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The social psychology of biodiversity conservation in agriculture

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We investigate farmers' intentions to apply biodiversity conservation practices from a psychological perspective, using an adapted version of the theory of planned behaviour (TPB), including group norms and putting emphasis on moral norms and self-identity. The study is based on a quantitative survey ($n = 99$) in Belgium, analysed using confirmatory factor analyses and path analysis. Results suggest that the impact of attitudes, social norms and perceived behavioural control on intentions is almost fully mediated through moral norms and self-identity. To have a sustained impact, change actions should strive to embed biodiversity conservation into the social norms and into the good farmer identity of the farming community. While acknowledging the explanatory nature of this study, the findings could suggest another view on how to induce behavioural change.

Keywords: Belgium; biodiversity; conservation adoption; theory of planned behaviour

1. Introduction

Today, it is commonly acknowledged that the eco-systemic, and the inter- and intra-specific diversity of natural life are under threat of being irremediably lost (Negri 2005). In a region where the 'agricultural' environment is by far the most dominant environment, the link between agriculture and biodiversity in the EU is very close. Indeed, about half of the total land area in the EU is farmland (McCracken 2011). The literature stresses the strong link between agriculture and biodiversity (Donald 2004) and many papers focus on the negative influences of agriculture on biodiversity (e.g. Benton, Vickery, and Wilson (2003). Conservation of biodiversity is vital for the future on this planet and the provision of ecosystem services (Kremen 2005), not in the least for food security and agricultural production itself (Thrupp 2000). Fortunately, agriculture can have a positive influence on biodiversity as well (Scherr and McNeely 2008). Recent studies show that with a proper farming system and management, agriculture can retain biodiversity by providing food, living places and shelter for small animals, plants and micro-organisms which develop their living in agricultural areas. For instance, Hinsley and Bellamy (2000) showed that farmers can apply strategies such as a reduction in pesticide use, diversification of vegetative structure or retention of hedgerows to increase the number of birds. Fischer and Lindenmayer (2002) found that small habitat patches could be a successful habitat for wild species.

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In the EU, policies to induce farmers to change their production practices to more environmentally friendly production methods have largely been based on voluntary adoption. Economic incentives, in the form of agri-environmental schemes, aim to stimulate the adoption of specific packages of conservation practices by offering a compensation payment to farmers. The uptake of such schemes is voluntary and research has shown that this uptake is largely dependent on farmers' attitudes, motives and intentions (e.g. Ducos, Dupraz, and Bonnieux 2009; Barreiro-Hurlé, Espinoza-Goded, and Dupraz 2010). The success of such policy approaches remains critically dependent on the factors that induce farmers to respect and foster biodiversity. Perrings *et al.* (2006) and Norris (2008) state that in order to enhance biodiversity conservation, we need to integrate conservation science with agricultural and social sciences. Mascia *et al.* (2003) point out that "conservation interventions are the product of human decision making processes and require changes in human behaviour to succeed" (Mascia *et al.* 2003, 649).

Factors affecting farmers' intentions to use practices for biodiversity conservation have been investigated in many countries and across scientific disciplines. Siebert, Toogood, and Knierim (2006) provide an overview of the state of knowledge. They reviewed about 160 publications and research reports from about 20 mainly European countries. Altogether, they found a mixture of theoretical, conceptual and empirical studies, with 15 scientific disciplines represented in the sample. According to their review, adoption of biodiversity conservation practices was most explained by farmers' willingness, farmers' ability and direct and wider social influences. Farmers' willingness refers to their motivation. According to these authors, financial and economic incentives are often necessary to provide good motivations. Farmers' ability refers to barriers and obstacles and to the practical compatibility of the conservation measures with the farming context. Direct and wider social influences refer to the impact that other people have on farmers' conservation behaviour. Their analysis points to, amongst others, other farmers and advisors as important sources of social influence. Methodologically, they show that most studies are qualitative studies and inspired by single disciplines. Quantitative methods and behavioural theories combining individual perceptions with wider social influences are not present. Furthermore, they show that adoption is too much understood in a static sense.

Our study adopts the behavioural approach (Burton 2004a) that investigates the psychological characteristics of farmers that influence their behaviour. We use an adapted version of the theory of planned behaviour (TPB) (Ajzen 1991). The central thesis of the TPB is that a person's behaviour is guided by three considerations: attitude, or the degree to which a person positively or negatively evaluates the behaviour; subjective norm, or the perceived social pressure from significant others to engage or not in the behaviour; and perceived behavioural control, or the degree to which the person thinks (s)he is capable of performing the behaviour. The latter is an extension to the theory of reasoned action (TRA), the TPB's predecessor (Fishbein and Ajzen 1975). These three considerations together induce a positive or negative intention towards the behaviour. When there is sufficient actual behavioural control, people will normally carry out their intentions; perceived behavioural control is mostly regarded as a proxy for actual behavioural control, thereby having a hypothesized direct and indirect influence on behaviour.

The TPB is used in this study for a number of reasons. First, reviews and meta-analysis conclude that there is broad empirical support for the TPB (Armitage and Conner 2001). Second, the three central socio-psychological variables in the TPB correspond to the three main categories found in the review by Siebert, Toogood, and

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Knierim (2006). Attitudes refer to farmers' willingness; subjective norm refers to the direct and wider social influences, and perceived behavioural control refers to farmers' ability. Third, our approach meets some of the suggestions for further research identified by Siebert, Toogood, and Knierim (2006), such as the need for interdisciplinary studies and for representative empirical studies.

Socio-psychological approaches are needed to explain the reasons behind the actual biodiversity conflicts (Stoll-Kleemann 2001). Yet, the single most important shortcoming of the TPB as a comprehensive model is the fact that, for a lot of contexts and behaviours, it insufficiently incorporates concepts from social theory. Indeed, meta-analyses have shown that among the TPB concepts, subjective norms are the weakest predictors of intentions (e.g. Blue 1995; Armitage and Conner 2001). Therefore, this study extends the TPB with concepts from social theory. More specifically, we extend the model with (i) group norms (the subjective norm of the group to which the respondents belong), inspired by social identity theory; (ii) moral/personal norms, inspired by norm activation theory; and (iii) self-identity (the degree to which the behaviour fits with the self-concept of the respondents), inspired by identity theory.

