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Explaining the conversion to particularly animal-friendly stabling system of farmers of the Obwalden Canton, Switzerland – Extension of the Theory of Planned Behavior within a Structural Equation Modeling Approach

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Abstract:

Farmers' intentions about conversion to particularly animal-friendly stabling system (PAFS) are analyzed with a structural equation model. The Theory of Planned Behavior (ToPB, AJZEN 1985) is used as the theoretical basis of this study. Though ToPB is a well-defined theory, it is static rather than procedural and cannot model the individual decision-making as a process. Therefore, we first examine the general applicability of ToPB in an agricultural context and explain the variance in intentions of farmers to convert to PAFS. Second, we extend the ToPB to make it more procedural. For this purpose, research findings from the Diffusion Theory are included as part of the behavioral model.

The empirical results indicate that the model has a good fit to the data. The effects of the additional variables 'Goal' and 'Communication' are highly significant. This illustrates the importance of forming personal goals in the behavior domain and that people act in a goal-directed, rational way. Moreover, it gives empirical evidence that communication through personal channels has a great impact on individual decision-making. Altogether, this study shows that the extended ToPB provides an appropriate approach to investigate individual decision-making processes in agriculture.

1. Introduction

In 1996 the Swiss population voted in favor of a sustainable agriculture when they employ environmentally friendly methods of farming with financial support (direct payments). Particularly animal-friendly stabling system (PAFS) is one of the programs for which farmers get direct payments from the government, because it is seen as one of the existing alternatives for animal-friendly farming. However, up until 2004 only 41% of all Swiss farmers have converted to PAFS (BLW, 2005). In this study, this conversion is analyzed within a structural equation modeling (SEM) framework to identify farmers' reasons for the decision to convert to PAFS.

The application of SEM requires a well-defined theoretical framework, as it takes a confirmatory approach to the analysis of a given structural theory. The Theory of Planned Behavior (ToPB) is taken as the theoretical basis. This theory, developed by AJZEN (1985), is used in various studies of behavioral research, but rarely in the agricultural context.

The first aim of this study is to examine the applicability of ToPB in an agricultural context and to explain the variance in intentions of farmers to convert to PAFS.

Though ToPB is a well-defined theory it has some weaknesses. For example, it is more static rather than procedural and cannot model the individual decision-making as a process.

Thus, the second aim of this research is to extend the ToPB to make it more procedural. For this purpose, research findings from the Diffusion Theory are included as part of the behavioral model.

This study is the first to analyze the conversion to PAFS in Switzerland using structural equation modeling based on a social psychology theory.

