities to promote products and services based on customers' needs". Their age mode is in the 40s and 50s.
Type C	This type has a low "concern with home and going out". Although they use Company A's products and services, this does not change their "motivation to learn housekeeping knowledge and techniques" or a sense of job values and motivation. Therefore, they have low confidence in products and services, as well as low "abilities to promote products and service based on customers' needs". Their children are relatively grown and their age mode is in the 40s-50s.
Type D	This type has fairly high "motivation to learn housekeeping knowledge and techniques", they grow children well, and are younger service providers with an age mode in the 30s.

If the averages of purchases are focused on, Table 14 and Figure 5 show that amount of customer's purchases depends on service providers' abilities and a sense of values except for type D who are working on childcare. That is, the highest one is type B, in which both service providers' abilities and motivation are high, and the lowest one is type C, in which both service providers' abilities and motivation are low.

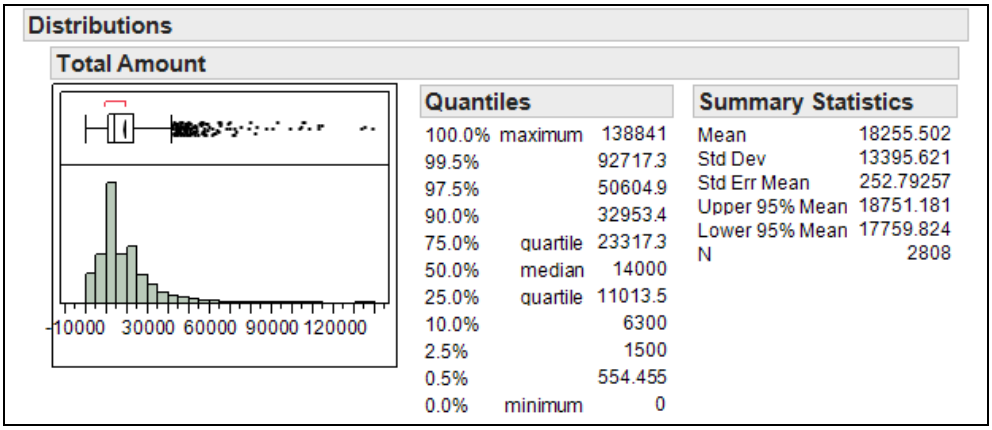
Most of service providers of type D are working on childcare and their average is low even though their motivation and skills are not so low.



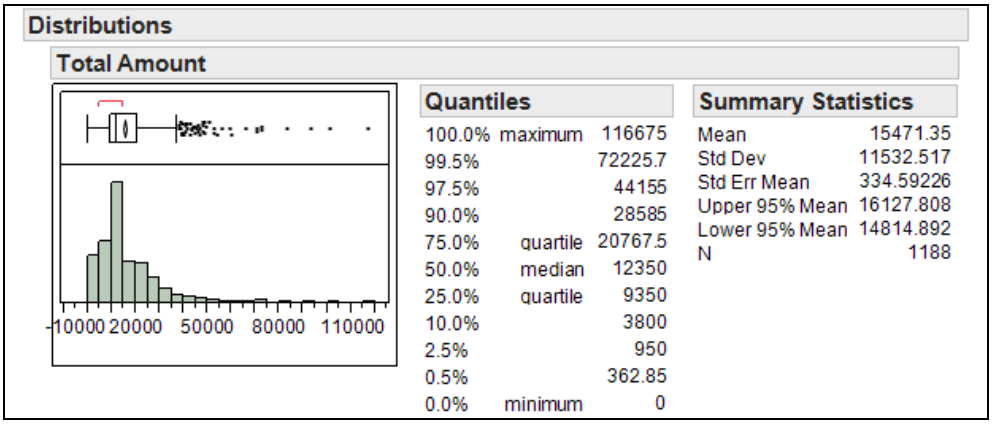
(a) Type A



(b) Type B



(c) Type C



(d) Type D

Figure 5. Histograms regarding sales by each service provider type and fundamental statistics.

Comparison and Investigation of the Structure of Bayesian Network for Each Combination Between Customer Types and Service Provider Types

Construction and discussion of each purchase Bayesian network model for each combination between customer types and service provider types. In this chapter, a purchasing Bayesian Network for each combination between customer and service provider types is constructed, extracted in previous chapters. Customers corresponding to service provider types are analysed, and have been typed by customer types (Figure 6).

customer type / service provider type	Type1	Type2	Type3	Type4	Type5	Type6
TypeA						
TypeB						
TypeC						
TypeD						

Figure 6. Combination between service provider and customer types.

As the data could not be analysed if no questionnaire survey response was provided for both service providers and corresponding customers, questionnaire survey data are analysed for 117 service providers with more than one customer-answered questionnaire survey, or 2,898 customers' survey data and their purchase history. A hypothesis is constructed in these Bayesian networks to narrow questionnaire survey variables to

those in product categories, to analyse how customers' sense of values, needs, and demands influence categories of purchase products. All variables were changed to variables with the below two values.

Transformation to the product categories' binary variable: Transform to "yes" when they purchase from the product categories, and "no" if they did not purchase.

Transformation to the questionnaire's binary variable: Transform levels 1, 2, and 3 to "low", and 4 and 5 to "high"; exceptions are as follows.

