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AND BEHAVIOUR IN THE AGRICULTURAL
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BY USE OF AN ATTITUDE MODEL

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Stefan Vogel

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Institut für Wirtschaft, Politik und Recht
Universität für Bodenkultur Wien

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Bestelladresse:

Institut für Wirtschaft, Politik und Recht
Universität für Bodenkultur Wien
Gregor Mendel-Str. 33
A - 1180 Wien
Tel: +43/1/47 654 - 3660
Fax: +43/1/47 654 - 3692
e-mail: h365t5@edv1.boku.ac.at

Internetadresse:

<http://www.boku.ac.at/wpr/wprpage.html>
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ENVIRONMENTAL ATTITUDES AND BEHAVIOUR IN THE AGRICULTURAL SECTOR AS EMPIRICALLY DETERMINED BY USE OF AN ATTITUDE MODEL¹⁾

Stefan Vogel ^{*)}

1. INTRODUCTION

The environmental effect of agricultural production has steadily increased in importance since the eighties in public discussion of environmental questions. Measured in terms of the extent of this discussion, there have been comparatively few empirical studies of environmental attitudes of the farming population in Central Europe. This work represents the first multivariate study of the environmental attitudes of farmers in the German-speaking areas, the core of the analysis being the complex nature of the interactive structure of various contributing factors. In this approach, the influence of variables reflecting the social basis of a person's environmental attitude on the components of this attitude, as well as the interactions within the environmental-attitude model presented, and the influence of all the variables on environmental behaviour are analysed.

At the outset of the investigation, a coherent model incorporating environmental attitudes and behaviour in agriculture was developed based on theoretical considerations of the attitude construct and available empirical studies (Fietkau/Gläser, 1981; Langeheine/Lehmann, 1986; ÖIBF, 1988; Rau, 1989; Schur, 1990; Urban, 1986; Wentigmann, 1988). A goal of the study was to test this model using path analysis on the results of a specially developed questionnaire on a database of some 2000 interviews of Austrian farmers. The method provided important information on the strength of the cause/effect relationship between the components of the model. Path analysis also provided useful criteria for evaluating the appropriateness of the basic model. By this means, certain principal questions in the debate concerning environmental attitudes were tested and clarified in relation to the data obtained. This article is intended to introduce the resulting attitudinal model and to discuss its validity by confronting it with various problem statements. One of the most important results of the model in comparison with other studies is the strong relationship derived between attitude and behaviour. For this reason, particular emphasis will be placed on the question of this relationship in the concluding discussion.

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2. BASIS FOR THE INITIAL MODEL AND ITS PRACTICAL APPLICATION

Efforts to analyse models of complex cause-and-effect relationships involving attitudinal components, additional influencing variables and behaviour by means of multivariate analysis (Mummendey (Ed.), 1988: 222) were introduced relatively late in attitude/behaviour studies. However, it is only possible to speak of attitudes as predictors of behaviour after carrying out such studies. To the extent that this could be ascertained, the first such multivariate studies for analysis of environmental attitudes — at least in the German-speaking areas — were carried out by Langeheine/Lehmann (1986) and Urban (1986) for segments of the general population of the Federal Republic of Germany. The work described herein represents a further such step, undertaking for the first time for a German-speaking area, a multivariate study of environmental attitudes and behaviour of the farming population. The attitudinal model is developed as a causal representation based on the multi-component paradigm for attitudes. This leads to a view of environmental behaviour in terms of a framework of cause and effect that is dependent on the attitudinal components and on selected variables derived from the social status and background of the individual. Details of the model based on this view are outlined in this section.

Attitudes are frequently described in terms of personal consistency, as a "latent concept" that is individual-dependent, whereby "attitude" is emphasized as a salient feature or characteristic. This characteristic, feature or component of attitude derives from knowledge, feelings or behaviour.

These attitudinal components were combined into a so-called "three-component approach" (Rosenberg, 1960). According to this approach, attitude as an "inner condition" or "firm characteristic" of an individual is composed of the following components (for greater detail see Schmidt et al., 1975: 19 et seq.): the cognitive components include attitudinal elements derived from knowledge and perception. Knowledge and perception also lead to the development of an opinion or judgement. Judgement here, in contrast to valuation, is not meant as emotional subjectivity, but rather as knowledge-based subjectivity. The emotional or affective components concern emotion, feelings, or the emotional-subjective valuation of a social object or group of objects by the individual. The action component or "disposition to act in a specified manner" corresponds to a common viewpoint that identifies "attitude" with a "consistency of reaction to a specified class of stimuli" (Green, 1974: 335) or a "state of readiness" (Allport, 1967: 8). An important conclusion seems to be that these components do not depend on actual behaviour, but rather that "one develops certain specific behavioural tendencies in relation to the attitudinal object" (Schmidt et al., 1975: 19 et seq.), i.e. a "readiness to act".