Group norms are the social pressure from behaviourally relevant peer groups. Several authors (Terry and Hogg 1996; Terry, Hogg, and White 1999) argued that rather than being influenced by aggregated impressions of important others, many behaviours will be influenced by the expectations and behaviour of group members who are relevant to that behaviour. This expansion of the TPB is inspired by social identity theory (e.g. Hogg 2006).

Moral/personal norms stem from the norm activation theory. Schwartz (1977) defined moral norms as internalized values that are experienced as feelings of personal obligation to engage in a certain behaviour. Some studies of environment-friendly behaviour found that by adding moral norms to the other predictors of TPB the amount of explained variance in behavioural intentions increased (e.g. Bamberg and Moser 2007). As implementing practices to conserve biodiversity is a behaviour likely to contain elements of personal morality and social responsibility, it was considered relevant to include this variable within the model (e.g. Tonglet, Phillips, and Read 2000).

The construct of self-identity is derived from identity theory, which describes the self as a collection of identities derived from the various social roles someone occupies. All these role identities have the potential to influence behaviour but it depends on their relative importance which of these will have the strongest influence. Self-identity refers to the extent to which a certain behaviour is seen as part of the self.

The effect of self-identity and moral norms on the behaviour of farmers has, to our knowledge, only been investigated by a few authors (McCarthy *et al.* 2007; Parminter 2009; Lokhorst *et al.* 2011). All three found that both self-identity and moral norms significantly predicted intention over and above attitude, subjective norm and perceived behavioural control. However, Lokhorst *et al.* (2011) found that this was only the case for non-subsidized conservation practices. Outside agriculture, the role of self-identity and moral norms has been investigated more often. The empirical evidence that self-identity and moral norms add predictive value to the original theory of planned behaviour is mixed (e.g. Harland, Staats, and Wilke 1999; Kaiser, Hubner, and Bogner 2005). In one of the first systematic studies, Kaiser and Scheutle (2003) found that the addition of moral norms did not improve the explanatory power of the TPB. Kaiser (2006) also found that attitudes and moral norms overlap. Yet, Bamberg and Moser (2007) found in a meta-analysis that personal norms significantly improved the predictive value of the TPB. Rise, Sheeran, and Hukkelberg (2010) did a meta-analysis of the role of self-

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identity in the TPB and found that it explained an additional 6% of the variation in intention. Some authors have argued that the influence of these variables may be to mediate the impact of traditional TPB-variables. Bamberg, Hunecke and Blöbaum (2007), for instance, found that moral norms stem from both anticipated feelings of regret and perceived social norms. In our exploratory study, we want to contribute to this field, by testing the hypothesis that self-identity and moral norms, as internalized predictors of intention, mediate the influence of the traditional TPB-variables. De Snoo *et al.* (2013) stated that "…if these influences fail to become embedded into the 'good farmer' identity, their impact is likely to be limited to farmers with pre-existing sympathies towards biodiversity provision" (De Snoo *et al.* 2013, 69). Pretty (2003) stated that people often revert to their old ways of doing things after some external motivations ceased to exist, unless there had been a change in norms. We hypothesize that, if it is so crucial to be able to influence self-identity and personal norms, then their influence must be more than just adding to the influence of attitude, subjective norms and perceived behavioural control. This leads us to consider an alternative TPB, in which moral norms and self-identity mediate the role of the traditional TPB-variables.

In this study, farmers' intentions towards two biodiversity enhancing practices were investigated. First, buffer strips are strips made up of a mixture of grasses or natural vegetation left to itself at a field border. Fertilization and use of agro-chemicals on these lands must be avoided. Second, planting and maintaining small landscape elements, such as copses, hedges and hedgerows offer nest and shadow places for farmland birds and small mammals. Compared to many previous TPB studies in agriculture, we also investigate the underlying belief structure of attitudes, perceived behavioural control and subjective norm, using an approach as in Wauters and Mathijs (2013). This better allows for the identification of improvements to policy instruments and extension schemes, as it can elicit the reasons why farmers have unsupportive socio-psychological characteristics towards conservation schemes. Indeed, the mere knowledge that a negative attitude towards a conservation practice is an important determinant of non-adoption is itself not instructive for the development of policy and extension intervention. Knowing which beliefs and opinions are (part of) the reason for this negative attitude, on the contrary, offers insights into what efforts may have an effective impact on farmers' attitudes.

While predicting the intention towards two individual agrobiodiversity conservation practices, we make an important theoretical contribution by aligning a behavioural framework that is widely used in agri-environmental settings, with more advanced insights stemming from norm theories and identity theories. In doing so, we build a more detailed behavioural model around which policy interventions can be designed and extension programs can be developed. Furthermore, we present a methodology to unravel the underlying beliefs behind some of the socio-psychological concepts that explain adoption that may be applied for many other conservation practices and in other regions.

2. Study materials and methods

2.1 Study context

The study was performed on a cross-sectional sample of farmers in Flanders, the northern region of Belgium. Flanders is a densely populated area of about 13,500 km^2, of which, nonetheless, 45% is under agricultural production. It is estimated that around 12% of all bird species, less than 1% of all animal species and 132 plant species are specifically tied to agricultural land. In Flanders, about 4% of the area is Natura 2000 protection area

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(INBO 2014), meaning that it is a protection area that is established under the 1992 Habitats Directive. In total, of all European habitat areas, 47 are in Flanders, and 38 of these are in very unfavourable condition (INBO 2014). Agriculture in Flanders is dominated by intensive livestock systems, and arable systems relying on external inputs and mostly conventional tillage practices.

2.2 *Research approach*

The theoretical framework we used was an adapted version of the TPB. In the original TPB, intentions are explained by attitude, subjective norm and perceived behavioural control. We hypothesize that, next to subjective norms, group norms, i.e. the norms from the specific referent group to which the farmer belongs, will influence intention. Furthermore, we hypothesize a behavioural model structure in which the influence of these four socio-psychological constructs on intention must be understood as being mediated by self-identity and moral norms. These constructs reflect the degree to which the behaviour has become part of the identity and the internal norms of the farming population.

