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TRUST IN SOCIAL ACTORS AND ATTITUDES TOWARDS GENETICALLY MODIFIED ORGANISMS IN SLOVENIA

ABSTRACT: This article tries to fulfil the research gap left by the fact that no study to date has examined how trust in social actors affects attitudes towards genetically modified organisms (GMOs). Therefore, two key hypotheses were posited: a) trust in social actors is a more important factor of attitudes towards GMOs than knowledge about GMOs; and b) trust in certain social actors is a more important factor than trust in other social actors. Telephone survey data of adult Slovenians were used. The analyses show that: a) general trust in social actors has a positive effect on attitudes towards GMOs; b) trust in various social actors has different effects; and c) trust in social actors has a stronger effect on attitudes towards GMOs than knowledge about GMOs.

KEY WORDS: trust in social actors, attitude towards GMOs, knowledge, linear multiple regression, principle component analysis

Zaupanje v družbene akterje in stališča o gensko spremenjenih organizmih v Sloveniji

IZVLEČEK: Ker obstoječe študije niso obravnavale vpliva zaupanja v družbene akterje na stališče do gensko spremenjenih organizmov (GSO), skuša članek zapolniti to raziskovalno vrzel. Na tej predpostavki sta bili postavljeni dve ključni hipotezi: a) zaupanje v družbene akterje je pomembnejši dejavnik stališč do GSO kot znanje o GSO in b) zaupanje v določene družbene akterje je pomembnejši dejavnik kot zaupanje v druge družbene akterje. Za preverjanje hipotez so bili uporabljeni podatki telefonske ankete na populaciji polnoletnih prebivalcev Slovenije. Analize podatkov kažejo, da a) zaupanje v družbene akterje pozitivno vpliva na stališča o GSO, b) da ima zaupanje v različne akterje različen vpliv in b) da ima zaupanje v družbene akterje močnejši vpliv na stališča o GSO kot znanje o GSO.

KLJUČNE BESEDE: zaupanje v družbene akterje, stališča o GSO, znanje, multivariatna linearna regresija, metoda glavnih komponent

1 Introduction

In the last twenty years, few themes of biotechnology have received as much public attention as genetic modified organisms (GMOs) and accompanying research and technologies have become some of the most controversial issues in our society (Bukenya and Wright 2007; Šorgo and Ambrožič-Dolinšek 2009). Intense debates among proponents and opponents have emerged in almost all fields of GMOs (Christoph et al. 2008; Pardo et al. 2002). What is acceptable in some parts of the world (e.g. United States of America) is unacceptable in others, for instance in Europe (Finucane 2002; Moseley 2002; Ramon et al. 2008; Sybesma et al. 2006; Šorgo et al. 2012). Although existing studies on public attitude towards GMOs establish that attitudes vary according to the use of GMOs (Frewer and Shepherd 1995; Hamstra 1998), they deal only with the attitudes towards specific use of GMOs. Therefore, our study examines the population's attitudes towards all types and uses of GMOs. Previous studies have mainly compared the attitude towards the use of GMOs in medicine with the attitude towards the use of GMOs in agriculture and food for people and animals and found out that majority of interviewees have a most positive attitude towards the use of GMOs in medicine (Batrinou et al. 2008; Bonny 2003; Eurobarometer 341 2010). This can be explained with the fact that people are the most tolerant of innovation in the field of health (Paparini and Romano-Spica 2004).

Which are factors having effect on public attitudes towards GMOs? There is a growing body of literature concerning public attitudes toward GMOs which shows that factors, such as trust in social actors (Lang and Hallman 2005; Moon and Balasubramanian 2004; Priest et al. 2003), are better predictors of public attitudes towards GMOs than individual's knowledge (Siegrist and Cvetkovich 2000). Scholars and practitioners widely acknowledge importance of trust (Giddens 1990; Seligman 2000). Different social actors compete in public opinion for public trust because people are motivated to respond to information provided by more trustworthy actors (Frewer et al. 1996; 2003; Poortinga and Pidgeon 2005; White et al. 2003). Our goal is to explore how trust in social actors affects Slovenians' attitudes towards GMOs.