In a further step towards construction of the model, the component approach described was applied in the area of agriculture; it was then expanded to develop an extra dimension — a distinction between components relating to a rather general environmental attitude and components related to the area of the respondent's own sphere of activities in order to differentiate the environmental attitudes of a farmer.

The model that forms the basis of this study and the attitudinal components referred to above were reflected in a questionnaire that incorporated both scaled items and multiple-choice questions. In particular, questions and scales were employed that had proved successful in other empirical studies (multivariate analysis — Urban, 1986; univariate analyses of environmental

attitudes in agriculture — Fietkau/Gläser, 1981; ÖIBF, 1988; Rau, 1989; Wentigmann, 1988: scale to assess materialism — Ingelhart, 1979: 279 et seq.). The greater part of the questionnaire comprised scaled items on a seven-step scale. These and the additional items developed were tested within the framework of a pre-test using factor analysis to prepare them for use in the final questionnaire. The attitudinal components (**bold italics**) are presented below together with the questions relating thereto.

General orientation to societal values (personal value system — degree of post-materialism):

This reflects the extent of a materialistic or post-materialistic attitude.

How should our society look?

[3 = agree strongly]

A society that gives higher priority to environmental protection than to economic development	3 2 1 0 1 2 3	A society that gives higher priority to economic development than to environmental protection
A society that tries to create prosperity but not at the cost of risk	3 2 1 0 1 2 3	A society that knowingly accepts risks in order to create prosperity
A society that in the first instance emphasises job satisfaction as the fruit of human labour	3 2 1 0 1 2 3	A society that in the first instance emphasises the economic aspects of human labour
A society in which individuals are judged primarily on the basis of their human qualities	3 2 1 0 1 2 3	A society in which individuals are judged primarily on the basis of what they have achieved
A society with numerous possibilities for citizens to take part in the political process	3 2 1 0 1 2 3	A society in which political decisions are taken by persons responsible
A society that makes an effort to maintain nature as it is	3 2 1 0 1 2 3	A society that stresses exploitation of nature to achieve general prosperity

Problem-based knowledge: this does not refer to knowledge obtained through schooling, but rather to estimates made by those questioned based on their ecologically-oriented knowledge (e.g. in respect of the nitrate burden of groundwater). This included questions such as these:

If you were to observe a major case of environmental contamination, would you know to whom you could make a complaint? [yes/no]

How would you grade your knowledge of "environmental problems"? [1–5]

How well informed are you about the following problem areas:

[3 left:right » agree:disagree strongly]

– nitrate burden and groundwater?	3 2 1 0 1 2 3
– pesticide residues in food?	3 2 1 0 1 2 3
– productivity increases through use of hormones?	3 2 1 0 1 2 3
– environmental protection regulations and measures in agriculture?	3 2 1 0 1 2 3
– environmental protection regulations and measures in the household?	3 2 1 0 1 2 3

General attitude towards the environment: this includes those emotions and cognitive attitudes that affect the various aspects of environmental problems of society as a whole.

Indicate your agreement or otherwise with the statements below: [3 left:right » agree:disagree strongly]

I do not believe that the environment is as polluted as people say	3	2	1	0	1	2	3
Mankind has always solved its problems until now, and it will also master the problem of environmental contamination	3	2	1	0	1	2	3
Air quality is becoming worse because of the dust and poisonous substances	3	2	1	0	1	2	3
The result of human folly in respect of the environment will be massive changes in climate	3	2	1	0	1	2	3
Chemical substances found in food today have no negative effects because they are present in very low concentration	3	2	1	0	1	2	3
Nuclear power plants should be closed down	3	2	1	0	1	2	3
There will soon be a shortage of freshwater in our latitudes because of environmental contamination	3	2	1	0	1	2	3

Environmental attitude as a farmer: they represent an emotional and cognitive attitudinal dimension related to the respondent's own sphere of activity, occupational and otherwise.

