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Original Research

Towards a Sustainable Environment: Understanding Chinese Farmers' Adoption of Renewable Energy Sources Through Green Intentions

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Abstract

Renewable energy is absolutely necessary in order to stop the deterioration of the environment and to guarantee reliable access to environmentally friendly energy sources. Based on the conformity theory, logistic regression, propensity score matching, and stepwise regression are all used in the current study to investigate the mediating role of green intentions in the conformity tendencies of Chinese farmers' adoption of renewable energy sources. This research was motivated by the notion of the dissemination of innovations as well as the technological adoption model, and it aims to shed light on how individuals are socialized and how green intentions mediate their conformity tendencies to adopt renewable energy sources. The results revealed that the average age of the farmers was 42 years, and they were primary school graduates. More than 50% were male. Almost 26% of farmers reported that they use renewable energy sources on their farms. Generally, the farmers were green intended and would like to adopt renewable energy sources. The regression results disclosed a significant impact of socially inspired peer adoption ($p<0.01$) on the farmers' adoption of renewable energy sources. Renewable energy adoption is impacted more by the adoption of strong connections than by the adoption of renewable energy by weak relations, which means that farmers are more likely to adopt renewable energy if their peers also do so. Nevertheless, the extent to which farmers have green intentions regarding the use of renewable energy technology had a significant influence on the farmers' conformity tendencies, influenced by the different intensities of their social networks.

Keywords: sustainable agriculture, green farming, renewable energy, green intentions

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Introduction

A limited supply of energy is being met by an endless demand for it, which has resulted in a predicament for civilization known as energy scarcity [1]. Because of the rapidly expanding populations and economies of developing countries, the demand for energy is skyrocketing at a rate that has never been seen before. The majority of energy consumption now takes place in Asia, with China at the forefront of this trend [2]. Traditional energy sources, such as firewood, coal, and straw, continue to be the primary domestic energy suppliers in rural regions of developing nations. This is the case despite the importance of the rural sector to the national energy system [3], which is discussed in the following sentence. The unrestricted use of these energy sources is damaging health and sustainable development in rural regions. Since it leads to increases in GHG emissions, worsening of the environment, and increases in resource scarcity [4-8].

Emerging economies are concentrating their energy transition efforts on renewable sources of power such as solar, biogas, wind, and other forms of clean energy as a reaction to mounting environmental concerns and challenges to sustainable development. For example, the energy that is obtained from the sun is not only plentiful [2], but it is also affordable [9], friendly to the environment [10], and works particularly well in rural areas [11].

Rural areas in Asia, which are home to many of the region's developing economies [12], contain a significant amount of potential that has not yet been fully realized. The Chinese government places a high value on the utilization of renewable energy, particularly in more rural areas. According to managerial perspectives on quickening the transformation of rural housing construction and village structure, solar energy products and technology should reach widespread use in rural areas by the year 2021. As part of the thirteenth 5-year plan for renewable energy development, it was advised that dispersed photovoltaic and photovoltaic plus utilization projects should be aggressively encouraged in rural areas. Moreover, the subsequent fourteenth 5-year plan for the development of renewable energy, 2022, placed an emphasis, as it has done previously, on the utilization of solar energy in a wide variety of settings. Because of the careful planning that went into the many programs, the government has been able to accomplish much of what it set out to do, including taking various steps. According to the findings of the Third Agricultural Census, there are 560,000 rural families that use renewable (solar) energy as their main source of energy. This represents 0.2% of the total rural households [13].

The current rate of renewable (solar) energy utilization in China is far lower than its potential. However, more than two-thirds of the total area of China is rich in sunlight, a resource of solar energy. In his address to the 75th General Assembly Session of the United Nations in the year 2020, the President of China, Xi Jinping, stated that his nation will increase its intentions toward nationally determined contributions by adopting dynamic policy measurements. As we want to reach our goal of being carbon neutral by the year 2060, we need to make rapid progress in the field of energy transformation. It is anticipated that the peak in carbon dioxide emissions will occur well before that year. An important question to consider is how to successfully promote rural energy transformation and maximize rural areas' potential for renewable energy sources [14].