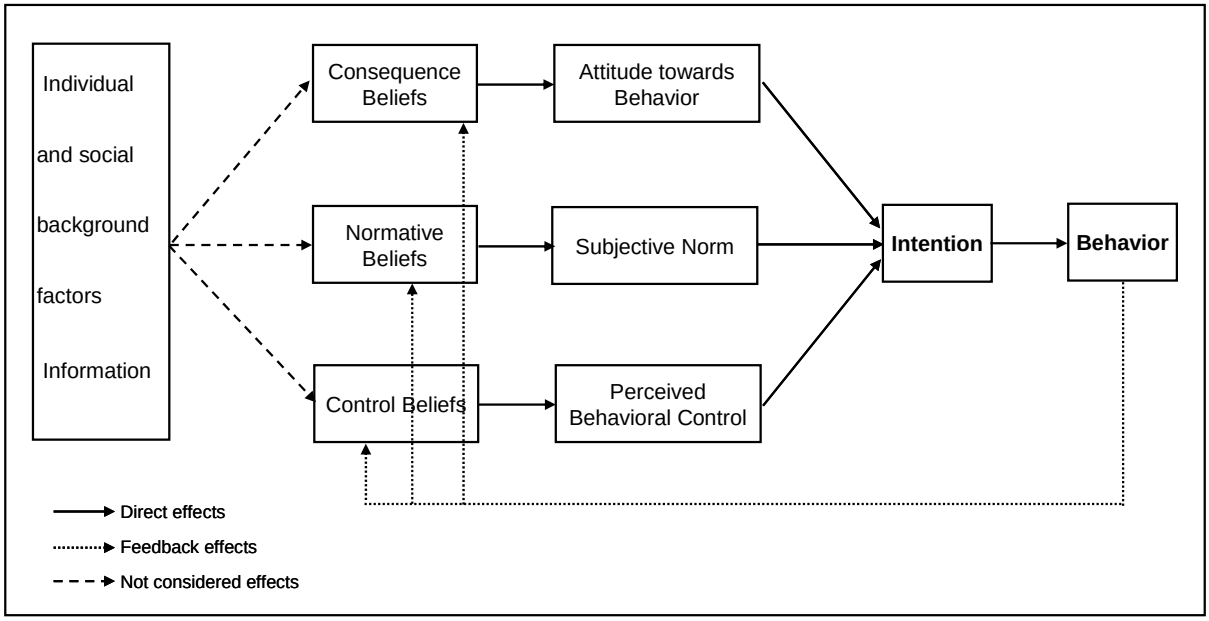
2. Theoretical background

Theory of Planned Behavior (ToPB)

The Theory of Planned Behavior (ToPB) (AJZEN 1985) is a general theory of every kind of social behavior. It encompasses three theoretical constructs (see Figure 1), which influence the intention to perform a given behavior, viz. the attitude towards behavior, the subjective norm, and the perceived behavioral control. These constructs are formed by three different kinds of beliefs[1], namely consequence beliefs, normative beliefs and control beliefs. Consequence beliefs influence the attitudes towards the behavior. These attitudes are subjective evaluations of the consequences of performing the given behavior. Normative beliefs cause the subjective norms with regard to the given behavior. The subjective norm shows the perceived social pressure to perform the behavior. Control beliefs, in comparison, form the perceived behavioral control. Perceived behavioral control contains the subjective assessment about a person's ability to control the behavior in question.

[1] These different beliefs are influenced by individual and social background factors such as age, gender, culture and information; but these influencing factors are not considered in the theory.

Figure 1: Theory of Planned Behavior (ToPB)



Source: Adapted from AJZEN & FISHBEIN 2005

The more favorable the attitude toward a given behavior and the subjective norm, and the greater the perceived behavioral control, the stronger should be the person's intention to perform the behavior in question (AJZEN 1985). Once an intention is formed, people are expected to carry out their intentions when the opportunity arises. After performing a behavior people can revise and change their beliefs, because personal experience is seen as one of the important factors for changing attitudes. Therefore, there is a feedback between the performance of the behavior and the three different kinds of beliefs. When beliefs are changed, a change in attitudes, subjective norm and perceived behavioral control will also follow.

The foundation of the ToPB is the subjective expected utility theory (SEU) and, like the main assumption of the SEU, persons are assumed to behave in a rationally way. It means that persons are systematic information processors and they behave in accordance with their subjective expected or perceived utility (FISHBEIN & AJZEN 1975).

According to BAMBERG & SCHMIDT (1993), ToPB is one of the prominent theories in the social psychology domain. This theory has proved to be useful in explaining many cases such as recycling behavior (BAMBERG & LÜDEMANN, 1996), choice of public transport (BAMBERG & SCHMIDT, 1997), use of tobacco and alcohol (HIGGINS & CONNER, 2003), blood donation behavior (GILES & CAIRNS, 1995) and exercise behavior (ARNSCHEID & SCHOMERS, 1996).

