FACTORS AFFECTING THE FARMERS' DECISION FOR AGRICULTURAL PRODUCTION UNDER CLIMATE CHANGE IN VIETNAM

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Abstract

Climate change is one of the significant challenges facing agricultural production today, especially for developing countries where agriculture plays a crucial role in the economy. Therefore, research on the factors affecting farmers' decision in agricultural production plays an extremely important role in the current context. Using data of 180 agricultural production households in 06 Northern Vietnam provinces, the article proposes 06 factors affecting farmers' willingness to change agricultural production, including natural conditions, market knowledge, household characteristics, supporting policies, infrastructure and climate change. Regression results show that all these six factors have a strong influence on farmers' decisions. In particular, the increase of climate change makes farmers more ready and prepared to change production methods to achieve the set plan. In addition, the article also proposes many solutions to promote agricultural production towards sustainable development.

Keyword: Climate change, Agricultural Production, Production Decision, Vietnam, Farmers' Decisions, Sustainable Development

INTRODUCTION

Climate change has been a global catastrophe. Vietnam is one of the five countries in the world most heavily affected by climate change. Climate change will cause extreme weather phenomena such as hail, drought, flood, sea-level rise, greenhouse effect... On the other hand, agricultural production depends a lot on due to natural conditions; when the weather changes erratically, it will make the agricultural production process very difficult.

Vietnam is a developing country; in 2018 the labor force in agriculture accounted for about 40% of the country's labor force, so the role of agricultural production in our economy is very important; because strong development of agriculture will be a solid premise for other economic sectors to develop. We cannot fight climate change, so for agricultural production to develop, farmers need to know how to adapt and respond to climate change. They have to make vital decisions in agricultural production when the condition of arable land is decreasing, the situation of drought, pests, and diseases is increasing,.. Therefore, study the factors affecting farmers' decisions in agricultural production to combat climate change is one of the essential things.

The study objective is to build a theoretical basis and evaluate the factors affecting the decision of farmers on agricultural production activities in the context of climate change in Vietnam. From there, propose solutions to improve decision-making efficiency in the agricultural production of farmers in Vietnam.

LITERATURE REVIEW

Research on factors affecting producer behavior change is abundant. Most of these studies are based on Ajzen's theory of planned behavior (Cynthia, 2001; Dolores et al., 2001; Niles, Lubell and Haden, 2013). The application of this theory to the study of behavioral change in the agricultural sector is also popular (Lapple and Kelly, 2013; Joao et al., 2014; Chin, Alwi and Mohammmed, 2016; Andrea et al., 2017), in which there are many studies on the behavior of farmers towards agricultural production such as Lukas, 2011; Lapple and Kelly, 2013; Liguo et al., 2017).

Regarding climate change, first of all, we need to confirm that this is an ongoing problem in Vietnam. Analyzing data from 112 hydrometeorological stations over 40 years (1975-2014), Nguyen-Duc, Ancev and Randall (2019) found strong statistical and visual evidence that climate change is happening all over Vietnam, especially the Red River Delta and Mekong River. This is a matter of concern for the Vietnamese government.

Assessment of the impact of climate change on agricultural production decisions is one of the issues of great interest in scientific research. Trinh et al. (2018) studied the determinants of agricultural production to adapt to climate change in central Vietnam and determined that there are 7 factors affecting farmers' adaptability to climate change, including attendance of training courses, farm size, damage level, education level, farming experience, access to credit and gender. The authors also pointed out that participation in training on climate change and farm size were the strongest influencing factors. Meanwhile, the ability to work and join local organizations are not affected.

Climate change, taken as a whole, is a historical issue, and its impact on agriculture is controversial. Wiréhn (2018) argues that climate change brings both challenges and opportunities, and the problem here is how to limit the negative impacts and benefit from climate change. The study also said that humanity actually needs to accept climate change as an inevitable part of the trade-off and should try to find policies to adapt to climate change. For the Nordic region, the study highlights that failure to address climate change challenges can impede agricultural development and long-term benefits.

