

Computer model for predicting organic food consumer behavior in Croatia

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ABSTRACT

In last 15 years Croatian agriculture tries to follow European organic movement due to increasing demand for healthy food. Increasing demand for organic food is related to consumers' concern regarding food safety and quality as well as health and nutritional aspect of food. Survey of consumer perceptions regarding organic food was analyzed previously in Eastern Croatia on sample of 124 examinees. The questionnaire included questions regarding consumer behavior (frequency and structure of organic food consumption), consumer attitudes concerning organic food price, purchase motives, reasons which indicate negative reactions on consumers, supply satisfaction and future intentions of consumers regarding organic food. Aim of paper was to create computer model for prediction potential organic food consumption in Eastern Croatia based on survey results. The results of organic food consumers' behavior pattern was build into the computer model. Consumers' behavior pattern was defined considering consumer's gender, age, education, income, and residence place impact on present and possible purchase of organic food. The model enables prediction of changes in needs for organic food as a result of different gender, age and education inhabitants' structure and as a consequence of detected consumers' perception of theirs' relation to organic food. Model could be also useful in choosing most efficient strategies in organic food marketing depending on target consumers' segmentation groups.

Keywords: computer model, organic food, consumers' behavior, consumption, prediction

1. INTRODUCTION

Croatian socio-economic development is based on ecologic and economic orientation in farm business. Croatian agriculture tries to follow organic movement in Europe in last 15 years due to increasing demand for healthy food related to negative externalities of industry-like production which turned public attention to organic farming (TAKACS, 2007). Increased consumers' concern and care regarding food safety and quality as well as health and nutritional aspect of food resulted in increased demand toward organically produced food. Such trend is a kind of reaction to numerous health affair related to processed food (TAKACS, 2007; DAVIES ET AL., 1995).

The demand for organic food globally has been growing at an annual rate of 20% (SQUIRES ET AL., 2001). The proportion varies from country to county. In the period of 1997-2000 the largest growth rate of the per capita spending are in Sweden and New Zealand with 202% and 389% respectively (REHBER AND TURHAN, 2002). Denmark has one of the highest per capita levels of organic food consumption in the world (SQUIRES et al., 2001). Expenditures for organic products in Denmark represent 2-3% of total food expenditures; in Germany, it represents 1.2%; in UK, Ireland and The Netherlands it is less than 1%.

Research regarding consumer attitudes and preferences for organic food vary a lot (STEFANIC et al., 2001; SQUIRES et al., 2001; GIL et al., 2000; MAGNUSON et al., 2001; HARPER AND MAKATOUNI, 2002; GENDALL et al., 1999; PEARSON, 2001).

The emerging organic agricultural industry and the related market for organic products in Croatia are only beginning to develop, and currently only enjoy a marginal importance at the national level. European movement regarding increased consumer concern regarding food safety and quality as well as health and nutritional aspect of food is present in Croatia as well.

Aim of paper was to create computer model for analyzing organic food consumption in Eastern Croatia and to predict organic food consumption in Croatia, based on survey results. Face-to-face survey was carried on sample of 124 respondents during 2007 with a view to research perceptions of consumers related to organic food consumption in Eastern Croatia. Similar research about consumers' motives and attitudes relating to organic food in Croatia are conducted in Zagreb (RADMAN, 2005) and Osijek (ŠTEFANIĆ, 2001).

2. MATERIAL AND METHODS

Face-to-face survey with a view to determine perceptions of consumers regarding organic food consumption was carried out in association with BIOPA advertisement actions (72 questionnaires) and students of Faculty of Agriculture in Osijek during 2007 (52 questionnaires).

Questions can be lined up in a few groups: sample description (gender, age, place of residence, education, monthly family income and number of family members), buying behavior (frequency and structure of purchase), analysis of purchase motives (nutritional-health impact, taste, environment care and habit), reasons which indicate negative reactions on consumers (price, availability, promotion, package and look of product), supply satisfaction and consumers' future intentions, evaluation of purchase place suitability, evaluation of declaration elements (shelf life, nutritional value, presence of functional food elements, absence/low level of harmful substances, organic product certificate, product brand, package and producer) and consumers' opinion regarding product origin (local producers, regional producers or foreign producers). Mostly, questions were two of multiple answer questions and only three were open-ended questions. Some attributes of organic food (purchase motives, reasons which indicate negative reactions on consumers, suitability of purchase places, declaration elements and different origin of producers) were measured by means of five-point Likert scale from 1 to 5 (1=low or bad degree of the characteristic and 5=high or good degree of the characteristic).

