Applied Studies in Agribusiness and Commerce – APSTRACT
University of Debrecen, Faculty of Economics and Business, Debrecen
DOI: 10.19041/APSTRACT/2020/3-4/4

SCIENTIFIC PAPER

STATISTICAL AND MULTI-CRITERIA DECISION MAKING ANALYSIS FOR CONSUMER ATTITUDE AND BEHAVIOR: IN CASE OF MONGOLIAN ORGANIC FOOD MARKET

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Abstract: *Nowadays, consumers have a full knowledge on products and services, and their daily consumption of healthy and environmentally friendly products has been increasing. Therefore, businesses need to implement green marketing activities, so they need to be aware of environmental issues and consumer needs while maintaining financial sustainability and competitiveness (Belz, Karstens, 2002). Examples are the rapid growth of organic food products, as consumers are concerned with their health and environmental issues in their day-to-day purchasing decisions. Over 20 years ago, in 1999, the market for organic food products sales was $ 15.2 billion, while sales in 2017 increased to $ 97 billion, indicating that the world's organic food market is growing rapidly. The organic food market is growing by $5 billion a year, and as of 2014, 172 countries have organic food farm land according to the "The World of Organic Agriculture". Since the market for organic products is a new market for Mongolia, previous surveys are relatively small. Therefore, this is aimed at conducting a study on behavioral approaches of consumers of organic food products in Ulaanbaatar. We have run statistical and multi-criteria decision making analysis based on given data of consumers. We also apply Harker's techniques for complete and incomplete evaluation matrices which are defined from consumers decision making. Numerical examples are presented.*

Keywords: *consumer behavior, statistical analysis, multi-criteria decision making*
(JEL Classification: *M30, M31, M37*)

INTRODUCTION

Consumer's knowledge about the benefits of eating organic foods is supported by consumers' ever increasing purchase. Consumers are keen to buy more traditional grown food products and are more than delighted to offer more money to buy such products. Thus, entrepreneurs and farmers are keen to focus on their organic food production by strengthening their own competitive advantages in the market while without using strong fertilizers and less chemicals. Moreover, consumer gender is another factor in buying and consuming organic foods. According to Davies et al. (1995) and Urena et al. (2008), women buy more organic foods and tend to be more positive towards organic foods than men. Davies et al. (1995) and Roitner-Schobesberger et al. (2008) assume that organic food consumers have higher income levels than others. Many studies have also shown that also the purchasing frequency is low for the younger consumers, they tend to be more willing to purchase organic foods even if they have to pay more. In other words, organic food consumers tend to be younger than the counterpart consumers (Jolly,

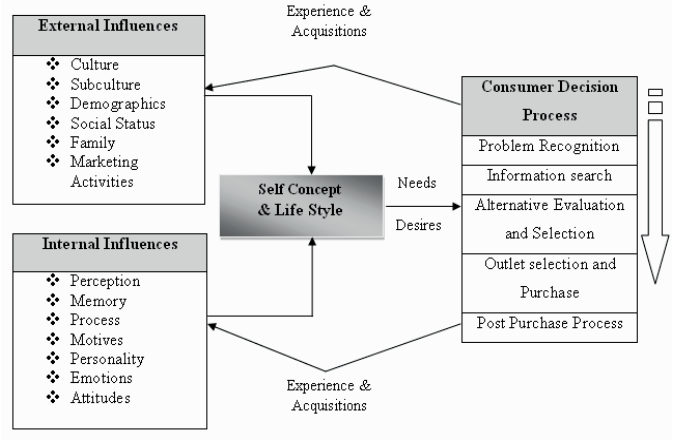
1991). But senior citizens tend to prefer organic foods as well (Durham, 2007). Based on these findings, we aim to bring the main purpose of our research from the consumer's behavioral purchasing behavior of Mongolian consumers, whether it is consistent with the results of the survey and to distinguish between Mongolian users from other countries users.

