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Drivers of consumer's adoption of innovative food

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Abstract. Over the last years, food safety, health and environmental issues are a few among many other reasons that force consumers to adopt new innovative food products – organic, private label, genetically modified and functional – as part of their consumption. This spectacular shift of the consumption forwards "innovative" food products attracts the interest of the analyst as it can shed new light on consumer's behaviour and on modeling and understanding better his long-term behaviour. Thus, this study attempts to investigate the factors that influence consumer's decision in purchasing either traditional or new innovative products and to what extend this shift between those two groups of products is related to pre-defined elements. This is achieved by employing both descriptive statistics and multivariate analysis. Two-step cluster analysis was used to explore the different levels of innovative products adoption and a categorical regression model was estimated to determine the relation between consumer's characteristics and willingness to adopt innovative products.

Keywords: adoption, consumption, food, innovative products, multivariate analysis**.**

1. Introduction

Food is one of the sectors that have highly drawn the attention, over the last years, due to its traditional and susceptible role -to feed people- and due to recently appeared tendencies and related problems. Consumers and associated organizations (state or private) on the one hand and food industries on the other made efforts to respond to each other's needs.

The last decades all over the world a drastic change of consumers' attitudes against food products is observed; food products are not seen any more just as the mean for survival and pleasure. Many other factors-barriers affect consumers' decisions in selecting food products to follow their food pyramid. Among the most influential recent factors driving consumers' decisions are: food safety and health issues, environmental issues and social and economic aspects. All these factors made consumers to become increasingly conscious in their food choices; at the same time their choices provide them with substantial power in influencing food industry's decisions in producing and developing new food products.

Thus, it is extremely important for any establishment engaged in the food sector to know the important drivers of consumers' food category choices. It is among the variables that help them made the right movements in sparing resources and made their businesses successful. Van Kleef et al, (2002), showed that food professionals are often not able to foresee which new food concepts consumers really appreciate. Thus, investing in the development of a food category without listening consumers is a risky, costly and complex process, that is why a great proportion of newly introduced foods fail in the market. Apart from business establishments, identifying the reasons driving consumers to adopt or not new innovative products it is important generally for the society and policy makers to related sectors.

Following the above, the present study aims to identify the reasons that consumers decide to shift their consumption pattern from traditional food products to new innovative. Specifically, the reasons that drive consumers to consume or not to consume innovative products such as organic products, functional food, own label products and genetically modified products are examined. Moreover, the study aims to examine

any common characteristics of people that choose to select such products and hence consist a specific target group. The study performing a research with 500 questionnaires, in the urban area of the prefecture of Thessaloniki, aims to identify the drivers by using the two-step clustering methodology in collaboration with the categorical regression model. After the introduction the innovative food categories examined in the study are presented followed by the presentation of the methodology used in the analysis. Finally, the results of the analysis and some concluding remarks are presented.

2. Innovative products under study

The main reasons generally affecting individual consumers' food decisions examined by Asp (1999), pointed out that their decisions affect both the healthfulness of their food intakes and the success or failure of food products food market. Moreover, in the same study, the author stresses the power of the consumers, as the main segment in the food system. Consumers power as decision makers in the food sector influences the success or not of a new product in the new consumer driven food markets. The success rate of new products is very low while at the same time the cost of introducing a new product in the market is extremely high (Sloan, 1994 and 2005; Van Kleef et al, 2002). Thus, crater attention and study of consumers demand will assist the success of new products.

Cultural factors, psychological factors, lifestyle factors and food-trends are the four groups of reasons that affect consumers' decisions examined by Asp (1999). Moreover, she groups the barriers that prevent consumers from choosing foods that meet Food Guide Pyramid (FGP) recommendations; such as barriers related to food, to consumer behavior and to dietary guidance. The examined consumers, in the present study, food decisions are lie within the four groups reported in Asp (1999). Whereas, the intention of the current study is to explicitly examine consumers' food choices for the four specific innovative food product categories (organic, functional, own label and genetically modified products).

New reasons, related to the selection of the abovementioned innovative food product categories, can be added to Asp (1999) groups. The last years' new trends and problems appeared and related to the food sector, they lead to new or modified reasons that drive consumers' preferences. Actually, these new trends and problems affected the consumers' food demand patterns and lead to the appearance of new food group categories. Environmentally sensitive and health conscious people decide to shift their food consumption to the broad category of organic food products. Moreover, policy reasons drive directly and indirectly the promotion of organic food products; such as the protection of the environment, land and ground water conservations, production diversification and extensiveness, farmers' support etc.

