



Influential factors of farmers' demands for agricultural science and technology in China



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ABSTRACT

Agricultural science and technology (AST) is of great significance to the development of rural China. In order to boost farmers' demands for AST, possible influential factors affecting the demands are analyzed by this study. With regard to multiple types of AST for Chinese main agricultural industries—breeding and planting, the study discusses farmer families' demands instead of farmer individual demands. Using linear regression analysis, variables of the possible influential factors are categorized in four groups: family characteristics, farmers' operational status, farmers' attitudes toward AST and government service. Based on 3669 valid questionnaires collected from 15 towns of Anhui Province in China, the paper does the factor analysis and reliability test as well as examines the significance of possible influential factors, indicating that labor saving in farmers' attitudes group is the most important factor for planting industrial AST, and showing that capital support in government service group has the most crucial effect for breeding industrial AST. Hence, differences do exist among diverse factors, and the most significant factors affecting the demands for breeding and planting industrial AST are disparate. According to these results, suggestions concerning the most significant factors are specifically given to the Chinese government on how to expand the demands for AST and how to stimulate rural development.

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1. Introduction

The paper discusses the influential factors of farmers' demands for AST and compares the significance of the factors utilizing multiple regression analysis. Previous studies on the analyses of demands for AST normally focus on farmer individuals and fail to present a way to find out the significant factors. While Chinese agriculture is generally based on the family as a unit, farmer individual demands may not be able to perfectly represent farmer families' demands. Every farmer has his or her own demands and preference, but not every farmer individual's decision can affect the demands for AST. For instance, an elder farmer may not want to use the AST. However, since his or her sons and daughters who are also farmers are fond of adopting the AST, the elder farmer's family is large likely to use the AST for farming. In this way, the elder farmer's individual AST demands are not as representative and valid as his or her families' demands for studying the influential factors. In China, the decision on whether or not the AST will be adopted is usually made by at least the majority (if not all of) farmers of the farmers' family, and it is improper to simply research the demands on farmer individuals. Therefore, this paper identifies the possible factors that may influence the demands on farmer families and systematically offers a method of regression analysis to compare the influential factors' significance.

AST is a basic method for a nation or a region to guarantee the supply of its agricultural products, to promote the products' quality and versatility, and to achieve the sustainable and stable of its agricultural development in a long term. According to the Ministry of Agriculture in China, contribution rate of AST to the Chinese agricultural development increased from 45.97% in 2003 to 53.5% in 2011. While the rate is higher than that of lands, labor and materials, it is still much lower than the level of developed countries (70%–85%). Hence, it is necessary to further enhance the demands for AST in China.

The agriculture generally has two major industries: breeding and planting. In this study, the possible influential factors of multiple types of AST on these two industries are discussed based on 3669 questionnaires collected from 15 towns of Anhui Province in China. The paper utilizes SPSS 17.0 to cluster each industry's AST into two categories, and to sort variables of the possible influential factors into four groups: family characteristics group, farmers' operational status group, farmers' attitudes toward AST group and government service group. Based on linear regression analysis, the paper explores the following orders: 1) Orders of impacts of the four factor groups on farmers' demands for AST. 2) Orders of significant factors in the four groups that influence breeding and planting industrial demands for AST. 3) Orders of significant factors in the four groups that influence each cluster of breeding and planting industrial demands for AST. Further, influential factors are figured out by the paper, which may either have a positive or a negative effect on farmers' demands for AST. By enhancing the positive influences and reducing the negative influences, the paper ultimately

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proposes suggestions to raise the demands for AST and promote the agricultural development. Especially, the paper tries to sufficiently understand the farmer families' demands for AST. In this way, targeted services on AST can be given to farmers' families, which can both fulfill farmer families' demands and accelerate the AST development in China.

As a result, the factor analysis and reliability test verify the distinctiveness among diverse influential factors. The regression analyses show that the most significant factors are different if the types of AST are multiple. For planting industrial AST, labor saving in the farmers' attitudes toward AST group is the most significant one, whereas capital support in government services group affects the demands the greatest for breeding industrial AST. Besides, it is noted that previous literatures generally choose significant factors like labor's age, education level of farmers, output scale of farming and government services, without offering reasons or criteria for their choices. Since the first three factors are not the most significant ones affecting the demands for both breeding and planting industrial AST in this study and the government services factor is only the most significant for breeding, the paper points that the results are disparate on researching the farmer individuals and farmer families.

