Proceedings of the 2017 International Conference *"ECONOMIC SCIENCE FOR RURAL DEVELOPMENT" No 45*
Jelgava, LLU ESAF, 27-28 April 2017, pp. 276-280

ANALYSIS OF LATVIA INHABITANTS' CONFIDENCE TOWARDS GMO

Inese Aleksejeva[1], Dr.oec; **Biruta Sloka**[2], Dr.oec., professor[+]; **Inara Kantane**[3], Dr.sc. admin., researcher, associate professor and **Anastasija Vilcina**[4], Dr.oec., professor

[1, 2] University of Latvia; [3]University of Latvia; The University of Economics and Culture; [4]Latvia University of Agriculture

Abstract. The aim of the paper is to study Latvian inhabitants' confidence in politicians and decision makers, competent supervisory and control authorities, mass media, enterprises responsible for GMO elaboration, scientists responsible for the risk assessment of GMO, organisations that protect consumer rights, food producers and traders and environmental activists and environmental protection organisations towards GMO. The study is based on the results of Latvian inhabitants' survey performed in 2014 and 2015.

Methods applied in the paper: analysis of scientific publications, analysis of the survey data. For survey data analysis - descriptive statistical analysis, cross tabulation, Mann-Whitney U test were applied.

The obtained results show that Latvian inhabitants' confidence in politicians and decision makers, competent supervisory and control authorities, mass media, enterprises responsible for GMO elaboration, scientists responsible for the risk assessment of GMO, organisations that protect consumer rights, food producers and traders and environmental activists and environmental protection organisations towards GMO was low. From all sources of information on GMO, most trustful source of all Latvia inhabitants was scientists responsible for the risk assessment of GMO and environmental activists and environmental protection organisations.

Key words: GMO, consumer attitude, survey, statistical indicators.
JEL code: D81, I18, O31, Q18, M30.

Introduction

Recent political activities and discussions on USA – EU Trade agreement as well as CETA agreement have raised also questions on attitude towards GMO, which has been discussed at different levels: policy makers, scientists, mass media and society. The regulations adopted in the European Union are very precautious towards GMO, but in some countries of the world, including the USA the support for GM food, feed and pharmaceuticals is higher. Researchers world-wide have made numerous research on GMO issues in many fields of science and national economy. Research on consumers' attitude towards GMO is monitored by *Eurobarometer* on regular basis in all European countries.

The aim of this paper is to analyse attitude of inhabitants' confidence in politicians and decision makers, competent supervisory and control authorities, mass media, enterprises responsible for GMO elaboration, scientists responsible for the risk assessment of GMO, organisations protected consumer rights, food producers and traders and environmental activists and environmental protection organisations towards GMO. Research methods applied: scientific publications' studies, survey of Latvia's inhabitants on analysed aspects of GMO. The tasks for research are: to evaluate scientific publications related to consumers' attitude towards GMO; to evaluate Latvia's inhabitants' trust in various sources of information towards GMO and compare the results of the survey by age group and gender. The survey of Latvia's inhabitants was conducted from September 2014 until June 2015. To ensure random selection of respondents included in the sample – to apply random sample approach (by use of systematic sample), telemarketing company was hired that applied their inhabitant data base and made telephone calls to respondents with invitation to participate in the survey and giving instructions on participation in the survey. If the respondent had not replied, next call was given to selected respondent in two weeks with reminder to fill the survey. If after the second reminder it was not done, then it was reminded third time. For questionnaire designed, especially for the inhabitant's survey, authors applied evaluation scale 1 – 10 to evaluate the attitude of inhabitants, where 1 – do not support at all; 10 – fully support. For survey data analysis,

descriptive statistics (indicators of central tendency or location and indicators of variability or dispersion), cross tabulations, Mann-Whitney U test, Kruskal Wallis test were applied.