MATERIAL AND METHODS

Customer behavior

Consumer behavior is the study of a decision to purchase goods and services to meet their needs and wants. And to take steps to change their decisions (Hawkins, Mothersbaugh, 2016). According to Blakwell, Minard, and Engel (2001), the behavior of consumers is the process of finding, buying and using a product or service

Figure 1: Consumer behavior behavior main chart



Source: Mothrsbaugh and Hawkins, 2016

Organic products

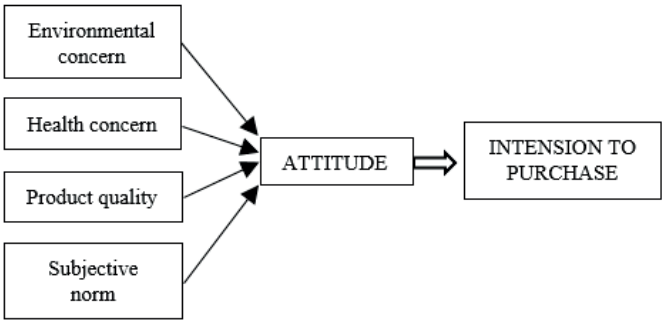
Organic produce is made without the help of chemical fertilizers or insecticides for the reason of genetic changes (Smith Spangler, 2012). Therefore, organic food is considered to be healthy because it does not contain any chemicals (Suprapto and Wijaya, 2012). Also, in many scientific articles, organic food is expressed in terms of natural, local, fresh, and impure.

In recent years, consumers' perceptions of chemical ingredients and their effects on food products have contributed to the rise in purchasing of organic foods. Basha and Mason analysts conducted a trend study on consumer nutrition in 2015 and in the study, the most common catalysts that influence organic purchasing decisions on organic consumers are:

- Environmentally friendly
- Health Benefits
- Product quality
- Social impacts are examined.

As a result of the survey, general knowledge about organic products has increased, and the purchasing trend has been increasing (Basha, Mason 2015).

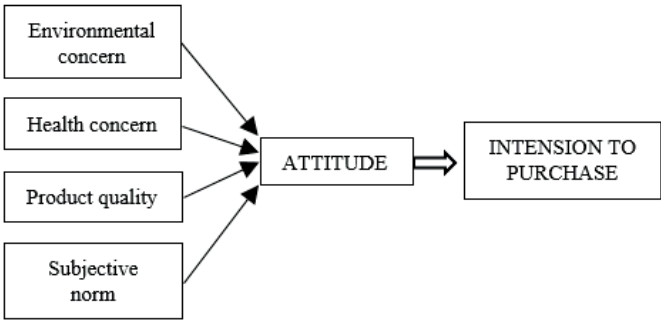
Figure 2. The approach to purchasing organic food



Source: Basha, Mason, et al. 2015

Rana and Paul (2017) believe consumers' health-promoting, quality and safety, and environmentally-friendly features are of great importance to consumers that are buying organic food products. Also, when a product has an organic produce certificate, it generates an uneven purchasing tendency for consumers. Consumers who buy non organic produce tend to have low social consciousness.

Figure 2. The approach to purchasing organic food



Source: Basha, Mason, et al. 2015

Rana and Paul assumed that consumers would be able to use regular organic food products, and to provide consumers with the right to use the right information in multiple channels and to distribute organic food products through broad channels.

Research Survey

1. Secondary data

The approach to approaching organic food is being studied by international scientists in their own prospective countries. Most scientists have learned that consumers are buying tendencies based on their time, financial status and resources when purchasing organic food products. The most important thing is that organic products are positively influenced by human health, so they choose to buy environmentally friendly products.