This study selects Anhui Province as the research sample, because Anhui is known as an important province for agricultural production and possesses almost all kinds of Chinese agricultural industries. Anhui Province Agriculture Committee (<http://www.ahny.gov.cn/info.asp?typeid=139>) says that planting industry in Anhui is around 54% of the total agriculture output and breeding industry is around 41% of the total value. Also, according to National Bureau of Statistics of China, planting industry takes up around 56% of the total Chinese agriculture output while breeding industry takes up around 41%. Since the data of Anhui Province are really close to the data of the nation, the sample of Anhui Province can be representative for the Chinese farmers' demands analysis for AST. The remainder of the paper is organized as follows: In Section 2, we review previous theories and literatures on farmers' demands for AST and show their relationships with this study. Section 3 describes the research method in the analysis. Statistical results are then offered and discussed in Section 4. In Section 5, conclusions and suggestions are summarized and presented on amplifying the demands for AST.

2. Literature review

Previous literatures on AST have shown the importance of AST for agricultural development. Reganold et al. (2011) researched on US agriculture to find out that reorientation of publicly funded AST is as significant as incentives for appropriate markets and reform of US farm-related policies on accelerating implementation of more sustainable agricultural system. Using the data from Yunnan Province of southern China, Ding et al. (2011) figured out that farmers who adopted ASTs had incomes approximately 15% higher than non-adopters in rural China. Fan and Pardey (1997) discussed on Chinese agriculture to argue that investing in a functioning and productive technology generation system is a prudent way to ensure the process of market liberalization to come closer to achieve its full growth-promoting potential over the long run. Applying an econometric model, Huffman and Evenson (1992) empirically showed econometric evidence on the contributions of public and private science and technology to US agricultural productivity.

Under this basis, researchers, on one hand, accelerate agricultural development by creating new ASTs or improving the technology for existing ASTs. With a real scenario, Phupattanasin and Tong (2014) provided an overview of the novel of an AST named Information-Centric Networking (ICN) architecture with a particular spotlight on content distribution and mobility technologies to make development of agriculture more sustainable. Focusing on growth rate, photosynthetic rate and ribosome activity, De Bossoreille de Ribou et al. (2013) researched plant breeding technology to increase global crop yields and to achieve "low input, high output" agriculture. Ma et al. (2011) employed a translog

cost function to study feed grain-saving technology for Chinese hog production promotion. On the other hand, some researchers try to expand the AST demands to achieve the sustainability of agriculture. Applying Social Network Analysis (SNA), Ramirez (2013) analyzed a sample of 37 farmers in southeast Texas to increase the adoption of an agricultural technology. The result suggests that participation in organizations is a key influential factor. Kiiza and Pederson (2012) indicated that accessing to ICT-based market information is important to the adoption of agricultural seed technology which can positively affect farm yields and farmer incomes. Based on the Bass diffusion model and Abrahamson's diffusion and rejection typology, Sneddon et al. (2011) empirically investigated how and why AST is adopted or rejected by examining the diffusion process of an AST called wool testing technology in Australian wool industry. Li and Niu (2011a) studied on the AST demands in new rural Chinese Construction, and put forward policy proposals to promote the application of new ASTs. Comparing two irrigation districts in Canada, Bjornlund et al. (2009) studied factors that influenced agricultural technology adoption in the two districts to encourage a large increase in AST adoption.

However, since all of these studies are based on farmer individuals as a unit, they have not amply addressed problems on AST demands from the farmer families' standpoint. For example, Li and Niu (2011b) analyzed factors that determine the demands for AST through the Bayesian network model. Their study discusses factors which are all focused on farmers' individual information, such as farmers' age, education degree, and ability to understand and accept new things. It is believed by our study that analyses on farmer individuals are insufficient in representing farmer family's traits and decisions. Therefore, this paper discusses demands for AST on the basis of farmer family and finds out if there are any differences between our study and previous studies which are based on farmer individuals as unites. Moreover, few literatures provide methods to compare the significance among various factors that affecting the demands. Instead, they merely give a list of what these influences might be and what policies we might have. However, since labors and capitals are not infinite in reality, only those most significant factors can be focused. It is impractical to spare equal efforts to every factor that affects the demands. Therefore, this paper uses regression analysis to systematically analyze the significance of all possible factors affecting the demands and present policies emphasizing only on the most significant one or two factors.

In conclusion, this paper discusses 15 possible influential factors of farmer families' demands for AST, utilizes regression analysis to find some most significant factors out of all factors, and deal with these factors specifically.

3. Method

3.1. Measures

3.1.1. Possible influential factors to farmers' demands

The paper empirically classifies 15 possible influential factors into four groups: family characteristics, farmers' operational status, farmers' attitudes toward AST, and government service. Each factor group includes at least three variables. Due to the large sample size and the limited knowledge of farmers, the paper adopts three scale measures to reflect the farmers' attitudes toward AST: need, not sure, not need.

3.1.2. Variables of the possible influential factors

Possible influential factors are listed as follows. Definitions of the factors are in Appendix A.

- (1) Family characteristics (contain four variables): ratio of farmers to the farmer families' population (abbreviated as "labor ratio"), labor's gender (male-headed or female headed in the family), labor's age range and the highest education level of the farmers' family.

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