Identifying the factors affecting on farmers’ intention to engage in organic certification scheme in China

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Abstract. The main purpose of this study is to investigate the factors affecting the intention of farmers to engage in organic certification scheme (OCS) in China. A research-based model incorporating the theory of planned behavior (TPB) is proposed to obtain a better understanding of psychological factors that influence farmers’ intention to adopt improved fertilization practice under OCS. The TPB hypothesizes that adoption is driven by intention, which in turn is determined by three psychological constructs: attitude, subjective norm, and perceived behavioral control. Results show that factors leading to a greater probability of changing fertilizer application in accordance with the organic certification scheme included age, perceived resources, subjective norms, crop type, and attitude.

1. Introduction

Organic agriculture can lead to win-win outcomes in terms of both improving food quality and reducing the environmental impact of farming. With the introduction of relevant laws, regulations, and standards, organic agriculture has developed rapidly in China since the 1990s. The organic certification scheme is a policy that promotes sustainable agricultural production modes and provides guidance for reducing fertilizer application by farmers. However, the scheme demonstrates important issues that need attention, including a lack of robustness, important lags in research and promotion of organic production techniques, insufficient public trust in organic products, and a poor understanding of organic product standards among farmers [1].

Whilst the organic certification scheme perceivably benefits farmers, reduced fertilizer applications continue to remain below expectations. Research indicates that the over use of fertilizers may be due to a lack of awareness, perceived benefits, and difficulties in implementation [2]. Farmers, especially from the non-certification area, may prefer to rely on the use of chemical fertilizers to reduce human input [3]. However, variance in fertilizer applications is often found to be contingent on factors that are under the control of farmers, such as the extent of policy constraints and management skills [4].

Therefore, the present study aims to investigate the influence of psychological factors, farmer characteristics, and organic certification policy on farmer fertilizer-application behaviour under the recently introduced organic certification scheme. This study uses the national-level organic product certification demonstration zones in China as a case study from which a generalized lesson can be drawn for better targeting initiatives designed at encouraging farmers to take up organic agriculture practices.
2. Materials and Methods

2.1 Surveys
The final survey questionnaire, which was based on literature review, expert consultations, farmer interviews and pre-surveys, consisted of three parts: (1) Survey of farmer characteristics, including farmer age, educational level, technical support received, and crop types; (2) Policy restraints: samples were divided into policy-restrained Sample Group 1 (farmers located in organic certification demonstration zones or creation zones) and non-policy-restrained Sample Group 2 (farmers in other zones); (3) Survey of farmer knowledge and intention regarding

The data used in the present study were acquired from a survey including 462 farmers in Sichuan Province, China. This survey was carried out using a structured questionnaire and a quota-controlled sampling method[5]. Since the launch of organic product certification demonstration and creation activities in 2013, Sichuan Province has established six national-level organic product certification demonstration zones and six approved creation zones, as along with three provincial-level organic product certification demonstration zones and 24 creation zones. As of May 2018, the total cultivation area under organic certification in the province has reached 8.4 million mu (approximately 560,000 hectares). The sample data consisted of 203 survey questionnaires completed by farmers in organic certification demonstration zones or creation zones, and 259 survey questionnaires completed by farmers located in other zones.

2.2 Data analysis
Samples were divided into two groups according to differences in policy environments, with samples from organic agricultural product certification demonstration or creation zones belonging to Sample Group 1, and the remaining samples belonging to Sample Group 2. The following binary logistic model was adopted for the selection of all samples and linear regression of all explanatory variables:

\[
\ln \left[ \frac{P_i}{1-P_i} \right] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} \quad (1)
\]

where \(i\) is the \(i\)th observed value of the samples, \(P_i\) is the probability of the outcome, \(\beta_0\) is the intercept, and \(\beta_1, \beta_2, \ldots, \beta_k\) are the regression coefficients of the variables \(X_{1i}, X_{2i}, \ldots, X_{ki}\).[6]

Based on linear regression, a likelihood-ratio test was performed. Seven explanatory variables, namely, crop type, farmer age, educational level, agricultural education background, organic agriculture technical training, agricultural cooperatives, and policy environment were confirmed. Through the marginal effects of regression results, the influence of the respective variables was further explained, with marginal effects of each dummy variable estimated as the difference between probabilities calculated at the sample mean when the dummy variable takes on values of 1 and 0. Larger marginal effects indicated a greater influence of explanatory variables on dependent variables.