Table 1: Statistical studies on international organic foods

Top of research	Citation	Country context	Methods	Factors (Very important)
Effect of situation on the purchase intention and behavior	Grimmer et al. (2015)	Australia	Empirical tests, using consumers (n=772)	Price Availability Ease of purchase High perceived prior knowledge High levels of future orientation
An extension of the benefit segmentation base for the consumption of organic food	Gad Mohsen and Dacko (2013)	UK	Questionnaire (Correlation and regression)	
Factors influencing purchasing behavior of organic food	Shamsolla et al (2013)	Malaysia	Questionnaire (Descriptive Analyses, Correlation, Coefficient Analysis)	Knowledge and Education Environmental Concern Health Consciousness Demand is Price Inelastic
Demand analysis of organic milk	Government (2016)	Germany	Price-elasticity estimates on a panel data set of 20000 households.	
Purchase behavior and influence of social economic factors with reference to organic food products	Santhi et al. (2007)	India	Questionnaire (Descriptive Analysis, Chi square, ANOVA and factor analysis)	Marital status Food habits (Vegetarian) of the respondents
Determinants of regular and occasional consumers' intentions to buy organic food	Pino et al. (2012)	Italy	Survey and Structural Equation Model	Ethical commitment Food safety Availability Income Health and environmental considerations Visual attractiveness of products Quality and Safety
Determinants of purchasing behavior for organic and integrated fruits and vegetables in Slovenia	Shamsolla and Juvancic (2010)	Slovenia	Questionnaire (Ordered Profit Model)	
Quality, safety, and consumer behavior toward organic food	Lucas et al. (2008)	Germany (Berlin) Portugal (Lisbon)	Questionnaire (Chi square, ANOVA)	
Community of organic food consumers: An expiratory study	Essoussi and Zahaf (2008)	Canada	Survey: (Content analysis-verbatim transcripts of the audio-taped interviews)	Knowledge of organic content Labeling and certification Health Environmental concern Animal welfare
Attitudes and behavior toward organic products: An expiratory study	Tsakiridou et al. (2008)	Greece	Questionnaire (Descriptive statistics and non-parametric tests - Mann Whitney and Kruskal-Whallis)	

In these international articles, organic food producers have a positive impact on human health and the environment, so consumers are more likely to buy organic products. Also one of the important factors about organic food is the labeling and safety.

According to the above studies, most developed countries in the world have knowledge about organic foods and tend to buy regularly. Manufacturers and entrepreneurs are rapidly entering the market, taking their own positions within the market and increasing their profits while most importantly, the environment and the people are satisfied with the needs of the customers.

2. General information of the survey participants

According to the general data of the surveyed participants, the majority of them are men, accounting for 56.7%. In terms of age, 31.5% are 36-45 years old, 28.2% are 26-35 years old, 16.7% are from 16-25 years old, 11% are 46-55 years old, 9.8% are 56-65 years old, and lastly the lowest being 2.3% were over 66 years of age.

The most important factor for the consumers of organic foods was that there are no chemicals agents and the average value is 4.11. The deviation from the mean is 1.17.

Table 2: Factors that make consumers buy organic foods

Factors	Means	Standard Deviation	Frequency				
			1	2	3	4	5
Taste	4.06	1.12	5.20%	3.30%	18.70%	25.20%	47.50%
Price	3.87	1.22	6.90%	7.90%	17.00%	27.50%	40.70%
Smell	3.86	1.22	7.90%	5.20%	18.70%	28.50%	39.70%
Freshness	4.29	1.00	2.60%	4.30%	11.10%	24.60%	57.40%
Experience	4.01	1.14	6.20%	4.30%	14.80%	31.50%	43.30%
Ingredients	4.07	1.12	4.60%	6.90%	11.50%	30.80%	46.20%
Manufacturer's prestige	3.73	1.20	6.90%	9.20%	20.30%	30.80%	32.80%
Brand's prestige	3.72	1.18	7.20%	8.50%	18.40%	36.70%	29.20%
Advice from other people	3.43	1.29	11.10%	12.50%	23.90%	26.60%	25.90%
Sales, bonus	3.28	1.42	17.70%	11.80%	20.70%	23.60%	26.20%
To not have chemical agents	4.11	1.17	3.90%	9.80%	10.80%	22.00%	53.40%
Expiry date	4.08	1.15	5.20%	5.20%	15.40%	23.90%	50.20%
Information on label	3.98	1.18	5.60%	7.50%	15.10%	26.90%	44.90%
Size and weights	3.77	1.38	10.50%	10.50%	14.80%	20.00%	44.30%
Choice by family members	3.85	1.21	5.20%	10.20%	19.70%	23.90%	41.00%
Package	4.04	1.14	3.30%	9.20%	15.40%	23.90%	48.20%
Standard	4.03	1.18	5.20%	7.90%	13.40%	24.60%	48.90%