As a potential source of energy for the future, renewable energy will provide an incredible source of clean energy. Recently, researchers interested in the practicability of renewable energy have been doing research on a variety of issues, including benefit evaluation [15-17], development analysis [18-21], and technical innovation in application [22-24]. Despite this, there is a dearth of studies that are based on microdata and investigate the elements and mechanisms that drive farmers to adopt solar electricity. It has been discovered that demographic parameters such as age, gender, and level of education play a role in the amount of renewable energy consumed in residential settings. Demographic factors such as the age of respondents, their education level, and gender have a significant impact on whether or not a household adopts renewable energy technologies like solar [25-27]. It appears that factors such as the number of people living in a household and the annual income play a role in the decision to use solar energy or not. For instance, homes with fewer people were more likely to use renewable energy than households with more people [28]. In rural Botswana, Ketlogetswe and Mothudi [29] found that families with greater incomes were more likely to adopt solar water heaters.

Researchers have conducted a variety of research to investigate how risk aversion influences the decisions that farmers make on a daily basis. For example, Gao et al. [30] and Tanko [31] have conducted substantial research on the variations between farmers with varying degrees of risk preferences in relation to the adoption of new techniques at the farm. Yet, geographical conditions have a significant impact on the renewable energy that farmers are able to adopt. It has been established that the amount of time it takes to get from the market to the house has a substantial impact on the ability of a family to purchase energy [32].

In conclusion, there is an extreme lack of research that takes conformist points of view into consideration, coupled with the farmer's green intentions. In fact, conformist tendencies are more prevalent in economically disadvantaged rural areas of emerging nations with poor infrastructure and insufficient farmer knowledge, which in turn leads to information asymmetry as well as underdeveloped market systems [33]. In addition, the farmers in these regions typically have a lower overall level of education. These farmers are among those who have the least amount of knowledge regarding renewable energy sources. Farmers don't just look at the data in front of them when determining whether or not to accept a new piece of technology. They also take into account the choices made by other farmers, which frequently appear more sensible to them because those farmers may have access to information they don't [34]. In the beginning, there will only be a small group of people experimenting with renewable energy; the successful experiment itself will provide practical knowledge for the non-adopters. Lastly, everyone's thoughts will be taken into consideration before a decision is made regarding whether or not to adopt renewable energy. The results of the experiment will provide most farmers who have not yet converted to renewable energy with beneficial information.

Peer influence is the process by which an individual is impacted by the beliefs, behaviors, and conventions of their social group [35]. Peer influence can take the form of both positive and negative influences. Several studies, for example [36–38], are focusing on the role of conformity tendencies in the adoption of new technologies. The Ethiopian farmers were more likely to adopt seed improvement and fertilizer application technology from neighbors than from extension organizations [39]. Indian farmers often copied their neighbors while choosing BT cotton seeds, according to Maertens [40]. Complex social networks seem to affect conformity. Farmers were affected differently depending on who else used straw, such as their personal family, neighbors, village affluents, or local cadres [41].

It is confirmed that the policies alone will not persuade farmers to switch to renewable energy technologies. Conformity tendencies play a crucial role in the adoption of new technology, especially when the adopter has more green intentions. Therefore, this study examined farmers' adoption of renewable energy technology's cyclical effects and mechanisms using logistic regression and propensity score matching (PSM). Finally, concerning green intentions, the mediation stepwise regression model analyzes farmers' conformity tendencies toward decision-making to adopt renewable energy technology, which gives credibility to the study's findings and informs policymakers.