Socio-psychological variables are unobservable and are normally measured using measurement scales. These usually take the form of the semantic differential (Osgood, Suci, and Tannenbaum 1957). Such measures, which come in many forms, are analytically sound and allow the researcher to test the validity of a framework such as TPB. Yet, the mere knowledge that a farmer's attitude positively influences his adoption of a conservation measure is not a starting point for changing this behaviour. To overcome this, we present and adopt an approach to unravel the underlying beliefs behind the socio-psychological characteristics, based on the expectancy value theory (EVT). EVT was originally developed as an indirect way to measure attitudes. It examines beliefs and evaluates the attributes or outcomes of the behaviour under consideration (Fishbein 1963; 1973; Fishbein and Ajzen 1975). EVT explains a person's attitude towards an action, by assessing the person's evaluations of the possible consequences of the action considered. EVT also examines the beliefs about the likelihood of these attributes' occurrence. These various aspects are linked to determine the attitude in the following manner:

$$A = \sum_{i=1}^{n} b_i e_i$$

where b is the beliefs about the likelihood of the potential attributes, e is the evaluation of these attributes and i is the total number of characteristics a person considers. This measure of attitude is, in fact, a farmer-oriented assessment of the innovation's relative advantage, which is considered one of the most important factors explaining adoption of agricultural innovations (Pannell *et al.* 2006). While originally developed as a model to uncover the antecedents of attitudes, the EVT has now become the basis for indirect measures for other socio-psychological constructs in other models. In the theory of planned behaviour, the expectancy-value model is used to indirectly measure subjective norms and perceived behavioural control in the following manner (Ajzen 1991):

$$SN = \sum_{i=1}^{n} n_i m_i$$

$$PBC = \sum_{i=1}^{n} p_i c_i$$

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where n is the respondent's opinion about what referent i would want the respondent to do; m is the respondent's motivation to comply with referent i; p is the perceived ability of control factor i to facilitate a particular behaviour; and c is the respondents' perception of whether control factor i is absent or present.

2.3 Study sample and variables

The study was a sequential mixed-method study, in which we did a qualitative data collection in the first stage, followed by a quantitative survey in the second stage. The qualitative data collection consisted of semi-structured interviews with non-randomly selected farmers. The sample was a convenience sample of 11 farmers that we were able to contact thanks to previous contacts between these farmers and our research group. In a qualitative study, the purpose of the sampling is not to be representative, but rather to select those individuals from which we expect to learn the most information. The semi-structured interviews were loosely based on an interview guide centred around advantages and disadvantages of the investigated conservation practices, referents who may have, or try to have, an influence on the farmers' conservation behaviour and around drivers and barriers that render the adoption of the specific conservation practice difficult or easy. The outcome of this stage was a list of outcomes, referent group and barriers that we subsequently used in the construction of the survey instrument.

In the second stage, we developed a survey instrument (see below) which was first pilot-tested with 6 randomly chosen farmers. Upon adaptation of the survey instrument, it was sent by regular mail to an initial random sample of 520 respondents. After a few weeks, a reminder was sent, resulting in a 20% response rate (106 respondents). However, after data cleaning and missing value analysis, we had to delete 7 cases due to a too large proportion of missing values. Hence, our final sample had 99 respondents. A response rate of around 20% is around what is reported in the literature for a mail survey (e.g. Yammarino, Skinner, and Childers 1991). Pennings, Irwin, and Good (2002) analysed non-response to mail surveys among farmers and showed that factors influencing the willingness to participate were the perceived length of the survey, the period in which it was sent, the sender of the survey and the amount and form of compensation. We decided not to offer compensation in any form, since we believe that, while offering a reward may increase the survey's response rate, it is not effective in avoiding biases. On the contrary, when offering a reward, farmers who are more motivated by economic incentives may be more eager to participate. Especially in a survey assessing farmers' motives for their behaviour, such biases should be avoided. We took other recommendations into account, by sending the survey in Winter which is usually the least busy period for the target population, we made sure that it was clear that the survey was sent through a research institute and not the government, and we kept the survey as short as possible.

The survey instrument that was used in this study was designed to measure three groups of variables: (1) the socio-psychological characteristics towards each of both specific conservation practices; (2) the underlying beliefs towards each specific conservation practice, based on the outcome of stage 1; and (3) general characteristics of the farm and the farmer. With respect to measuring socio-psychological variables – the first group of variables – Podsakoff *et al.* (2003) point to the distinction between a formative and a reflexive model when measuring psychological characteristics. The psychological characteristics are unobservable or latent constructs that are to be measured by observable indicators. If these indicators are assumed to cause the latent construct, a formative model should be used. The Human Development Index (HDI) is

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one of the better known examples of such a latent construct. In the case where the latent construct is causing the indicators, a reflective model should be used (Edwards and Bagozzi 2000). The choice of formative or reflective model should be driven by the underlying theory. In the case of variables such as attitudes and norms, the underlying theory posits that the model is reflective (e.g. Hansson, Ferguson, and Olofsson 2012). Confirmatory and exploratory factor analysis can be used to measure a latent construct using a reflective measurement model. The first requires a set of previously developed measurement items that have been used to measure the respective items. When such a set is not available, exploratory factor analysis becomes necessary. Attitudes, norms, identity and perceived behavioural control in the setting of farmers' conservation and environmental behaviour have been assessed by several past studies (e.g. Fielding *et al.* 2005; Wauters *et al.* 2010). Although none of these studies specifically dealt with the conservation practices in our study, we consider these measurement items sufficiently valid for our case. Hence, attitudes, different types of norms, perceived behavioural control and intention towards biodiversity conservation practices were measured in our survey using a slightly adapted version of existing measurement items. All items were 7-point Likert-type items, were arranged in a random order and a number of items was reverse scored. All constructs and their intended indicators are presented in Table 1.

For each accessible outcome, farmers were asked (i) to rate the probability of that outcome, resulting from adoption of the conservation measure, on a scale from 1 to 7

Table 1. Latent constructs and hypothesized item structure.