Research results and discussion

Scientific research and consequently scientific publications on public attitude towards GMO are developed in many countries and related to all aspects of GMO in relation to consumers' trust to different sources of information on GMO, studies are published in extensive scientific monograph, edited by scientists from the USA and Italy (Evenson and Santaniello edit., 2006), on EU expert's attitude towards GMO (Aleksejeva, 2014), on Latvia's inhabitants attitude towards GMO (Aleksejeva, 2016, Aleksejeva *et al,* 2016), on different strategies and sources of information on GMO (Vigani, Olper, 2013), aspects on perception of GMOs by scientists and practitioners and the critical role of information flow about transgenic organisms is on research agenda of several scientists (Malyska et al., 2014), on determining group and individual concerns regarding genetic engineering (Frewer et al, 1997), on consumer acceptance of transgenic crops (Frewer et al, 1998), scientific discussions are carried out also on issues of consumers' knowledge level and influence of this knowledge on attitude towards GM food (Cuite *et al,* 2005), on consumers attitude and policy makers (Baker and Burnham, 2001).

Multi-country assessment on consumers' acceptance and willingness to pay for GM vegetable oil and salmon was performed by researchers from the USA, Japan, Norway and Taiwan (Chern et al, 2002), on consumers' attitude towards labelled and unlabelled GM food products (Soregaroli et al, 2003), on applications for food (Brady and Brady, 2003). Extensive research on consumers' knowledge and choice (Noussair et al, 2002), on consumers' trust in new technologies including GMO (Roller, 2001), on how much the consumers trust in food selection and GMO across national cultures (Priest *et al*, 2003). Several recent research has been conducted in various fields and in many countries to evaluate consumers' attitude towards GMO for feed (Turkac, 2016), on consumers' attitude towards GMO for pharmaceuticals (Vazquez-Salat, 2013), (Straub, 2002), for wine production (Plahuta, 2007), (Pretorious, 2000).

There are evaluated aspects of labelling of GMO in the USA – how consumers want to see it done – those aspects were investigated in detail by American researchers' group (Teisl et al, 2003). Analysis of trust in information sources on GMO are analysed in different countries: Italy (Bocaletti and Moro, 2000), comparative analysis on consumers attitude in Italy and the USA (Harrison *et al,* 2004), results on consumer attitude towards GMO and source of information on GMO in Norway (Grimsrud, 2002), in Spain (Lujan and Todt, 2000), in Singapore (Subrahmanyan et al., 2000). and in the USA (Hallman *et al*, 2002).

Several research methods are used in scientific publications world-wide to measure consumers' attitude towards GMO and GM including information source evaluation: indicators of central tendency or location, indicators of variability, as well as regression analysis (Soregaroli et al, 2003), (Hossain and Onyango, 2004).

In research community, the extensive and deep scientific discussions on experimental investigation of consumer willingness to pay for non-GM foods when an organic option is present are carried out with more and more emotions of different parts of society (Bernard et al, 2006).

The European Commission performs extensive document publications and legislation update on regular basis (European Commission, 2017).

The survey of Latvian inhabitants was conducted in 2014 and 2015. The systematic sample was used in order to ensure a random sample approach and selection of respondents' randomly. That was not an easy task as the GMO

issues are very sensitive and some part of society has very emotional attitude in conversations on GMO issues. The list of potential respondents for Latvian inhabitants was gained from telemarketing company inhabitants' data base. The hired telemarketing company made telephone calls to potential respondents with invitation to participate in the survey and also giving instructions on participation in the survey. There were three approaches for respondents included in the sample if: the selected respondent had not responded in two weeks, reminder was given in two weeks and third reminder - after next two weeks. The number of respondents in the survey was 1184. For deeper analysis of respondents' attitude towards GMO, evaluations scale 1 to 10 was used.

The support of Latvian inhabitants for the use of GMO was low. About 37 % did not support the use of GMO in pharmacy, about 50 % for improving the properties of crops, about 74 % for genetically modified animals, about 64 % for genetically modified animals feed.