Table 3: Analysis of what information consumers much prefer from the label of organic foods

Information on label	Frequency		Mean	Standard deviation
	Yes	No		
Calories	57.7%	42.3%	0.57	0.49
Fat	55.4%	44.6%	0.55	0.49
Salt	49.5%	50.5%	0.49	0.5
Supplement	51.8%	48.2%	0.51	0.5
Vitamin	39.7%	60.3%	0.6	0.49
Expiry date	77.7%	22.3%	0.77	0.41
Sugar	61.0%	39.0%	0.6	0.48
Produce date	74.4%	25.6%	0.74	0.43
Manufacturer's information	47.9%	52.1%	0.47	0.5
Product warranty	50.8%	49.2%	0.5	0.5
Fiber	42.3%	57.7%	0.42	0.49

According to the results, 77.7% of the surveyed participants reported that the expiry date of organic food and the date of manufacture is the most important. while the lowest was 39.7% which represents the vitamins that are in the organic produce. 42.3% of participants considered the representation of fiber. The two parameters of vitamin and fiber also have a lower standard deviation than other variables.

3. Correlation analysis

Pearson's correlation analysis was carried out to examine the correlation between income, age, gender, family size and education in organic food consumers.

Table 4: Dependency Testing Table

		1	2	3	4	5
1	Satisfication	1				
2	Education	.169**	1			
3	Age	-.118*	-0.06	1		
4	Sex	- 0.01	.20**	0.07	1	
5	Income	.130*	.40**	-0.10	0.02	1
6	Family members	0.06	0.02	-.13*	- 0.01	- 0.06

. Correlation is significant at the 0.01 level (2-tailed)

The satisfaction after buying organic products is not dependent on education, family size, age, gender, or income. In order to confirm the hypothesis, we made a Pearson Correlation Analysis on a 95% confidence level. According to the above study, income and education is positively related to each other, however, the correlation force is very low, Pearson correlation 0.130 (revenue) is 0.169 (education). However, depending on the number of family members and sex, the difference in customer satisfaction is the value of sig (2-tailed) 0.749 (sex) sig (2-taled) 0.292 (family). While the age is associated with post-satisfaction, sig (2-tailed) indicates that the 0.39 value is expressed and the Pearson correlation -0.118 indicates that it is very negative in satisfaction.

The following hypotheses are shown in the results of the research:

H1: Purchase of organic products that are produced in Mongolia is influenced positively.
According to research findings, the influence of education level to purchase organic food is very positive.
H2: The age of the consumers has no effect on purchase of organic food products in Mongolia.
This hypothesis is also proven. The satisfaction of the younger generation from both organic food and other food is almost the same.
H3: Gender has an effect on post-purchase satisfaction of organic food produced in Mongolia.
This hypothesis is refracted, in other words gender related factors are less important.
H4: The income level positively affects purchase of organic foods produced in Mongolia.
Factual analysis shows that this hypothesis is proven, influence is quite weak.
H5: The number of family members is a factor of the purchase of organic foods produced in Mongolia.

This hypothesis confirms that the number of family members does not affect purchase amount.

4. Cluster analysis

Cluster analysis was made in order to classify the users of organic food products by their characteristics, and the Two Step Cluster method was used to do it. This method is more realistic because the software automatically calculates the quantities and creates the most likely clusters. The cluster analysis is a method of determining segments that can be based on the similarities of responses to each respondent's questionnaire, and our survey results are as follows. Initially identifying personal information or profile of the segments, and then intended to give a convenient name to each of those segments depends on what they're referring to when buying organic food.

