

Article

Adoption of Renewable Energy Technology on Farms for Sustainable and Efficient Production: Exploring the Role of Entrepreneurial Orientation, Farmer Perception and Government Policies

Jinxing Wang ¹, Wanming Li ^{1,*}, Shamsheer ul Haq ²  and Pomi Shahbaz ² 

¹ School of Economics and Management, Shihezi University, Shihezi 832000, China

² Department of Economics, Division of Management and Administrative Science, University of Education, Lahore 54770, Pakistan

* Correspondence: 20172316015@stu.shzu.edu.cn

Abstract: Traditional energy consumption raises greenhouse gas emissions, which is a major concern in China. Agricultural energy consumption accounts for one third of China's greenhouse gas emissions. Thus, current patterns of energy consumption on farms are both unsustainable and inadequate since rural communities in emerging nations have limited access to energy sources. This study explores the factors affecting the adoption of renewable energy on farms and examines the effect of such adoption on technical efficiency. The data were collected from 801 farmers selected through a multistage random and purposive sampling method in a face-to-face survey in China. Logistic regression, data envelopment analysis and propensity score matching were used to analyze the data. The descriptive statistics depicted that renewable energy technology was adopted by more than 25% of the total farmers. The logistic regression results depicted that education, farm size, government financial support, perceptions of renewable energy (usefulness, cost effectiveness, environmental friendliness and information availability) and farmer entrepreneurial orientation dimensions (risk-taking, innovativeness and pro-activeness) all significantly affected the adoption of renewable energy technology on farms. Farmers who perceived renewable energy as more useful and cost-effective than conventional energy technology were 1.89 and 2.13 times more likely to adopt it on their farms, respectively. Farmers who perceived renewable energy as more environmentally friendly than traditional energy technology were 1.54 times more likely to use it on their farms. The findings also showed that innovative farmers were 2.24 times more likely to adopt renewable energy technology on their farms. The propensity score matching results showed that the technical efficiency of adopters of renewable energy was 10% higher than that of nonadopters. The study suggests that agriculture must be transformed to fulfill the existing and forthcoming demand for food and energy in an impartial and ecologically sustainable manner.

Keywords: renewable energy; sustainable rural development; resource management; farm efficiency; sustainable agriculture; green agriculture



Citation: Wang, J.; Li, W.; Haq, S.u.; Shahbaz, P. Adoption of Renewable Energy Technology on Farms for Sustainable and Efficient Production: Exploring the Role of Entrepreneurial Orientation, Farmer Perception and Government Policies. *Sustainability* **2023**, *15*, 5611. <https://doi.org/10.3390/su15075611>

Academic Editors: Guo Wei, Tasawar Nawaz and Ehsan Elahi

Received: 18 February 2023

Revised: 18 March 2023

Accepted: 20 March 2023

Published: 23 March 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Energy and agricultural food systems are deeply entwined and almost one third of the world's total energy is utilized in agricultural food systems. The energy used by agricultural food systems is also accountable for one third of their GHGs [1]. Agriculture and energy systems are also important for achieving Sustainable Development Goals (SDGs) and they also have a big effect on people and the environment. About 2.5 billion people around the world depend on agriculture as their main source of income. This makes agriculture a key factor in the growth of the world economy. Making sure that reliable, economical and ecologically friendly energy is available for primary production and post-harvest handling