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ACCEPTABILITY OF A LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTE REPOSITORY

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ABSTRACT

Siting of a radioactive waste repository, even for the waste of low and intermediate level (LILW) radioactivity, presents a great problem in almost every country that produces such waste. The main problem is not a technical one, but socio-psychological, namely the acceptability of this kind of repository. In general, people are opposed to any such kind of facility in their vicinity (NIMBY). In this study we try to establish the factors that influence people's behavior regarding the construction of a radioactive waste repository in their local community, with the use of Ajzen's model of planned behavior. Two different scenarios about the construction of a radioactive waste repository in their community, together with a set of questions were presented to participants from different schools. Data from the survey were analysed by multivariate methods, and a model of relevant behaviour was proposed. From the results it can be seen that different approaches to local community participation in site selection process slightly influence people's attitudes towards the LILW repository, while significant differences in answers were found in the responses which depend on participants' knowledge. Therefore the RAO Agency will further intensify preparation of the relevant communication plan and start with its implementation to support LILW repository site selection process, which will also include educational programme.

1 INTRODUCTION

Already in 1981, Slovic et al. asserted that the success of energy production policies will depend vitally on public attitudes, and that energy decisions cannot be determined by technical criteria alone. In a similar way, Eiser and van der Pligt (1988) found out that a number of nuclear accidents and many uncertainties associated with this technology resulted in demands by the public to be more involved in energy policy matters. Even before the most known nuclear accidents (TMI, Chernobyl), there was public opposition to the use of nuclear energy. Many research studies revealed that nuclear power appears to evoke greater feelings

of dread than any other technological activity (Slovic et al., 1981). One of the reasons for such attitudes rests in the association of nuclear energy with nuclear weapons; that is, in its violent origin. Therefore people tend to view its risks as uncontrollable, lethal and potentially catastrophic. These opinions are in great discrepancy with the opinions of experts who are dealing with nuclear technology.

Although the fear of the general public towards nuclear energy has no rational background from the experts point of view, it has to be taken into account. Moreover it must be accepted that even relatively “non-dangerous nuclear activities” like the siting and construction of low and intermediate level radioactive waste repositories will be met with strong opposition. The main reason is that the general public hardly discriminates between the different aspects and phenomena in the area of nuclear energy and has different conceptions of them. By coupling people’s conceptions of the nuclear field with the occurrence of NIMBY (not in my backyard) as legitimate attitudes toward constructing undesirable buildings in one’s neighborhood, a tremendous effort to locate any kind of nuclear facility in a local community is expected. Therefore, the knowledge of the public attitudes and behaviors, and the factors that influence them is essential.

After the failure of site selection, which was performed between 1990 and 1993, the RAO Agency was urged to start a new site selection process for low and intermediate radioactive waste (LILW) in which special emphasis has been given to public involvement and participation (Mele, Železnik, 1998) since the very beginning of the process. Therefore several studies have been performed concerning public attitudes towards radioactive waste repository in Slovenia. To obtain additional information on the opinion of the local communities, a public opinion poll on five locations, selected in the previous site selection, was conducted (Železnik, Mele, 1999). On those bases, a communication strategy with local communities for the LILW repository site selection has been developed (Kos, Polič, 1999), in which the results of the previous analyses have been included. To obtain supplementary information on people’s behavior in a high technological risk environment, the RAO Agency together with the Department of Psychology at the University of Ljubljana decided to perform research in which we endeavor to establish a possible model of people’s behavior regarding the construction of LILW repository in one’s community and to get information about the possible influences which could change public acceptance of the LILW repository.

2 THEORETICAL BACKGROUND

From among the many psychological models which explain the relationships between attitudes and behaviors, Ajzen’s (1988) theory of planned behavior was chosen, as this rather general model is applicable to many different domains. Schematically it is presented in Figure 1.

Ajzen’s theory presents a possible answer to the prediction and explanation of specific action tendencies by considering the relevant behavioral dispositions. According to this theory, attitudes toward the behavior, subjective norms and perceived behavioral control should account for the specific behavior. A person forms an intention to engage in certain behavior, and then translate it into action. When dealing with volitional behavior we should expect that people will do what they intend to do. The question is how intentions are determined. Intentions are the function of three basic determinants of personal and social nature. The first is the individual’s attitude toward the behavior, that is, his positive or negative evaluation of the consequences that are typical for certain situation. The consequences are evaluated with the probability of certain event occurring and the importance

of that event to the person. The second is his perception of social pressure to perform or not to perform certain behavior, i.e. his subjective norms (perceived normative prescriptions).