Table 5: Clusters

	Cluster A	Cluster B	Cluster C
Personal information	26-35 years old, works in business organization, 3-4 family members, income of 1,000,101-1,300,000₮, and most of them are lives in Khan-Uul district and have higher education.	For the those who are 36-45 years old, works in business organizations, 3-4 family members, income of 320,000-500,000₮, those who live in Bayangol district, have higher education.	36-45 years old, government staffs, 2 family members, income of 500,001-700,000₮, mostly live in Songinokhairkhan district, which high school diplomas.
Things that are important to purchase	The label addresses the choice of expiry date, weight, ingredients, manufacturer's reputation, brand's reputation, taste, have important effects on family members.	Packing, expiry date, price, and freshness are more important	Price, taste, brand reputation, standard satisfaction, expiry date, weight, ingredients, discounts, have important effects of family choice.
Purchase behavior	Purchases for the sake of health 9000 plus MNT per purchase, directly use at any time, purchases weight of 200gr, and buy a plastic bag based on past experiences, which often have a significant impact of family purchases	Purchases for the sake of health, 9000 plus MNT per purchase, directly use at any time, purchases weight of 200gr, and buy a plastic bag based on past experiences, which often have a significant impact of family purchases.	Purchases for the sake of health, 9000 plus MNT per purchases, uses daily and over 1000 gr packages products for per purchases.

5. Analytical hierarchical process and Harker's method

The analytical hierarchical process (AHP) method was first developed by Saaty, (1980). This method is widely used in economics, social sciences, politics, operational research and game theory. For the excellent comprehensive survey dealing with AHP, we refer to Saaty, (1980), (1994). In this section, we recall briefly Harker's method which is an extended method of AHP to the incomplete matrix which is arising from some real problems and apply this method for some incomplete matrices from Cluster analysis in Section 2.2.4. After that approach, we obtain some complete reciprocal matrices derived from initial incomplete matrices. In some practical problems, it is impossible or difficult to have comparisons of some pairs of alternatives. It is very important to estimate incomplete comparisons data to have alternative's weights. In the Harker's method, however, weights are calculated without estimating unknown comparisons.

If (i,j) - component is missing, put the artificial value $\frac{w_i}{w_j}$ into the vacant component to construct a complete reciprocal matrix A(w). Then consider the eigensystem problem:

$$A(w)w=\lambda w \ .$$

Now we consider Harker's method briefly.

Given incomplete matrix $A=(a_{ij})$, define the corresponding derived reciprocal matrix $\tilde{A}=(a_{ij})$ as the following:

$$a_{i,j} = \begin{cases} 1+m_i, & \text{if } i = j \\ 0, & \text{if } a_{i,j} \text{ is missing} \\ a_{i,j}, & \text{otherwise} \end{cases}$$

where m_i denotes the number of missing components in the i-th row.

The Harker's algorithms can be described as follows:

Step 1. Construct a derived reciprocal matrix $\tilde{A}$ of A(x).
Step 2. Calculate the largest –eigenvalue ($\lambda_{\max}$) of $\tilde{A}$ and its associate eigenvector.
Step 3. Normalize the eigenvector into a priority weight vector.

6. Numerical Results

In this section, we consider Harker's method applications and AHP methods for some incomplete matrices which are obtained by survey of organic food consumer behavior. We divide consumers into three clusters such as Songino-Hairhan district, Bayangol district, and Han–Uul district. A total of 30 incomplete computational matrices were obtained from each cluster survey. After computing each arithmetic mean of 30 matrix computations of each cluster, two clusters arithmetic mean matrices still remain as incomplete matrices and one is derived as complete matrix.

By using Harker's method, we construct a derived reciprocal matrix A and calculate the largest eigenvalue (($\lambda_{\max}$) of $\tilde{A}$ and its associate eigenvector and normalize the eigenvector into a priority weight vector. Calculate the largest eigenvalue of and its associate eigenvector. Normalize the eigenvector into a priority weight vector. Random Index Values for n-terms had compared in Saaty, (1994). Degree of consistency is satisfactory if $\frac{CI}{RI} < 0.10$.

For example, we show that Bayangol District and Khan-Uul districts consumers data analysis respectively as the following:

Table 6: Bayangol district

	16.25	
n	15	
CI	0.08928	
CR	0.05615	Satisfactory

Table 7: Khan-Uul district

	17.09	
n	15	
CI	0.149292	
CR	0.093895	Satisfactory

Finally, we unify AHP method analysis for all districts and order some impacts as the following.