Diffusion Theory (DT)

The Diffusion Theory is used as another theoretical background to extend the ToPB. The Diffusion Theory has been mainly developed to explain the farmers' adoption of innovations (LEEUWIS 2004). The adoption of an innovation is seen as a process and follows five main phases (ROGERS 1995, 2003):

1) **knowledge** about the innovation, to become aware of the innovation; in this phase, mass media plays an important role as a source of information;
2) **persuasion**, evaluation of the attributes of an innovation, i.e. formation of attitudes regarding the innovation, comparing its advantages and disadvantages; and friends and neighbors are the most important sources of information at this stage;
3) **decision** to adopt the innovation or not; this stage is described as an active information seeking and processing phase, the aim is to reduce uncertainty about the advantages and disadvantages of the innovation; important sources of information again are friends and neighbors;
4) **implementation** of the innovation; sometimes an adaptation of the innovation to the own farm environment may be needed and personal experience is very important at this stage of the adoption process;
5) **confirmation**, i.e. the individual seeks reinforcement for the innovation-decision already made.

According to the Innovation Theory (ALBRECHT 1992; ROGERS 1995, 2003; VAN DEN BAN & HAWKINS 1996), the adoption of an innovation depends on the attributes of the innovation, social norms and communication channels which are used as information sources to reduce uncertainty about the innovation.

The attributes of the innovation are the relative advantages, the compatibility, the complexity, the trialability and the observability.

Social norms are established behavior patterns within a social system. Not to behave like the norms will cause some kind of consequences.

Uncertainty about an innovation exists because not all persons have the same information or understanding of the innovation. Information sought through different communication channels can reduce uncertainty. Mass media channels are relatively more effective in creating general knowledge about the innovation and can therefore reduce uncertainty. However, interpersonal channels are relatively more effective in forming and changing attitudes toward the innovation and thus influence the decision to adopt or reject the innovation.