Computer model was made as Excel application with aim to analyze and predict behavior of organic food consumer. Basic part of model for analyzing organic food consumer behavior was created according to survey results. Hence, analyzing is possible in a scopes embraced by survey. The scopes are different for each attribute:

1. population gender: 0%, 48% or 100% of female,
2. rural population share: 0%, 30% or 100%,
3. population age: younger than 25, 25-40, 40-55 or older than 55,
4. education level: primary school, high school or university level,
5. monthly family income: less than 400€, 400-800€, 800-1200€, 1200-1600€ and more than 1600€.

At the same time, determined trends, relations and regressions are used for scopes widening beyond borders of survey and between categories of ages, income or education level. Using this approach, the model was created for costumer behavior prediction in wider scopes (Figure 1) and without discontinuous calculations.

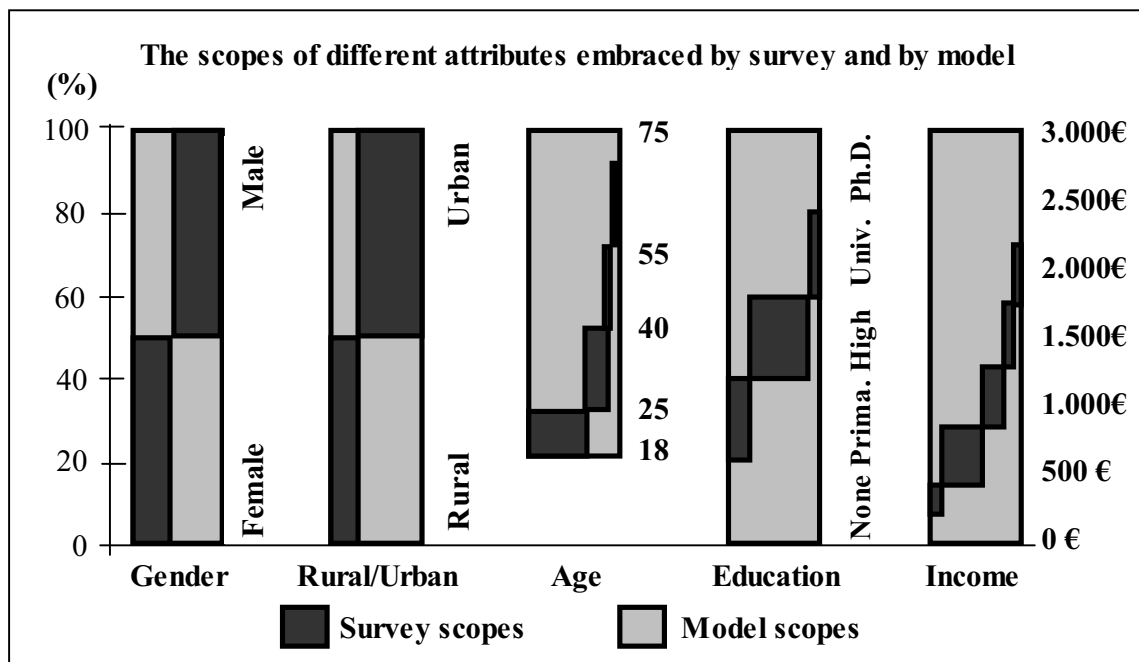


Figure 1. The comparison of scopes of analyzed attributes embraced by survey or model

The dark gray area on Figure 1 presents all ranges of each attribute embraced by survey, and light gray areas are ranges of the same attributes embraced by model. The height of dark gray area is presenting relative level of attribute compared to theoretically possible level (for example 47,6 % of female population compared to theoretically possible 0 or 100 % of female population), and the share of categories are presented by width of dark gray area (for example 23% of primary school, 65% of high school and 10% of university level in column presenting level of education). It is obviously that there is lack of some survey data (all light gray areas), but computer model overcome all these gaps, and moreover, extends age range up to 75, education level from not educated consumer up to Ph.D. level, and monthly family income up to 3.000 €.