Construct	Items
Attitude (A)	Applying practice x is very unimportant – very important
	Applying practice x is very bad – very good
	Applying practice x is very unpleasant – very pleasant
	Applying practice x is very useless – very useful
	Applying practice x is very negative – very positive
Subjective norm (SN)	Most people whose opinions I value think I should apply practice x
	Most people who are important to me think I should apply practice x
	It is expected of me that I apply practice x
Perceived behavioural control (PBC)	It is mainly up to me whether I apply practice x
	For me, it is almost impossible – very possible to apply practice x
	I have very little control – very much control over the decision to apply practice x
Self-identity (SI)	I am not the kind of person that applies practice x
	Applying practice x is an important part of who I am
Group norm (GN)	Many farmers that I know think I should apply practice x
	Most farmers from my village are applying practice x
	Most farmers that I know are applying practice x
Moral norm (MN)	How obliged do you feel to apply practice x
	I would feel guilty if I would not be applying practice x
Intention (I)	I plan to apply practice x in the near future
	I am resolved to apply practice x in the near future
	I intend to apply practice x in the near future

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with the endpoints 'absolutely not' – 'absolutely'; and (ii) to evaluate each accessible outcome on a scale from 1 to 7 with endpoints 'extremely bad' – 'extremely good'. For each accessible referent, respondents were asked (i) to indicate their perception of whether that particular referent would think that the farmer should adopt the conservation practice on a scale from 1 to 7 with endpoints 'absolutely not' – 'absolutely'; and (ii) to indicate the farmer's tendency to comply in general with the opinion of that referent on a scale from 1 to 7, with endpoints 'absolutely not' – 'absolutely'. The usual approach with respect to the control factors is to let the farmer rate the perceived ability of the control factor to facilitate the particular practice and the extent to which that control factor is present. However, the pilot-test of the survey instrument revealed that it was difficult for farmers to distinguish between these two dimensions, as the perception on the extent to which a particular control factor facilitates a conservation practice is already largely influenced by the extent to which this control factor is present. Hence, we decided to assess the strength of all control factors to act as a barrier with one single item. Farmers rated the extent to which each control factor acts as a barrier on a scale from 1 (very severe barrier) to 7 (no barrier at all).

Last, in the survey we also collected information on farm and farmer characteristics such as age, education, tenure, size and farm activities. Furthermore, we added questions related to farmers general knowledge, awareness and opinions on biodiversity, biodiversity conservation and the bi-directional link between farming and biodiversity. For a complete list of these variables, we refer to Table 2 in the results section. The desire

Table 2. Summary statistics of the sample ($n = 99$).

Characteristic	Sample
Farm and farmer characteristics	
Age (years)	53.19 (10.42)
Farm size (ha)	34.39 (31.52)
Percentage leased land (%)	46.07 (31.60)
Farm type	
Arable farming	24.2%
Mixed farming	31.3%
Horticultural farming	22.3%
Livestock farming	22.2%
Perceived knowledge[*]	
Perceived knowledge about the impact of biodiversity on farming	4.00 (1.51)
Perceived knowledge about the impact of farming on biodiversity	4.05 (1.48)
Perceived state of biodiversity[†]	
Globally	3.94 (1.57)
In my country	3.58 (1.57)
In my region	3.44 (1.54)
On my farm	3.08 (1.48)
Amount of 'nature' in the farm's surroundings	3.56 (2.11)
Previous experience with the practice	
Buffer strips	30%
Small-landscape elements	37%

[*]Average on a scale from 1 (very little knowledge) to 7 (very knowledgeable).
[†]Average on a scale from 1 (very bad state) to 7 (very good state).

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to keep the survey as short as possible unfortunately reduced the number of questions we could include in this category.

2.4 Data analysis

Structural equation modelling allows investigating the validity of the reflective measurement model and the structural model simultaneously. However, for complex models, this requires large sample sizes. We use a two-step procedure in our study (see e.g. Mastrangelo *et al.* 2013) that allows testing of more complex models in cases where sample sizes are typically lower. First, we performed a series of confirmatory factor analyses (CFAs), to check whether we can retain the hypothesized item structure. The CFA's goodness of fit was evaluated using different goodness-of-fit measures. Items with loadings smaller than 0.50 were excluded. To validate the results of the CFA, item-to-item and item-to-total correlation and Cronbach's alpha's of the eventual measurement scales were calculated.

Second, we tested the fit of the overall model and investigated the relationships between the different psychological constructs using path analysis on composite scores of all constructs calculated as the average of the individual item scores. The validity of our models was evaluated based on a variety of goodness-of-fit indices. Upon approval of the overall model, we examined the sign and significance of the relationships between the variables. All analyses were carried out using AMOS and SPSS (IBM, Chicago, IL, USA).

We used analysis of variance (ANOVA) to compare the difference in mean scores for all items of the belief structure between high intenders and low intenders. High intenders were defined as farmers with a mean of 4, on a scale from 1 (very low intention) to 5 (very high intentions). Low intenders were defined as those farmers with an intention score below 4.

3. Results

3.1 Summary statistics

All summary statistics for our final sample are shown in Table 2, means and standard deviations of the TPB-variables are presented in Table 4. The farmers in our sample are on average 53 years old, cultivate 34 ha of land of which they rent slightly less than half. In the farmers' population, the average age is 54 years old. Average farm size is 25.04 hectares. Taking into account that this includes greenhouse growers and pig and poultry farms, who typically use small land areas, our sample is not biased in terms of land cultivated. Average land ownership versus tenancy status is somewhat different in the population, where on average 63.9% of land is leased, compared to 46.07% in our sample. Based on this small number of farm and farmer characteristics, we conclude that there is no bias towards age, size or tenure in our sample. The farmers judge their knowledge about the impact of biodiversity on farming and vice versa as medium good. Although the differences are small, farmers, on average, judge the state of biodiversity to be better the closer to their own farm. In the sample, 30% had previously practiced buffer strips and 37% had previously practiced small landscape elements. Data on the population-wide adoption rates of these practices does not exist. However, it is known that 30% of all arable farms, 20.2% of mixed farms and 15.8% of livestock farms (excluding pig and poultry farms) have engaged in one or more agri-environmental

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schemes. Considering that there exist more agri-environmental schemes than those for buffer strips and small landscape elements, on the one hand, and that the number of farmers who engaged in an agri-environmental scheme most likely underestimates the actual adoption rate on the other, we conclude that our sample counts a proportionally higher number of farmers with previous experience with the practice than the target population, but that the difference is not very large.