Not only does it affect agricultural productivity, but climate change also affects trade and market responses. Using the CAPSiM agricultural partial equilibrium model and the CAPSiM-GTAP global equilibrium model, Xie et al. (2018) assessed the impact of climate change on China's food production, prices, trade and self-sufficiency. Research results show that climate change will reduce wheat yield by 9.4% by 2050, but the market will respond to this negative impact in the direction of reducing the impact of climate change. Accordingly, the loss of wheat production fell to only 4.3%. The reason is that farmers will adjust production, and exchange prices in the market will increase. The study also suggested that the state should integrate market and trade responses when calculating the impacts of climate change, thereby making appropriate adjustment policies.

For Vietnam, Phan Sĩ Mẫn and Hà Huy Ngọc (2013) said that the lives of farmers in general and agricultural production, in particular, are heavily affected by climate change. Vietnam needs synchronous and comprehensive solutions to adjust production, helping farmers better respond to climate change.

In general, although there have been many studies on the impact of agricultural production, however, agricultural production does not only include production but a process, including pre-production, in production and post-production. Currently, there is no work that fully assesses the decision-making of farmers for agricultural production in the context of climate change in Vietnam.

IMPACT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTION IN VIETNAM

Climate change is the greatest challenge facing humanity in the century. Climate change for Vietnam is serious, and the risk of being the target of poverty reduction and sustainable development (Ministry Natural Resources and Environment, 2012). Under the medium emission scenario (B2/ RCP6.0), if the sea level rises by 1m, approximately 38.9% of the Mekong Delta area will be flooded, and Ho Chi Minh City will be flooded over 17, 8% of the area; about 10 - 12% of the population of our country is directly affected, and the loss is about 10% of GDP. According to the report of the Central Steering Committee for Natural Disaster Prevention and

Control, in 2016 alone, natural disasters and the impacts of climate change have caused heavy damage with the total damage estimated at 39,000 billion VND (1.7 billion USD, 18 provinces and cities of Vietnam have declared a state of natural disaster, more than 828,661 hectares of rice and crops have been seriously affected and reduced rice production by an estimated 800,000 tons, equivalent to nearly 2% of the total rice production of the whole country (Ministry of Industry and Trade, 2016). In 2017, the level of disaster risk of climate change was aggravated when Vietnam ranked fifth globally, up third places compared to 2016. The total damage caused by natural disasters, climate change in 2017 is estimated at 59,300 billion VND, equivalent to about 2.7 billion USD (MARD, 2017. General Department of Disaster Prevention and Control, 2018).

Agriculture is still an important economic sector and the backbone of the economy with a contribution of about 14.57% of Vietnam's gross domestic product (GDP) in 2018 (GSO, 2019); agricultural land occupies about 35% of the total area of the country and creating about 47% of jobs (FAO), many households still rely on agriculture to ensure food security (WB). In 2018, the value of agricultural exports reached 40.02 billion USD, in which timber and fisheries products accounted for a large proportion (over 22%). However, in time to agricultural production in general and the production of food crops, in particular, will be more challenging due to demand food security, increased, the consequences of climate change, degradation of natural resources; Previously, Vietnam's main export product, rice, only accounted for about 7.6% of the total export value of the whole industry (MARD, 2019).

According to IPSARD (2016), natural disasters and extreme weather events have the strongest impact on farming households, followed by aquaculture households. Livestock production households are less affected by extreme weather events. Among the types of extreme weather that have a great impact on agricultural production include storms, droughts, floods, unseasonal rains and prolonged heat. Although, in general, for all agricultural production activities, saltwater intrusion is not a factor that has a great impact, saltwater intrusion can have a heavy impact on crop production, especially rice production in the coastal provinces of the South Central Coast and the Mekong Delta.

According to the Ministry of Agriculture and Rural Development (2016), 11 out of 13 provinces in the region are affected, especially those bordering the sea such as Kien Giang, Ca Mau, Tra Vinh,...affected by saltwater intrusion as well. And the drought of 2016 reduced about 800,000 tons of rice (about 2% of the country's rice production). Research shows that climate change can, directly and indirectly, affect agricultural production, which can reduce agricultural output in Vietnam by about 2-15%. In Vietnam, climate extremes such as floods, droughts, salinization,...could reduce rice production by about 2.7 million tons/year by 2050. In the context

of climate change, the expansion of production scale food production and export may be subject to increased risks due to the impact of abnormal changes in weather and climate conditions, especially extreme climate events. The reduction of food production will also threaten poverty reduction and national food security, especially in situ food security for vulnerable areas (Northern mountainous areas, remote areas, remote areas, ethnic minority areas).