3. RESULTS AND DISCUSSION

3.1. Model calibration

The model was calibrated within borders (for all five attributes from lowest up to highest level with a numerous combination of leveling just one, two, three, four or all five attributes):

1. gender: male/female ratio from 0 to 1,
2. rural population share: rural/urban ratio from 0 to 1,
3. consumer age: from 18 up to 75,
4. education: no education (0 years of education) up to Ph.D. level (20 years of education),
5. income: from 0 to 3.000 € of monthly family income.

In addition, model was calibrated using three possible scenarios of organic food consumer structure comparison:

1. scenario: old urban population vs. young rural population,
2. scenario: poor uneducated population vs. rich educated population,
3. scenario: poor - 30 years old – primary school vs. rich – 60 years old – Ph.D.

Finally, model calibration was made by using and comparing demographic data of different parts of Republic of Croatia:

1. Republic of Croatia,
2. City of Zagreb,

3. Osijek-Baranya County,
4. Zagreb County,
5. Lika-Senj County,
6. Split-Dalmatia County.

3.2. Organic food purchase frequency

The model shows that gender issues could impact very significant on organic food purchase frequency. Lower share of female than male consumer would often purchase organic food (20% of female vs. 23% of male), or wouldn't purchase organic food (10 vs. 18%). At the same time, higher share of female than male consumer (70 vs. 58%) would purchase organic food rarely. However, described differences are not significant in real gender ratios since there weren't significant differences between populations (as consumers) in analyzed 5 Croatian counties and Republic of Croatia.

The similar results were conducted analyzing rural/urban population split. The extreme model values (rural vs. urban populations) shows than more urban share would purchase organic food rarely (17% more than rural), 28% lower share of urban population would purchase often, but 15% lower share of urban population wouldn't buy any organic food. The differences between counties showed that highest deviation from state level (for comparison to counties presumed as 100%) could be expected in City of Zagreb and Lika-Senj County since often purchase in City of Zagreb would be 85% comparing to state level and in Lika-Senj County 107%, rarely purchase 108% vs. 96% and no purchase 92% vs. 104%.

More interesting is prediction of impacts of age, monthly family income and education on organic food purchase frequency (Figure 2).

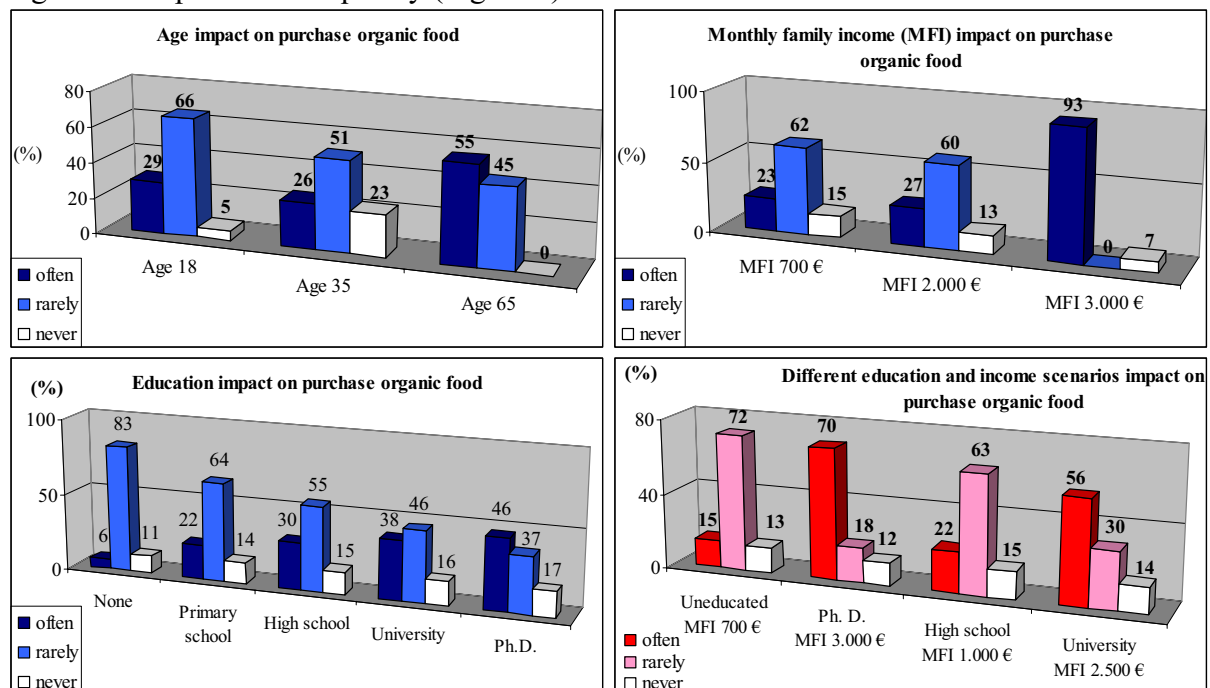


Figure 2. Age, family income, education and different scenarios impact on purchase organic food frequency