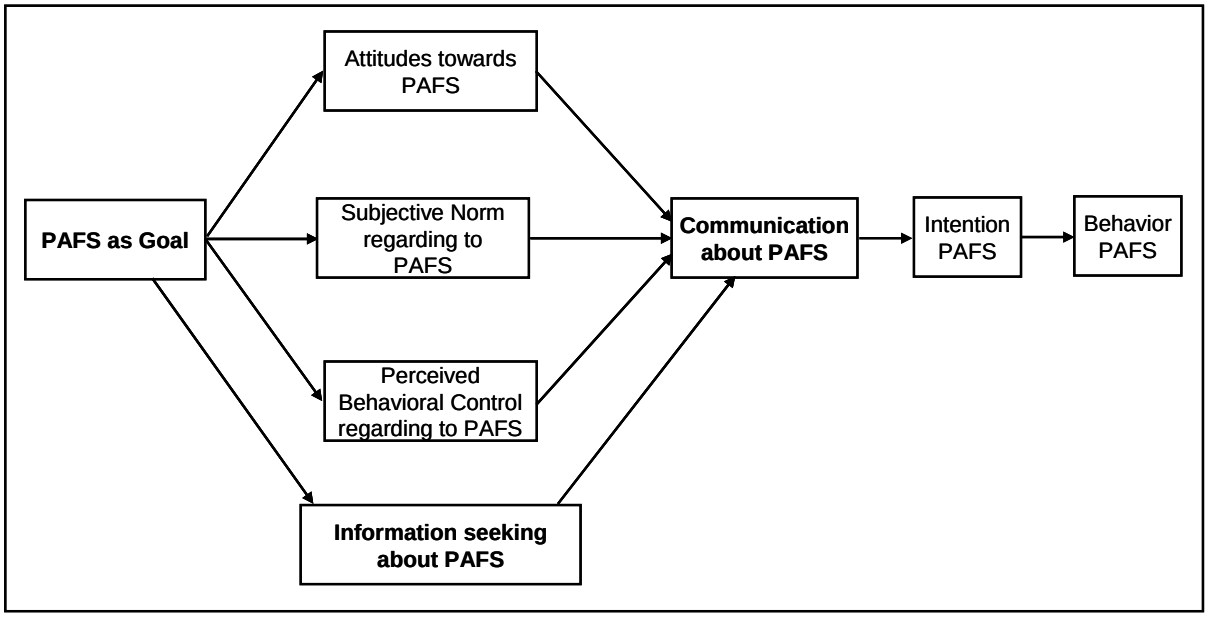
Combined Approach

There are, of course, lots of criticisms regarding the usefulness of the ToPB (see JONAS & DOLL 1996 for an overview). For example, it is criticized that ToPB is too static and cannot model the mental process of decision-making (BAGOZZI 1992). Another argument is that individuals are not rational as supposed within the ToPB. Therefore, the aim of the combined approach is to model the mental process of decision-making as well as to prove the rationality assumption.

With the combined approach, the ToPB can be made more procedural (see Figure 2). The inclusion of communication about the behavior as a relevant variable is helpful to build the decision-making process. Communication can also be seen as a proxy-indicator for

uncertainty with the assumption that the more persons communicate about the behavior the more information should they have and therefore the more reduced uncertainty. The rationality assumption is proved with the integration of individual goals which farmers form to convert or not to convert to PAFS as one additional variable. A second variable to build in rationality is information-seeking with regard to PAFS. In this way, one can prove if individuals' behavior is goal-oriented or not.

Figure 2: Combined behavior model



All variables in the combined model (Figure 2) are latent variables, which cannot be measured directly. Therefore they need to be operationalized through indicator variables (see Table 1).

Table 1: Operationalization of the latent variables

Latent variables	Code	Indicator variables and their wording
PAFS as Goal	**Goal**	How important is PAFS as an operational goal: very important (7) – not important (1)
Subjective norm regarding to PAFS	**Norm1**	If I convert to PAFS, people in my own social environment would: favor it (=7) – not favor it (=1)
	Norm2	If I convert to PAFS, the non-farmers would: favor it (=7) – not favor it (=1)
Attitudes towards PAFS	**Atti2**	With regard to income and amount of work for conversion to PAFS would be: very profitable (=7) – not profitable (=1)
	Atti4	I am confident that PAFS is a good alternative for improved animal protection: agree strongly (=7) – do not agree at all (=1)
Perceived behavioral control about PAFS	**Cont1**	I am capable of dealing with PAFS in an efficient way: agree strongly (=7) – do not agree at all (=1)
	Cont2	I could manage the amount of investments needed for PAFS: agree strongly (=7) – do not agree at all (=1)
Information seeking about PAFS	**Info**	I have informed myself about PAFS (regulations, direct payments, stabling systems): very well informed (7) – not informed (1)
Communication about PAFS	**Co-Im**	How important is PAFS as a communication subject: very important (7) – not important (1)
	Co-Fr	How often do you communicate about PAFS or conversion to PAFS: very often (7) – not often (1)
Intention to convert to PAFS	**Intention**	For me, the conversion to PAFS within the next two years is: highly probable (=7) – not probable (=1)

3. Methods of data collection and data analysis

To measure the above theoretical constructs a questionnaire was prepared and a survey was conducted with all the farmers (782 in all) in Canton Obwalden in November 2004. All theoretical constructs are assessed by means of indicator variables, graded on a seven-point scale. The return rate of the survey was moderate with 266 responses (i.e. 34%). The survey data is divided into PAFS- and Non-PAFS-farmers because of the causal direction of the theories' constructs. The analysis is conducted only with the 176 Non-PAFS-farmers who responded. The PAFS-farmers who are already practising particularly animal-friendly stabling system were not included in the analysis.

The Structural Equation Modeling (SEM) used in the current study is a statistical method that takes a confirmatory approach to the analysis of a structural theory bearing on some

phenomenon. It is a technique available to specify and to estimate models of linear relationships among measured variables (MV) and latent variables (LV). LVs are hypothetical constructs that cannot be directly measured like all the variables of the behavioral model. Therefore, each construct has to be represented by MVs that serve as indicators of them. A SEM model is a hypothesized pattern of directional and nondirectional linear relationships among a set of MVs and LVs. Directional relationships imply directional influence of one variable on another (regression paths), whereas nondirectional relationships are correlational and imply no directed influence (BOLLEN 1989; BYRNE 2001).