Table 8: The matrix for the importance of clusters is the mean values

	Cluster A	Cluster B	Cluster C	Sum
Price	3.1	2.4	3.8	9.3
Taste	7.8	8.9	5.5	22.2
Smell	6.1	5.2	5.8	17.1
Freshness	8.7	5.5	7.2	21.4
Experience	2.1	3	5.2	10.3
Ingredients	2.3	4.2	7.6	14.1
Brand & prestige	3.2	4.5	2.6	10.3
Advice from other people	2.4	3.8	3.56	9.76
Sales, bonus	5.35	2.17	7.45	14.97
To not have chemical agents	8.55	7.91	7.65	24.11
Expiry date	7.85	7.08	6.87	21.8
Information on label	6.42	3.86	3.1	13.38
Choice by family members	3.87	4.96	7.12	15.95
Package	4.21	2.32	7.56	14.09
Standard	4.89	6.81	4.17	15.87

Table 9: Determination potential release from normalize unit

	Cluster A	Cluster B	Cluster C	Sum
Price	0.33	0.26	0.41	1
Taste	0.35	0.40	0.25	1
Smell	0.36	0.30	0.34	1
Freshness	0.40	0.26	0.34	1
Experience	0.21	0.29	0.50	1
Ingredients	0.16	0.30	0.54	1
Brand & prestige	0.31	0.44	0.25	1
Advice from other people	0.25	0.39	0.36	1
Sales, bonus	0.36	0.14	0.50	1
To not have chemical agents	0.35	0.33	0.32	1
Expiry date	0.36	0.32	0.32	1
Information on label	0.48	0.29	0.23	1
Choice by family members	0.24	0.31	0.45	1
Package	0.30	0.16	0.54	1
Standard	0.31	0.43	0.26	1
P	0.35	0.32	0.33	1

Based on the unified analysis, we can conclude the following results. Cluster A as we named as "new generations'' - most of them 26-35 years old, and work in business organizations with family members of 3-4 and income is 1,100,101 - 1,300,000₮, with most of them living in Khan–Uul district. Their academic background of bachelor and or above. They usually care about the label and expiration date. Rather in cluster B, most of them work in business organizations and are from 36-45 years of age. Their family members include 3-4 people and their income is 320,000 - 500,000₮. Most of them live in Bayangol District, with an academic background of bachelor and or above consumers. For the Cluster C, individuals that are civil servants preferred the label, expiry date, weight, size, ingredients, manufacturer's brand's prestige and taste. Cluster C individuals age would be from 36-45 years of age. Their family members consisting of 2 and their income is 500,001 – 700,000₮. They live in Songino-Hairhan District. While their educational background is up to a high school diploma.

CONCLUSION

The study aimed to conduct research on the user behavior of organic food products across six Districts of Ulaanbaatar. Based on the result of research the following conclusions are made.

- In recent years, the consumption of organic products has been growing worldwide and the knowledge of importance and demand of organic food also increasing. According to the survey results, 94.1% of participants said that they purchase organic food products and the consumption of organic food in Ulaanbaatar is high.
- Consumers who purchase organic foods regularly consider health benefits, quality, safety and environmentally friendly issues of organic foods.
- Most of the consumers, or 86.2% of participants, purchase organic food in order to take care of their wellbeing and most of them tend to buy small packed products.
- Mongolians often buy brands that they are most familiar with. 22.6% of them purchase at supermarkets while 19% of them buy from food markets, and 81% of participants tend to buy organic food products that are produced in Mongolia. Additionally, the purchasing habit of organic products is influenced much more by family members rather than doctors or consultants.
- Quality and design of packaging is very important for Mongolian consumers to buy organic foods.
- Internationally, organic foods are mostly purchased by the consumers who are mostly highly educated, women, young, and have above average salary income.
- We apply statistical and multi-criteria decision making methods for Mongolian organic food consumers given data and analysis on decision making impacts.
- Based on the initial data sources, the five trend assumptions of Mongolian organic food consumers have been compared with secondary data sources. As a result, education level, income level and being young are positively influenced to the satisfaction of organic foods, while their marital status and gender have no effect.

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