Indicate your agreement or otherwise with the statements below: * [3 left:right » agree:disagree strongly]

Agricultural activities today lead to the destruction of natural biotopes and to a reduction in wildlife as well as wild plants	3	2	1	0	1	2	3
Commercial fertilisers and pesticides reduce the continuing natural productivity of the land and the product quality	3	2	1	0	1	2	3
The use of chemical substances in agriculture works against nature	3	2	1	0	1	2	3
Environmental problems resulting from agricultural activities are exaggerated by the media	3	2	1	0	1	2	3
The groundwater burden resulting from the washing out of fertiliser is worse than many people imagine	3	2	1	0	1	2	3
Farmers are the best protectors of the natural environment, even if mistakes are made from time to time	3	2	1	0	1	2	3
Commercial fertilisers and pesticides have no harmful effects; they promote high-quality production	3	2	1	0	1	2	3
The use of chemicals in agriculture makes sense as long as it brings greater returns than costs	3	2	1	0	1	2	3
Maintaining a proper balance in nature requires a more complex form of operational organization	3	2	1	0	1	2	3

* Certain questions served as "controls" to check for consistency in responses. Such "reversed" questions were not placed within the same subset of questions in the actual questionnaire.

Feeling of stress: The consciousness of being burdened by environmental problems, registered as the subjectively perceived stress. Questions included the following:

Do you feel personally affected by environmental problems in your area? [yes/no]

If so, which?

Let us assume that a nitrate burden bordering on the critical has been discovered in the drinking water that comes from your community's own common well. How would you react? [3 = agree strongly]

The situation would bother me very much	3	2	1	0	1	2	3	The situation would not bother me at all
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Preparedness to act: This, as a component closely allied to "action" itself, represents the readiness of an individual to change something in his or her behaviour. Questions include the following:

How would you react to such a nitrate burden in drinking water? [3 left:right » agree:disagree strongly]

First think it over quietly and continue as always	3	2	1	0	1	2	3
Something must be changed immediately; things cannot continue as they have until now	3	2	1	0	1	2	3

I would take part in a campaign to clean up a polluted landscape [yes/no]

Imagine that you own unused wetland. You consider draining it. However, in the interests of its animal and plant systems, you have been requested to maintain the wetland as it is. Do you feel that such a request is justified? [yes/qualified yes/no]

If your future income were assured by means of agricultural policies, that is to say no net economic disadvantage would result, would you then of your own accord: [3 left, yes indeed; 3 right, definitely not]

– take additional measures to conserve the landscape?	3	2	1	0	1	2	3
– use less chemical sprays?	3	2	1	0	1	2	3
– use fertilisers only in "environmentally appropriate" quantities?	3	2	1	0	1	2	3
– manage completely without chemical insecticides and mineral fertilisers, i.e. switch over to organic farming?	3	2	1	0	1	2	3

If not assured: [3 left, yes indeed; 3 right, definitely not]

Would you be prepared to accept a small loss of income if you adopted one or more of these measures?	3	2	1	0	1	2	3
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Would you then complain about the situation? (continuation of the first question under "problem-based knowledge", cf. possibilities for registering complaints.)

The attitudinal components described above are presented here in a sequence that conforms to their anticipated position in the attitudinal model in terms of their effect on environmental behaviour (the variable of interest at the end of the chain of influences). However, in the questionnaire, they were arranged so that the responder could not make a guess at a preferred answer.

Environmental behaviour: Actual involvement was registered in the questionnaire through the following questions:

Have you ever taken part in a meeting of an environmental protection organisation? [yes/no]

Are you or have you ever been a member of an environmental protection organisation? [yes/no]

Do you farm according to the guidelines for organic farming? [yes/no]

Have you done anything during the last three years that was specifically oriented towards the conservation of nature, the landscape or the environment? [yes/no]

If yes, then what? [measures to be indicated yes/no from among the following]

- changes in fertiliser or pesticide use
- changes in the preparing and working the soil
- changes in crop rotation
- testing or analysis of: the soil; spraying equipment; etc.
- requesting advice on environmental questions relating to your farming activities
- proper disposal of containers for spray chemicals as well as other polluting substances or objects (old batteries, motor oil, etc.)
- other (to be specified)

Do you avoid the purchase of certain products because they burden the environment? [yes/no]

Do you collect waste glass and paper for individual collection or to take to local waste containers? [yes/no]

Have you ever made a formal complaint concerning environmental pollution? [yes/no]

Additional influencing variables, drawn especially from the social background of the responder and his or her sphere of activity, have often been used to refine the relationship between attitude and behaviour. Thus, in the present work, in addition to the variables relating to attitude and to environmental behaviour, another category of variables was registered, exogenous, independent variables that relate to the social basis of environmental consciousness (e.g. age, gender, education and certain farm-related economic factors).