Latvian inhabitants' confidence in politicians and decision makers, competent supervisory and control authorities, mass media, enterprises responsible for GMO elaboration, scientists responsible for the risk assessment of GMO, organisations that protect consumer rights, food producers and traders and environmental activists and environmental protection organisations towards GMO was low. Most of all Latvian inhabitants had confidence in scientists responsible for the risk assessment of GMO and also in environmental activists and environmental protection organisations. Half of the respondents evaluated confidence in scientists responsible for the risk assessment of GMO and environmental activists and environmental protection organisations with 7 or more points – median values were 7 points, arithmetic mean values were 6.3 and 6.2 points, mode values 8 and 7 points, respectively, the evaluations were quite heterogeneous (standard deviation – 2.59 and 2.52, respectively). Less part of Latvian inhabitants had confidence in politicians and decision makers and food producers and traders, median – 3 points, arithmetic mean – 3.1 and 3.2 points, respectively, mode – 1 point, the evaluations were heterogeneous (standard deviation – 2.24 and 2.16, respectively) (Table 1).

Table 1

Statistical indicators of respondents' evaluations on confidence

Factors	Mean	Median	Mode	Standard deviation	Minimum	Maximum
Politicians and decision makers	3.1	3	1	2.2	1	10
Competent supervisory and control authorities	5.6	6	5	2,5	1	10
Mass media	4.1	4	5	2.2	1	10
Enterprises responsible for GMO elaboration	3.9	4	1	2.7	1	10
Scientists responsible for the risk assessment of GMO	6.3	7	8	2.6	1	10
Organisations protected consumer rights	5.6	6	5	2.5	1	10
Food producers and traders	3.2	3	1	2.16	1	10
Environmental activists and environmental protection organisations	6.2	7	7	2.52	1	10

Source: authors' calculations based on Latvia inhabitants' survey conducted by Inese Aleksejeva, 2014 – 2015, n=1184, evaluation scale 1 – 10, where 1 – do not trust at all; 10 – fully trust

The females' confidence in scientists responsible for the risk assessment of GMO, organisations that protect consumer rights and environmental activists and environmental protection organisations was higher than males' evaluations were (Table 2). The evaluations of females and males' evaluations differed

statistically significant, proved by the result of Mann-Whitney U test, $p \leq 0.002$.

Table 2

Average values of females and males evaluations

	Females			Males		
	Mean	Median	Mode	Mean	Median	Mode
Politicians and decision makers	3.2	3	1	3.1	2	1
Competent supervisory and control authorities	5.7	6	5	5.4	6	7
Mass media	4.1	4	5	4.0	4	5
Enterprises responsible for GMO elaboration	4.0	4	1	4.0	4	1
Scientists responsible for the risk assessment of GMO	6.5**	7	8	5.8**	6	8
The organisations protected consumer rights	5.7*	6	5	5.2*	5	5
Food producers and traders	3.2	3	1	3.1	3	1
Environmental activists and environmental protection organisation	6.4**	7	7	5.8**	6	7

p=0.002; **p<0.001
Source: authors' calculations based on Latvia inhabitants' survey conducted by Inese Aleksejeva, 2014 – 2015, n=1184, evaluation scale 1 – 10, where 1 – do not trust at all; 10 – fully trust

For all evaluated sources of information on GMO, scores given by female respondents were higher. The females' evaluations and males' evaluations were heterogeneous (standard deviation values greater than 2.10 points).

Young people (aged 18 to 39) bit higher have evaluated confidence in politicians and decision makers, as well as enterprises responsible for GMO elaboration, as well as food producers and traders; the evaluations differed statistically significant (Mann-Whitney U test, $p<0.05$), but on the whole the evaluations were low (average values were around 3 points).

Conclusions, proposals, recommendations

1) In general, Latvian inhabitants' confidence in several sources of information on GMO: politicians and decision makers; competent supervisory and control authorities; mass media; enterprises responsible for GMO elaboration, scientists responsible for the risk assessment of GMO; organisations protecting consumer rights; food producers and traders and environmental activists and environmental protection organisations towards GMO was low.
2) From all sources of information on GMO, most of all Latvian inhabitants trusted to scientists responsible for the risk assessment of GMO and environmental activists and environmental protection organisations.
3) Young people (aged 18 to 39) had a bit higher evaluated trust in sources of information on GMO such as politicians and decision makers, enterprises responsible for GMO elaboration, food producers and traders.