4. Results

The following results are calculated with SPSS 13 and AMOS 4 is used for the structural equation modeling. The estimations are based on the Maximum Likelihood Method.

There are 782 farmers in Canton Obwalden, where 220 (28%) are PAFS farmers and 562 (72%) are Non-PAFS farmers. The respondents of 266 comprise 167 (63%) Non-PAFS farmers and 99 (37%) practicing PAFS farmers.

Though model calculations are made only with Non-PAFS farmers, it is interesting to look at the mean differences between PAFS and Non-PAFS farmers. In Table 2, it is clear that all mean differences are highly significant except the difference in Atti2, which is only significant at the 5%-level.. Therefore the accuracy of discrimination of the variables between PAFS and Non-PAFS farmers is very high. It is also remarkable that the means of all variables of Non-PAFS farmers are less than the means of PAFS farmers. As expected, the Non-PAFS farmers have less favorable attitudes, norms and perceived behavioral control about particularly animal-friendly stabling system than the PAFS farmers themselves.

Table 2: Mean differences between PAFS- and Non-PAFS-farmers

	Mean		Standard deviation		Standard error of mean		Significances of the differences
Variables	Non-PAFS	PAFS	Non-PAFS	PAFS	Non-PAFS	PAFS	
Norm1	4.75	5.79	1.78	1.45	0.14	0.15	***
Norm2	4.96	6.15	1.77	1.26	0.14	0.13	***
Atti2	3.95	4.51	1.90	2.18	0.15	0.22	*
Atti4	4.77	5.92	2.05	1.46	0.16	0.15	***
Cont1	5.10	6.53	1.94	1.06	0.16	0.11	***
Cont2	2.94	5.68	2.14	1.86	0.17	0.19	***
Co-Im	4.23	5.59	2.00	1.62	0.16	0.17	***
Info	4.23	5.59	2.00	1.62	0.16	0.17	***

** = 5%-significance level, ** = 1%-significance level, *** = 0,1%-significance level*

In Table 3, the correlation matrix of the variables for Non-PAFS farmers is presented. The norm indicators have the highest correlation coefficient (r=0.74). The correlation between the attitude indicators is also high (r=0.62) but the correlation between the indicators of perceived behavioral control is poor with 0.28. However, the correlations between the indicators of norm and attitudes and perceived behavioral control have sometimes higher correlations than between the control indicators themselves. This could be a strong indication for existing multicollinearity.