In the literature it is stated that health has become the major driver in consumers' food choices (Sloan, 2004 and 2005). The last years' increasing health problems related to food consumption enhanced consumers' consciousness for healthy and pure food products. Also, factors related to healthy lifestyle, continuous population ageing, increased cost of health care, food science progress and the competition among food industries induced the appearance of the so-called functional foods. Functional foods intent to provide, additionally to their nutrition basic role, health benefits. Functional foods are selected by consumers to ensure their overall well-being, to improve their performance (eg. in sports) to assist their diet, to prevent diseases etc, (Urala and Lähteenmäki, 2003). Yield maximization and resource spare and efficient use, economic and policy reasons, are among the determinants lead to the appearance of genetically modified food products; reasons that are not related significantly with consumers needs. Finally, economic problems, income allocation, market power of the large retail food chains are among the many factors induced the appearance of the own label food products.

The identification of the factors that made consumers to change their attitudes and add in their consumption pattern the above four categories of innovative products is modeled next by employing the two-step clustering methodology in collaboration with the categorical regression model.

3. Data and methodological framework

Data were collected through a survey addressing 500 food consumers, carried out in the period May-July 2009 in the urban area of the prefecture of Thessaloniki. The purpose of the survey was twofold: (a) to determine the current behaviour of food consumers related to the adoption or not of innovative food products and (b) to relate differences in adoption parameters among four different categories of innovative food products (organic, private label, genetically modified and functional). In particular, the

questionnaire included sections on: (a) knowledge of innovative food products; (b) adoption of innovative food products; (c) adoption reasons of innovative food products; (d) non-adoption reasons of innovative food products; and (e) several questions relating to sex, age, education, marital status, occupation, income and several other personal characteristics.

The investigation of the factors that influence consumer's decision in purchasing either traditional or new innovative food products and to what extend this shift between those two groups of products is related to pre-defined elements; it is achieved by employing both descriptive statistics and multivariate statistical analysis. In particular, (a) two-step cluster analysis was used to classify the respondents in discernible clusters in order to explore the different levels of innovative food products adoption and (b) categorical regression (Kooij and Meulman, 1997), that was used to handle the optimally transformed categorical variables in order to determine the relation between consumers' characteristics and willingness to adopt innovative products.

4. Results

According to the descriptive statistics analysis, the main research findings are presented in four sections: (a) knowledge of innovative products (Table 1); (b) adoption of innovative products (Table 2); (c) reasons for adopting (Table 3) and (d) for non-adopting (Table 4) innovative products.

From the data in Table 1 it is obvious that, among the four categories of innovative food products the most familiar to the consumers of Thessaloniki are the organic ones as 76% of the sample indicated a well knowledge of organic products. On the other hand, only one third of the sample announced a well knowledge of functional products and almost 50% announced a well knowledge of genetically modified and private label products (53% and 52% respectively). In addition, with the exception of organic products, the respondents are rather confused about their knowledge of innovative food products. In particular, a quarter of the respondents indicated "knowledge' uncertainty" about the genetically modified products (26%), the functional products (24%) and the private label products (23%).

Table 1. Knowledge of Innovative Food Products.

Level of knowledge	*Organic Products*	*Private Label Products*	*Genetically Modified Products*	*Functional products*
Yes	76%	52%	53%	32%
Not sure	11%	23%	26%	24%
No	13%	25%	21%	44%

Private label products and organic ones have been adopted more widely by the consumers of Thessaloniki compared to functional and genetically modified products. In particular, 50% of the respondents adopt (very often or oftentimes) private label products and almost one third of them adopt organic products. On the other hand, the majority of the respondents do not adopt functional and genetically modified products (58% and 55% respectively). Moreover, a significant part of the respondents present an uncertainty about the adoption or not of genetically modified and functional products (22% and 13% respectively).

Table 2. Adoption of Innovative Food Products.

