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Uptake of animal health and welfare technologies by Scottish farmers. Analysis of longitudinal survey data

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Introduction

There is an ever growing literature analysing technology adoption behaviour in agriculture. Part of this literature focusses on the factors that influence decision making as regards adoption of technology (Fairweather & Keating, 1994; Beedell & Rehman, 2000; Nuthall, 2001; Flett et al., 2004; Rehman et al., 2007). However few studies analyse change in uptake over time and whether the impact of identified determinants on uptake changes as well.

This study builds on existing literature and analyses the impact of a priori identified determinants of adoption of innovative animal health and welfare technologies by Scottish livestock farmers. Using a panel dataset and longitudinal modelling allows us to identify and compare the strength of impact of various factors on past and current uptake, and identify behavioural change.

Methods

We used longitudinal structural equation modelling with observed and latent variables to test the impact of factors on technology adoption intentions and behaviour, and assess the strength of these relationships, i.e. how much these factors influence one another and primarily the behaviour and intentions.

We perform model estimation with the Diagonally Weighted Least Squares (DWLS) method using the statistical package Lisrel 8.80 (Jöreskog and Sörbom, 2007). DWLS estimation method is consistent with the types of variables included in the model (i.e., ordinal and categorical) and the deviation from normality in some of these variables (Finney and DiStefano, 2006).

The variables included in the model are:

- profit orientation,
- technological investment,
- past technological uptake,
- attitudes towards uptake of technology,
- frequency of access to information (past & current),
- identified successorship,
- being a recipient of a single farm payment,
- current technological uptake and intentions to uptake technologies such as EID reading equipment for sheep or cattle management (e.g. handheld EID tag reader or EID enabled crates and pens), and precision livestock farming using management tools aimed at continuous automatic monitoring of each animal in real time (recording e.g., welfare, health, environmental impact, production).

The data used in this study were collected through two large scale surveys of Scottish agricultural holdings in 2013 and 2016, which investigated farmers' technological uptake and intentions to uptake and the factors influencing behaviour. The panel dataset analysed in this study comprises 441 observations for livestock farmers.

Results

The model has a good fit according to the measures of absolute, incremental and parsimonious fit (Hair et al., 2006). The model explains 75 per cent of the variance in uptake and intentions to uptake technologies.

- Profit orientation,
- technological investment,
- past technological uptake,
- attitudes towards uptake of technology,
- frequency of access to information (past & current),
- identified successorship,
- and being a recipient of a single farm payment

have significant influence on technology adoption, while

- technological investment and
- current and past technological uptake

have a significant influence on intentions to uptake technologies.

The path diagram is presented in Figure 1.

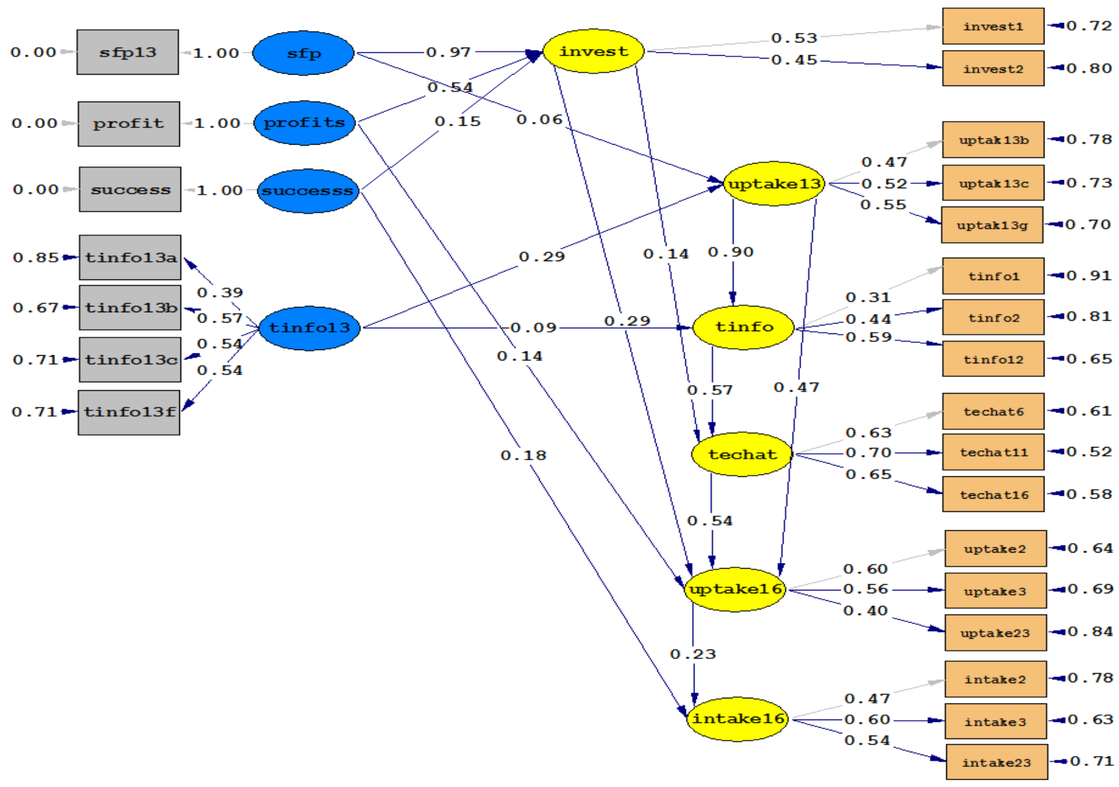

Figure 1. Path diagram – direct standardised effects

Conclusions

Our study analysed the factors influencing multiple technology adoption by Scottish livestock farmers and tested the impact of factors common to all technologies with the aim of demonstrating what proportion of the variance in technological uptake/intentions is explained by these factors.

The results confirm findings from the literature that, in addition to economic factors, access to technological information influences technological uptake. To encourage the use of a particular technology, identification of the most likely adopters is useful to avoid the costs involved in reaching those who are not likely to adopt the technology.

The findings are policy relevant as they give some indication on the factors influencing the process of targeting specific technological information transfer through the appropriate channels to the most likely technology adopters amongst agricultural producers, which builds a potential driver of behavioural change.

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