Transformation to the questionnaire's binary variable (exception);

Transformation to the childcare binary variable: Transform if not raising a child to "no", or to "yes" if raising a child.

Transformation to the binary variable of junior high school students: Transform 0 children as "no", or one child or more to "yes".

Additionally, Bayesian Network models were constructed using BAYONET, a Bayesian network-constructing support system. The probability structure research was conducted using AIC criteria by Greedy search.

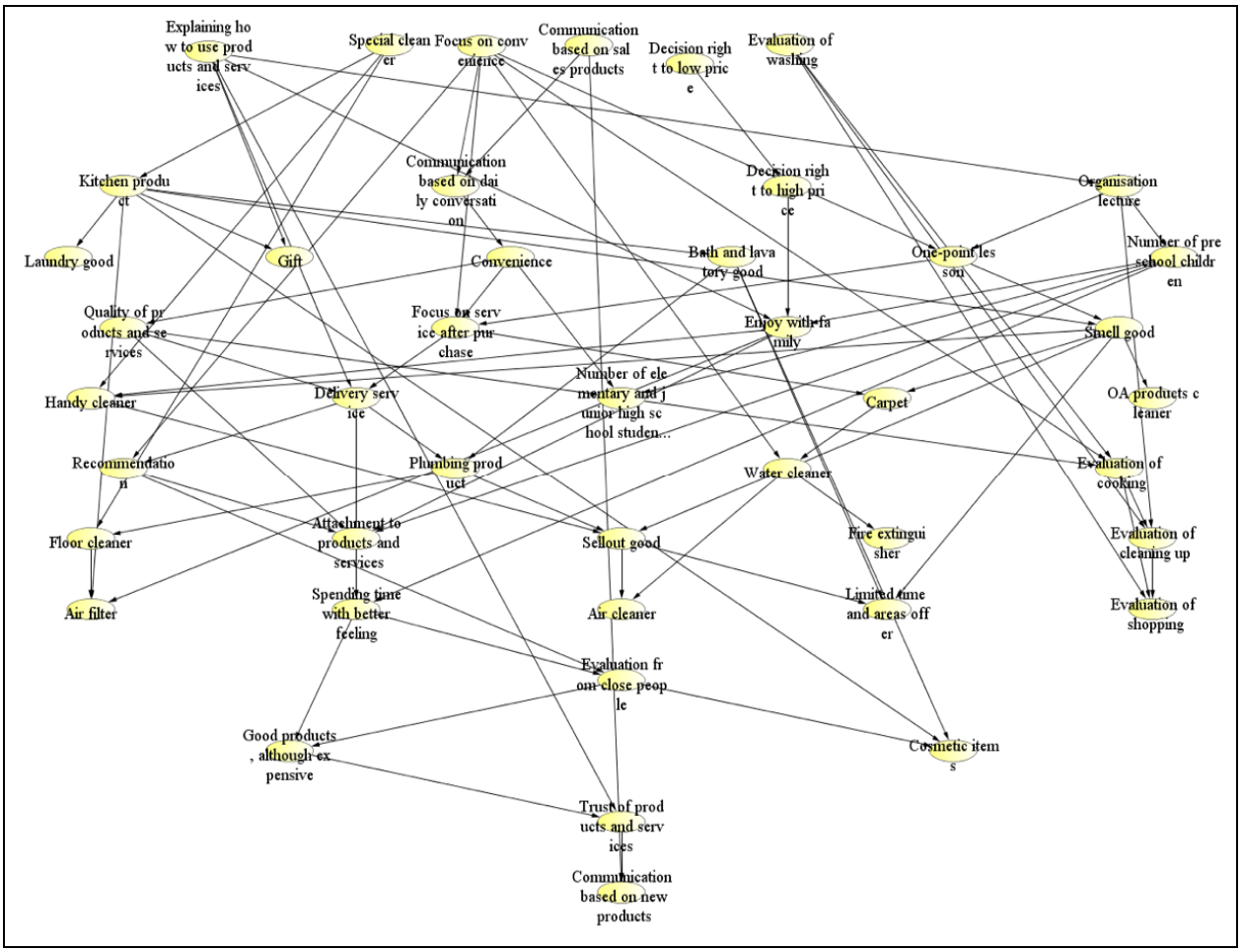


Figure 7. Purchasing Bayesian network model spD/cu3.

Figure 7 illustrates an example of a purchasing Bayesian network with a combination of service provider type D and customer type 3, noted as "spD/cu3" below.

The connection between customers' sense of values, needs, and preferences and their purchase behaviours is examined in Figure 7. The "Explaining how to use products and services" node connects to the "lecture of organisation", "delightfully clean up with family", "delivery service", "trust products and services", and "gift" nodes. This demonstrates that the "how to use products and services" node is a parent node of the five children nodes. Therefore, the "Explaining how to use products and services" parent node is key among the nodes. The "hub" concept is introduced in this paper (Imoto, 2011), and refers to a strong variable of influence to the child nodes in each Bayesian network model. Hubs in this study are extremely reduced when they are defined as having more than five child nodes. Similarly, hubs extremely increase when they are defined as having more than three child nodes. Therefore, there is no merit in discussing "hubs" in this instance, as hubs are defined as having more than four child nodes. Table 16 summarises the hubs in each purchasing Bayesian network for the combination of service provider and customer types. Each variable's left digit refers to the number of child nodes in Table 16.