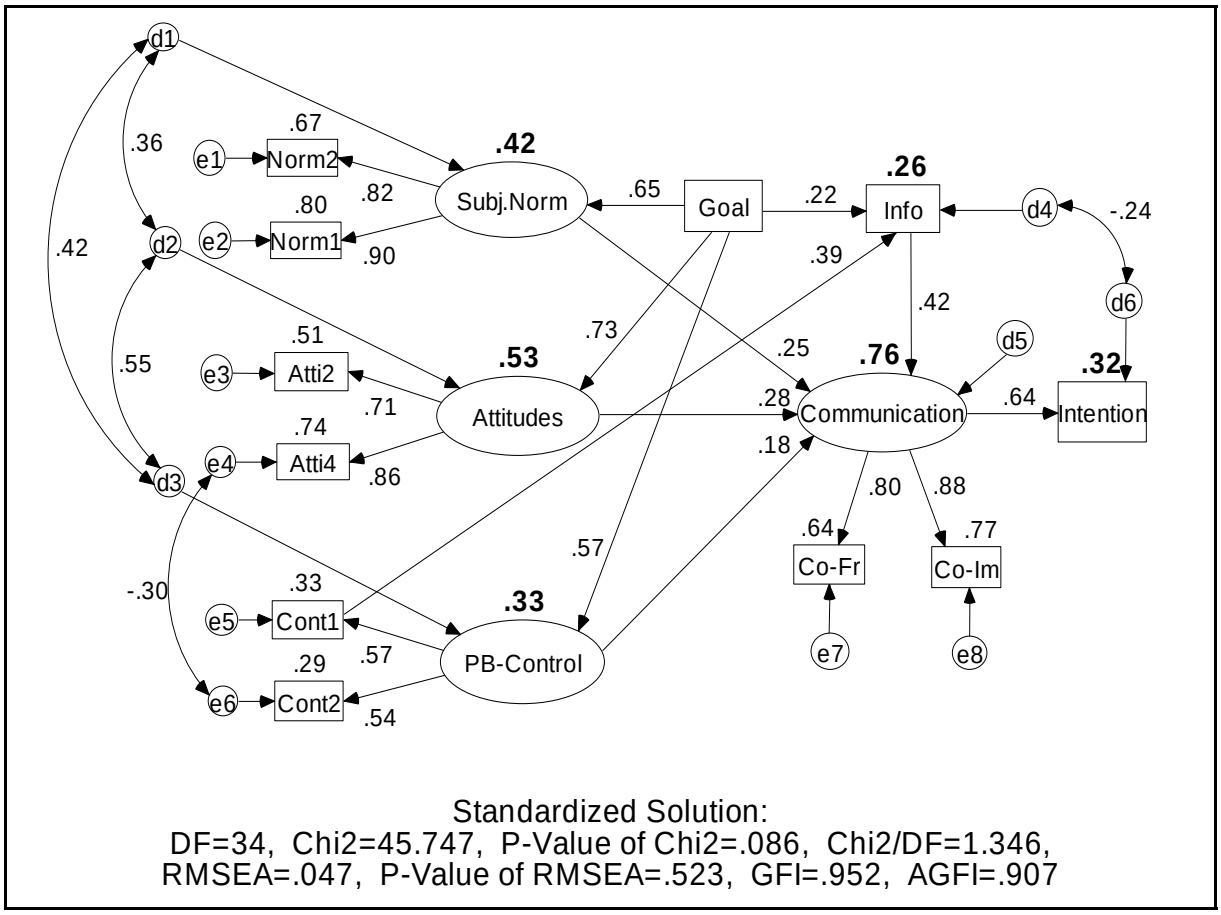
Table 3: Pearson Correlations

r	Norm1	Norm2	Atti2	Atti4	Cont1	Cont2	Goal	Co-Im	Co-Fr	Info	Intention
Norm1	**1.00**										
Norm2	0.74	**1.00**									
Atti2	0.41	0.36	**1.00**								
Atti4	0.53	0.47	0.62	**1.00**							
Cont1	0.33	0.39	0.24	0.38	**1.00**						
Cont2	0.26	0.29	0.26	0.21	0.28	**1.00**					
Goal	0.60	0.48	0.52	0.62	0.33	0.28	**1.00**				
Co-Im	0.44	0.44	0.45	0.56	0.42	0.42	0.62	**1.00**			
Co-Fr	0.40	0.43	0.36	0.41	0.42	0.35	0.52	0.70	**1.00**		
Info	0.14	0.21	0.15	0.25	0.48	0.25	0.34	0.54	0.50	**1.00**	
Intention	0.36	0.29	0.34	0.41	0.27	0.31	0.44	0.46	0.52	0.21	**1.00**

In Figure 3, the path diagram of the behavioral model of Non-PAFS farmers is shown. In this diagram, measured or indicator variables are symbolized as rectangles and latent variables are symbolized as ellipses. The circles symbolize the measurement errors (associated with

rectangles) and residual errors (associated with ellipses). The numbers above the rectangles show the explained variances of the measured variables (indicator reliability), the bold numbers above the ellipses show the explained variance of the latent variables (construct reliability). The numbers close to the arrows show the regression coefficients of each causal relationship. The numbers close to the double headed arrows show the correlations of modeled non-causal relationships.