A theoretical background in the first section will be followed by a method section. Then, results of statistical analysis of a multivariate linear regression and principal component analysis will be presented. In the concluding section, results will be summarized and discussed.

2 Theoretical backgrounds with hypothesis

The attitudes are formed in the long term, based on the existing attitudes and the broader social context (Eagly and Chaiken 1993). Individuals integrate each new cognitive element and adapt it to already existing attitudes (Festinger 1957; Stroebe and Jonas 1990). Many studies emphasize the knowledge as one of the important factors influencing the attitudes towards GMOs (Banducci et al. 2004; Lang and Hallman 2005; Eurobarometer 64.3 2006; Eurobarometer 341 2010). Knowledge is produced with experience and processing of information. It can be implemented in all life

situations, but most typically in the process of formally institutionalized education, and informally by use of mass media (Lundvall 2000). Information obtained by use of mass media is especially important in forming attitudes without direct experience (Eagly and Chaiken 1993). In Slovenia, there is no cultivation of genetically modified plants and only a few scientists in the field of biotechnology – which carried out an experimental cultivation of genetically modified plants in closed system – have experiences with GMOs. Since population of Slovenia use mass media as the main sources of information about GMOs (Erjavec et al. 2012) and those media most often quote non-governmental environmental organizations and politicians as primarily source (Erjavec and Zajc 2011; Zajc and Erjavec 2012), we can conclude that the population of Slovenia obtains the information about GMOs from these two social groups.

There is no single definition of trust. Already Luhmann (1979) has pointed out early on that social scientists need to build a theory of trust. Bernard Barber (1983) was first who defined the concept of trust in three dimensions: expectations of 1) moral activity, 2) professional qualifications/competence of actors and their behaviour, and 3) fiduciary responsibility – putting the interest of others above their own. In further research, some authors have emphasized only one dimension of trust (Dunn 1988; Eurobarometer 341 2010; Sitkin and Roth 1993) while others have analyzed several dimension of trust (Gabaro 1987; Giffin 1967; Lang and Hallman 2005; McKnight and Chervany 1996; Rempel et al. 1985). Due to similar research topic, in our research the definition of trust by (Lang and Hallman 2005) was used: trust is a perception of positive attributes of social actors that is based on three dimensions: 1) competence – knowledge and expertise; 2) honesty and truthfulness; and 3) concern and care – doing a good job for the public. These three dimensions are in line with a general sociological concept of trust, where the reputation of the social actors, and their performance and appearance are understood as elements of primary trust or 'reflected trustworthiness' (Sztompka 1999). Trust in social institutions is particularly important in the situation when the knowledge of individuals is weak (Siegrist and Cvetkovich 2000). Studies on public attitudes towards GMOs indicate the importance of factor trust in social actors (Lang and Hallman 2005; Moon and Balasubramanian 2004; Priest et al. 2003). Trust becomes even more central and critical during periods of uncertainty due to social crisis (Weick and Roberts 1993), in which we are today. According to Marris (2001), key stakeholder in the GMOs field are particularly those social actors who actively participate in public discussions and other meetings about GMOs, or whose work is (potentially) connected to GMOs. Different social actors compete in public opinion for public trust because people are motivated to respond to information provided by more trustworthy actors (Frewer et al. 2003; Poortinga and Pidgeon 2005; White et al. 2003). Because numerous studies show that specific institutions or groups, such as advocacy groups and media (Batrinou et al. 2008; Finucane 2002) affect the formation of attitudes towards GMOs, our study includes trust in different social actors and not just single spokespersons associated with particular isolated messages. In general, data from the international surveys show that, from the comparative perspective, social trust in Slovenia is low at all measured levels: on (inter)personal (as a low level of social capital),

national (towards national institutions, e.g., government, parliament, political parties) and on international (towards international institutions, e.g., UN, EU) (Malnar 2004). Selection of social actors is based on the findings of international studies (Navarro et al. 2009; Eurobarometer 341 2010) and the Slovenian contexts (identification of social actors in the Slovenian mass media) (Erjavec and Zajc 2011).