Temperature increase, the phenomenon of extreme weather occurs with frequency increasing and severity growing,...requires agriculture Vietnam must act urgently to find solutions effective response methods, suitable to natural conditions and agricultural production activities of each region, locality and country. Smart agriculture with climate change has three main pillars: "sustain and stabilize productivity, increase resilience, reduce emissions wherever possible, ensure food security and development" (FAO, 2010) is considered as a possible solution to effectively respond to climate change of the agricultural sector.

RESEARCH METHODS

To study the factors affecting the decision of farmers in agricultural production in the context of climate change, the paper uses correlational methods with regression according to Enter method. This is a modern, suitable method to identify and evaluate the influence of factors.

Due to limited time and financial resources, the article researches and conducts field investigations in 06 northern provinces of Vietnam, including Phu Tho, Yen Bai, Bac Kan, Thai Nguyen, Cao Bang, Tuyen Quang. In each province, the author surveyed 30 households. Households were selected by a convenient sampling method. The total number of surveyed households is 180 households.

The author uses questionnaires to collect data. The survey form consists of two parts: (i) basic information about the surveyed household; (ii) assessment of the factors affecting the farmers' willingness to change in agricultural production (natural conditions, market knowledge, household characteristics, supporting policies, infrastructure and climate change). The author uses a 5-scale Likert scale to collect the respondents' evaluations.

Table 1. Likert Scale

Point	Range	Interpretation
5	4.20 - 5.0	Strongly Agree/Excellent
4	3.40 - 4.19	Agree/Good
3	2.60 - 3.39	Neither Agree or Disagree /Average
2	1.80 - 2.59	Disagree/Poor
1	1.0 - 1.79	Strongly Disagree /Weak

After conducting the trial and adjusting survey, the questionnaire were sent to farmers through social organizations (Farmers' Union, Women's Union, Statistician). At some locations, the author conducts a direct survey of farmers. After collecting the survey results, the author entered the data into Excel software and did regression analysis using SPSS software. The research hypothesis of the model is as follows:

Hypothesis 1: More favorable natural conditions will reduce farmers' willingness to change agricultural production.

Hypothesis 2 : More market knowledge will increase the farmer's willingness to change agricultural production.

Hypothesis 3 : The more favorable the characteristics of the household, the more suitable for agricultural production will increase the farmer's willingness to change agricultural production.

Hypothesis 4 : The better supporting policy knowledge will increase the farmer's willingness to change agricultural production.

Hypothesis 5 : Better infrastructure will increase farmers' willingness to change agricultural production.

Hypothesis 6 : Increasing climate change will increase farmers' willingness to change agricultural production.

RESEARCH RESULTS

Six independent variables were be used in the regression analysis: natural conditions, market knowledge, household characteristics, support policies, infrastructure and climate change. The dependent variable is the willingness to change in agricultural production. The Enter procedure is used to do the study.

Table 2. Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.796	0.634	0.621	0.39693	2.217

Adjusting the R-square reflects the ability to interpret changes in the dependent variable by the independent variables. Accordingly, an adjusted R-square of 0.621 shows that, 62.1% of the change in farmers' willingness to change in agricultural production is due to 06 factors mentioned in the study. With the Durbin-Watson test result of 2.217, the model does not have autocorrelation.

Table 3. ANOVA of the Model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	47.247	6	7.874	49.980	0.000
Residual	27.256	173	0.158		
Total	74.503	179			

Rejecting the null hypothesis that all regression coefficients are zero and assuming at a 95% confidence level that the linear regression model fits the data yields a p-value of less than 0.05, as evidenced by F equal to 49.980 and significance equal to 0.00 (i.e., less than 0.05).