Hypothesis Development

The realization that humans are both "economic people" and "social people" accounts for the human tendency towards conformity. Sacerdote [35] described that people's participation in social networks can be influenced not just by economic and market factors, but also by the activities of their peers. Similarly, Lan et al. [42] described that PV installations tended to cluster in the same locations, a phenomenon influenced by neighborly imitation and the geographical distribution of socioeconomic indicators like wealth and population. The research on conformity tendencies is gaining popularity at the time. The influence of one's peers has been proven to be a limiting element in all studies of conformity. Newer studies often define peers as people who are geographically close to one another, such as individuals who live in the same city or within a specific radius [43]. The "neighbor effect" describes this tendency towards conformity. Yet, one's neighbors may also include people he or she finds distasteful or with whom he or she is unfamiliar [44]. Those with these characteristics don't appear to belong in the comparative group. However, this research overcame this restriction by selecting a proper socially inspiring peer (SIP) on the basis of their social resemblance.

In the rural parts of China, where the "acquaintance society" structure is more prevalent, researchers may find relevant data for this investigation. Since they are more likely to interact with farmers, SIP is seen as more credible by farmers in rural China [41], and they are also seen as more pleasant by farmers [45]. This research utilizes farmers' adoption of renewable energy as a case study and considers their friends, relatives, or any other person as a SIP to determine whether adopting renewable energies is prone to conformity tendencies.

The real world includes both weak and strong connections with peers. In a series of debates on the significance of social networks in the dissemination of new technologies, Granovetter [46] classified social relationships as either "strong ties" (ST) or "weak ties" (WT). Researchers have shown that people who are connected with one another are more likely to become socially isolated than the general population.

Nonetheless, it has been argued that weakly linked peers with high heterogeneousness play a more central role in the dissemination of innovative technologies [47-48]. Nonetheless, most experts today acknowledge that social media is more reliable and efficient for spreading news. Hence, ST has had a far larger effect on the dissemination of technology than WT [49-50]. In the current study, Fei's theory of differential order pattern is used. This theory proposes that individuals' social networks are organized into nested spheres that are similar to the waves on the water surface pushed out by circles [51].

People are more inclined to work together and reach consensus when the circle is closer to the center. This study establishes the ST and WT of SIP based on their New Year's visit [52]. During Chinese New Year, loved ones gather together to welcome the new year and renew old bonds. While it is not required that close peers visit each other in the new year, it is rare for close peers to not gather together at the new year's welcome ceremony [53].

So, the custom of visiting one another on New Year's Day is a sign of a deeper friendship, more social interaction, increased information exchange, and mutual influence. These kinds of connections are only allowed within ST and the inner circle. Those that aren't inside the inner circle, like WT, are a different SIP. As a conclusion, the study divides SIP into ST and WT categories in accordance with the strong-weak links theory and the differential order pattern to examine the circular effect of conformity. In light of this debate, we propose the following hypothesis:

H1: Because of SIP's solar power use, more farmers will make the transition to renewable power sources.

H2: Farmers are more influenced by ST's proclivity for solar power use than by WT's.

According to the idea of the diffusion of innovations, for an innovation to spread, it must be both noticeably better and generally acknowledged as such by its intended users [54]. In a similar spirit, the technology acceptance model [55] described perceived utility or satisfaction as one of the key elements of the adoption of technology. It highlights the significance of people's perceptions of advantages in the dissemination of new technology. However, due to a lack of understanding and distribution, farmers' adoption of renewable energy is frequently a hazy decision in the early stages of their exposure to renewable energy technology. Insufficient public support prevents the widespread use of solar power [56]. According to social learning theory [57], individuals pick up knowledge from their immediate environments.

Peers have an inherent advantage when it comes to information transfer since they are an integral part of their environment [58]. Farmers' correct understanding of green technologies, reduced cognitive biases, and pro-environmental behavior [59] can all result from information conveyed by peers in the initial stages of technology dissemination. The health, financial, and environmental benefits of renewable energy sources are better understood by non-adopting families thanks to SIP's usage of solar energy, which they may learn about either first-hand or second-hand via SIP.