Higher share of older consumer often buy organic food, there isn't significant differences between consumers in age 18 and 35 considering often buy, but big difference exist considering rarely purchase of organic food. At the same time the highest share of consumer 35 years old wouldn't buy organic food, since there isn't consumer in age of 65 with that

behavior (Figure 2). At the same time, age of consumers didn't caused significant differences between analyzed counties, since the deviations from state average (100%) were in range 98,6 to 101,5%.

The monthly family income impacts significantly on purchase frequency, since increased income results in higher share of often purchase, lower share of rarely purchase or absence of purchase (Figure 2).

Years of education impacted almost linearly on purchase frequency. Share of absence of purchase and of often purchase increased from uneducated up to consumers with university and Ph.D. levels, since share of rarely purchase decreased at the same time (Figure 2). Education impact on consumer behavior in analyzed counties was on the state average (100%) in Osijek-Baranya, Zagreb and Split-Dalmatia counties. The highest differences from state average were predicted for Lika-Senj County (often purchase 90% of state level) and City of Zagreb (often purchases 111% and rarely purchases 95% of state level).

The scenario comparing old urban population vs. young rural population (Figure 2) resulted in lowest absence of purchase in case of urban consumers in age 65 and highest in case of 25% urban consumers in age 30. There wasn't significant difference in rarely purchase of organic food, but the most frequent purchase of organic food could be expected if consumers are urban in age 65; if consumers are 75% urban and in age 50 the often purchase will be 13% lower, 25% lower if rural consumers are in age 18, and the lowest (64%) if consumers are in age 30 and 25% are urban.

The scenario comparing poor uneducated population vs. rich educated population (Figure 2) shows even higher differences, especially in frequency of often and rarely purchase of organic food. The poor uneducated consumer would results in highest share of rarely purchase and lowest share of often purchase. Comparing to that as a scenario starting point, the lowest (26% lower) rarely purchase would be if consumers are rich and at the Ph.D. level, and the highest often purchase would be if consumers are rich and at the university or Ph.D. levels (381 and 476% higher, respectively).

3.3. Price willingness and future purchase intentions

The gender issues has significant impact on price willingness too, since men are ready to pay 16,4% more for organic food, and women only 13,2% (20% lower than men). However, women are ready to increase organic food purchase 13,1%, and men only 11,6% (13% lower than women). Analyzing counties and state average, the gender didn't result in any differences of price willingness and future purchase intentions.

The differences in price willingness and future purchase intentions are higher considering urban/rural consumer split. The urban consumers are ready to pay 23% more for organic food than rural consumers, but they intent to increase future organic food consumption in 7% lower amount than rural consumers. Analyzing urban/rural consumer split in Croatian counties, there were some significant prediction modeled: price willingness in City of Zagreb would be 10% higher than state average, and in Lika-Senj County and Zagreb County 5% lower than state average. At the same time, the intentions in future purchase of consumers in City of Zagreb are 4% lower than state average, and in others counties are at the state average level.

The impact of age, income and consumer education on price willingness and future purchase intentions are different and very significant (Figure 3).