3. MATERIALS AND METHODS

Following the pre-test, the planned study was initiated by including the questionnaire in the April 1991 supplement of the journal "Blick ins Land", which appears in Austria monthly and is sent to every farm and related agricultural enterprise in Austria. A total of 2095 farmers responded and sent in completed questionnaires. The questionnaire also incorporated questions relating to other farming matters (these were assessed separately), and they additionally served to "camouflage" the environmentally oriented aspects. A database is now available containing the results of a quantified, largely standardised, written questionnaire dealing with the environmental attitudes of farmers.

Because of the manner in which the study was carried out, the sample is not representative in a statistical sense. However, this does not invalidate the results obtained, since the aim was to test the underlying theoretical model, and the analysis of cause and effect within the environmental attitude and between attitudinal components and environmental behaviour. It may properly be assumed that the framework of cause and effect between components of the model and the exogenous variables can be sufficiently tested on the basis of an empirical, large sample of the entire universe represented by Austrian farmers.

For each interview, the responses to the individual questions relating to each attitudinal component were combined to form an index for that component; where necessitated by the wording of the question, a "polarity reversal" was made so that the "higher" concept in terms of environmental attitude always lay at the higher-value end of the index scale. The various indices were linearly transformed to a median value of zero (0) and a standard deviation of unity (1) to prepare them for the calculations relating to path analysis.

Path analysis is a method that, using data from a set of test variables, discovers causal connections in a related set of variables of interest in terms of their order and the direction and level of influence of direct and indirect effects (Bortz, 1984: 395 et seq.; Holm, 1977: 7 et seq.; Kim/Kohout, 1975: 368 et seq.). It was calculated in the study as a set of multiple regression analyses, using as input the indices derived by combining the results of the questionnaire for each component of the theoretical model. The calculations were carried out using the "statistical package for the social sciences" (SPSS). These calculations result in path coefficients, i.e. linear, standardised, partial-regression coefficients.

For path analysis, the data had to correspond to a rational, i.e. regular-interval, scale and the relationship between the data elements had to be linear and additive. With few exceptions, the responses transform directly to data on an ordinal scale. It should be noted that since the reverse-sense control questions (see footnote to "environmental attitude as a farmer") in each case resulted in a mirror-image response, it is clear that the intervals between values on the seven-step scale appear to have had meaning to the respondents and cannot therefore be arbitrarily changed. Under these conditions, the ordinal scales may also be employed for the form of path analysis used (Kim/Kohout, 1975: 368-397).

For regression calculations, it is a pre-condition that data must be normally distributed. An appropriate test indicated that this condition was met for the data used in the study for each of the partial components used in the path analysis, though not for most of the data at the level of individual questions.

3.1. Qualitative requirements set for the study

Any path for which the path coefficient did not differ significantly from zero (<95% probability) was discarded. A similar procedure was followed for data relevance, paths being discarded for which the value of the path coefficient was less than |0.10|. Finally, the difference between the covariance of the individual variables in a data set and that covariance predicted by the model was required to be less than one-third of the total covariance of the data set. This ensured that the level of "defined" influence (as determined from the data) of variables on a given factor in the model exceeded the level of any "undefined" influence — otherwise no meaningful interpretation could be made.

4. EMPIRICAL RESULTS

4.1. The model for environmental attitudes and behaviour in Austrian agriculture

The structure of the cause/effect chain postulated for the first path model had the endogenous variables (the components) ordered as follows:

personal value system → problem-based knowledge → general attitude to environment → environmental attitude as farmer → feeling of stress → preparedness to act → environmental behaviour

In this recursive model, it was expected that each variable would have an effect on *each* following variable in the chain, but only on following variables.

The actual causal structure of the variables derives from the various steps in the regression calculations. The quality of the model is expressed in terms of the degree of agreement between the values for the dependent variables estimated from the path coefficients and the actual values of those variables — namely, the multiple coefficient of determination (multiple R_1^2) gives the proportion of the total variability of the actual values of the dependent variables in relation to those values derived from path coefficients. Figure 1 shows the most acceptable model derived for the data obtained, i.e. the most "efficient" representation of the cause/effect structure. All significant ($\geq 95\%$ probability) and relevant (path coefficient ≥ 0.10) direct relationships are

indicated. The direct effect of one variable on another can be seen from the weighting given by the path coefficient; its value lies in the range -1 to $+1$ and indicates the relative change in the dependent variable for a change in the independent variable. Any additional, indirect influences are determined by multiplying together the path coefficients of an indirect path.