In light of the growing importance of renewable energy sources, these families may have a greater preference for renewable energy [60-61]. Farmers, in general, use a process called "conformity tendencies-perceptions-adoption" [62] to learn new things and make judgments. Several studies [63-64] have verified that consumers adopt renewable energy technology owing to economic concerns in a market context. Therefore, post-materialist theory suggests that as incomes rise, so do farmers' hopes for a pollution-free, sustainable community. Farmer discontent with energy efficiency has led to calls for more attention to hygiene and ecological considerations [65-66]. Renewable energy sources like solar are better for the planet and people's health [67]. Traditional energy sources, such as firewood, are a major cause of air pollution and health problems for many rural communities today [68]. Some SIPs are considering the use of solar energy after hearing about its advantages from others who currently use it [69]. The following hypothesis was developed:

The objective of the current study was to identify the role of socially inspiring peers to use solar energy. Moreover, it turned out that green intentions are a crucial intermediary between farmers' conformist tendencies and their actual behavior toward the adoption of solar energy.

H3: A farmer's green intentions are a significant mediator in making the decision to adopt a renewable energy source, i.e., solar energy.

Materials and Methods

Study Area and Sampling Techniques

The studies were conducted in Sichuan Province. It is located in the middle of China and features a wide variety of topographic features, from mountains and hills to valleys and plains. Sichuan Province has an abundance of solar resource regions classified as Class I, II, III, and IV [70]. These areas receive between 750 and 2680 hours of sunshine per year and have an annual radiation average of 3200 to 6390 MJ/m2. The province of Sichuan in China is a very important place because it is the land for the crystal-like silicon PV industry [71] because of its rich silicon resources. Around 70% of the world's polysilicon will come from China in 2021, with an approximately 13% contribution from the province [14]. The provincial government of Sichuan is also launching experimental solar photovoltaic development and photovoltaic poverty reduction programs. The total installed photovoltaic capacity in the province was 2.044 million kW at the end of September 2022, including both centralized (1,730,000 kW) and decentralized photovoltaic (314,000 kW) [72].

The research focuses on a variety of issues, including but not limited to residential energy use, population trends, environmental awareness, and other related topics. We obtained our typical sample by using a stratified random sampling method with equal probability. From the counties of the province, 4 counties were selected at random. Next, 4 towns from each county were selected randomly. Thereafter, considering the economic development of the villages, from each town, 2 villages were chosen randomly. In a final step, 25 rural residences were selected at random as interviewees in each community using the list of farmers. In-depth, face-to-face interviews were performed at the homes of the farmers; it took almost 90 minutes to complete the questionnaire. The questionnaire was divided into many sections. The 1st section entailed informed consent and the purpose of the study. The 2nd section contained questions about the socio-economic characteristics of the farmers. It includes information about their age, education, income per year, internet use, etc. The 3rd section comprised questions regarding the farmer's social relationships, in which information about the adoption of a well-known relative or friend was obtained. The 4th section contained information about their green intentions and the associated benefits of solar energy.

Table 1. Variable description.

Variables	Definition	Units
Dependent variable		
Adoption of renewable energy source	Does your home use renewable energy sources?	1 = Yes, 0 = No
Independent variable		
Social inspiring peer	Do your friends or relatives use renewable energy sources?	1 = Yes, 0 = No
Strong ties with peer	Do your peers who participate in welcoming the new year use renewable energy?	1 = Yes, 0 = No
Weak ties with peer	Do your peers who do not participate in welcoming the new year use renewable energy?	1 = Yes, 0 = No
Control variables		
Age of family head	Age of family head	Years
Gender	Gender of family head	1 = Male; 0 = Female
Education	Education of family head	Years
Family size	Total family members	Number
Income	Annual household income	Yuan
Risk	Although using renewable energy technology involves financial expenses, I do it anyway.	Likert scale
Distance	Distance from home to market	Kilometer
County	Dummy variable	Jiajiang = 0
Mediator variable		
Green intentions (GI)		
GI-1	I plan to spend more on renewable energy sources rather than conventional products.	Likert scale
GI-2	I intend to adopt/continue to use renewable energy sources because they positively affect the environment.	Likert scale

