

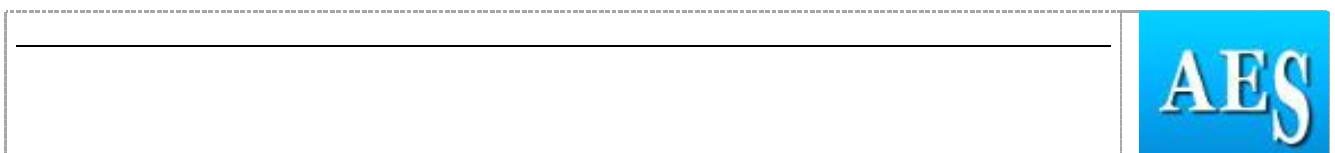
## Extended Abstract

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<b>Paper/Poster Title</b>	<b>Humus formation as a business model? Analysis of farmers' perceptions on carbon sequestration programmes.</b>
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**Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.**

<b>Abstract</b>	<i>200 words max</i>
<p>Mitigating climate change by sequestering carbon in agricultural soils through humus formation is a crucial component of sustainable agriculture. This study examines the uptake of non-governmental humus programmes to promote carbon sequestration by analysing, for the first time, farmers' intentions and factors influencing participation. Humus programmes are still recent innovations, so current knowledge about farmers' motivation to participate is limited. We specifically investigate behavioural factors underlying farmers' adoption of humus programmes using the Theory of Planned Behaviour. To this end, we collected data using an online survey with 190 German farmers and apply partial least squares structural equation modelling. Results show that perceived economic benefits, fellow group norm and moral norm influence farmers' intention to participate in a humus programme. In contrast, perceived ecological benefits, political group norm as well as perceived arable and regulatory behavioural control have no considerable effect. Furthermore, there are deficits in knowledge among farmers about registration and the general functioning of humus programmes. These findings, which could also be an interesting starting point for European agriculture as a whole, suggest that emphasising the financial benefits of humus programmes, combined with the use of community expectations and moral considerations, can increase participation in such initiatives.</p>	
<b>Keywords</b>	agricultural soils, carbon sequestration, farmers, humus, Theory of Planned Behaviour
<b>JEL Code</b>	Q15, Q54, Q570, Q580 see: <a href="http://www.aeaweb.org/jel/guide/jel.php?class=Q">www.aeaweb.org/jel/guide/jel.php?class=Q</a> )
<b>Introduction</b>	<i>100 – 250 words</i>
<p>Agriculture might hold the key to successful climate change mitigation, particularly through the formation of humus in agricultural soils. Humus consists of plant residues and other organic material that stores carbon dioxide from the atmosphere in soil. The carbon storage capacity in soils is promising as it is three times greater than the carbon pool of the atmosphere. In response to the increasing importance of strategies to avoid and remove greenhouse gases and the pricing of carbon emissions, 'humus programmes' have emerged. With humus programmes, non-governmental organisations link humus formation and humus certificates. In this way, farmers receive a payment for building up humus, which is linked to the final increase</p>	



in humus. The payment is funded by the sale of humus certificates to companies or private households that want to offset their carbon emissions.

Although the potential of carbon storage in the soil for climate protection is increasingly recognised, farmers' awareness and adoption of humus programmes is still limited. To support an effective design of humus programmes and increase their scope, it is essential to understand farmers' decision-making. As there is no study on the adoption of carbon sequestration programmes in general, the aim of this study is to identify and analyse how various behavioural factors influence farmers' intention to adopt a humus programme. This is the first study that aims to gain a deeper understanding of farmers' motivation to participate in humus programmes by applying the conceptual framework of the Theory of Planned Behaviour (TPB).

### **Methodology**

*100 – 250 words*

The TPB predicts human behaviour by analysing individual's intention to perform a certain behaviour. We used the TPB to assess farmers' intention to participate in a humus programme, as the behaviour in our case is participation in humus programmes. According to the framework of the TPB, we investigated the influence of attitude, divided into perceived ecological and economic benefits, the influence of social norm, divided into political and fellow group norm, and the influence of perceived behavioural control, divided into arable and regulatory perceived behavioural control, on the intention to participate in humus programmes. In addition, we have extended the TPB by going beyond existing constructs and adding a new construct: moral norm.

Structural Equation Modelling (SEM) facilitates the estimation of causal relationships between independent (exogenous) and dependent (endogenous) latent variables or constructs. This study uses Partial Least Squares SEM (PLS-SEM) for two reasons: it has fewer limitations in terms of data structure than covariance-based SEM (CB-SEM), which requires normally distributed data, and it permits the use of constructs with only one or two indicators. As the target variable (actual participation) is binary, we estimated a logistic regression with the independent variables represented by the factor scores for arable and regulatory perceived behavioural control as well as intention to participate.

For this study, we collected primary data from German farmers in an anonymous online experiment in January and February 2023. In the end, 190 fully completed questionnaires were used for the econometric analysis.

### **Results**

*100 – 250 words*

The descriptive results for the indicators used to form the constructs indicates that several approaches are needed to increase participation in humus programmes. This includes improving the visibility and perceived value of these programmes, providing clear economic incentives and information, simplifying regulatory procedures and harnessing farmers' intrinsic motivation to contribute to environmental sustainability.

The core finding of the PLS-SEM is that perceived economic benefits, fellow group norm and moral norm are the key motivators for farmers to participate in humus programmes. They all show statistically significant path coefficients for the intention to participate. The economic benefit is the greatest motivation for participation. The opinion and actions of other farmers (fellow group norm) are also relevant for decision-making, suggesting that information on peer experience is valued. The moral norm, i.e. the self-generated pressure to do the right thing, also influences farmers' intention to participate. Farmers thus seem to have high expectations of themselves, which influences their actions in terms of climate-friendly land use. Further results show that the perceived ecological benefits, the political group norm and the perceived behavioural control do not statistically significantly motivate farmers to participate in humus programmes. According to the logistic regression, the actual participation in humus programmes is positively and statistically significantly influenced by the intention, formally confirming that there is no intention-behaviour gap.

### **Discussion and Conclusion**

*100 – 250 words*

Policy-makers, programme providers, and researchers should focus on the monetary added value of humus programmes in order to increase farmers' willingness to participate. Due to the increasing demand for greenhouse gas storage, emissions are becoming more and more expensive, so that more money will be available to offset carbon sequestration. To mitigate monetary incentives, an appeal can be made to farmers' moral norms and social networks. The self-generated pressure to counteract climate change and the orientation towards the actions of other farmers are the main drivers for the decision to participate in humus programmes, in addition to the financial benefits.

We contribute to the literature by identifying the behavioural factors that influence farmers' decision to participate in a humus programme. This is necessary to develop efficient carbon sequestration programmes. In order to increase their acceptance, the following should be considered: (i) The potential financial benefits of humus programmes and the fact that the financial perspective is dynamic, i.e. increasing, should be better publicised. (ii) More networks for direct dialog between farmers should be created. In this context, pioneer farmers in particular should be given space to share their (positive) experiences. (iii) A stronger appeal can be made to farmers' intrinsic motivation, e.g. through nudging. (iv) The knowledge gap about how a humus programme works and how to sign up for such a programme needs to be tackled. (v) The current policy guidelines could be enhanced with social nudges to improve their effectiveness in terms of participation in humus programmes.