Additionally, the attributes (age, condition of the youngest child, average daily childcare time, and usage period of products or services) and average sales in each combination between service provider and customer types are noted in Figure 8.

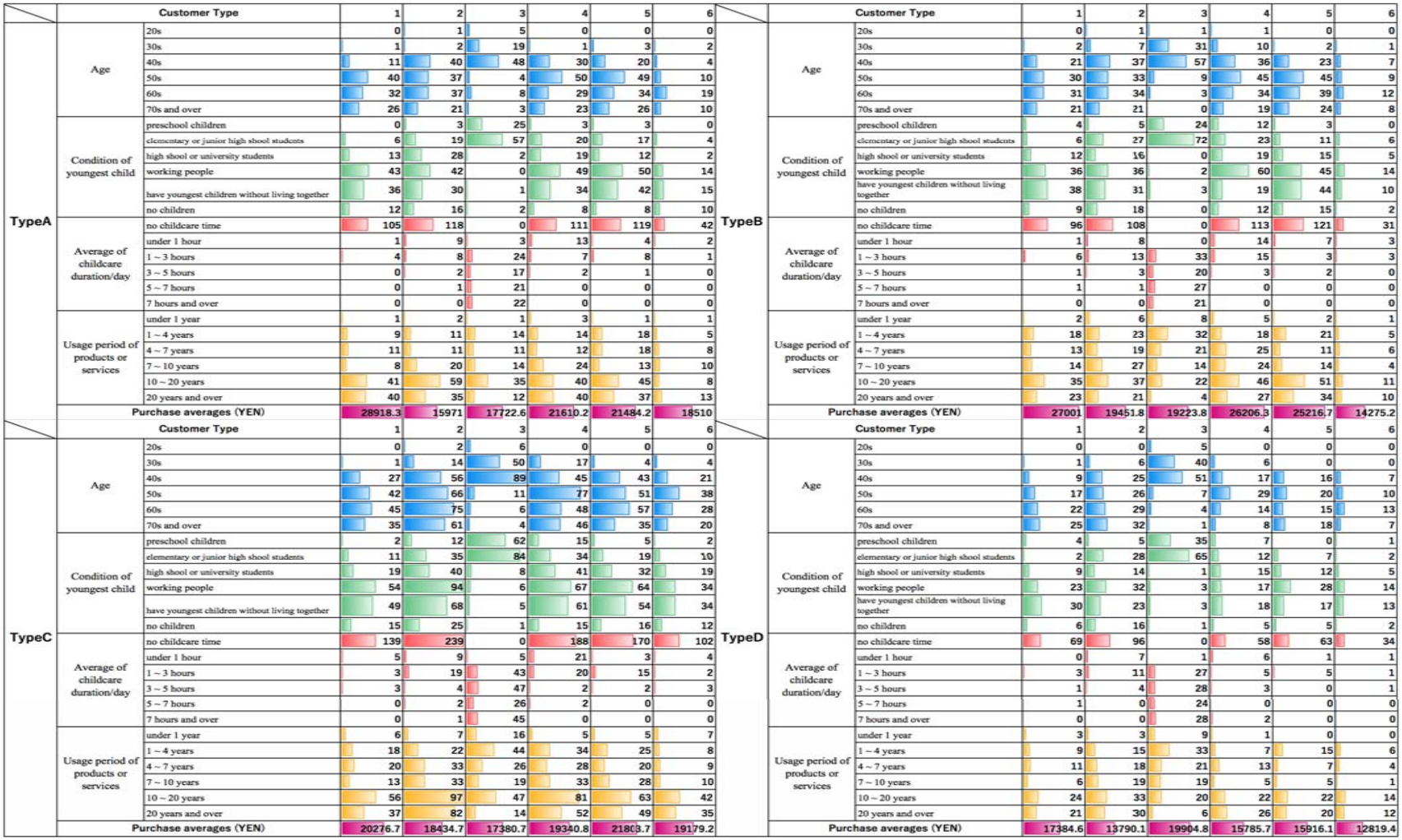
Table 16

The Hubs on Each Purchase Bayesian Network

	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6	
Type A	5	Explaining how to use products and services	5	Attachment to products and services	6	Number of preschool children	4	Number of elementary and junior high school students	5	Enjoy with family	6	Evaluation from close people
	4	Delivery service	5	Evaluation from close people	5	Good products, although expensive	4	Smell good	5	Recommendation	4	Focus on service after purchase
	4	Evaluation of washing	4	Time of raising children	4	Evaluation of washing			4	Evaluation of cleaning	4	Quality of products and services
	4	Evaluation of cooking	4	Decision right to low price	4	Organisation lecture			4	Evaluation from close people	4	Evaluation of shopping
	4	Evaluation of cleaning							4	Quality of products and services	4	Recommendation
	5	Bath and lavatory good							4	Organisation lecture	4	Explaining how to use products and services
									4	Bath and lavatory good		
									4	Cosmetic items		
Type B	7	Evaluation of washing	6	Attachment to products and services	5	One-point lesson	5	Focus on service after purchase	8	Evaluation of washing	6	Focus on convenience
	5	Decision right to high price	4	Trust of products and services	4	Delivery service	5	One-point lesson	6	Evaluation from close people	4	Evaluation of cooking
			4	Convenience	4	Good products, although expensive	5	Kitchen product	4	Attachment to products and services	4	Evaluation of washing
			4	One-point lesson	4	Quality of products and services	5	Living good			4	Evaluation of cleaning