Analysing the females' evaluations and males' evaluations on trust in information source in scope of all evaluated sources of information towards GMO, female respondents had given higher scores that male respondents had. The evaluations by both gender respondents were heterogeneous.

Acknowledgements

The paper was supported by the National Research Program 5.2. EKOSOC-LV

Bibliography

1. Aleksejeva, I. (2014). EU Experts' Attitude towards Use of GMO in Food and Feed and Other Industries. *Procedia - Social and Behavioral Sciences*, Volume 110, pp. 494 – 501.
2. Aleksejeva, I. (2016). An Empirical Study of Latvian Consumers' Attitudes and Perceptions towards Genetically Modified Organisms, *European Integration Studies,* Volume 10, pp. 157-168.
3. Aleksejeva, I., Sloka, B., Kantane, I., Vilcina A. (2016). Attitude towards GMO in Latvia – Results of Inhabitants' Survey. *Economic Science for Rural Development: Integrated and Sustainable Regional Development, Production and Co-operation in Agriculture.* Issue 42, pp. 194-199.

4. Baker, G.A., Burnham, T.A. (2001). Consumer Response to Genetically Modified Foods: Market Segment Analysis and Implications for Producers and Policy Makers. *Journal of Agricultural and Resource Economics*, Volume 26, Issue 2, pp. 387-403.
5. Bernard, J.C., Zhang, C., Gifford, K. (2006). An Experimental Investigation of Consumer Willingness to Pay for Non-GM Foods When an Organic Option Is Present. *Agricultural and Resource Economics Review.* Volume 35, Issue 2, pp. 374–385.
6. Boccaletti, S., Moro, D. (2000). Consumer Willingness to Pay for GM Food Products in Italy. *AgBioForum*, Volume 3, Issue 4, pp. 259-267.
7. Brady, J.T., Brady, P.L. (2003). Consumers and Genetically Modified Foods. *Journal of Family and Consumers Sciences.* Volume 95, pp. 12-18.
8. Chern, W.S., Rickertsen, K., Tsuboi, N., Fu, T.-T. (2002). Consumer Acceptance and Willingness to Pay for Genetically Modified Vegetable Oil and Salmon: A Multiple-Country Assessment. *AgBioForum*, Volume 5, Issue 3, pp. 105-112.
9. Cuite, C.L., Aquino, H.L., Hallman, W.K. (2005). An Empirical Investigation of the Role of Knowledge in Public Opinion about GM Food. *International Journal of Biotechnology*, Volume 7, Issue 1-3, pp. 178-194.
10. Frewer, L.J., Hedderley, D., Howard, C., Shepherd, R. (1997). 'Objection' Mapping in Determining Group and Individual Concerns Regarding Genetic Engineering. *Agriculture and Human Values*, Volume 14, Issue 1, pp. 67-79.
11. Frewer, L.J., Howard, C., Aaron, J.I. (1998). Consumer Acceptance of Transgenic Crops. *Pesticide Science*, Volume 52, Issue 4, pp. 388-393.
12. Grimsrud, K., Mccluskey, J., Loureiro, M., Wahl, T. (2002). Consumer Attitudes Toward Genetically Modified Food in Norway. *Journal of Agricultural Economics*, Volume 55, Issue 1, pp. 75 -90.
13. Hallman, W.K., Adelaja, A.O., Schilling, B.J., Lang, J. (2002). Public Perceptions of Genetically Modified Foods: Americans Know not What They Eat. Publication No. RR- 0302-001, Food Policy Institute, Rutgers University. A Food Policy Institute Publication, New Brunswick, NJ, pp. 1-62.
14. Harisson, J.W., Bocalleti, S., House, L. (2004). Risk Perceptions of Urban Italian and United States Consumers for Genetically Modified Foods. *AgBioForum*, Volume 7, Issue 4, pp. 195-201.