On average, farmers have a negative intention towards both practices (2.910 for buffer strips and 3.103 for small landscape elements, on a scale from 1 (very low intentions) to 7 (very high intention). Furthermore, moral norms are the most negative characteristics towards these practices, indicating that farmers do not feel a moral obligation to apply these practices. Also group norms (the norms from the in-group of farmers) are quite low, whereas subjective norms (the social influence from the out-group) appears to be higher. Attitude, perceived behavioural control and self-identity are all moderate, but slightly negative.

3.2 *Measurement models*

The results of the confirmatory factor analysis are presented in Tables 3 and 4. Overall, the confirmatory factor analysis confirmed the hypothesized item structure. A few items with insufficient loadings were excluded. For the practice buffer strips, we had to delete one item in the measurement scale for PBC and GN because of a too small loading. For

Table 3. Goodness-of-fit statistics, range of item-to-total correlations and range of item-to-item correlations for the measurement models.

	Buffer strips	Small-landscape elements
Goodness-of-fit measures		
Chi-square	157.31	128.09
Df	89 ($p = 0.000$)	89 ($p = 0.004$)
Chi-square /df	1.768	1.439
CFI	0.928	0.959
RMSEA	0.088	0.067
Item-to-total correlations		
A	0.775 –0.909	0.853–0.933
SN	0.326–0.394	0.246
PBC	0.576	0.469
GN	0.558	0.410–0.539
MN	0.517	0.464
SI	0.417	0.482
I	0.794–0.869	0.802–0.860
Item-to-item correlations		
A	0.635–0.875	0.781–0.896
SN	0.228–0.318	0.246
PBC	0.576	0.469
GN	0.558	0.265–0.446
MN	0.517	0.464
SI	0.417	0.482
I		0.767–0.842

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Table 4. Means, standard deviations, scale reliabilities (Cronbach alpha) and correlations among variables.

Buffer strips	Mean (SD)‡	I	A	SN	PBC	GN	SI	MN
I	2.910 (1.977)	0.92						
A	3.507 (1.740)	0.698***	0.94					
SN	3.233 (1.372)	0.612***	0.639***	0.54				
PBC	3.672 (1.962)	0.766***	0.647***	0.510***	0.73			
GN	2.650 (1.609)	0.552***	0.470***	0.523***	0.421***	0.72		
SI	3.260 (1.775)	0.731***	0.727***	0.574***	0.666***	0.417***	0.58	
MN	2.434 (1.516)	0.702***	0.701***	0.637***	0.514***	0.604***	0.590***	0.68
Small-landscape elements								
	Mean (SD)‡	I	A	SN	PBC	GN	SI	MN
I	3.103 (1.878)	0.92						
A	3.878 (1.741)	0.744***	0.96					
SN	2.879 (1.540)	0.577***	0.545***	0.39				
PBC	3.819 (1.766)	0.643***	0.590***	0.446***	0.64			
GN	2.646 (1.277)	0.423***	0.431***	0.403***	0.262**	0.65		
SI	3.653 (1.785)	0.800***	0.785***	0.577***	0.629***	0.355***	0.65	
MN	2.725 (1.562)	0.691***	0.661***	0.574***	0.513***	0.485***	0.690***	0.63

** $p < 0.05$; *** $p < 0.001$.
‡ Mean and standard deviation on a scale from 1 (negative) to 7 (positive).

small landscape elements, we removed, for the same reasons, one item in the measurement scale for PBC and SN. Deletion of these items improved the overall fit of the measurement model. Goodness-of-fit measures, item-to-total correlations and item-to-item correlations for all constructs are shown in Table 3 and scale reliabilities, as measured by Cronbach's alpha are presented in Table 4. Overall, the fit of our measurement models is acceptable, although some item-to-total correlations are below the cut-off value of 0.40 (Hair *et al.* 2010) and some item-to-item correlations are below the cut-off value of 0.30 (Hair *et al*. 2010). However, given the goodness-of-fit statistics and the theoretical support for our hypothesized measurement item structure, we consider both final measurement models acceptable. Hence, we then proceed to calculate the composite variables as the average of all items for each respective latent construct.

3.4 Path models

The results of the structural model for small landscape elements are shown in Figure 1. All regression coefficients are highly significant and the model explains 68% of the variation in intention. The results of the structural model for buffer strips are shown in Figure 2. Analogous to the previous model, all regression coefficients are significant and the model explains 72% of the variation in intention. Goodness-of-fit measures for both models are shown in Table 5. Both models show that the influence of both subjective norms and group norms is mediated through farmers' personal moral norms. The influence of attitudes is mediated by both moral norm and self-identity. Perceived behavioural control has a direct influence on intention, but part of its influence is mediated though self-identity.

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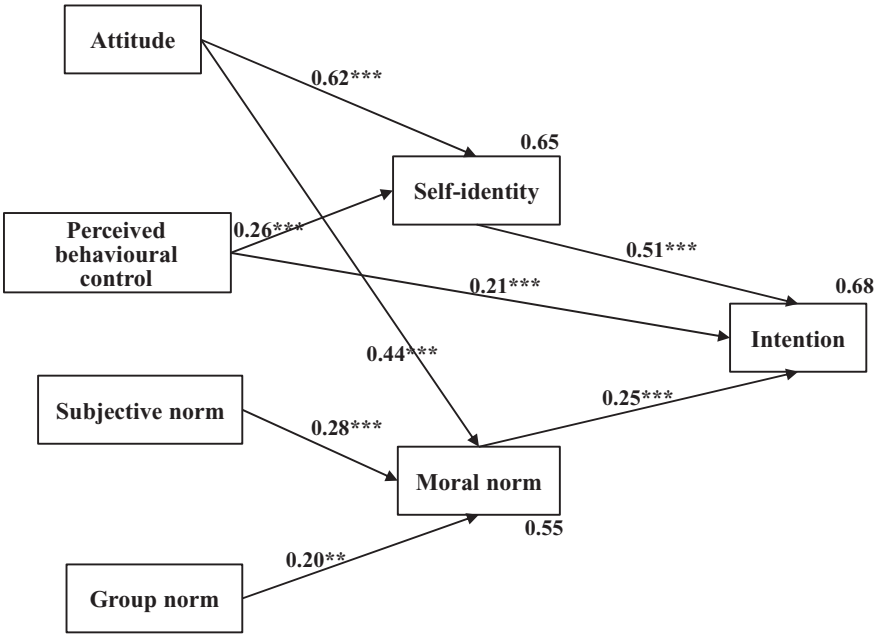