(Table 16 continued)

Type B							4	Special cleaner			4	Attachment to products and services
							4	Laundry good				
Type C	5	Explaining how to use products and services	5	Evaluation from close people	7	Recommendation	7	One-point lesson	9	Evaluation of cleaning	5	Recommendation
	4	Enjoy with family	5	Evaluation of washing	6	Good products, although expensive	7	Attachment to products and services	6	Trust of products and services	5	Focus on convenience
	4	Evaluation of shopping	5	Time of raising children	5	Attachment to products and services	6	Focus on convenience	5	Attachment to products and services	4	Good products, although expensive
	4	Kitchen product	5	Enjoy with family	5	Organisation lecture	4	Focus on service after purchase	5	Focus on convenience	4	One-point lesson
			5	Communication based on new products	4	Evaluation of cleaning	4	Time of raising children	4	Evaluation of cooking	4	Limited time and areas offer
					5	Bath and lavatory good	4	Recommendation	4	Bath and lavatory good		
							4	Enjoy with family				
							5	Limited time and areas offer				
Type D	4	Evaluation of shopping	5	Trust of products and services	6	Focus on convenience	5	Communication based on sales products	6	Spending time with better feeling	6	Focus on service after purchase
	4	Communication based on sales products	5	Attachment to products and services	5	Explaining how to use products and services	4	Spending time with better feeling	5	Good products, although expensive	4	Attachment to products and services
			5	Evaluation of cooking	4	Number of preschool children			5	Focus on convenience	4	Evaluation of shopping
			5	Plumbing item	6	Kitchen product			4	Evaluation of cooking		
					5	Smell good			4	Explaining how to use products and services		



TypeA		Customer Type	1	2	3	4	5	6
	Age	20s	0	1	5	0	0	0
		30s	1	2	19	1	3	2
		40s	11	40	48	30	20	4
		50s	40	37	4	50	49	10
		60s	32	37	8	29	34	19
		70s and over	26	21	3	23	26	10
	Condition of youngest child	preschool children	0	3	25	3	3	0
		elementary or junior high shool students	6	19	57	20	17	4
		high shool or university students	13	28	2	19	12	2
		working people	43	42	0	49	50	14
		have youngest children without living together	36	30	1	34	42	15
		no children	12	16	2	8	8	10
	Average of childcare duration/day	no childcare time	105	118	0	111	119	42
		under 1 hour	1	9	3	13	4	2
		1 ~ 3 hours	4	8	24	7	8	1
		3 ~ 5 hours	0	2	17	2	1	0
		5 ~ 7 hours	0	1	21	0	0	0
		7 hours and over	0	0	22	0	0	0
	Usage period of products or services	under 1 year	1	2	1	3	1	1
		1 ~ 4 years	9	11	14	14	18	5
		4 ~ 7 years	11	11	11	12	18	8
		7 ~ 10 years	8	20	14	24	13	10
		10 ~ 20 years	41	59	35	40	45	8
		20 years and over	40	35	12	40	37	13
	Purchase averages (YEN)		28918.3	15971	17722.6	21610.2	21484.2	18510

TypeB		Customer Type	1	2	3	4	5	6
	Age	20s	0	1	1	1	0	0
		30s	2	7	31	10	2	1
		40s	21	37	57	36	23	7
		50s	30	33	9	45	45	9
		60s	31	34	3	34	39	12
		70s and over	21	21	0	19	24	8
	Condition of youngest child	preschool children	4	5	24	12	3	0
		elementary or junior high shool students	6	27	72	23	11	6
		high shool or university students	12	16	0	19	15	5
		working people	36	36	2	60	45	14
		have youngest children without living together	38	31	3	19	44	10
		no children	9	18	0	12	15	2
	Average of childcare duration/day	no childcare time	96	108	0	113	121	31
		under 1 hour	1	8	0	14	7	3
		1 ~ 3 hours	6	13	33	15	3	3
		3 ~ 5 hours	1	3	20	3	2	0
		5 ~ 7 hours	1	1	27	0	0	0
		7 hours and over	0	0	21	0	0	0
	Usage period of products or services	under 1 year	2	6	8	5	2	1
		1 ~ 4 years	18	23	32	18	21	5
		4 ~ 7 years	13	19	21	25	11	6
		7 ~ 10 years	14	27	14	24	14	4
		10 ~ 20 years	35	37	22	46	51	11
		20 years and over	23	21	4	27	34	10
	Purchase averages (YEN)		27001	19451.8	19223.8	26206.3	25216.7	14275.2