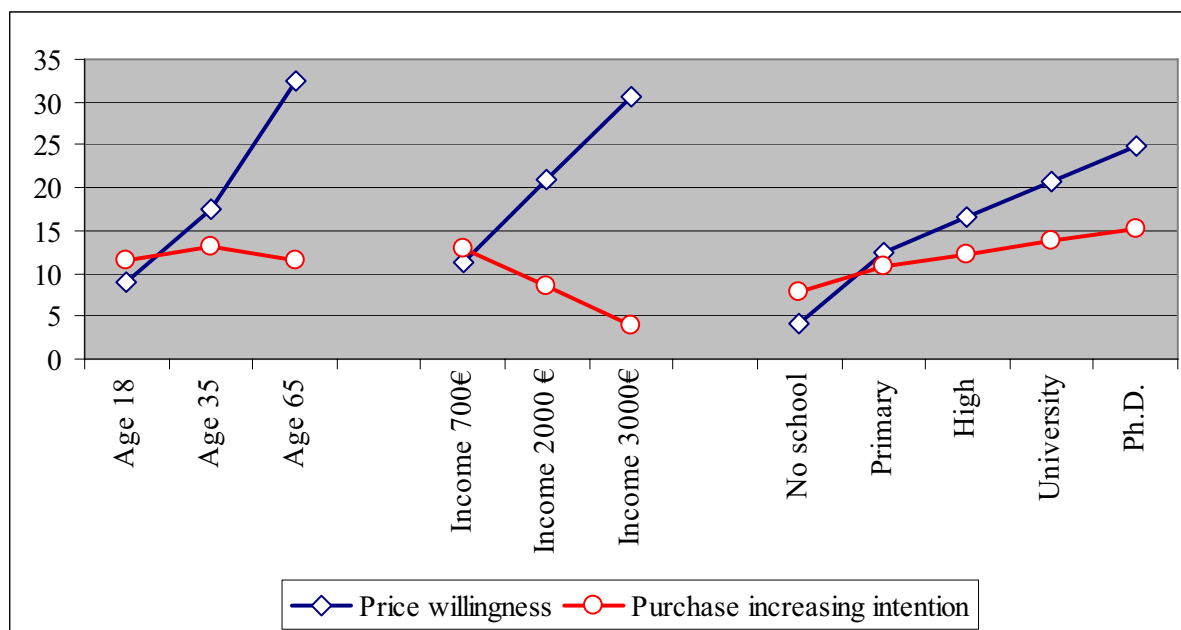


Figure 3. Impact of age, monthly family impact and consumer education on consumers' price willingness and theirs' future organic food purchase intention

The strongest impact on price willingness was determined as age impact. Thereat, the youngest consumers are ready to pay only 9% more, older consumers (in age 35) 17,5% more, and more older consumer (in age 65) even 32,6% more for organic food. The same trend was determined as impact of income increasing. Even consumers with only 700 € income are ready to pay 11% more for organic food, and higher income up to 3000 € increased willingness up to 31%. Impact of consumer education is also very important, but differences between categories are lower than between age and income categories. Uneducated consumer are ready to pay only 4% more, consumer with primary school 12,5%, with high school 16,6%, with university diploma 20,7% and with Ph.D. diploma 24,9% more for organic food than for conventional food.

Although the absolute values are different, the same trend was established analyzing age, income and education impact on price willingness, but the impact on future organic food purchase intention was completely different. The age has no significant impact (Figure 3), and income increasing from 700 € to 3000 € decreased future purchase from 13% down to 4%. Only consumers' education has the same impact on future organic food purchase intention as on price willingness, since more year of education (uneducated up to Ph.D. level) resulted in increasing of future organic food purchase from 8 up to 15%.

The same analysis on state level and for five Croatian counties shows the lowest impact of consumer age on price willingness and future organic food purchase. The highest differences of price willingness from state average (19,1% more for organic food, for comparison to counties presumed as 100%) was established for Osijek-Baranya County (97,9 % of state average) and Split-Dalmatia County (102,8% of state average), although the differences aren't significant. The differences from state average (12,4%) in future organic food purchase was in analyzed counties even lower (0,5 % deviation from state average).

On the other hand, consumer education in analyzed counties significant impacted on price willingness. State average predicted by model was 14,5% (for comparison to counties presumed as 100%), the lowest price willingness was predicted for Lika-Senj County, only

91% of state average, and the highest for City of Zagreb (110% of state average). Predicted state average for future organic food purchase was 11,5%. The impact on future organic food purchase was predicted on lower levels than impact on price willingness, since future organic food purchase was predicted as 96% of state average for Lika-Senj County and 105% of state average for City of Zagreb.

Different combination of age, rural/urban ratio, income and education presented by different scenarios (Figure 4) shows similar predicted results as age impacts (Figure 3). The scenario with young rural population vs. old urban population resulted in increasing of price willingness (11 up to 24%) and in very low insignificant decreasing of future organic food purchase (12,8 to 11,8%). The second scenario, poor uneducated population vs. rich educated population, resulted in stronger price willingness increasing (8 up to 28%) and decreasing future organic food purchase (12,2 to 9,6%). Finally, third scenario, poor - 30 years old – primary school vs. rich – 60 years old – Ph.D., resulted in significant price willingness increasing (14 to 23%) and in insignificant future organic food purchase decreasing (12,3 to 11,2%).