Level of adoption	*Organic Products*	*Private Label Products*	*Genetically Modified Products*	*Functional products*
Very often	14%	33%	4%	7%
Oftentimes	22%	27%	8%	9%
Sometimes	36%	17%	11%	13%
Rarely	15%	11%	21%	28%
Never	11%	5%	34%	30%
I'm not sure	2%	7%	22%	13%

Table 3 presents the main reasons, on the part of consumers, for adopting innovative food products. In particular, for the adopters of organic products the most important reason for adopting them (97%) is that organic products are pure and without chemical preservatives. In addition, many adopters indicated the suitability of organic products for children nutrition (88%), the nice taste-aroma of those products (83%), the high quality of those products (81%) and that those products are healthy (77%); those were the most important reasons for adopting organic products. This suggests that the majority of the adopters of organic products face the same, more or less, challenges in consuming pure and healthy food products suitable for their children nutrition. On the other hand, the adoption reasons for the rest of the innovative food products present a significant diversification. For example, for the adopters of private label products the most important reasons for adopting them is that such products are inexpensive (88%), well substitute to other expensive ones (61%) and oftentimes comprised in profit packages (56%). In addition, the adopters of genetically modified products indicate as the main reasons for their decision the high quality of the products (46%) and that they are innovators or early adopters (35%). Moreover, for the adopters of functional products the most important reasons for adopting them is their doctor recommendation (45%), the nice advertisement of the products (32%) and that functional products are healthy (28%).

Conclusively, the adopters of innovative food products support that: (a) organic products are pure, healthy, tasty and aromatic (b) private label products are inexpensive (c) genetically modified products are the most innovative and of high quality and (d) functional products are recommendable from doctors as they are suitable for some diseases and a healthy nutrition.

Table 3. Reasons for adopting innovative food products.

Reason	*Organic Products*	*Private Label Products*	*Genetically Modified Products*	*Functional products*
Healthy	**77%**	-	3%	**28%**
Pure - without chemical preservatives	**97%**	-	-	2%
Nice taste-aroma	**83%**	8%	13%	8%
Nutrition habitude	6%	4%	1%	3%
Inexpensive	-	**88%**	12%	-
Support the producers	12%	2%	-	-
High quality	**81%**	28%	**46%**	13%
Protect the environment	22%	-	-	-
Trust the producers	11%	5%	6%	5%
Suitable for children nutrition	**88%**	-	-	2%
Dissatisfied from other products	5%	12%	11%	3%
Remind old "real" products	9%	-	-	-
Packaging benefits	1%	**56%**	5%	-
Early adopter-innovator	11%	13%	**35%**	12%
Substitution of other products	-	**61%**	7%	12%
Doctor recommendation	3%	-	-	**45%**
Nice advertisement	-	12%	2%	**32%**
Other reasons	2%	1%	2%	3%

Table 4 presents the main constraints related to the non-adoption of innovative food products. The constraints include consumers' beliefs that: (a) the organic products are expensive and that they do not trust the related certification (b) the private label products are not of high quality and their appearance is not satisfactory (c) the genetically modified products are not health safe and that they do not trust the producing companies and (d) the functional products are expensive. It thus becomes obvious that consumers, which on the one hand are non-adopters of organic and functional products are on the other hand non-adopters of private label and genetically modified products, comprise two distinct groups in terms of the reasons for non-adopting innovative food products.

Table 4. Reasons for not adopting innovative food products.

Reason	*Organic Products*	*Private Label Products*	*Genetically Modified Products*	*Functional products*
Not found easy	5%	13%	8%	5%
I prefer the conventional products	15%	16%	31%	-
Expensive	**88%**	-	3%	**85%**
Not trust the certification	**43%**	5%	-	-
Not like their taste	13%	7%	-	-
Family disagreement	18%	8%	7%	6%
Not like their package	2%	12%	-	-
Not trust the production procedure	7%	6%	**42%**	2%
Not health safe	5%	-	**68%**	9%
Appearance	13%	**45%**	-	-
Not trust their quality	5%	**62%**	3%	1%
Other reasons	-	1%	1%	2%

The two-step cluster method extracted automatically the optimal solution of four clusters. According to the table 5, the majority of the respondents (342 or 68.4%) was included in the third cluster (late adopters), 88 of them (17.6%) in the fourth cluster (no adopters), 56 of them (11.2%) in the second cluster (early adopters) and finally only 14 of them (2.8%) in the first one (innovators).