TypeC		Customer Type	1	2	3	4	5	6
	Age	20s	0	2	6	0	0	0
		30s	1	14	50	17	4	4
		40s	27	56	89	45	43	21
		50s	42	66	11	77	51	38
		60s	45	75	6	48	57	28
		70s and over	35	61	4	46	35	20
	Condition of youngest child	preschool children	2	12	62	15	5	2
		elementary or junior high shool students	11	35	84	34	19	10
		high shool or university students	19	40	8	41	32	19
		working people	54	94	6	67	64	34
		have youngest children without living together	49	68	5	61	54	34
		no children	15	25	1	15	16	12
	Average of childcare duration/day	no childcare time	139	239	0	188	170	102
		under 1 hour	5	9	5	21	3	4
		1 ~ 3 hours	3	19	43	20	15	2
		3 ~ 5 hours	3	4	47	2	2	3
		5 ~ 7 hours	0	2	26	2	0	0
		7 hours and over	0	1	45	0	0	0
	Usage period of products or services	under 1 year	6	7	16	5	5	7
		1 ~ 4 years	18	22	44	34	25	8
		4 ~ 7 years	20	33	26	28	20	9
		7 ~ 10 years	13	33	19	33	28	10
		10 ~ 20 years	56	97	47	81	63	42
		20 years and over	37	82	14	52	49	35
	Purchase averages (YEN)		20276.7	18434.7	17380.7	19340.8	21803.7	19179.2

TypeD		Customer Type	1	2	3	4	5	6
	Age	20s	0	0	5	0	0	0
		30s	1	6	40	6	0	0
		40s	9	25	51	17	16	7
		50s	17	26	7	29	20	10
		60s	22	29	4	14	15	13
		70s and over	25	32	1	8	18	7
	Condition of youngest child	preschool children	4	5	35	7	0	1
		elementary or junior high shool students	2	28	65	12	7	2
		high shool or university students	9	14	1	15	12	5
		working people	23	32	3	17	28	14
		have youngest children without living together	30	23	3	18	17	13
		no children	6	16	1	5	5	2
	Average of childcare duration/day	no childcare time	69	96	0	58	63	34
		under 1 hour	0	7	1	6	1	1
		1 ~ 3 hours	3	11	27	5	5	1
		3 ~ 5 hours	1	4	28	3	0	1
		5 ~ 7 hours	1	0	24	0	0	0
		7 hours and over	0	0	28	2	0	0
	Usage period of products or services	under 1 year	3	3	9	1	0	0
		1 ~ 4 years	9	15	33	7	15	6
		4 ~ 7 years	11	18	21	13	7	4
		7 ~ 10 years	6	19	19	5	5	1
		10 ~ 20 years	24	33	20	22	22	14
		20 years and over	21	30	6	26	20	12
	Purchase averages (YEN)		17384.6	13790.1	19904.8	15785.7	15916.1	12819.4

Figure 8. Attribution and average of sales for the combination between each service provider type and customer type.

Table 16 illustrates that variables with high factor loading scores of the first factor "loyalty caused by realising feelings from using products and services" become hubs in customer types 2, 3, 4, 5, and 6, which are not high loyalty. This means customer loyalty is an important element during purchase behaviour for non-loyal customer types. However, the first factor's variables do not appear as a hub in service provider type A/customer type 4, and service provider type B/customer type 4. Further, the first factor of customer type 4 is evaluated as "middle", but the average first factor score for customers corresponding to service provider type A is 0.247; the average for service provider type B is 0.211, and the factor score for customer type 4 is second, followed by customer type 1. Additionally, service provider types A and B exhibit high ability and loyalty. Therefore, the first factor variable does not appear as a hub because the loyalties of combinations between service provider type A/customer type 4, and service provider type B/customer type 4 are relatively high.

Alternatively, the variables with high factor loading scores in the first factor do not appear as hubs in customer type 1 because the loyalty of customer type 1 is already high. However, variables have high factor loading scores for the second factor, "family's evaluation of housework", and fourth factor, "demand for products and services as a housewife".

Further, the average customer purchases of customer type 3, which raises children, tends to depend on the service provider types.

Figure 8 notes that the averages of customer purchases corresponding to service provider types B and D are high in customer type 3. In service provider type D, the sales averages of all except customer type 3 are lower than other service provider types, but customer type 3's sales average is the highest. As service providers in type D and customers in type 3 raise children, this service provider type understands customers' feelings regarding raising children, and can take an appropriate approach. Additionally, type B service providers have high abilities and motivation; therefore, the purchase averages of customer type 3 as corresponding to service provider types B and D are also high, and service providers in type B can offer customer-oriented service. Moreover, customer type 6 further investigated in Table 6, which notes that these customers do not communicate with their service providers, and their loyalty is evaluated as "low-middle". The sales averages of customers in type 6 as corresponding to service provider types A and C are relatively high. However, one of the customers corresponding to service providers in type A is an outlier, and demonstrates abnormally high purchasing. The average of customer sales except for the outlier is 16,508 yen. Therefore, the purchase average of customers in customer type 6 corresponding to service providers in type C, except the outlier, is the highest. The type C service providers' abilities and motivation are low, and their self-evaluation is the lowest of all service provider types. Customers in type 6 do not wish to communicate with service providers; therefore, they essentially match service provider type C's sales.

The "kitchen and smell goods" appeared as hubs for service provider type D/customer type 3. According to hearing survey for local service providers in City I, it was found that "kitchen products" include detergents that can wash vegetables and baby bottles. The Bayesian network results were led by an analysis of service providers' sales data. Therefore, the hub analysis of the Bayesian network compels service providers to subconsciously check their own behaviours, and reaffirm and share their knowledge.