This final version of the model fulfils the qualitative requirements set (cf. §3.1). Its development was a two-stage process. In the first stage the model was appropriately adjusted, in the second all statistically non-significant and non-relevant paths were eliminated.

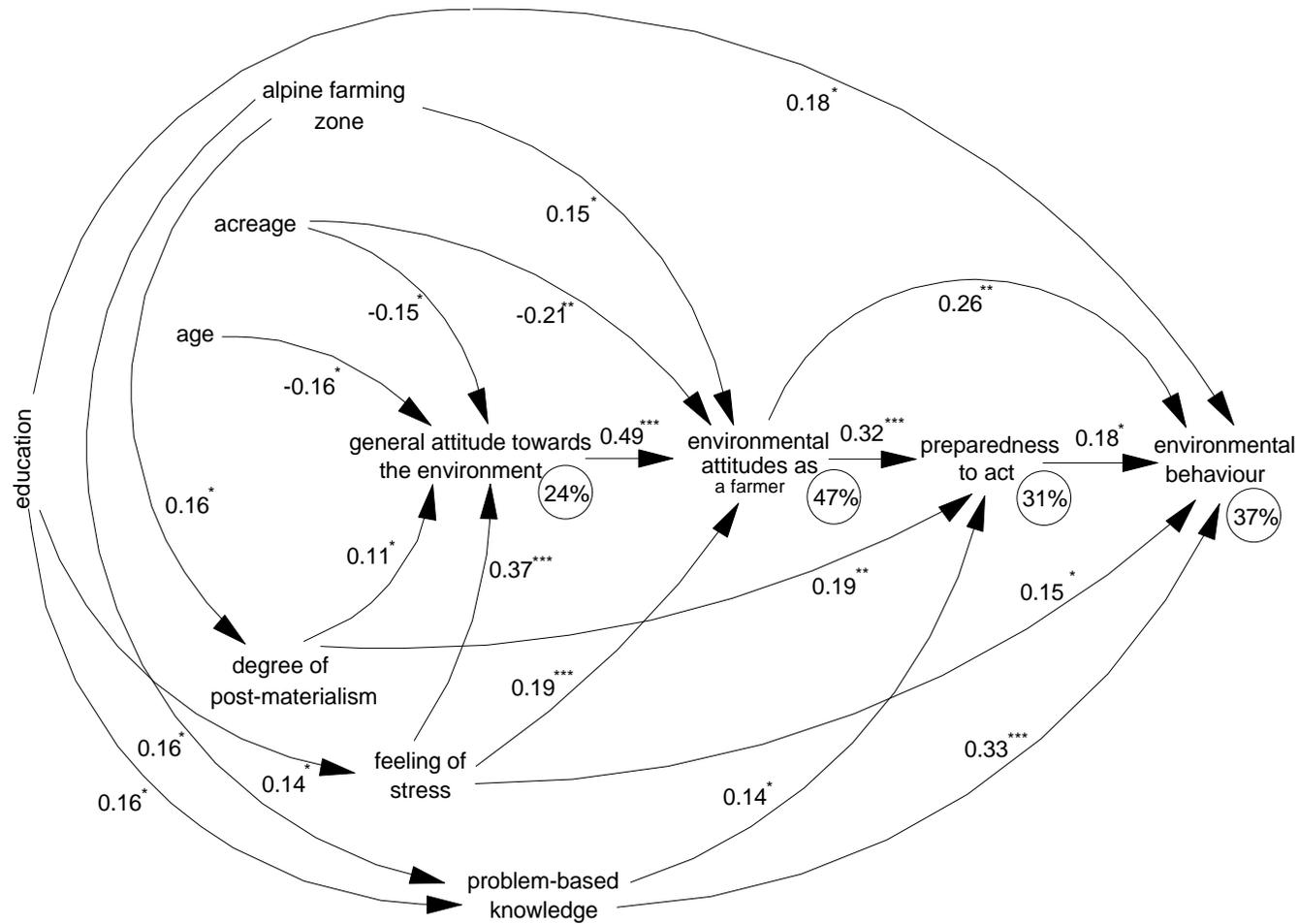


Figure 1. Relationship between environmental attitudes and behaviour for Austrian farmers.

Path diagram of the final model. The path coefficients are linear, standardised, partial regression coefficients. The significance levels are: * $0.05 \geq p > 0.01$; ** $0.01 \geq p > 0.001$; *** $0.001 \geq p$. The values in circles give the multiple coefficients of determination (multiple R_1^2) for the key attitudinal components and environmental behaviour in per cent. Data source: responses from 2095 Austrian farmers, April 1991.