15. Hossain, F., Onyango, B. (2004). Acceptance of Genetically Modified Foods. *International Journal of Consumer Studies*, Volume 28, Issue 3, pp. 255-267.
16. European Commission (2017). Genetically Modified Organisms – official webpage of EC. Retrieved: http://ec.europa.eu/food/plant/gmo_en. Access: 18.01.2017.
17. Evenson, R.E., Santaniello, V. edit. (2006). Consumer Acceptance of Genetically Modified Foods. CABI Publishing. 245 p.
18. Lujan, J.L., Todt, O. (2000). Perceptions, Attitudes and Ethical Valuations: The Ambivalence of the Public Image of Biotechnology in Spain. *Public Understanding of Science*, Volume 9, Issue 4, pp. 383-392.
19. Malyska, A., Maciagi, K., Twardowski, T. (2014). Perception of GMOs by Scientists and Practitioners – the Critical Role of Information Flow about Transgenic Organisms. *New Biotechnology,* Volume 31, Issue 2, pp. 196-202.
20. Noussair, C., Robin, S., Ruffieux, B. (2002). Do Consumers not Care about Biotech Foods or do they Just not Read the Labels? *Economics Letters*, Volume 75, Issue 1, pp. 47-53.
21. Plahuta, P., Tivadar, B., Raspor, P. (2007). Slovenian Public Opinion Regarding Genetically Modified Organisms in Winemaking. *Acta Alimentaria*, Volume 36, Issue 1, pp. 61-73.
22. Pretorius, I.S. (2000). Tailoring Wine Yeast for the New Millennium: Novel Approaches to the Ancient Art of Winemaking. *Yeast*, Volume 16, Issue 8, pp. 675-729.
23. Priest, S.H., Bonfadelli, H., Rusanen, M. (2003). The "Trust Gap" Hypothesis: Predicting Support for Biotechnology across National Cultures as a Function of Trust in Actors. *Risk Analysis*, Volume 23, Issue 4, pp. 751-766.
24. Roller, S. (2001). Genetically Modified Foods: Threat or Opportunity? *Food Technology and Biotechnology*, Volume 39, Issue 4, pp. 259-263.
25. Soregaroli, C., Boccaletti, S., Moro, D. (2003). Consumer's Attitude towards Labelled and Unlabelled GM Food Products in Italy. *International Food and Agribusiness Management Review*. Volume 6, Issue 2, pp. 111 – 127.
26. Straub, J.O. (2002). Environmental Risk Assessment for New Human Pharmaceuticals in the European Union According to the Draft Guideline/Discussion Paper of January 2001. *Toxicology Letters*, Volume 135, Issue 3, pp. 231-237.
27. Subrahmanyan, S., Cheng, P.S. (2000). Perceptions and Attitudes of Singaporeans toward Genetically Modified Food. *Journal of Consumer Affairs*, Volume 34, Issue 2, pp. 269-290.
28. Teisl, M.f, Garner, L., Brian R., Vayda, M.E. (2003). Labeling Genetically Modified Foods: How Do US Consumers Want to See It Done? *AgBioForum*, Volume 6, Issue 1&2, pp. 48-54.
29. Turkec, A., Lucas, S.J., Karacanli, B., Baykut, A. Yuksel, H.. (2016). Assessment of a Direct Hybridization Microarray Strategy for Comprehensive Monitoring of Genetically Modified Organisms (GMOs). *Food Chemistry*, Volume 194, Volume 1, pp. 399-409.
30. Vàzquez-Salat, N. (2013). Are Good Ideas Enough? The Impact of Socio-Economic and Regulatory Factors on GMO Commercialisation. *Biological Research*, Volume 46, Issue 4, pp. 317-322.
31. Vigani, M., Olper, A. (2013). GMO standards, endogenous policy and the market for information, *Food Policy*, Volume 42, pp. 32 – 43.