Table 5. Two-step clustering characteristics of innovative products' adoption (mean scores)

Adoption of innovative products [(*)]	***Four clusters***			
	'Innovators' (14 consumers)	'Early adopters' (56 consumers)	'Late adopters' (342 consumers)	'No adopters' (88 consumers)
Organic products	4.83	3.72	3.21	1.89
Private label products	4.78	4.11	3.58	1.72
Genetically modified products	3.01	2.56	1.47	1.18
Functional products	3.08	2.64	1.91	1.25

[(*)] 1=never, 2=rarely, 3=some times, 4=oftentimes και 5=very often

The paramount attributive characteristics (PAC) of innovative products' adoption in each cluster were inquired using Kruskal-Wallis and Mann-Whitney tests (Table 6). The analysis shows that the PAC of the first cluster includes the very often use of organic and private label products and the limited use of genetically modified and functional products. The PAC of the second cluster consists of the often use of organic and private label products and the limited use of genetically modified and functional products. The PAC of the third cluster consists of the limited use of organic products, the often use of private label products and the rare use of genetically modified and functional products. Finally, the PAC of the fourth cluster consists of the rare use of organic and private label products and the no use of genetically modified and functional products.

Table 6. Paramount attributive characteristics of innovative products' use in each cluster

Clusters			
"Innovators"	**"Early adopters"**	**"Late adopters"**	**"No adopters"**
Very often use of organic products	Often use of organic products	Limited use of organic products	Rare use of organic products
Very often use of private label products	Often use of private label products	Often use of private label products	Rare use of private label products
Limited use of Genetically modified products		Rare use of Genetically modified products	No use of Genetically modified products
Limited use of Functional products		Rare use of Functional	No use of Functional

	products	products

Reliability analysis (Bohmstedt, 1970; SPSS, 2007) for the thirteen items of table 7 was then used to determine the extent to which these items are related to each other to get an overall index of the internal consistency of the scale as a whole and to identify items that had to be excluded from the scale. In fact, no-one item was excluded from the primary number of the items.

The value of Cronbach's alpha (α) reliability coefficient was found equal to 0.87 (SPSS, 2007), thus indicating that the employed scale is reliable. Friedman two-way analysis of variance, with x2=2,096 (α=0.00) and Hotelling's T2=1,256 (F=32.68 and α=0.00), indicated the significance in differences of item means.

Having accepted the consistency of the items, the average rankings for each respondent were used as the numerical values of the dependent variable "adoption of innovative food products" which along with the categories of thirteen independent variables are shown in Table 7.

Table 7. Selected independent variables

Independent variables	Type	Categories
Knowledge of organic products	Ordinal	1=yes, 2=not sure, 3=no
Knowledge of private label products	Ordinal	1=yes, 2=not sure, 3=no
Knowledge of genet. modified products	Ordinal	1=yes, 2=not sure, 3=no
Knowledge of functional products	Ordinal	1=yes, 2=not sure, 3=no
Classification of respondents	Ordinal	1=innovator, 2=early adopter, 3=late adopter, 4=no adopter
Marital Status	Nominal	1=married, 2=not married
Number of children	Scale	-
Area of origin	Nominal	1=city, 2=village, 3=island,
Gender	Nominal	1=male, 2=female
Age	Ordinal	1=under 25, 2=25-45, 3=45-65, 4=over 65
Education	Ordinal	1=six or less years, 2=from seven to nine, 3=ten to twelve, 4=higher education, 5=post graduate education
Annual income	Ordinal	1=less than €10000, 2=€10001-€20000, 3=€20001-€30000, 4=more than €30001
Occupation	Nominal	1=dependent, 2=public officer, 3=employee, 4=farmer, 5=merchant, 6=self-employed, 7=other

The categorical regression model yielded an R of 0.76 indicating moderate relation between the "adoption of innovative food products" and the group of selected predictors. However, since R^2=0.58, it is indicated that 58% of the variance in the "adoption of innovative food products" rankings is explained by the regression of the optimally transformed variables used. The F statistic value of 7.96 with corresponding α=0.00 indicates that this model is performing well.

Further, the exploration of the standardized coefficients presented in Table 8 imply that the transformed variables 'annual income, 'classification of respondents, 'number of children' and 'knowledge of private label products' are significant in relation to "adoption of innovative food products" by consumers. In fact, from the zero order correlation coefficients between transformed predictors and the transformed response we get a better understanding of how these predictors are doing.