3. Results and discussion

3.1 Statistical description of the sample
Table 1 shows the statistical description of the variables included in the regression model. In all, 462 samples were obtained, among which 203 (44%) were from organic certification demonstration zones or creation zones (Sample Group 1). Cereals, vegetables, fruits and nuts, and tea accounted for 31%, 28%, 23%, and 18% of the crop types cultivated by surveyed farmers, respectively. The ages of surveyed farmers were mostly within the 35-44 year group; 42% of all surveyed farmers were educated beyond high school, 6% had an agricultural education background, 18% had previously attended organic agriculture technical training, and 68% were members of agricultural-technique popularization or professional cooperatives.

| Variable      | Value assignment | Mean | SD  |
|---------------|------------------|------|-----|
| Crop type     | 1=Cereals, 2=Vegetables, 3=Fruits and Nuts, 4=Tea | 2.11 | 0.98 |
3.2 Regression Analysis

For the full sample, Table 2 shows the results of regression analysis for the influencing factors on farmer fertilizer-application behaviour under the organic certification scheme. Variables that had a significant effect at 1% level of probability included attitude, perceived behavioural control, perceived resources, fruit and nut crops, age within 35-44 years, organic agriculture technical training, and organic agricultural product certification policy. The intentions are influenced significantly and in a positive direction by subjective norms at the 5% level. Crop types of tea and age groups 45 to 54 showed a significant effect at the 10% levels of probability.

Table 2. Regression coefficients of influencing factors on farmer fertilizer-application behaviour based on the organic certification scheme.

| Explanatory variable                  | Full sample | Sample Group 1 | Sample Group 2 |
|---------------------------------------|-------------|----------------|----------------|
|                                       | Coefficient | SD             | Coefficient   | SD             | Coefficient   | SD             |
| Attitude                              | 0.29***     | 0.05           | 0.18          | 0.11           | 0.41***       | 0.09           |
| Subjective norms                      | 0.19**      | 0.10           | 0.30*         | 0.18           | 0.15          | 0.10           |
| Perceived behavioural control         | 0.41***     | 0.11           | 0.28***       | 0.14           | 0.48***       | 0.10           |
| Perceived resources                   | 0.43***     | 0.08           | 0.45***       | 0.22           | 0.38***       | 0.12           |
| Crop type a)                          |             |                |               |                |               |                |
| vegetables                            | 0.81        | 0.50           | 1.05          | 0.98           | 0.83          | 0.58           |
| fruits and nuts                       | 0.96***     | 0.36           | 0.48          | 0.63           | 1.09***       | 0.40           |
| tea                                   | 0.45*       | 0.28           | 0.82*         | 0.49           | 0.37          | 0.31           |
| Age b)                                |             |                |               |                |               |                |
| <35 years                             | 0.04        | 0.35           | 1.04          | 0.98           | -0.42         | 0.41           |
| 35-44 years                           | 1.27***     | 0.41           | 2.41***       | 0.87           | 0.83*         | 0.49           |
| 45-54 years                           | 0.46*       | 0.50           | 1.62*         | 0.96           | -0.29         | 0.58           |
| 55-64 years                           | 0.43        | 0.25           | 0.92**        | 0.44           | 0.27          | 0.30           |
| Educational level                     | 0.22        | 0.24           | -0.15         | 0.49           | 0.39          | 0.31           |
| Organic certification policy          | 0.80***     | 0.27           |               |                |               |                |

* , ** and *** represent significance at 10%, 5%, and 1% probability level, respectively; a: cereals represent the control group for crop type; b: age ≥ 65 years represent the control group for age.

We found that the variables: perceived behavioural control and perceived resources, had a positive influence on the determination of farmers’ fertilizer-application behaviour by the organic certification scheme; such influence was more significant in the case of farmers in non-organic certification demonstration zones.

Previous studies indicated that subjective norms influence human intentions and behaviour, as humans make decisions under the influence of the social environment. In the present study, the variable—subjective norms—had a significant effect on all samples from the organic certification demonstration zones; whereas it exerted a smaller influence on fertilizer application behaviour, and had no significant effect on samples from non-organic certification demonstration zones. This showed
that currently, the organic certification scheme exerts less influence on fertilizer application behaviour of farmers in organic certification demonstration zones, whereas the response of farmers towards the organic certification scheme in other zones remains weak.

The variable of extended TPB—attitude—has a positive influence on farmers’ intentions to apply fertilizer in accordance with the organic certification scheme in non-organic certification demonstration zones. However, this effect is not visible in organic certification demonstration zones. This means that farmers unstrained by policy are more likely to adopt the organic-agriculture practice if they evaluate the outcomes of performing the behaviour more favourably than other farmers [7]. This result is consistent with previous TPB studies, which found that attitude is a significant predictor of the intention to adopt voluntary agricultural practices.

Farmer characteristics have a significant influence on fertilizer-application behaviour. Previous studies showed that the probability of farmers applying fertilizer according to standards increased with decreasing farmer age. This result supports the opinion that relatively younger farmers have a longer planning horizon and are more likely to adopt environment friendly practices [8].

4. Conclusion
On the basis of the theory of planned behaviour, the present study analysed some of the factors that influence the intention of farmers regarding fertilizer application in accordance with the organic certification scheme under different policy restraints. The main conclusions derived from the study are as follows: The organic certification scheme had a significant influence on farmers’ intention to reduce fertilizer application. Factors leading to a greater probability of changing fertilizer application in accordance with the organic certification scheme included age, perceived resources, subjective norms, crop type, and attitude. However, the factors influencing such intentions differed between zones with different degrees of policy restraint.

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