Table 4. Hypotheses testing results

Variable	Standardized Coefficients	t	Sig.	Collinearity Statistics	
				Tolerance	VIF
(Constant)	2.429	6.825	0.000		
Natural Conditions	-0.490	-4.942	0.000	0.215	4.645
Market Knowledge	0.171	1.719	0.087	0.213	4.688
Household Characteristics	0.195	2.903	0.004	0.471	2.123
Supporting Policies	0.376	4.132	0.000	0.255	3.915
Infrastructure	0.420	3.445	0.001	0.142	7.019
Climate Change	0.758	6.293	0.000	0.146	6.857

VIF index less than 10 shows that the model does not have a multicollinearity phenomenon. The survey results show that all six proposed factors have a significant impact on farmers' willingness to change in agricultural production. All the proposed hypotheses are valid. Specifically, the more favorable the natural conditions, the lower the willingness to change in agricultural production. On the contrary, when market knowledge increases, the characteristics of farmers are favorable for production, better support policies, and better infrastructure, the willingness to change in agricultural production increases. In particular, as expected, climate change has an extremely strong impact on the willingness to change in agricultural production to counteract the negative effects. At the same time, this is also the most influential factor. The remaining elements have the level of impact in the order of natural conditions (-0.490), infrastructure (0.420), supporting policies (0.376), household characteristics (0.195) and market knowledge (0.171). The results are completely consistent with reality.

CONCLUSIONS AND POLICY RECOMMENDATIONS

To develop agriculture in a sustainable way, we need to use the following solutions:

* Sustainable agricultural development planning solutions :

- Planning and protection of agricultural land conducted detailed planning, stabilizing the agricultural land allocated to households or individuals, in accordance with production models

large and equipped camps, convenient for mechanization and transformation of production structure.

- Prestigious development plan rural must be associated with the development of infrastructure serving agricultural production: Perfecting the system of internal traffic to these areas of concentrated production, intensive farming areas, farms, creating linkage in agricultural production activities, support between agricultural fields in the district.

- Agricultural development planning associated with science and technology transfer, agricultural extension and agricultural production support activities: Promote linkages and joint ventures with scientific research agencies, deploy and applying scientific and technical advances in agriculture to production, taking advantage of the locality specializing in agriculture to develop services of plant varieties and livestock.

* Sustainable agricultural development based on efficient exploitation of resources:

- Enhancing the efficiency of human resources in agricultural development towards sustainability: research, review and categorize the labor force, the rational use of labor resources, labor distribution reasonable, improving high cultural level, technical level and professional level of employees. Implement socialization, diversify education and training, open training courses on knowledge, experience and technology transfer for farmers through the application of new plants and animals, farming methods, production methods. Training a team of skilled technical workers in the field of agricultural production, associated with the program of science and technology development through activities in association with training units in the area and training institutions and Create another reputation.

- Use of capital investment in agricultural production in a sustainable way, correctly to determine the direction of investment capital, using effective investment from government subsidies and capital under development objectives mobilizing credit capital and other funding sources. For the district's budget capital, it is necessary to have a plan for rational use through budget allocation, the rate of accumulation between investment and expenditure.

* Sustainable agricultural development based on agricultural development policy:

- Encourage, support and facilitate economic development cooperation on the basis of association, voluntary among households and farms in many forms. Guide farmers to apply new science and technology, link with businesses to invest in the production and consumption of products.

- Encourage people to use new plant and animal varieties, put high-yield and good-quality plant varieties and livestock into popular production in the area, and at the same time associate with post-harvest preservation technology. plan.

- Implement policies on vocational training for farmers in order to raise the level of labor in rural areas, especially in the agricultural sector. Create an appropriate mechanism to attract businesses to consume products for the people, and at the same time, provide inputs for agricultural production.

* Sustainable development of agriculture associated with the development of science and technology:

- Applying scientific advances to agricultural production to exploit advantages in agriculture, taking advantage of the district's abundant labor force to create more jobs for workers.

- Strengthening linkage between science and technology with economic activities in agriculture according to market relations. Connecting scientific and technological research organizations with production units and enterprises.

- Improve the endogenous capacity of organizations and individuals with the function of applying science and technology in the district in order to apply scientific and technical advances to production with maximum efficiency.

LIMITATIONS OF THE STUDY

This study identifies and evaluates the factors affecting farmers' decisions in agricultural production in 06 Northern Vietnam provinces. These results may be not identical with other areas. Therefore, future research may cover a broader scope or other locations of Vietnam (especially in the South of Vietnam) and other areas in the world. Besides, this study only mentions 06 factors (natural conditions, market knowledge, household characteristics, supporting policies, infrastructure and climate change) with an explanation level of 62.1% variation. Future studies may add other factors with larger sample sizes.

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