Based on results of relevant studies (Lang and Hallman 2005; Moon and Balasubramanian 2004; Priest et al. 2003) showing that trust in social actors is an important factor in attitudes toward social issues, we developed the following general hypothesis: *trust in social actors affects attitudes towards GMOs.* This general hypothetical starting point was amended with the following:

- H1: *Trust in social actors is a more important factor of attitudes towards GMOs than knowledge about GMOs.* In this framework, we also intend to explore differences between individual social actors – we expect that *trust in some social actors is a more important factor than trust in other social actors.*
- H2: *The effect (predictive power) of demographic factors (such as age, gender, and education) overcomes the effect of trust and knowledge.*

3 Method

The data was collected by a telephone survey of adult Slovenian population conducted in January 2012. A simple random sampling procedure based on telephone directory was applied to select 1762 private telephone numbers (institutional numbers were excluded as non-eligible). On the next stage an adult person was selected randomly (a person with the most recent birthday). Finally a sample of 446 respondents has been realized (approximately 25% response rate). To correct biases deriving from the sampling procedure and non-responses the weighting procedure was applied. An extensive standardised questionnaire included a set of demographic variables (gender, age, education, type of settlement, region of living, employment, and satisfaction with financial situation), attitudes towards GMOs, knowledge about GMOs and trust in relevant social actors in the field of GMOs. The results were evaluated and analysed using SPSS software. We tested the effect of trust in social actors on attitudes towards GMOs using the linear multiple regression model where the effect of trust in actors was controlled for the following variables (also possible factors of attitudes towards GMOs): knowledge about GMOs, self-assessment of knowledge, education level, type of education, size of place of living, satisfaction with financial situation, gender, and age. And it was the same for all of the predictors: the effect of each predictor was controlled for all other predictors included in the model.

3.1 Attitudes towards GMOs

Attitudes towards GMOs were measured on the Likert-like scale from 1 (completely opposed to GMOs) to 5 (completely supportive of GMOs). Attitudes were measured with nine items covering different specific aspects of GMOs: different sorts of GMOs (plants, animals and microorganisms), different usage of GMOs (in food for people, in feed for animals, in pharmacy/medicine and in industry), geographical distance (production of GM plants in and out of Slovenia) and GMOs in general[1]. Analysis has shown predominately negative attitudes toward all measured aspects of GMOs among Slovenians. The results of the principal component analysis supported our expectation about the uni-dimensionality of the measurement scale (the first component explains 56% of the common variance). Based on this result, we decided to develop one composite index including all nine items, which was also supported by the reliability test for the scale (Cronbach's alpha = 0.902). The index was computed as a mean value of the answers to all nine items. Thus the measurement scale was the same as for single items, from 1 to 5 (mean value of the index on the whole sample was 1.92 with standard deviation of 0.83 and with standard error of estimation of 0.040). A relatively high (significant) correlation of the index with a single item measuring the general attitude towards GMOs (Pearson's r = 0.667) showed that we were able to measure general attitudes towards GSOs by this index.
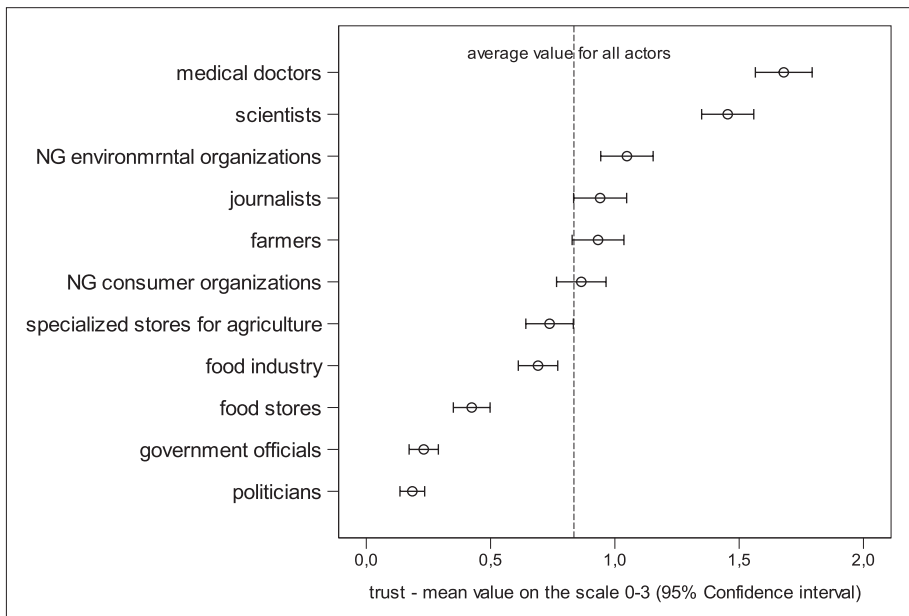
3.2 Trust in social actors