4.2. The social basis of environmental consciousness

(exogenous factors)

An important question in the discourse on attitude was to be examined as a part of the study: Is the "level of education" hypothesis correct, i.e. the assumption that concern about the environment increases with the level of formal education? This hypothesis was not confirmed by the study in respect of the general attitude towards the environment, though it was for the attitudinal components "feeling of stress" and "problem-based knowledge" (see Fig.1). Furthermore, "problem-based knowledge" was found to have a much stronger influence on environmental behaviour than the level of education.

Initial assumptions were also made regarding certain other significant exogenous variables, namely age, gender, alpine-farming zone, farm size (acreage), and principal- or subsidiary-income farming.

Firstly, it was assumed that age and gender would affect all attitudinal components as well as environmental behaviour. Indeed, it was explicitly postulated in respect of age that younger respondents would exhibit a more environmentally conscious attitude than their elders. This could be confirmed only for environmental topics other than those related to their spheres of activity, i.e. for the "general attitude towards the environment". Furthermore, no significant difference could be confirmed on the basis of gender ($\geq 95\%$ probability).

Secondly, in respect of alpine farming zone, acreage and socioeconomic type of farm (principal- or subsidiary-income farming), it was assumed that these would influence both the general and environmental attitude and that as a farmer, the preparedness to act and environmental behaviour. While the first two variables did appear to influence both the general and farming-based environmental attitudes, no difference could be ascertained for socioeconomic type.

4.3. The cause/effect chain derived from the data

The assumptions regarding the sequence of components in the cause/effect chain of the initial attitudinal construct were theoretically and empirically supported, and reflected a growing tendency to take action (cf. §4.1).

However, the path diagram finally derived (Fig.1) indicates that the cognitive attitudinal component "problem-based knowledge", although originally placed at the beginning of the sequence, does not exert its influence at that point but rather at the stages preparedness to act and environmental behaviour. It is itself not influenced by any attitudinal variable (only by two exogenous variables — education and alpine farming zone). Furthermore, the attitudinal component "feeling of stress" influences only the general and farming-based environmental attitudes, and environmental behaviour, while it is itself also not affected by any attitudinal component (only by an exogenous variable — education).

A central question in the attitudinal debate is: "Does a person's subjective value orientation (key concept – change in values) underlie the attitudinal construct and thus attitudinal changes as

well? In the initial theoretical model, this question was answered in the affirmative and, for this reason, "person's value system" stood at the very beginning of the cause/effect construct (cf. §4.1). The final path diagram, however, shows that value system affects solely two attitudinal components — general environmental attitude and preparedness to act — and these but weakly. An effect on other attitudinal components of the personal value system (i.e. materialistic or post-materialistic influence) cannot be confirmed from the data obtained, nor is the value system influenced by any attitudinal component (only by the exogenous variable — alpine farming zone).

Thus, in confutation of the initial model, the components value system, feeling of stress and problem-oriented knowledge cannot be integrated into the cause/effect chain, i.e. no attitudinal components influence them. They do, however, influence components in the final chain (Fig.1).

This insight leads to *the need to differentiate between environmental attitude in the narrower sense and the wider sense.*

Thus, environmental attitude in the broader sense is represented by these three "quasi-exogenous" components: this view is supported by the fact that their variances, as compared with those of the attitudes in the final cause/effect chain, cannot be satisfactorily "explained". Environmental attitude in the narrower sense is reflected in the components of the final cause/effect chain, i.e. general environmental attitude, farming-based attitude and preparedness to act.

This new insight precisely relates to the core of the original question about environmental attitude that led to the present work: "What are the cognitive, emotional and action-oriented dimensions of environmental attitude and behaviour in relation to society in general and to the farming environment in particular?"

4.4. Selected aspects of the final attitudinal construct

The more that farmers have personally experienced environmental pollution (feeling of stress), the greater (high path coefficient of 0.37) their concern about the environment in general and the better their understanding of the problematic environmental effects of agricultural practices. Thus the component "environmental attitude as a farmer" has a great significance because of the way it influences environmental behaviour, i.e. it results in

action that derives from a subject's personal perception of environmental shortcomings This sense of environmental stress leads directly to greater interest in environmental matters; the resulting increased perception and knowledge of general environmental problems in turn causes farmers to recognise to an ever increasing extent such problems deriving from agricultural practices.