Figure 1. Graphical output of the structural model explaining the intention to implement small landscape elements (numbers above arrows are standardized regression coefficients, numbers close by a rectangle are squared multiple correlations (R^2). Significance is indicated as follows: *** and ** represent significance with $p < 0.001$ and $p < 0.05$, respectively).

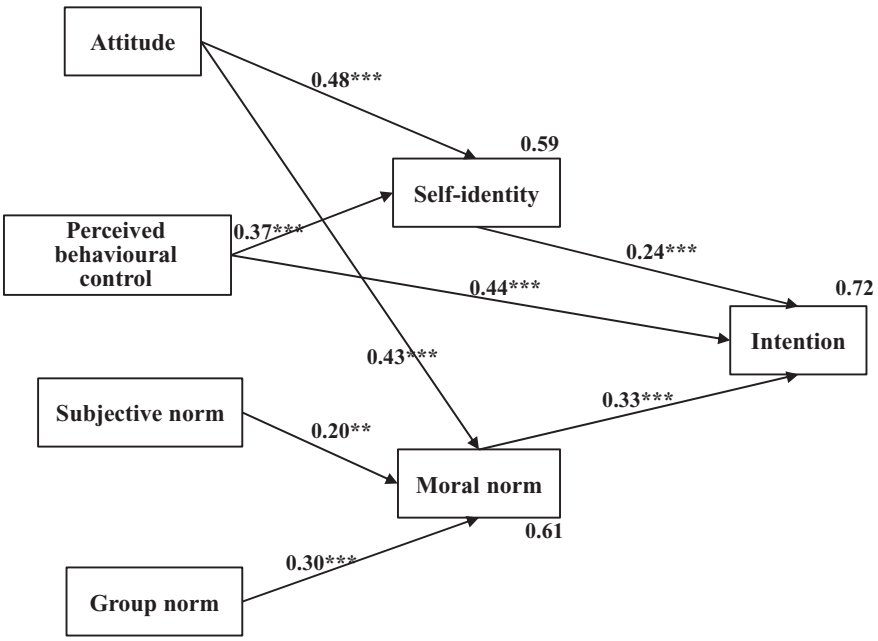

Figure 2. Graphical output of the structural model explaining the intention to implement buffer strips (numbers above arrows are standardized regression coefficients, numbers close by a rectangle are squared multiple correlations (R^2). Significance is indicated as follows: *** and ** represent significance with $p < 0.001$ and $p < 0.05$, respectively).

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Table 5. Model fit indices of the structural models.

Model	Chi-square	Df	Chi-square/df	NFI	CFI	RMSEA
Small landscape elements	23.772	7 ($p = 0.001$)	3.396	0.941	0.955	0.156
Buffer strips	7.614	7 ($p = 0.368$)	1.088	0.982	0.998	0.030

3.5 *Belief structure*

The belief structure for buffer strips is presented in Table 6. Overall, the belief structure confirms the validity of the expectancy value model. More specifically, high intenders rate the probability of positive outcomes (improved aesthetics, less nitrate leaching) higher, and the probability of negative outcomes (production loss) lower than low

Table 6. Belief structure of the psychological constructs for the practice buffer strips.

Subjective probability of outcomes[a]	Low intenders	High intenders	*p*-value
Improved aesthetics	2.24	3.94	0.000
Additional work load	5.22	4.98	0.564
Easier tillage activities	3.38	3.83	0.296
Less nitrate leaching	3.38	4.92	0.000
Production losses	5.47	4.33	0.003
Subjective evaluation[b]			
Improved aesthetics	4.71	1.32	0.091
Additional workload	2.42	3.51	0.002
Easier tillage activities	5.67	5.57	0.711
Less nitrate leaching	5.93	6.15	0.350
Production losses	2.09	2.81	0.049
Perceived normative influence[c]			
Nature organizations	5.20	6.09	0.014
Farmers' organizations	3.09	5.06	0.000
Governments	4.70	6.11	0.000
Motivation to comply[d]			
Nature organizations	1.65	3.00	0.000
Farmers' organizations	2.63	3.66	0.004
Governments	2.29	3.90	0.000
Barriers[e]			
Lack of land	1.78	3.02	0.000
Farm type	2.13	4.06	0.000
Opposition to change	3.11	4.34	0.002
The increased workload	2.33	3.66	0.000
The production loss	1.67	2.89	0.000
Lack of financial support	2.00	2.74	0.017
High fertile land	2.40	3.27	0.018

[a] Average on a scale from 1 (very unlikely) to 7 (very likely).
[b] Average on a scale from 1 (very bad) to 7 (very good).
[c] Average on a scale from 1 (totally no positive pressure) to 7 (very positive pressure).
[d] Average on a scale from 1 (totally not motivated to comply) to 7 (totally motivated to comply).
[e] (Average on a scale from 1 (very severe barrier) to 7 (totally not a barrier).

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intenders. High intenders are also more perceptive and influenced by social norms: they perceive higher social influence from all identified referents, and have a higher motivation to comply with others. Finally, high intenders perceive the identified control factors less as an obstacle compared to low intenders.

The belief structure for small landscape elements is presented in Table 7. Also here, the overall results are very supportive of the expectancy value model to unravel the

Table 7. Belief structure of the psychological constructs for the practice small-landscape elements.