The following eleven social actors were evaluated: consumer's NGO's, environmental NGOs, food industry, specialised agricultural stores, food stores, farmers (food producers), scientists, governmental officials, politicians, journalists and medical doctors. Respondents answered the following three questions (for each actor) with 'yes' or 'no': 1) Have they enough knowledge for the assessment of GMOs? 2) Are they sincere or do they speak the truth about GMOs? 3) Are they expected to act for the benefit of citizens where GMOs are concerned? Counting answers 'yes', an index of trust was developed for each social actor – values from 0 (no trust) to 3 (positive answers on all three questions, high level of trust). A comparison of social actors shows that medical doctors are the most trustworthy (1.68), while politicians are the least trustworthy (0.19) (Figure 1).

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1. Other surveys used the same measurement with nine items for specific aspects of GMOs (Hamstra, 1998; Eurobarometer 64.3, 2006; Eurobarometer 341, 2010). We added two more aspects in our survey: geographical distance and general attitude towards GMOs.

Figure 1: Trust in social actors regarding GMOs (mean values on the scale 0-3)

We expected that the structure of trust in social actors would be multi-dimensional. We therefore applied the principal component analysis (with the oblimin rotation of components) to test this expectation. The results confirmed the pattern of component structure, which indicated multidimensionality. Namely, three components, explaining 59.7% of variance, were extracted (each with eigenvalue higher than 1). The results suggest that we can (conditionally) speak of the following three groups (dimensions): 1) *The first* component (conditionally) represents trust in *experts* and includes scientists, medical doctors, farmers, food industry and specialised agriculture stores (actors which are expected to have knowledge and direct information about GMOs); 2) *The second* component represents trust in *politics* (government officials and politicians); 3) *The third* component represents trust in *civil society organisations*: consumer NGOs and environmental NGOs. Two actors (journalists and food stores) were not unambiguously related to a single component: similar loadings for food stores on the first and the second component, and similar loadings for journalist on the first and the third component. When we excluded these two actors from the analysis we got the same component structure with just slightly higher variance explanation (65.9%)

Results (based on oblimin rotation of components) also showed that there are moderate positive correlations among all three rotated components (0.15, 0.33, 0.43), which suggests that we can also speak of a one-dimensional structure of trust in social actors. Based on these results, for further analyses, we prepared a composite index of trust for all 11 actors together (which means that also food stores and journalists were included). The index was formed in the following way: the sum of the values for individual social

actors was divided by three. Thus we calculated the index on a scale range from 0 to 11 (Cronbach's alpha = 0.828).