In the model, environmental behaviour is the variable at the end of the cause/effect chain, the one to be explained. Within the framework of the original model (§4.1), a causal connection was postulated between the components of attitude and behaviour: furthermore, each endogenous variable of the concept was also supposed to have an effect on environmental behaviour — a further key theme of the study, namely: "Are attitude and behaviour related? And if so, how strong is the relationship for farmers in Austria?"

"

The empirical results deriving from the data show that there are certain strong influences of the attitudinal components on behaviour, those represented by the two high-value path coefficients emanating from problem-based knowledge and farming-based environmental attitude. There is, however, no direct influence on environmental behaviour of two components of the initial model that were distant from the "action end", namely general environmental attitude and a person's value system.

5. DISCUSSION

Deriving from the data set, the model presented here assigns considerable significance to the progressive environmental attitudes of farmers in Austria (multiple coefficient of determination (multiple R_1^2) of 0.37 for environmental behaviour). The question to what extent environmental attitudes determine environmental behaviour is of practical relevance for problem-oriented counselling undertaken as part of agricultural policy as a means of indirectly influencing behaviour. For this reason, the discussion below will deal closely with this question of the environmental attitude/behaviour relationship. Following a brief description of the current status of research, explanations will be sought for the relatively limited success researchers have had until now in explaining the relationship. Finally, an attempt will be made to reflect upon and explain the relatively high correlation between attitude and behaviour obtained in this study.

On the basis of a comparative analysis of the studies available at the time on the attitude/behaviour relationship, Wicker (1969: 41-78) determined that the correlation between attitude and overt behaviour was frequently close to zero. He suggested that these would scarcely attain a value of 0.30, which would correspond to an explained part of the variance of about 10% for attitudinal and behavioural variables. Through the inclusion of other influencing variables deriving from the social basis of the attitude-holder and his or her social environment (e.g. valuation of one's own behaviour and taking into account perceived consequences of actions taken), the relationship between attitude and behaviour for a number of studies could be improved to a R_1^2 of about 20% (Mummendey (Ed.), 1979: Mummendey, 1988).

However, these values relate to the attitude/behaviour analyses in various subject areas.

In analyses of environmental attitudes and behaviour, an even lower value of the explained part of the variance can be observed. In a meta-analysis of 128 United States studies of environmental awareness and behaviour, Hines et al. (1984) calculated an average correlation of 0.35 between environmental awareness and behaviour, which corresponds to an explained part of the variance of less than 15%. Studies in the German-speaking area (Diekmann/Preisendörfer, 1992; Langeheine/Lehmann, 1986) have given similar results.

What is the explanation of this low correlation between environmental attitude and behaviour both in absolute terms as well as relative to results of attitude/behaviour analyses in other fields?

A fundamental problem arises from economic rather than social aspects (Diekmann/Preisendörfer, 1992: 240 et seq.). Environmental consciousness results in appropriate behaviour above all in "low-cost" situations, i.e. situations in which the behaviour costs the subject little. In high-cost situations, a far lower correlation between attitude and behaviour is registered.

Connected to the attitude/behaviour relationship in low-cost and high-cost situations is the problem of the existence of the public good "environmental quality". The fact that this asset must be collectively maintained can also be employed to interpret the low explained part of the variance found in studies of environmental attitude and behaviour. It may be, from the perspective of an individual, that action on his or her part is not productive, since an improvement in environmental quality requires concerted action by others also, and he or she, as an individual, can only play a

small part (Diekmann/Preisendörfer, 1992: 245 et seq.; Kirsch, 1991: 250; Stroebe/Frey, 1990: 227 et seq.). Somewhat more provocatively, and under the premiss of rational economic behaviour, this can lead to a "free-rider" situation (Kirchgässner, 1991: 55 et seq.). From a socio-psychological viewpoint, this situation reflects Festinger's (1957) dissonance theory. The individual as a "free rider" exists in relation to a certain environmental quality; since he or she does not even contribute financially or otherwise to its maintenance, there would be, assuming that the person exhibits a progressive environmental attitude, a dissonance between attitude and behaviour.

What can be then the explanation for the relatively positive attitude/behaviour relationship in the present study, in which after all 37% of the variance in environmental behaviour is explained? A possible objection in the sense that the results were so good because the attitude/behaviour relationship was studied only in low-cost situations can be refuted. This objection does not apply, since the behavioural variables considered in the questionnaire refer to changes in operational behaviour that are not low-cost (e.g. high-cost environmental measures in one's own business operation such as switching to organic farming). Precisely the relationships raised have to be considered for the farmer as high-cost measures, and thus they would be expected to force the empirical results downward rather than upward.