Next, combination types are compared. As aforementioned, the hubs of service provider type C/customer type 3 are compared with hubs of service provider type D/customer type 3. Service provider type C has low abilities and confidence in their products and services. Therefore, three variables with high first factor loading appear in these hubs. Additionally, service providers type C's sales average for customer type 3 is the lowest,

and bath and lavatory goods appear in these hubs. This point is considered as characteristic of service provider type C's sales, because the same situation with service provider type C/customer type 5 is discovered.

Predictions from stochastic reasoning in the Bayesian network for each combination between service provider and customer types. This chapter illustrates the predictions from stochastic reasoning in the Bayesian network for each combination of service provider and customer types. The stochastic reasoning method is used to set the conditions of the customer questionnaire survey ("high" or "low"), and to set product category objective variables ("yes" or "no") and compare the purchase probabilities between the "high" and "low" conditions. Table 17 provides an example of the differences in purchase probability in "high" and "low" conditions.

Table 17

The Differences in Purchase Probability, Conditioned by "High" and "Low"

	Time of raising children	Evaluation of cooking	Evaluation of washing	Evaluation of cleaning up	Evaluation of shopping	Spending time with better feeling	Quality of products and services	Convenience	Attachment to products and services
OA products cleaner	0.00%	-0.01%	0.00%	0.00%	0.00%	-0.02%	0.00%	0.01%	0.01%
Gift	0.00%	-0.01%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.23%
Laundry good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Water cleaner	0.00%	-1.09%	0.00%	0.00%	0.00%	-0.08%	0.14%	0.76%	-0.22%
Cosmetic items	0.00%	-0.01%	0.00%	0.00%	0.00%	-0.27%	-0.02%	0.00%	-0.16%
Air filter	0.00%	0.01%	0.00%	0.00%	0.00%	0.09%	-0.01%	0.00%	0.42%
Limited time and areas offer	0.00%	-0.04%	0.00%	0.00%	0.00%	-0.14%	-0.02%	0.02%	0.12%
Air cleaner	0.00%	-0.18%	0.00%	0.00%	0.00%	-0.04%	0.01%	0.12%	-0.01%
Smell good	0.00%	-0.09%	0.00%	0.00%	0.00%	-0.23%	0.01%	0.07%	0.13%
Floor cleaner	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.02%	0.01%	0.03%
Fire extinguisher	0.00%	-0.21%	0.00%	0.00%	0.00%	-0.01%	0.03%	0.14%	-0.04%
Plumbing product	0.00%	-0.01%	0.00%	0.00%	0.00%	-0.63%	-0.21%	-0.06%	-0.28%
Special cleaner	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kitchen product	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Handy cleaner	0.00%	0.02%	0.00%	0.00%	0.00%	0.50%	0.00%	0.01%	2.11%
Living good	0.00%	-0.01%	0.00%	0.00%	0.00%	-0.20%	-0.08%	-0.01%	0.26%
Carpet	0.00%	0.49%	0.00%	0.00%	0.00%	0.07%	0.03%	0.23%	0.18%
Bath and lavatory good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

	Trust of products and services	Recomme-ndation	Evaluation from close people	Good products, although expensive	Focus on convenience	Focus on service after purchase	Decision right to low price	Decision right to high price	Enjoy with family
OA products cleaner	-0.02%	-0.03%	-0.01%	-0.01%	-0.10%	-0.09%	0.00%	0.00%	-0.04%
Gift	0.52%	0.42%	0.16%	0.12%	0.00%	0.05%	0.00%	0.00%	1.80%
Laundry good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Water cleaner	-0.13%	-1.36%	-0.40%	-0.21%	-9.72%	-0.27%	0.00%	0.00%	-0.05%
Cosmetic items	-0.51%	-0.49%	-1.83%	-0.89%	-0.07%	-0.04%	0.00%	0.00%	-0.02%
Air filter	0.06%	0.01%	0.01%	0.02%	0.00%	-0.01%	0.12%	0.23%	2.66%
Limited time and areas offer	-0.09%	-0.23%	-0.08%	-0.06%	-0.51%	-0.50%	0.03%	0.05%	0.33%
Air cleaner	-0.03%	-0.28%	-0.08%	-0.05%	-1.63%	-0.08%	0.01%	0.02%	0.22%

(Table 17 continued)

Smell good	-0.19%	-0.32%	-0.12%	-0.09%	-1.22%	-1.14%	0.00%	0.00%	-0.49%
Floor cleaner	0.03%	0.12%	0.05%	0.03%	0.02%	0.04%	0.00%	0.00%	0.04%
Fire extinguisher	-0.03%	-0.26%	-0.07%	-0.04%	-1.85%	-0.05%	0.00%	0.00%	-0.01%
Plumbing product	-0.25%	-1.11%	-0.40%	-0.28%	-0.14%	-0.34%	0.00%	0.00%	-0.36%
Special cleaner	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kitchen product	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Handy cleaner	0.31%	0.19%	0.13%	0.13%	-0.11%	-0.08%	0.59%	1.13%	12.97%
Living good	-0.07%	-0.46%	-0.16%	-0.10%	-0.25%	-0.31%	0.10%	0.19%	1.96%
Carpet	0.03%	0.75%	0.22%	0.12%	4.22%	10.70%	0.00%	0.00%	-0.11%
Bath and lavatory good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