Figure 3: Extended ToPB-Model of Non-PAFS Farmers (n=167)



The results (see Figure 3) show that the conversion to particularly animal-friendly stabling system (PAFS) can be explained with the extended ToPB. The explained variance in intentions to perform PAFS is about 32%. The variable ‘Goal’ can explain its affected variables from moderate (33% ‘PB-Control=Perceived behavioral control’) to good (53%

‘Attitudes’). The model explains ‘Communication’ the best accounting for 76% of the variation.

‘Information’ has the highest standardized effect (regression coefficients) on ‘Communication’ (0.42). The ‘Attitudes’ have the second-highest standardized effect (0.28) on ‘Communication’ followed by ‘Subjective Norm’ (0.25) and ‘Perceived Behavioral Control’ (0.18). The effect of ‘Communication’ on ‘Intention’ is also very high (0.64). All effects are highly significant at the 1%-significance level.

In Table 4, the standardized total effects are shown. With the total effects one can see the direct and indirect effects between the variables in the model. Thus the variables ‘Communication’ and ‘Goal’ seem to be very important. ‘Goal’ has the second highest total effect on ‘Intention’ (0.39), followed by ‘Attitudes’ (0.18), ‘Perceived Behavioral Control’ (0.17) and ‘Subjective Norm’ (0.16).

Table 4: Standardized Total Effects

	Goal	PB-Control	Cont1	Info	Subj. Norm	Attitudes	Communication
PBControl	.57	.00	.00	.00	.00	.00	.00
Cont1	.33	.57	.00	.00	.00	.00	.00
Info	.35	.23	.39	.00	.00	.00	.00
Subj. Norm	.65	.00	.00	.00	.00	.00	.00
Attitudes	.73	.00	.00	.00	.00	.00	.00
Communication	.61	.27	.17	.42	.25	.28	.00
Norm1	.58	.00	.00	.00	.90	.00	.00
Intention	.39	.17	.11	.27	.16	.18	.64
Co-Fr	.49	.22	.13	.34	.20	.22	.80
Co-Im	.54	.24	.14	.37	.22	.24	.88
Atti2	.52	.00	.00	.00	.00	.71	.00
Cont2	.31	.54	.00	.00	.00	.00	.00
Atti4	.63	.00	.00	.00	.00	.86	.00
Norm2	.53	.00	.00	.00	.82	.00	.00

The model has a good fit according to the considered measures of fit (see Figure 3). The ratio of Chi^2 to the Degrees of Freedom (Chi^2/DF) indicates a very good fit. The Root Mean Square Error of Approximation (RMSEA) is also very good with 0.047, like its P-Value. The

Goodness of Fit Index (GFI) as well as the Adjusted Goodness of Fit Index (AGFI) are also relative good. All in all, the model can be seen as supporting the underlying theoretical structure.

5. Discussion and conclusions

To summarize, the results indicate that, overall, the model has a good fit to the data. Therefore, the extended ToPB is applicable in an agricultural context to explain behaviors such as the conversion to particularly animal-friendly stabling system in Switzerland.

The effects of 'Goal' on 'Attitudes', 'Subjective Norm' and 'Perceived Behavioral Control' are high. This shows the importance of forming personal goals in the behavior domain and that people act in a goal-directed, rational way.

'Communication' is the best explained variable and it has the third highest effect in the whole model. This can be seen as an empirical evidence that communication through personal channels has a great impact on individual decision-making.

The extended ToPB-model leads to results that are comparable to other behavioral studies. The explained variances, though similar to other study results, are sometimes moderate. Other influencing factors must also be taken into consideration for the conversion to particularly animal-friendly stabling system, such as age, education, and uncertainties about the market and about the direct payments. Variables that measure uncertainty directly have not yet been assessed but they should be taken into account in further research.