3.3 Knowledge

Knowledge about GMOs was measured by self-assessment (one survey question) and by a measurement scale for objective knowledge. The objective measurement scale consisted of five indicators (statements about GMOs). The indicators of knowledge were based on previous studies (House et al. 2005; Eurobarometer 64.3 2006) and did not measure complete knowledge about GMOs, but knowledge about the five concrete statements (four statements were false and one was correct). Respondents were asked to indicate at each statement whether it was true, probably true, probably false or false. Correct answers were scored with 2 points, while insecure correct answers ('probably') were marked with 1 point. By summing the scores for each answer, a composite index of knowledge was formed on the scale range from 0 to 10. The final results showed that general knowledge about GMOs is quite poor – population mean value is only 2.7 (SEM = 0.098, SD =2.06).

4 Results

The study among Slovenians shows predominantly negative attitudes towards all nine measured aspects of GMOs. Analysis on a bivariate level supported our general hypothesis: *trust in social actors has a statistical significant effect on attitude towards GMOs*. Our results show a moderate positive correlation between the common index of trust and the attitude index (Pearson's $r = 0.220$, $p < 0.01$). We also compared the relation between trust in each social actor separately on one side and attitudes toward GMOs on the other. We discovered a general pattern of weak (statistically significant) positive correlation (Pearson's r) ($p < 0.05$) between trust in individual social actors and attitudes towards GMOs. Only two correlations were not significant and lower than 0.100 ($p > 0.05$). The strongest positive correlation was revealed for trust in food stores (0.199) and the weakest positive correlation for politicians (0.092). Trust in journalists was an exception: the correlation was almost zero, but it had a negative direction (-0.012) which indicates the following possible trend: higher trust in journalists leads to more negative attitudes towards GMOs. When we applied a multiple linear regression model and controlled the effect of each specific trust for trust in other actors, just a few social actors seemed to be important (see Table 1). On the whole, the model was statistically significant but its predictive power was not very impressive: only 5.6% of variance of dependent variable (attitudes towards GMOs) was explained. Looking at the individual predictors, we can see that trust in food stores seems to have the most important positive effect ($\beta = 0.154$). It is followed by a significantly negative effect of trust in journalists (-0.119). There was one more significant positive effect – trust in scientists (0.105). The abovementioned negative (non-significant) bivariate relation between trust in journalists and attitudes towards GMOs became significant and stronger in the multivariate situation of the linear regression model.

It is obvious that trust in social actors has some effect and that trust in various social actors has different effect. This is in line with our hypothetical expectations. It is also important to note that a high level of trust does not necessarily lead to high effect: for example, medical doctors are the most trustful but, in the regression model, trust in medical doctors had no statistical significant effect ($\beta = -0.023$).

Table 1: Predictors of attitudes towards GMO – trust in social actors (OLS standardised regression coefficients)

predictors:	Standardized regression coefficients (β)
– *trust in food stores*	** 0.154
– *trust in journalists*	** -0.119
– *trust in scientists*	* 0.105
– trust in NG environment organizations	0.083
– trust in NG consumers organizations	0.071
– trust in food industry	0.043
– trust in specialized stores for agriculture	-0.025
– trust in farmers	0.023
– trust in medical doctors	-0.023
– trust in governmental officials	0.010
– trust in politicians	0.006
Weighted N	440
Adjusted R2	0.056
F	*** 3.349