Nevertheless, the successful performance of the intention is dependent on the person's control over the factors that may prevent it. Therefore the perceived behavioral control was introduced into the theory. To the extent that perceptions of behavioral control correspond to actual control, they provide useful information about expressed intentions. Depending on the specific intention, all three factors could together or in different combinations explain the intended behavior.

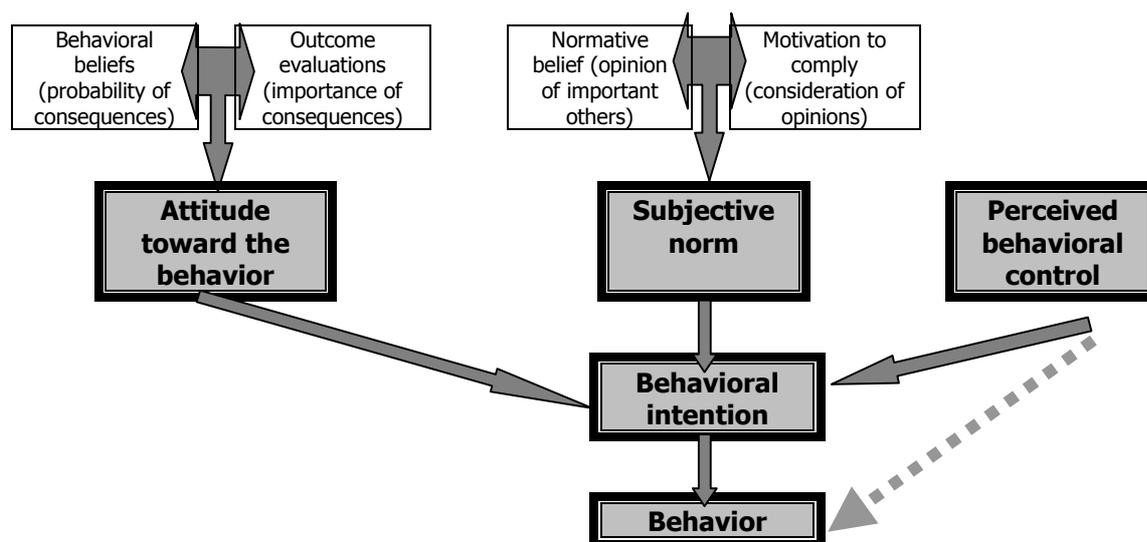


Figure 1. Ajzen's theory of planned behavior (Ajzen, 1988)

3 METHOD

Participants: In order to get information among the student population, this pilot research was conducted mainly at different departments of the University of Ljubljana. In the study, three groups of participants were questioned: 74 secondary school pupils, 140 students of social sciences (psychology, geography, pedagogy) and 50 students of natural sciences (physics, chemistry). The participants differed in their knowledge about radioactivity and also in other technically dependant backgrounds.

Material: Two scenarios were used in the study, covering the possibility of building of low and intermediate level waste repository in one's community. The aim of the scenarios was to put participants into different circumstances regarding the building of a LILW repository. In the first scenario (S1), the investor simply starts to construct the repository without getting the support of the local community, and the individual described in the scenario did nothing against it. In the second one (S2), the local community was asked to participate in the site selection process, and the individual involved in the scenario finally accepted the construction of the repository. Questionnaire consisted of 65 questions, covering attitudes (44 questions: 22 questions – probability of positive and negative consequences of , 22 – importance of those consequences), subjective norms (16 questions), perceived control over behavior (3 questions), and behavioral intentions regarding the construction of a radioactive waste repository (2 questions). The participants had to assess their answers on five points scales.

Procedure: Approximately half of the participants received the first scenario (N=129) and half the second (N=135). Their task was to become accustomed to the described situation, and evaluate the probability and importance of the consequences of building a LILW repository, opinions of important others about their described behavior, and their willingness to behave according to the proposed example, as well as the perceived control over their own behavior and their behavioral intentions regarding the situation described.

4 RESULTS AND DISCUSSION

Our analyses were mainly focused on three different areas. First we wanted to obtain information about weather different approaches to local community participation in the site selection process influence people’s willingness to host the LILW repository. Secondly, due to the different technical background of the participants we were able to compare their attitudes towards the consequences of repository construction and other parameters. And finally, a simple model was constructed, with which we try to explain relationships between participants’ attitudes and their behavioral intentions.

4.1 Differences in scenarios

The examination of participants’ answers clearly revealed that, on average, the different scenarios slightly influenced their answers, mainly regarding their attitudes towards probability of different consequences (Figure 2).