Furthermore, in this study, attitude and behaviour have been related to the social environment and spheres of activity (occupational environment) of the respondents. Thus the public good, free-rider and dissonance hypotheses do not apply because the resources to which the questionnaire implicitly and explicitly refers are the basis of the respondent's existence, and these are viewed differently from a public good in a more generalised concept of the environment. The fact that the resources considered are the respondent's own is one reason for the good results obtained: this is supported by the result in that the knowledge and attitudinal components based on experience have the strongest links to environmental behaviour.

The question of the validity of the self-assessed behaviour remains. To assess this, let us ask: Why would the respondents lie? Precisely in high-cost situations, such as exists in relation to the question whether or not the operation had been transformed to an organic one, it would appear unlikely that the respondents would lie; they would then also have to lie in answer to a direct question such as whether operations were carried out in accordance with the contractual guidelines for organic farming since no contract could exist.

Despite this, an effort was made to appraise the possibility of the respondent's having lied by means of a discriminatory analysis on the basis of responses in connection with the three attitudinal components (general environmental attitude, farming-based attitude and preparedness to act) to determine whether the respondent was an organic farmer or not. The discriminatory function was estimated using a random selection of half the entire sample, and it was then applied to the remaining half of the sample. A correct alignment could be made in 72% of the cases. This on the one hand helped to confirm the attitude/behaviour relationship, while on the other hand it served as an independent check that supported the assumption that the respondents had not cheated when describing their own attitudes and behaviour.

The indication that the

public good problem ("free-rider"-situation) did not apply to this study, which was based on the theoretical considerations presented above, was confirmed by the fact that the component

"problem-based knowledge" that resulted from personal experience had the highest value path coefficient of the entire model, thus assuming a special importance in terms of explaining environmental behaviour.

The results obtained were also supported by the results of research that considered whether personal experience gained improved the behavioural predictability as a function of attitude (Bentler/Speckart, 1979; Fazio/Zanna, 1981; Mielke, 1985; Regan/Fazio, 1977). Indeed, if one applies the concept of "feedback", it is evident that an individual's own experience reinforces appropriate behaviour, following the cycle: behaviour *reinforces* experience *reinforces* attitudes deriving from experience *reinforces* behaviour, and so on. The self-perception theory of Bem (1967, 1972) can be taken as a theoretical reference, postulating that an individual's attitudes are derived from his or her behaviour and resulting experience.

An appropriate societal explanation relating to the findings and corresponding postulates of the present study can be derived from Luhmann's theory (1986, 1988) that seeks to differentiate the functional subsystems in society. The component systems (Teilsysteme) of modern society are no longer family or class oriented, but according to the function they serve in society. Examples of such functional systems are science, education and, of course, agriculture. The simultaneous raising of the capacity for learning, performance and adaptability limits the redundancy of a component system. A component system reacts to events in the environment only within the framework of its own structural resonance. An important condition for system resonance is a form of communication that matches the system parameters. Such communication uses component-system-specific codes and programmes that must assign correctly appropriate and inappropriate comportment. The consequence is that the resonance (response) of society as a whole to ecological risks must operate via the individual functional (i.e. component) systems: it cannot be centrally controlled. Despite a possible charge of incompatibility between the sociological macro-approach and the socio-psychological micro-approach, the following concept is put forward: specific attitudes, especially those deriving from experience, are in the sense of behaviour seen as a system resonance a system element. Such attitudes result in action when they operate through system-specific programmes.

The present model confirms the importance of experience-based learning as means of inducing the desired environmental behaviour, the effectiveness of such learning being probably related to its marked ability to induce behavioural resonance.

6. CONCLUSION

The final attitudinal construct derived confirms the overall relationship between a progressive environmental attitude and better environmental behaviour. The strongest direct paths to environmental behaviour stem from problem-based knowledge as it relates to the personal experience of the individual (comparable relative importance to that indicated by e.g. Diekmann, 1992) and from the farming-based environmental attitude associated with the immediate sphere of activity of the individual. Thus the attitudinal components associated with personal experience of ecological problems show a stronger direct influence on environmental behaviour than the level of education. An effect of education is confirmed by the path coefficient of 0.18, but this has been impressively exceeded by the coefficient of 0.33 for problem-based knowledge, i.e. an 83% greater influence than that of education.

Thus, in terms of relevance for taking action in matters concerning the environment, the "educational-level hypothesis" has turned out to be a "problem-based-knowledge hypothesis".

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