*** p < 0.01; ** p < 0.05; * p < 0.10

In the next step, additional predictors of attitudes towards GMOs were included in the regression model (see Table 2). Since we were interested in general trust in social actors (not individual actors separately) being controlled for all other predictors (independent variables), we included a composite index of trust in social actors in the model as our main independent variable (and not trust in individual actors as in the previous model). In the first model (Model 1), we observed only the effect of 'soft' variables: trust in social actors controlled for objective knowledge about GMOs, and self-assessment of knowledge. In the second model, we added (as control variables) five demographic variables: age, gender, education level, type of education and size of place of living. Results revealed that trust in social actors has a stronger effect on attitudes towards GMOs than knowledge about GMOs. In the first model, trust demonstrated the highest effect (0.200), but knowledge followed it closely (0.179). By adding demographic variables to the model (Model 2), the effect of trust is reduced quite a bit (0.181), while the effect of knowledge was reduced substantially (0.096) (Table 2). How can we explain this positive effect of trust on attitudes toward GMOs? Since

we discovered positive correlations between trusts for all actors, we can say that our index also measured so-called 'basic trust' or 'trusting impulse' as a kind of general orientation indicating optimism, openness and future orientation (Sztompka 1999, 65). From this perspective, it is not surprising that high 'basic trust' also means a positive attitude towards GMOs as one of the 'targets' of this 'basic trust'.

Table 2: Predictors of attitudes towards GMO
(OLS standardised regression coefficients)

predictors:	Model 1 (β)	Model 2 (β)
– trust in social actors (index)	*** 0.200	*** 0.181
– knowledge about GMOs (index)	*** 0.179	* 0.096
– self-assessment of knowledge about GMOs	0.031	0.052
– age		*** -0.280
– gender: man (binary)		*** 0.139
– education level		*** -0.178
– size of place of living		* 0.085
– type of education: technical or natural science (binary)		0.042
Weighted N	431	418
Adjusted R2	0.075	0.181
F	*** 12.560	*** 12.526

*** p < 0.01; ** p < 0.05; * p < 0.10

A comparison of Model 1 and Model 2 also revealed that the predictive power of the model becomes substantially stronger when demographic variables are included: amount of explained variance (R^2) in the second model substantially increased in comparison to the first model (from 0.075 to 0.181). We can see that the age of respondents has the strongest effect (-0.280): young respondents are more in favour of GMOs than older respondents (see an illustration of this relation on a bivariate level in the Figure 2). It is also interesting that the level of education had a negative effect (-0.178) on attitudes towards GMOs: highly educated respondents were more critical towards GMOs than those with lower education. We can also see a significant effect of gender (0.139): men were less critical towards GMOs than women.

Figure 2: Attitudes towards GMOs according to the age of respondents (mean on the scale from 1 to 5)
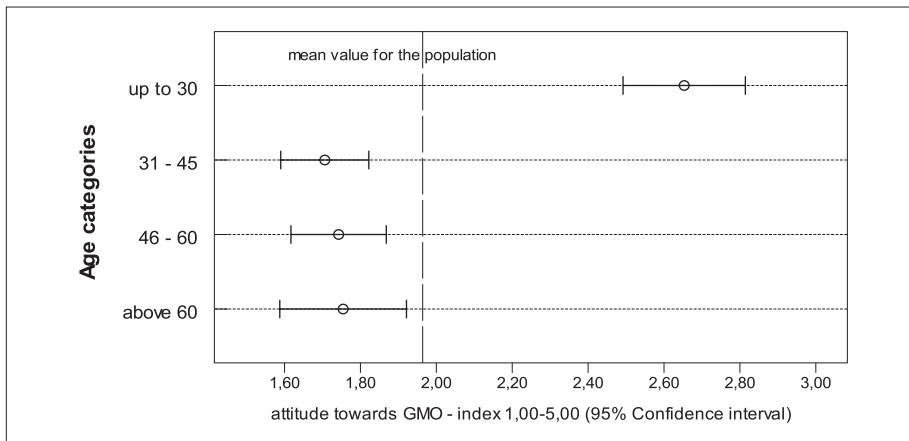
5 Discussion