Table 8. Categorical regression coefficients and other statistics

Independent variables	Standardized Coefficients	F	Correlations	Importance	Tolerance

	Beta	St. Error		Zero-order	Partial	Part		After	Before
Knowledge of organic products	0.04	0.04	12.32	0.38	0.08	0.06	**0.10**	0.63	0.59
Knowledge of private label products	**0.08**	0.06	1.88	0.31	0.07	0.06	**0.12**	0.57	0.55
Knowledge of genet. modified products	0.01	0.05	0.07	0.15	0.01	0.01	0.03	0.80	0.80
Knowledge of functional products	0.01	0.05	1.96	0.11	0.06	0.05	0.03	0.75	0.78
Classification of respondents	**0.18**	0.07	7.56	0.27	0.16	0.14	**0.17**	0.70	0.71
Marital Status	-0.07	0.05	2.05	-0.20	-0.07	-0.07	0.04	0.76	0.77
Number of children	**0.08**	0.06	1.22	0.07	0.05	0.05	0.08	0.67	0.54
Area of origin	0.05	0.05	1.26	0.07	0.06	0.05	0.02	0.97	0.98
Gender	0.02	0.05	2.03	0.08	0.05	0.05	0.05	0.72	0.71
Age	0.03	0.05	1.07	0.07	0.01	0.02	**0.11**	0.54	0.50
Education	0.04	0.06	0.05	0.17	0.02	0.11	**0.10**	0.58	0.58
Annual income	**0.24**	0.05	19.46	0.33	0.23	0.21	**0.14**	0.74	0.73
Occupation	-0.03	0.05	0.53	-0.09	-0.03	-0.03	0.01	0.96	0.96

The relative importance measures (Pratt, 1987) of the independent variables show that the most influential factors predicting the dependent variable correspond to 'classification of respondents' (accounting for 17%), followed by 'annual income' (14%), 'knowledge of private label products' (12%), 'age' (11%), 'knowledge of organic products' (10%) and 'education' (10%). The six variables' additive importance accounts for about 74%. Finally, the data illustrated in Table 8 make clear that the tolerances of all variables are high enough to assure exclusion of the multicollinearity problem.

5. Conclusions

Consumers tend to increasingly adopt new innovative food products suggesting that such products can helped them to drive real food safety, health, economic and environmental gains. In this paper, survey information from consumers had been analyzed using two-step clustering, categorical regression models and descriptive statistics analysis in order to identify the differential extent of innovative food products adoption and use by the consumers of a Greek city (Thessaloniki).

Regarding the adoption of innovative food products, four consumers' profiles (classes) were identified: 'innovators' (2.8%), 'early adopters' (11.2%), 'late adopters (68.4%) and 'no adopters' (17.6%). Furthermore, the four classes were found to differ in terms of gender, marital status, income, education and number of children. The increased level of disposable income along with exposure to innovative food products may well explain such a differential innovative food product adoption.

A further finding is that innovative food products' adoption is significantly related to factors such as 'annual income', 'classification of consumers', 'knowledge of organic and own label products', 'age' and 'education' with 'number of children' being a supporting factor. Such empirical findings support Rogers' (1995) socio-economic generalizations about early adopters.

From a methodological point of view the contribution of this paper provided an application of modern multivariate methodologies in the field of adoption theory. In particular, although several articles have been conducted to examine adoption parameters the current study presents a first application of categorical methodologies. The main benefit of employing the above methodologies is that they can handle optimally both continuous and categorical variables as well as attributes (Michailidis, 2007). Thus, a combination of categorical regression model with a two-step cluster analysis can be very useful, in the examination of adoption parameters, as the categorical variables of Table 7 can be better accommodated (Michailidis, 2007).

Consequently, this study may provide interesting and initial observations as well as it demonstrates verifiability. However, as a first systematic attempt to assess the adoption parameters of innovative food products, our study was limited to a rather small sample and a rather restrained amount of time for the

observations. Therefore, due to the small number of subjects (sample) and due to the indefinable number of innovative food products adopters (population) our study rather lacks generalizability. Nevertheless, the observations made in this study provide a beginning for further research, which could extend the investigation to more representative sample.

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