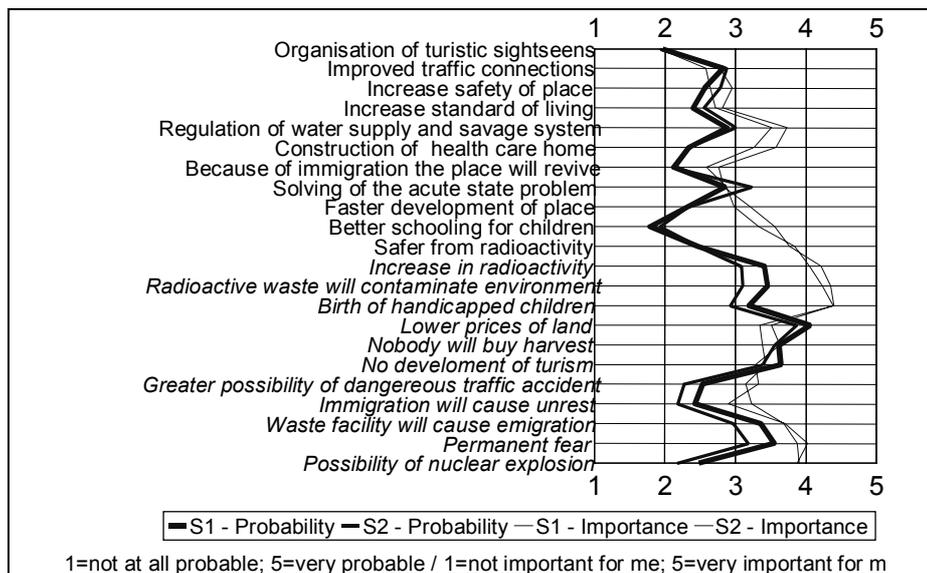


Figure 2. Probability and importance of consequences of building LIL waste repository in the cases of Scenarios 1 (S1) and 2 (S2).

Although these differences were small, it can be seen from a comparison of answers that the probabilities of negative consequences for S1 are higher than probabilities of negative consequences for S2, and that probabilities of positive consequences for S2 are higher than for S1. The average values for probabilities of positive and negative consequences for S1 and S2 are shown in Table 1. From those results it can be concluded that involving people in the decision-making process (S2) can improve their evaluation of the probability of different consequences.

Table 1. Average values for probabilities of positive and negative consequences for Scenario 1 and 2

Scenario 1		Scenario 2	
Probability of positive consequences	Probability of negative consequences	Probability of positive consequences	Probability of negative consequences
2.44	3.25	2.50	2.97

Nevertheless, participants on average estimated the negative consequences of building a radioactive waste facility as more probable than positive ones. Therefore we can imagine why people oppose these kinds of facilities. Simply because their negative consequences seem more probable.

Regarding subjective norms, participants thought, on average, that important others would not approve their behavior of not opposing construction of the radioactive waste facility, but they would mainly consider opinions of parents, friends (also boy/girl friend) and physicians (Figure 3). Differences between participants with regard to Scenario 1 or 2 were not significant, with the exception of considering the opinion of mayor and the physician, to which participants receiving Scenario 2 give a greater degree of consideration.