Our further research will consider the objective behavior, when the actual conversion data becomes available at the end of 2005. Furthermore, the extended ToPB model will be calculated with the statistical package LISREL, which is able to deal with ordinal variables like the ones in the data set.

6. References

AJZEN, I., FISHBEIN, M. (2005): The influence of attitudes on behavior. In: ALBARRACIN, D., JOHNSON, B.T., ZANNA, M.P. (Eds): Handbook of attitudes and attitude change: Basic principles. Mahwah, New York, Erlbaum Verlag.

AJZEN, I. (1985, Reprinted): Attitudes, personality, and behavior. Milton Keynes : Open University

ALBRECHT, H. (1992): Die Verbreitung von Neuerungen – Der Diffusionsprozess. In: HOFFMANN, V. (Hrsg.) (1992): Beratung als Lebenshilfe: humane Konzepte für eine ländliche Entwicklung. Margraf Verlag, Weikersheim.

ARNSCHEID, R., & SCHOMERS, P. (1996). Einstellung und Leistung in Gruppen: Eine Überprüfung der Theorie des geplanten Verhaltens bei Spielern der Basketball-Bundesliga. Zeitschrift für Sozialpsychologie, Band 27, Heft 1, 61-69.

BAGOZZI, R.P. (1992): The self-regulation of attitudes, intentions, and behavior. Social Psychology Quaterly, 55, 178-204.

BAMBERG, S., & LÜDEMANN, C. (1996). Eine Überprüfung der Theorie des geplanten Verhaltens in zwei Wahlsituationen mit dichotomen Handlungsalternativen: Rad vs. PKW und Container vs. Hausmüll. Zeitschrift für Sozialpsychologie, Band 27, Heft 1, 32-46.

BAMBERG, S., & SCHMIDT, P. (1993). Verkehrsmittelwahl - eine Anwendung der Theorie geplantes Verhalten. Zeitschrift für Sozialpsychologie, Band 24, Heft 1, 25-37.

BAMBERG, S., & SCHMIDT, P. (1997). Theoriegeleitete Evaluation einer umweltpolitischen Massnahme: Längsschnittliche Überprüfung der Wirksamkeit des Giessener Semestertickets mit Hilfe der Theorie des geplanten Verhaltens. Zeitschrift für Sozialpsychologie, Band 28, Heft 4, 280-297.

BOLLEN, K. (1989): Structural Equation Models with Latent Variables. New York.

BYRNE, B. (2001): Structural Equation Modeling with AMOS. Basic Concepst, Applications, and Programming. Lawrence Erlbaum Associates, Publishers: London

FISHBEIN, M. & AJZEN, I. (1975): Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Addison-Wesley: Reading

GILES, M., CAIRNS, E. (1995): Blood donation and Ajzen's theory of planned behaviour: An examination of perceived behavioural control. British Journal of Social Psychology, 34, 173-188.

HIGGINS, A.; CONNER, M. (2003): Understanding adolescent smoking: The role of the Theory of Planned Behaviour and implementation intentions. Psychology, Health & Medicine, Vol. 8, Nr. 2, 173-186.

JONAS, K.; DOLL, J. (1996): Eine kritische Bewertung der Theorie des überlegten Handelns und der Theorie des geplanten Verhaltens. Zeitschrift für Sozialpsychologie, Volume 27, Issue 1, 18-31.

LEEUWIS, C. (2004): Communication for Rural Innovation. Rethinking Agricultural Extension. 3. Edition, Blackwell Publishing: Oxford

ROGERS, E.M. (1995): Diffusion of Innovations. 4. Auflage, Free Press, New York, London.

ROGERS, E.M. (2003): Diffusion of Innovations. 5. Auflage, Free Press, New York, London.

VAN DEN BAN, A.W.; HAWKINS, H.S. (1996): Agricultural Extension. 2. Auflage, Blackwell Science, Oxford.