Variable Description

Table 1. describes the detailed description of the variables in the study. The dependent variable was the response variable. The adopter of renewable energy sources i.e., solar energy, was coded as "1" and the non-adopter as "0". The primary independent variables of the study are the socially inspiring peer and their relationship with the family head which describe the conformity tendency. Since the effect of ST and WT on the peer may vary. The conformity tendencies are comprised of these three variables: (i) whether the socially inspiring peer uses a renewable energy source; (ii) whether or not respondents receive New Year's visits from friends and family; and (iii) whether or not respondents receive New Year's visits from friends and family. The adoption of renewable energy by farmers is affected by a number of factors. Many studies have demonstrated the significance of personal and familial factors, as well as one's own risk assessment and surroundings. Therefore, there were many control variables, such as the age of the family head, his education, his gender, his family size, his annual income, and his risk awareness. Moreover, the distance from the house and market was also considered in Kg. The authors of this study used geographical dummy factors to take into consideration the climatic and cultural differences between the regions from which the study's samples were recruited.

The variable "Green Intention" was measured by 2 questions. "I plan to spend more on renewable energy sources than conventional products" and "I intend to continue to use renewable energy sources because they contribute positively to the environment". The response of the respondent strongly agreeing was coded as "1" and strongly disagreeing was scored as "0".

Statistical Models

Logistic regression

In response to the question of whether or not they make use of solar energy, farmers will only give one of two possible answers: "yes" or "no." As a direct consequence of this finding, a binary logistic model was chosen to serve as the basis for the regression analysis in this inquiry. The following is a concise explanation of the model.

$$A = ln\frac{p}{1-p} = \alpha_o + \sum_{1}^{\infty}\alpha_i y_i + \mu$$

In the model, the symbol α_o represents the intercept; the symbol y_i represents the control and principal independent variables; and α_i represents the coefficient to be determined. The symbol μ illustrates the random interference.

Propensity Score Matching (PSM)

The researcher can only infer how conformity tendencies and self-selection have affected farmers' adoption of renewable energy due to the observational nature of the data. The PSM method was used to establish a counterfactually based quasi-experiment by the researchers to overcome endogeneity [73]. Researchers in this study divided the participants into treatment and control groups based on whether or not their SIP uses renewable energy. The control variables were used to match up farmers in the experimental and control groups with propensity scores. Now that we have a way to compare how farmers do under different conditions of independent variables, we may use matched samples to extrapolate what might be the possible outcomes for similar respondents.

The effect of the independent variable stands out more clearly, and we reduced the influence of confounding variables. At last, the average treatment effect (ATT) is the difference in adoption among farmers when all other circumstances are the same but the independent variable conditions are different, and this may be calculated by using the matched samples. The general expression is given below.

$$ATT = E[(A_{1i} - A_{0i})|R_i = 1] = E\{E[(A_{1i} - A_{0i})|R_i = 1],$$
$$P(Y_i)\} = E\{E[A_{1i}|R_i = 1, P(Y_i)] - \{E[A_{0i}|R_i = 0, P(Y_i)]|R_i = 1\}$$

Based on the aforementioned model, if Ri = 1, then i belongs to the treaded cluster; otherwise, i goes to the control group. The propensity score $P(Y_i)$ is measured based on the matching conditions. The estimated outcomes for both the treatment and control groups are A_1 and A_0 *respectively* represented by the matching condition propensity score $P(Y_i)$. Each farmer's propensity score was initially calculated using a logistic model. Three different matching techniques, such as kernel matching (KM), radius matching (RM), and nearest neighbor matching (NNM), were used to get convincing results. Before measuring the final results, the balance test and common support assumption were confirmed.

All matching tests confirmed the common support assumption and ensured that most observations fell within the common range of values. Only short samples were unmatched, which described the small sample loss during the process of matching and the ideal matching effect that resulted.