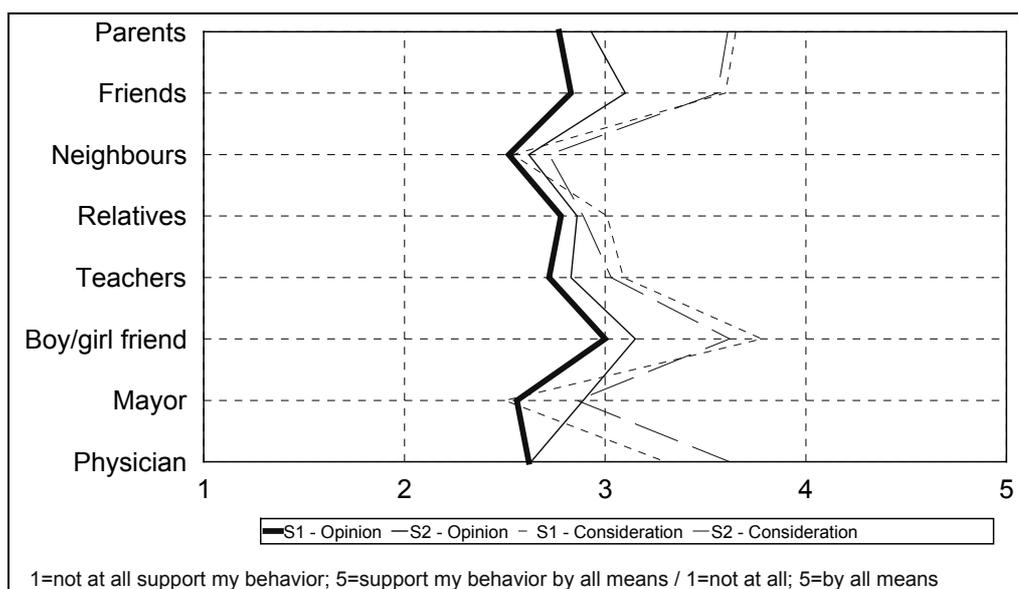


Figure 3. Perceived opinions of important others and their consideration for both scenarios.

Differences between behavioral intentions were not significant at all, and what is more important, in general the participants were not very willing to behave in the proposed way (i.e. not opposing the construction of the waste facility). This is in accordance also with results of other survey that people do oppose nuclear facilities.

4.2 Differences in background education

Analysis of the variance revealed a number of significant differences in the answers of participants from different schools. Knowledge is evidently an important factor influencing the attitudes and behavior of people. Instead of listing all the differences, we shall present

Structure coefficients clearly showed that the variable which discriminates the most between three groups is the probability of negative consequences (P-). Such result is logical. The most important factor concerning the attitude towards disposal facilities is particularly the perception of the probability of negative consequences. Evaluation of those consequences strongly depends on previous knowledge of the subject. Therefore the average values for parameter (P-) are the most different for the group with the highest background (group 3 – pure natural sciences) in the field.

The next variables that differ in greater degree are behavioral intentions. From the results it seems that for the most knowledgeable group (group 3) the described behavior is the least unacceptable.

4.3 Model

Finally we would also like to examine the whole model by applying multiple regression analysis² of the combined scores of relevant variables. For dependent variable BI was chosen and independent variables were: P-, P+, I-, I+, O, C, BC. For Scenario 1, at most 21,1 % of the variability of behavioral intention could be explained, mainly by the probability of positive consequences, the opinion of others, and perceived behavioral control items. For Scenario 2, the percentage of explained variability was greater (30,2 %), significant factors being the contributions of the probability of negative consequences, behavioral control and opinions of others. The much greater variability of dependent variables is therefore explained in the case of Scenario 2. While the contribution of perceived behavioral control factors could in both cases be at least partially explained by the similarity of wording, this is not so for other factors.

From the results it can be concluded that for Scenario 1, the probability of positive consequences had significant influence; for Scenario 2 only the probability of negative consequences had significant influence, and probability of positive consequences was not so significant. Perhaps in a situation when somebody is forced to accept something, he could console himself with the positive consequences of the situation. When freely deciding, negative consequences gain in importance. Evidently the probability of consequences had a greater influence than their importance. Even if a certain consequence is assessed as very important, but is of low probability, in everyday life it is not so important. For more reliable conclusions repetition of the survey would be needed.

5 CONCLUSIONS

This pilot research project is first attempt in which we try to establish a possible model of people's behavior regarding the construction of LILW repository in one's community and to understand the possible influences on people's preparedness to accept the LILW repository.

By comparing the answers of technical and other students who participated in the survey, we found that especially the perception of the probability of negative consequences of certain actions is influenced by knowledge of phenomena and other technical background.

² Multiple regression examines the relation between a single dependent variable and a set of independent variables. Typically explanatory research measures the variability in the dependent variable accounted for by the independent variables (i.e., the multiple R^2). Because multiple R^2 calculated in a sample overestimates the true multiple R^2 in the population, adjusted multiple R^2 is used. The relative importance of the independent variables is given by partial regression coefficients b . Usually we compare standardized forms of these coefficients β , which indicates the average standard deviation change in dependent variables associated with a standard deviation change in the independent variable, when the other independent variables are held constant.

The proposed model was only partially confirmed. Still a greater part of the variability of dependent variables should be explained. The results show that behavioral intentions on accepting the LILW repository presents a very complex problem. Therefore the model should be improved by inclusion of other independent variables (e.g. personal, demographic, and environmental factors, current media presentation of nuclear energy, credibility of administration) which could jointly more completely explain the behavioral intentions.

The results of the research once again confirmed that the process of communication with the general public will be very demanding and long-lasting. The acceptability of high risk projects such as LILW repository construction, depends on credibility, reliability of information and participation of local people from the very beginning. Because the conceptualization of the general public is different from that of the experts this must be taken into account. In its future activities, the RAO Agency will consider those differences in opinion and negotiate them to gain a common understanding of the problem.

6 REFERENCES

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