Compared to previous research about attitudes towards GMOs among Europeans, our research confirmed that Slovenians are more sceptical towards the use of GMOs in food, and even towards their use in medicine where they see fewer difficulties (Eurobarometer 64.3 2006; Eurobarometer 341 2010; Plahuta et al. 2007; Šorgo and Ambrožič-Dolinšek 2009). Slovenians have predominantly negative attitudes towards all nine measured aspects of GMOs, merged into the attitude index. When it comes to GMOs, Slovenians mostly trust medical doctors and scientists. The social actors with the lowest level of trust are politicians. This result is in line with the results of several surveys on the reputation of different professions where medical doctors are usually at the top of the list (Toš and Malnar 2002). Our results are also comparable to the results of other studies that measure trust in social actors in other scientific fields. Those results also show that Slovenians have an increased trust in scientists and a decreased trust in politicians (Ivanišin 2008).

Results show a statistically significant correlation between attitudes towards GMOs and trust in social actors. Besides that, trust in social actors is a more important factor for, and has a stronger effect on attitudes towards GMOs than individuals' knowledge about GMOs. Taking into account that our research also revealed low level of knowledge about GMOs among Slovenian population, that is in line with research of Siegrist and Cvetkovich (2000) who found out that when individual lacks knowledge about hazard, trust in authorities (i.e. social actors) managing the hazard determines perceived risks and benefits. On the other hand, they found no significant correlations between trust and perception of risk and benefits for hazards about people that were knowledgeable. Our research also shows that those who trust more in one individual social actor mostly place greater trust in other social actors. A higher level of trust in

social actors in general or individual social actors (especially food stores and scientists) leads to a more positive attitude towards GMOs. However, trust in various social actors has a different effect on attitudes towards GMOs. This is in line with our hypothetical expectations and previous research (Finucane 2002; Frewer et al. 2003). On the one hand, trust in food stores and scientists provides the most important positive effect on attitudes towards GMOs: those who trust in food stores and scientists are less afraid of the potential negative effects of GMOs, because they perceive those social actors to be competent enough (to have enough knowledge), honest (to tell the truth about GMOs) and to be working for the greater good of all citizens. On the other hand, among all the social actors, trust in journalists was an exception – the trend of correlation with attitude was just the opposite: a higher trust in journalists leads to more negative attitudes towards GMOs. The main possible question is therefore: do journalists spread negative attitudes towards GMOs? A media analysis of news text about GMOs in 2009 and 2010 showed a predominately negative representation of GMOs in the Slovenian mass media (Erjavec and Zajc 2011).

The next important finding of our research was that a higher level of trust in social actors does not necessarily lead to a stronger effect on attitudes toward GMOs: for example, our research shows that medical doctors are the most trustworthy. But, in the regression model, trust in medical doctors has no statistically significant effect on attitudes towards GMOs. A possible explanation for this could be the fact that journalists do not perceive medical doctors as important sources of information regarding GMOs. A source analysis of news texts regarding GMOs in the Slovenian mass media from 2009 to 2010 showed that medical doctors were not a key source of information about GMOs (Erjavec and Zajc 2011).

6 Conclusions

Our research confirmed all of our hypotheses about the relationship between trust in social actors and attitudes towards GMOs. Higher trust in one group of social actors leads to higher trust in other groups of social actors. This study also shows that trust in some social actors is a more important factor than trust in other actors. Higher trust in social actors in general or individual social actors, especially food stores and scientists, leads to more positive attitudes toward GMOs. But, a high level of trust does not necessarily lead to high effect: for example, medical doctors are the most trustworthy while in the regression model trust in medical doctors has no statistical significance. Among social actors, trust in journalists was an exception – higher trust in journalists leads to more negative attitudes towards GMOs.

Research also confirmed that trust in social actors is a more important factor for, and has a stronger effect on, attitudes towards GMOs than individuals' knowledge about GMOs. Results also confirmed the hypothesis that the effect (predictive power) of demographic factors (such as age, gender and education) overcomes the effect of trust and knowledge. Respondents who were young, male or had a lower level of education had a more positive attitude towards GMOs than older, female or highly educated respondents.

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