Mediation Effect Estimation

To test the transmission mechanism of conformist behaviors, the current study describes the following mediation model [74]:

$$A = aY + e_1$$
$$M_i = bY + e_2$$
$$A = \alpha' Y + \beta M_i + e_3$$

Here, the dependent variable A describes whether the farmers use renewable energy sources or not. Farmers' green intentions GI-1 and GI-2 are M in this model. The Y depicts conformity tendencies variables such as SIP, strong (ST), and weak (WT) ties. The regression residual is represented by the numbers e1 through e3.

Results and Discussion

Descriptive Analysis

Table 2. presents the socio-economic characteristics of the sampled respondents. Almost 26.4% of the sampled farmers were adopters of renewable energy sources. Nearly 45% of the famers' peers were adopters of renewable energy sources, and 45% and 67% of the sampled farmers were reported to have strong and weak ties with their inspiring peers, respectively. They were 42 years old and had completed only 5.58 years of schooling. Only 54% of family heads were male, while the remaining farm families were headed by females. The total family size was comprised of almost 4 members. The average annual income of the sample was 879000 yuan. The risk awareness level of the sampled farmers was near the normal level of awareness. The average distance between the market and the houses of the farmers was 3.78 km. The sampled farmers had more green intentions.

Factors Affecting the Adoption of Renewable Energy Sources

The multicollinearity test revealed a maximum VIF value equal to 1.46 between the tested variables. Hence, the condition for regression was satisfied, and multicollinearity did not exist among the variables. Table 3. displays the regression findings. The results of the regression analysis suggest that the adoption of renewable energy by farmers would grow dramatically if more peers like SIP began using it. Also, the marginal effect of SIP on the adoption of renewable energy by farmers verifies that a 1% rise in the value of renewable energy utilized by SIP results in a 23.1% point rise

Table 2. Demographic characteristics of sampled farm families.

Variables	Mean	SD
Dependent variable		
Adoption of renewable energy source (Yes/No)	0.264	0.40
Independent variables		
Social Inspiring peer (Yes/No)	0.45	0.32
Strong ties with peer (Yes/No)	0.45	0.43
Weak ties with peer (Yes/No)	0.67	0.52
Control variables		
Age (Years)	42.1	12.32
Education (Years)	5.58	2.54
Gender (Male=1)	0.54	0.31
Family size (Numbers)	4.02	1.78
Income (Yuan)	8.79	13.67
Risk (5-point Likert scale)	3.02	1.26
Distance (Kilometers)	3.78	3.08
Mediator variable		
Green Intentions (GI)		
GI-1	4.36	1.07
GI-2	3.99	1.53

in the possibility that farmers would adopt renewable energy. Similarities in personality and social upbringing between farmers and their peers might explain why both groups are so likely to adopt renewable energy [74]. The effect of strong ties with peers already using renewable energy has a positive and significant impact on renewable energy adoption by farmers. For every percentage positive change in the value of renewable energy consumption by ST, the marginal effect reveals that the chance of farmers adopting renewable energy rises by 18.7 percentage points. Tan et al. [45] also described that the frequent interaction between their peers strengthens their decision-making and their behavioral overlap between them. The positive and significant effect of using the renewable energy source by the weak ties on the adoption of renewable energy by farmers. Nevertheless, the marginal effect of weak ties describes that for every 1% rise in the value of renewable energy consumption, the chance that the farmer will utilize renewable energy improves by just 10.4%. This may be explained by the fact that there are a large number of people who can hasten technology adoption by spreading fresh knowledge and skills, even if farmers are relatively distant from them [75]. While both ST and WT affect the farmers' propensity to use renewable energy, the influence differs in terms of magnitude. In terms of marginal effect, strong ties clearly outperform weak ties. These findings suggest that proximity varies, even within SIP. Farmers are

Table 3. Conformity tendencies and their influence on the adoption of renewable energy.