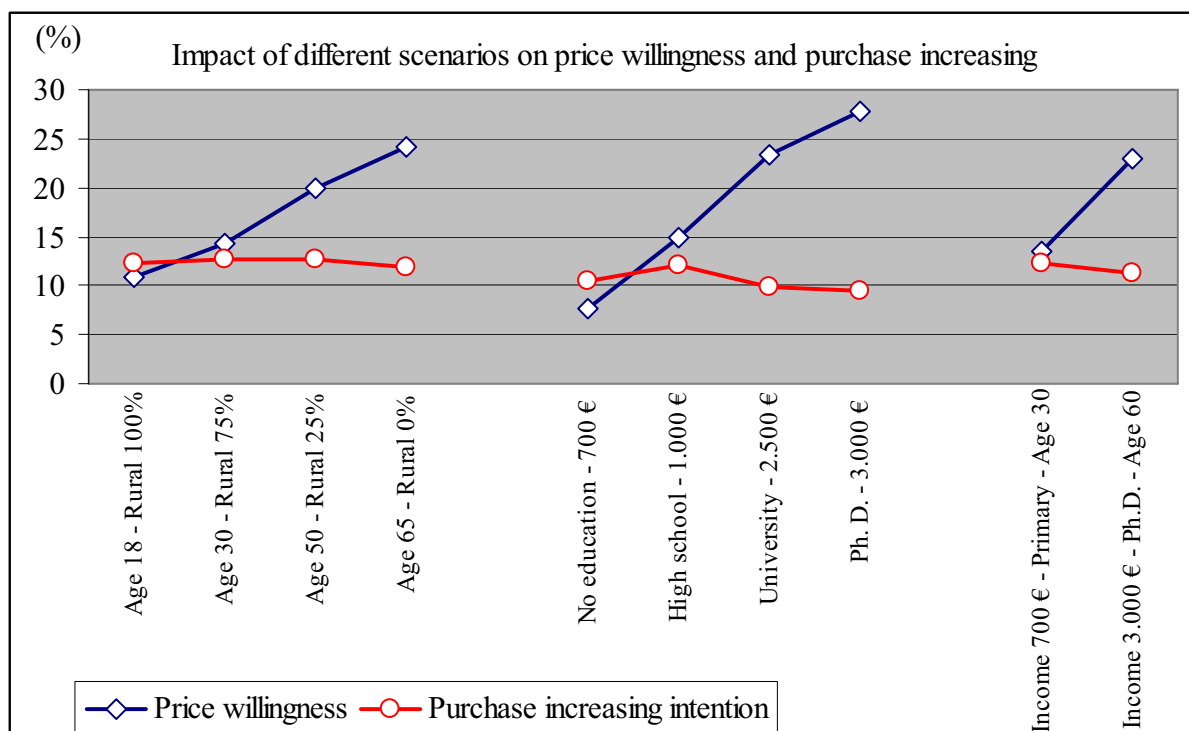


Figure 4. Impact of age, rural/urban population split, education and income on price willingness and future organic food purchase presented by different scenarios

The validation of computer model wasn't conducted because of lack of data beyond eastern Croatia. The same survey should be conducted in at least 4 different counties in Croatia and new data could be used for model validation. During model validation the feedback impact could be expected as changes in model functions and regressions. The validation with data from different Croatian counties may result in building into the model a regional specificity as a new consumer attribute.

4. CONCLUSIONS

The survey data are very useful and sufficient for building computer model for analyzing and predicting of organic food consumer behavior. Calibration of computer model shows model functionality since model is sensitive to changes of all input data (gender ratio, urban/rural ratio, age, income, and education).

Using terminal values of attributes resulted in new data which shouldn't be expected in real consumer population, but shows possible guidelines in consumer education approach and marketing strategy building. The terminal values and special scenarios results could be used for prediction behavior of special target consumer groups (housewives, students, businessmen, tourists, pensioners, laborers...). Possibility of numerous scenarios enabled model to predict consumer behavior in all possible situations. Also, scenarios for state level, regional level, and county level could save a lot of money by making field research less essential.

The model results shows that model isn't that sensitive to different counties, possible because of lack of attributes able to describe county specificity. The more attributes model includes, the more precise prediction would be. Hence, the two new aims are in front of model users: model validation and including new attribute describing regional or county specificity.

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