	Explaining how to use products and services	Delivery service	One-point lesson	Organisat-ion lecture	Communic-ation based on daily conversation	Communic-ation based on sales products	Communic-ation based on new products	Number of preschool children	Number of elementary and junior high school students
OA products cleaner	-0.16%	-0.05%	-1.00%	-0.52%	0.02%	0.00%	0.00%	-0.09%	0.04%
Gift	6.33%	1.89%	1.01%	2.03%	0.00%	0.00%	0.07%	0.37%	-0.16%
Laundry good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Water cleaner	-0.19%	-0.09%	-2.14%	-0.61%	2.13%	0.02%	0.00%	-0.11%	0.12%
Cosmetic items	-0.04%	-0.14%	-0.02%	-0.02%	0.01%	0.00%	-0.07%	-0.02%	0.01%
Air filter	0.65%	0.04%	0.09%	0.17%	0.00%	0.00%	0.01%	-0.18%	0.07%
Limited time and areas offer	-0.78%	-0.74%	-4.97%	-2.60%	0.10%	0.00%	-0.01%	-0.51%	0.22%
Air cleaner	-0.06%	-0.24%	-0.58%	-0.22%	0.36%	0.00%	0.00%	-0.06%	0.04%
Smell good	-1.96%	-0.67%	-12.25%	-6.37%	0.25%	0.00%	-0.02%	-1.15%	0.49%
Floor cleaner	0.14%	0.55%	0.03%	0.05%	0.00%	0.00%	0.00%	0.01%	0.00%
Fire extinguisher	-0.04%	-0.02%	-0.41%	-0.12%	0.41%	0.00%	0.00%	-0.02%	0.02%
Plumbing product	-1.27%	-4.93%	-0.23%	-0.42%	-0.01%	-0.01%	-0.04%	-0.07%	0.04%
Special cleaner	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kitchen product	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Handy cleaner	3.18%	0.94%	-0.64%	0.33%	0.02%	0.00%	0.04%	-0.97%	0.39%
Living good	-0.25%	-1.91%	-1.93%	-1.01%	0.04%	0.00%	-0.01%	-0.35%	0.15%
Carpet	-0.46%	0.70%	-2.48%	-1.51%	-0.65%	0.06%	0.04%	-0.27%	0.13%
Bath and lavatory good	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 17 reveals the significant differences in purchase probability, as evidenced by the questionnaire “Do you want products that can delightfully clean with family?”, as “delight with family”/“elow” falls under the condition between “high” and “low” (answer: “high”, “low”). The results are illustrated in Figure 9, a graph noting the purchase probabilities for combinations of service provider type D and customer type 3, and in Figure 10, which displays a graph of the purchase probabilities for service provider A in combination with service provider type D and customer type 3.

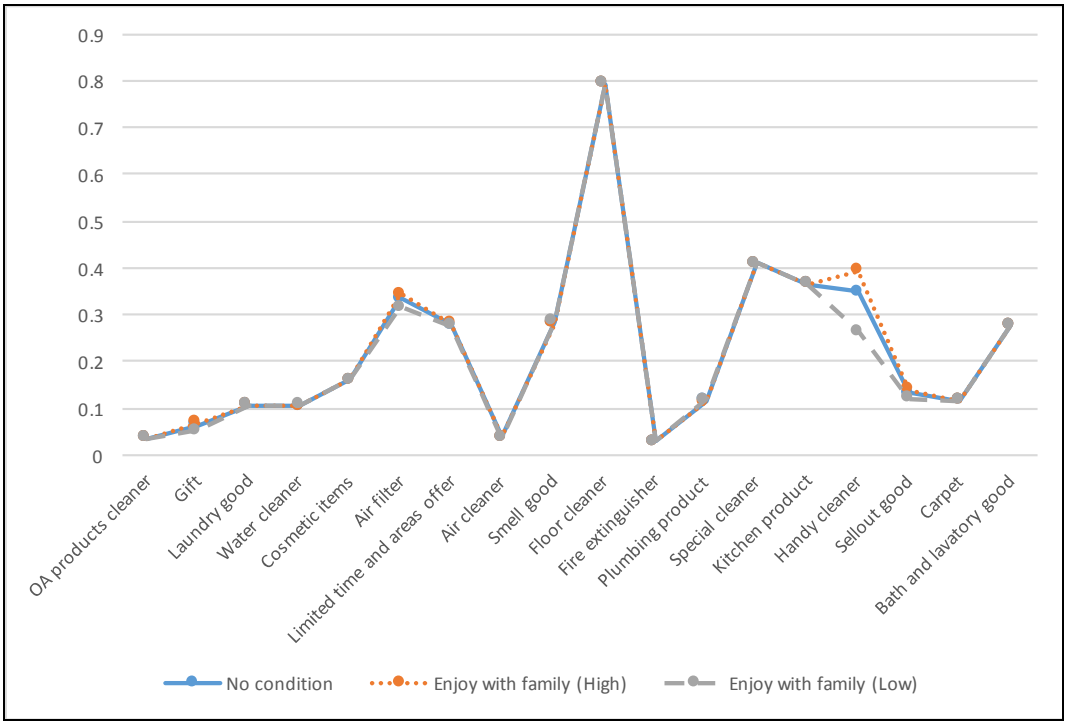


Figure 9. Purchase probabilities of spD/cu3 type.