Variables	Coefficient	SE	Marginal effect
Independent variables			
Social inspiring peer (Yes/No)	1.065*	0.310	0.231
Strong ties with peer (Yes/No)	1.745*	0.420	0.187
Weak ties with peer (Yes/No)	1.372*	0.243	0.104
Control variables			
Age (Years)	0.345	0.291	
Education (Years)	1.209*	0.302	
Gender (Male=1)	0.573**	0.209	
Family size (Numbers)	0.783*	0.223	
Income (Yuan)	1.467*	0.278	
Risk (5-point Likert scale)	0.032	1.260	
Distance (Kilometers)	-0.781**	0.312	
Constant	-2.894*	0.283	
Control variables	Yes		
Regional dummies	Yes		
Wald $\chi 2$	98.765*		
Pseudo R2	0.342		

Table 4. Biasness across the variables (before and after) matching.

	Sample	R-square	LR-χ2	p > χ2	Mean Biasness	Med Biasness
SIP	Unmatched	0.018	15.87	0.001	14.23	13.78
NNM	Matched	0.009	4.35	0.567	3.21	3.11
RM	Matched	0.001	1.87	0.352	4.13	3.99
KM	Matched	0.007	3.33	0.176	3.72	3.67
ST	Unmatched	0.022	21.67	0.007	13.21	15.34
NNM	Matched	0.001	1.78	0.643	2.34	1.97
RM	Matched	0.002	2.77	0.332	1.76	1.65
KM	Matched	0.0001	1.56	0.621	1.66	1.49
WT	Unmatched	0.019	17.67	0.004	15.78	14.67
NNM	Matched	0.001	1.37	0.786	3.40	2.78
RM	Matched	0.002	2.33	0.834	2.50	2.34
KM	Matched	0.005	4.11	0.789	3.80	2.99

Table 5: Analyzing the ATT effects based on different matching techniques.

Matching method/Variables	Treated	Control	SE	ATT
NNM				
SIP	0.456	0.012	0.054	0.353*
ST	0.576	0.038	0.036	0.267*
WT	0.578	0.019	0.025	0.189*
RM				
SIP	0.345	0.110	0.033	0.443*
ST	0.256	0.098	0.032	0.309*
WT	0.329	0.121	0.043	0.218*
KM				
SIP	0.638	0.078	0.013	0.329*
ST	0.567	0.032	0.024	0.216*
WT	0.398	0.109	0.023	0.198*

Note: * p<0.01

more likely to accept renewable energy technologies when they have close relations with those who have adopted the same technology. Therefore, the results are consistent with the first two hypotheses.

The results of the regression model involved the effects of the self-selection bias regarding the sampling, and to overcome this bias, the PSM model was used. Results from the balance tests are presented in Table 4. After matching, the balancing test shows no statistically significant P-values, which specifies that the samples from the treatment and control groups are matched. There are no differentiating characteristics between the two groups. Finally, the results from both the common support and balancing tests confirmed that all three matching methods were generally effective.

In the end, to examine the effect of conformity tendencies such as SIP, ST, and WT on the farmer's adoption, the ATT was calculated using KM, NNM, and RM, and the results are shown in Table 5. To alleviate the effects of the study's limited sample size, we compute standard errors by resampling the data 500 times, as shown in Table 5. The results of the ATT reveal that conformity tendencies have a significant effect on promoting farmers' use of renewable energy, even after correcting for apparent systematic changes between samples. The ATT results for the same group show some variation among the three methodologies; they

Table 6. Results of group regression.

Variables	Gender					
	Male = 384			Females = 416		
SIP	3.892* (0.353)			2.113* (0.098)		
ST		2.185* (0.245)			1.897* (0.054)	
WT			1.975* (0.187)			0.998* (0.012)
County	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes
Wald χ2	57.98*	56.78*	67.98	45.78*	48.56*	49.67*
	Income					
	≤879000			>879000		
SIP	2.920* (0.134)			1.620* (0.024)		
ST		1.132* (0.109)			1.002* (0.019)	
WT			1.005* (0.047)			0.355* (0.012)
County	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes
Wald χ2	55.73*	48.45*	44.53*	54.33*	52.34*	43.23*
	Education					
	≤5.58			>5.58		
SIP	2.112* (0.028)			2.435* (0.088)		
ST		1.885* (0.078)			2.011* (0.045)	
WT			1.071* (0.014)			1.324* (0.021)
County	Yes	Yes	Yes	Yes	Yes	Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes
Wald χ2	34.56*	62.12*	24.32*	33.67*	27.87*	42.34*

Note: * p<0.01

are all positive and statistically significant, indicating that socially inspiring peer behavior towards renewable energy consumption does indeed stimulate farmers to adopt renewable energy. Second, ATT results for ST are superior to those for WT across all potential matching techniques, just like the binary logistic model predicts.