	Low intenders	High intenders	*p*-value
Subjective probability of outcomes[a]			
Creation of nesting spots	4.46	5.39	0.007
Less soil erosion	3.84	4.73	0.014
Shadow for livestock	4.54	5.47	0.006
Shadow on crops	5.08	4.76	0.408
Wood production	4.14	5.16	0.014
Restoration landscapes	3.60	5.04	0.000
Increased workload	5.65	4.82	0.018
More weeds	5.64	4.37	0.001
Subjective evaluation[b]			
Creation of nesting spots	3.44	4.65	0.002
Less soil erosion	5.27	5.76	0.107
Shadow for livestock	5.24	5.41	0.572
Shadow on crops	2.28	2.55	0.414
Wood production	3.80	5.37	0.000
Restoration of landscapes	4.33	5.76	0.000
Increased workload	2.45	3.57	0.001
More weeds	1.67	2.88	0.000
Perceived normative influence[c]			
Nature organizations	5.56	5.98	0.248
Farmers' organizations	3.78	4.96	0.002
Governments	5.26	5.88	0.070
Motivation to comply[d]			
Nature organizations	1.88	2.85	0.010
Farmers' organizations	2.61	3.74	0.000
Governments	2.65	3.65	0.007
Barriers[e]			
The production loss	1.72	3.13	0.000
The increased workload	1.52	3.36	0.000
Lack of financial support	1.88	2.91	0.001
Unfamiliar with the practice	3.33	4.48	0.004
Lack of land	1.74	3.33	0.000
Practical issues	1.75	3.20	0.000

[a] Average on a scale from 1 (very unlikely) to 7 (very likely).
[b] Average on a scale from 1 (very bad) to 7 (very good).
[c] Average on a scale from 1 (totally no positive pressure) to 7 (very positive pressure).
[d] Average on a scale from 1 (totally not motivated to comply) to 7 (totally motivated to comply).
[e] (Average on a scale from 1 (very severe barrier) to 7 (totally not a barrier).

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cognitive foundations behind farmers' socio-psychological constructs. High intenders consistently rate the probability of positive outcomes higher, and the probability of negative outcomes lower compared to low intenders. Hence, the identified outcomes are among the key aspects for farmers, and their opinion with regard to these outcomes is a major determinant of their attitude. There are less differences in the values between high intenders and low intenders, although high intenders attach greater value to ecological benefits such as the creation of nesting spots for small animals and the restoration of landscapes. Higher intenders perceive more social influence from farmers' organizations and governments, and are consistently more motivated to comply with the opinion of others. Finally, to high intenders, issues such as lack of financial support, increased workload, practical issues are perceived less as a barrier compared to low intenders.

From the belief structure, some potential interventions can be derived. First, communication and demonstration about positive and negative consequences may affect the behavioural belief structure in ways that produce more positive attitudes. Second, social norms could be further exploited. Especially farmers' organizations could be a key referent in promoting more sustainable practices. Lastly, technical and financial assistance could help by relieving some of the barriers for farmers to implement buffer strips and small landscape elements.

4. Discussion and conclusions

This study used an adapted version of the TPB, including concepts from norm activation theory and identity theory to explain how underlying psychological constructs influence farmers' intentions to apply biodiversity conservation practices. The results show that the underlying psychological constructs play a very significant role in farmers' intentions. The variation in intention that is explained by our models (68% and 72% for small landscape elements and buffer strips, respectively) is considerably higher than that (39%) found in the most comprehensive meta-analysis of the TPB so far (Armitage and Conner 2001). It suggests that our adaptation of the basic theory, that assumes a central role for self-identity and moral norm and that adds group norms as a separate predictor, substantially improves the explanatory value of this theory. Overall, attitudes and perceived behavioural control had a higher influence than subjective and group norms, indicating that adoption of conservation practices is first driven by farmers' own perceptions about the practices. Yet, we show that social influence does have an important influence, and that group norms (social norms from the peer group) are an influence that is distinct from subjective norms (social norms from general out-group members), in line with Fielding *et al.* (2005). Perceived behavioural control had a partly non-mediated influence on intention, thereby suggesting the existence of difficulties that hamper adoption of these practices, regardless of how much farmers identify with these practices and of how much they feel morally obliged to adopt conservation practices. The importance of moral norms and self-identity corroborates the results of some previous studies in the agricultural domain. McCarthy *et al.* (2007) showed that moral obligations and self-identity increased the variation in explained intention to convert to organic farming. In Parminter (2009), self-identity significantly contributed to explaining sustainable land use management practices. Lokhorst *et al.* (2011) found that self-identity and moral norms were predictive of the intention to adopt non-subsidized conservation practices, but not for subsidized conservation practices. They explain this finding by the fact that the absence of external motivation in the form of a financial reward, makes farmers decide that if they adopt a conservation practice, it must be because they must be

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the kind of people who would do these things. This is an explanation based on self-perception theory (Bem, 1972), which posits that people construct their self-image based on their actions, and not the other way around. The conservation practices in our study are both subsidized, so the Lokhorst *et al.* (2011) study contradicts our findings. We believe this could be due to the difference in the measurement of the TPB-variables. Lokhorst *et al.* (2011) measured all variables with respect to 'subsidized conservation' and 'non-subsidized conservation', without explicating the specific practice. In that way, farmers are probed to think about conservation practices with and without a financial reward. In our study, we measure all variables with respect to 'buffer strips' and ' small landscape elements', i.e. directly with respect to the specific practice. Even though farmers could get subsidies for implementing these practices, the subsidy does not come automatically with adoption. Farmers have to actively apply for the subsidy and have to comply with certain rules, related to, for instance, the width of buffer strips, hence, for them, adopting these practices and getting a financial reward are not inextricably linked. This may have led our respondents to think about these practices in the same sense as respondents in the Lokhorst study have thought about non-subsidized conservation practices.