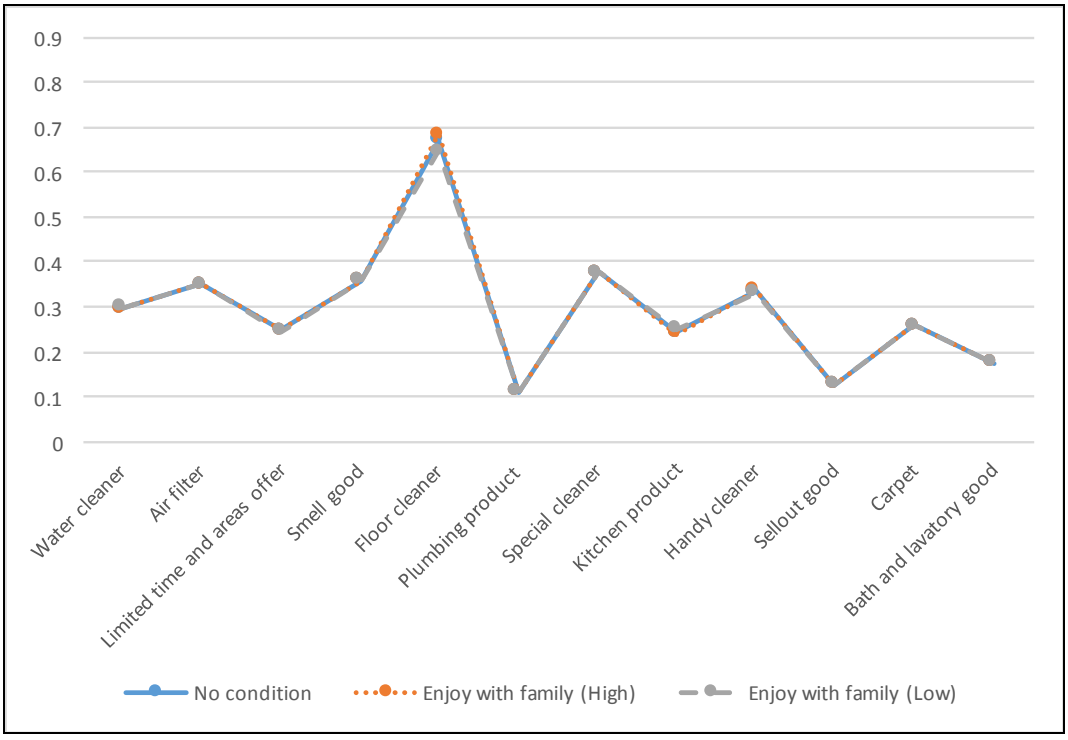


Figure 10. Purchase probabilities of service provider A in spD/cu3 type.

Figure 9 displays the significant differences in the purchase probabilities of a handy cleaner, as conditioned by the question involving “delight with family?”, which is characteristic of the combination of spD/cu3. This is because they are raising children, and may perceive the handy cleaner as easy for cleaning that

involves children. Therefore, the handy cleaner has sold well. However, the analysis results with service provider A do not parallel the above. It can be recommended that service provider A recommend the handy cleaner to the customer that answers “high” in the question “delight with family?”.

An analysis method to support service provider sales behaviours in presenting effective products categories is proposed. The recommended product categories are effective for each customer, and are led by analysing customers’ questionnaire data and purchase history.

Phase 1: Classify service providers and customers into types. Construct a purchasing Bayesian network with each combination of service provider and customer type.

Phase 2: Predict the purchase probabilities from stochastic reasoning, based on the structured purchasing Bayesian network constructed in Phase 1.

Phase 3: Display recommended product categories in each combined type.

Phase 4: Construct a purchasing Bayesian network by service provider, in belonging to the service provider type.

Phase 5: Predict the purchase probabilities from stochastic reasoning, based on structured purchasing Bayesian network as constructed in Phase 4.

Phase 6: Compare this to the results of differences in the purchase probabilities from stochastic reasoning in Phases 2 and 5. When a service provider cannot sell the products sold by other service providers in the type, the service provider will be supported with a recommended customer list.

Conclusion

This study clustered service providers and customers into types by their questionnaire survey answers about a sense of values, needs, and abilities. Purchase characteristics were then discussed as modelled by each combined-type Bayesian network, which were constructed of customer purchase history and questionnaire survey data. The variables were extracted as hubs in each combination type, and points were revealed that service providers must address to meet their customers’ needs. Hubs among combinations of customer and service provider types were compared and discussed. Further, stochastic reasoning predictions were indicated in structured purchase Bayesian network models as levels of customer questionnaire survey variables were set as conditions, and set the level of product category variables as objects. As a result, the difference in purchase probability with “high” and “low” levels is calculated in each type. Moreover, the purchasing Bayesian network model in each service provider in the type was structured, and the purchase probability for the service provider was predicted using stochastic reasoning. Finally, the differences between the purchase probabilities under “high” and “low” conditions for all service providers in the service provider type were compared with those differences for service provider A in the type. It was proposed that a support system could improve service providers’ sales skill by submitting recommendations for appropriate customers when there is a small difference in the purchase probabilities for the service provider in the type in comparison with those for all the number of the type.

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