Grouping Tests

Even farmers and their peers might describe the trend toward conformity. After the amount to which conformity is impacted by peers has been established, a heterogeneity analysis will be used to examine the impact of farmer diversity on conformity. Gender, income, and education were selected as indicators of farmer characteristics and family status. We used these three factors to categorize farmers and then performed group regressions. Table 6. presents the results of group regression.

SIP's use of renewable energy significantly motivates farmers regardless of education, gender, or income. For every single characteristic of farmers, ST showed a larger tendency towards compliance than WT. As such, it demonstrates that the influence of ST is much stronger than that of WT. Moreover, the results showed that technology diffusion conformance is objective and universal.

Table 7. Mediating role of Green Intentions

Mediator Variables	Paths	Variables	Stepwise Regression method		
			Y→Z	Y→M	Y→M→Z
GI-1	i	SIP	1.893* (0.121)	1.001* (0.133)	3.982* (0.432)
	ii	ST	1.564* (0.119)	0.592* (0.114)	2.653* (0.223)
	iii	WT	1.010* (0.202)	0.776* (0.201)	1.542* (0.379)
GI-2	iv	SIP	2.347* (0.292)	1.234* (0.219)	2.973* (0.333)
	v	ST	2.011* (0.203)	0.992* (0.122)	1.454* (0.211)
	vi	WT	1.677* (0.144)	0.873* (0.222)	1.321* (0.232)
Control			Yes	Yes	Yes
County			Yes	Yes	Yes

Note: * $p<0.01$

Consciousness is the basis for action, and intentions and behavior are strongly linked to each other [76]. Farmers with greener intentions are more likely to adopt renewable energy sources. Because of this, we decided to include farmers' green intentions as mediator variables, and the stepwise test, the most commonly used method for determining regression paths, was used in this study [77-78]. The results of the stepwise regression method are shown in Table 7. The effect of SIP, ST, and WT's adoption behavior of renewable energy on the green intention (Y→M) is statistically significant at 1%. It ensured that the mediating effect existed. In other words, the green intentions of farmers connect the many types of conformity (including SIP, ST, and WT conformity) that influence farmers' decisions to use renewable energy.

Conclusions

Our analysis of farmers' conformity tendencies and their influence on their adoption of renewable energy. The identification of the underlying mediating mechanism is based on data gathered in China's "Sichuan" province and employed a binary logistic regression and PSM approach. It's possible to have two major implications: Farmers with peers who utilize renewable energy are more inclined to adopt renewable energy, which demonstrates the circle effect and shows that ST has a higher influence than WT in this case. Second, the farmer's green intentions play a crucial mediating role in the farmer's conformity tendencies to adopt renewable energy. Yet, the magnitude of the influence varied across strong and weak relationships. The strong and weak relations in renewable energy behavior directly boost the GI and indirectly support the adoption of renewable energy sources among the farmers.

Researchers might learn something from China's promotion of renewable energy in rural regions, which could enhance the recommendations they provide to policymakers in other developing nations. Consequently, we can steer well-educated and politically active farmers towards the forefront of renewable energy use. Businesses can promote the word-of-mouth effect through two techniques, such as group preferential and other strategies that allow them to be led by peers. Improve farmer cooperation through updating rural communication and transportation networks. Events like "show up" gatherings, where farmers who use renewable energy may share their experiences and answer questions from people who are interested and greener intended in using renewable energy, can help educate communities who do not yet make use of renewable energy on its benefits, how to install it, and where to acquire it.

Conflict of Interest

The authors declare no conflict of interest.

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