The results suggest that the impact of the psychological constructs can best be understood as being mediated through self-identity and moral norms. As such, in order to encourage more environmentally friendly farming practices, policy makers and extension agents should strive to influence and activate farmers' moral norms and self-identity. The latter should be seen as a psychological construct that captures the degree to which taking care of biodiversity is embedded in the good farmer identity. Our results suggest that unless policy mechanisms or other actions succeed in changing the good farmer identity, their impact is likely to end when the policy mechanisms or actions end (De Snoo *et al.* 2013). The clue in developing policy and extension schemes that induce a behavioural change that will last longer than the time that the external motives (e.g. a subsidy) are present is to try to invoke an internal motivation in the farming population. As such, our results confirm those of Ryan, Erickson, and De Young (2003), who showed that farmers who are internally motivated have a higher tendency to apply conservation practices.

The activation of moral norms means the degree to which farmers want to apply biodiversity conserving practices because they think that this is the right way to farm. Moral norms stem from social and group norms, and thus the practice of conserving biodiversity should be bred into the social norms of the farming community. New social norms should become embedded in the peer group in order to generate lasting changes to the common farming practices (e.g. Fielding *et al.* 2005). Furthermore, these norms should become internalized in each individual farmer. Pretty (2003), for instance, notes that people often revert to their old way of doing things unless there have been accompanying changes in social norms.

Some limitations to this study are worth mentioning. First, compared to traditional socio-psychological research outside the agricultural domain, our sample size was rather small, resulting in a loss of power. Second, our survey suffered from non-response, which first caused the small sample size, but, more worrisome, may cause non-response bias, in which the respondents who complete the survey differ significantly from those who did not. Early investigations of non-response typically found that respondents were typically larger (e.g. Klein 1981) and younger. A comparison of our sample's average age and farm size does not suggest such a bias. Another potential bias is the strong self-selection of participants who hold certain favourable opinions towards the phenomenon under investigation. We compared the degree to which respondents in our sample had

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previously applied these practices with proxy data on general adoption rates. The latter do not exist, but we know that the proportion of farmers who have adopted any kind of agri-environmental scheme (AES) is between 15% and 30%, depending on the farm typology and sector. Judging that the true adoption rate is at least that high, potentially higher since farmers may apply buffer strips of small landscape elements, even without the subsidy that comes with an AES, we conclude that there may be weak self-selection bias, but not to the extent that it would invalidate our results. Third, the exploratory nature of our study should be acknowledged. Normally, structural equation modelling would be used in a confirmatory sense, i.e. confirming the good fit of a theoretically underpinned model. The model in which self-identity and moral norms were included as additional explanatory variables on top of attitude, subjective norm and perceived behavioural control showed inadequate goodness of fit, which has led us to test alternative models, inspired by the literature. However, up till now the mediating role of self-identity and moral norms in the TPB has received no theoretical support so far. Hence, our study should be regarded as the explanatory investigation it is, and replication in other contexts would be warranted. This behavioural model has important implications for designing policy instruments and for building extension efforts. First, the results of this study could be used to improve general public extension efforts. Farmer perceptions about the salient outcomes and salient barriers are very influential in the formation of their attitude and perceived behavioural control. Public extension efforts, such as promotion leaflets, study days and demonstration farmers, should therefore focus on these outcomes and barriers. At the same time, public research could target its' efforts towards reducing the likelihood of negative outcomes and towards adapting conservation practice such that the influence of important barriers decreased.

Second, the results of this study could be used to implement intervention policies that are more targeted towards specific beliefs. One example is the increased workload, which acts as a strong barrier for low intenders. One could think of setting up a cooperative system, whereby farmers who have more time available thanks to the specific circumstance of their farm activities pool their time and resources to install and maintain conservation practices such as small landscape elements, and get rewarded by the government. In that way, on and around the land of farmers who have a positive feeling about conservation practices and would otherwise intend to apply these practices, but lack the time, conservation practices can be installed. These so-called agri-environment cooperatives are emerging in several countries, governments could increase their support to these.

In Europe, agri-environmental payments and command-and-control measures have been the dominant approach to foster more environmentally friendly production practices. Agri-environmental payments have been shown to be able to induce a short-term change, especially when payments are attractively high. However, their longer term effect, and their impact on norms and on what constitutes the good farmer identity is much more uncertain. In fact, economic incentives can hamper the settlement of new norms in the farming community, by turning an internally motivated behaviour into actions that are contingent on the continued existence of financial incentives (Bénabou and Tirole 2003). Furthermore, Keenleyside *et al.* (2011) showed that in the EU, an important factor influencing the uptake of agri-environmental schemes was the extent to which the practice was already in place. This shows that financial compensation is rather going to farmers who have already adopted the practice, rather than convincing new adopters. Based on our analysis of the belief structure, lack of financial support is regarded a considerable barrier by low intenders, and less so by high intenders. In

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Flanders, farmers have the possibility to adopt an agri-environmental scheme for buffer strips and for small landscape elements. The fact that low intenders consider lack of financial support a significant barrier suggests that either these farmers are not aware of this possibility, or the level of payments are not high enough. Command-and-control measures can lead to a new norm and identities if they are widely accepted. However, our research showed that farmers are only moderately motivated to comply with regulations from national governments, who typically issue such regulations (Wauters and Mathijs 2013).

A more durable way to change farming practices may be the development of social networks and social learning platforms, that gradually change the perception of the good farmers' identity. Such social networks are increasingly being developed, both by public and private initiators. Whereas changing farming practices such that the new way of doing things becomes embedded in the norms and identities in this way may take more time, the results are likely to be more durable. Furthermore, farmers may perceive such approaches to be more equitable. Farmers identify, in general, very strongly with their peers, and the farming community forms a judgemental peer group in which members constantly compare themselves to each other (Burton 2004b).

In sum, implementing practices that improve biodiversity is currently very much absent in the perception of a good farmer's identity and in the personal norm of the farming community. Short-term improvements in the uptake of such practices will largely depend on external motivators, such as regulation (cross-compliance and greening requirements) and economic incentives. Yet, in order to guide durable changes to the dominant farming practices, efforts to internalize such behaviour, using education and communication, social and group influences and tools to remove barriers are of paramount importance.

Disclosure statement

No potential conflict of interest was reported by the authors.

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