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UNDERLYING DRIVERS THAT INFLUENCE FARMERS' SUSTAINABLE ADAPTATION STRATEGIES

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ABSTRACT

In order to minimize the adverse effects of climate change, appropriate adaptation strategies are paramount. Farmers' socio-demographic factors play a significant role in the selection of appropriate adaptation methods. However, there is a lack of empirical evidence on how farmers' socio-demographic factors affect the choice of specific adaptation strategies to minimize the negative effects of climate change. This study explores what the main determinants are for farmers when choosing specific adaptation strategies in the context of local climate. Data was collected using questionnaires and analyzed using statistical tools. The study found that income level, education level and experience had a positive and significant influence on farmers' choices of climate change adaptation strategies. This implies that well-educated, wealthy, and experienced farmers are able to adapt more easily. The results also showed that farmers are aware that climate change has affected livestock and land degradation, increased food costs, and increased rural-urban migration. These negative effects of climate change on ecosystem services and agricultural production in Malaysia could be barriers to achieving sustainable agricultural practices. Therefore, the findings bring new perspectives to policymakers when developing adaptation policies for farming communities in the Malaysian agricultural sector.

Contribution/Originality: The paper's primary contribution is finding that farmers' socio-demographic factors are necessary when choosing appropriate adaptation methods. Appropriate strategies to combat climate change can reduce adverse effects and protect farmers' livelihoods in Malaysia.

1. INTRODUCTION

Greenhouse gas emissions, mainly from burning fossil fuels, have been warming the earth. During the last three decades, the planet's surface temperature has been increasing constantly more than any decade since 1850 (IPCC, 2014). This global warming is threatening life on the planet by degrading ecological systems and interrupting the natural equilibrium of water, food and temperature (Cai et al., 2016), and agriculture is the most susceptible industry to the effects of climate variability (Pearson, Nelson, Crimp, & Langridge, 2011). This is mainly due to the fact that agriculture is highly dependent on water supply, soil quality, humidity, etc., making it extremely

vulnerable to climate variability, which affects all of the biophysical systems (Geng et al., 2016; Hossain & Paul, 2019). Studies by Vaghefi, Shamsudin, Makmom, and Bagheri (2011) and Zainal, Shamsudin, Abidin Mohamed, and Usman (2014) confirmed that the agricultural sector is already being affected by climate change resulting in a decline in production, an increase in food insecurity, and rising sea levels. In the long run, this may destroy the supply chain in the agricultural sector. Research has shown over the past century that crop yield has decreased by 1–2 percent per decade as a result of climate change (Gourdji, Sibley, & Lobell, 2013).

This reduction in agricultural income greatly affects farmers' livelihoods as well as economic growth. It is concerning that projections indicate that in the future these negative impacts are expected to increase (Field, 2014). Therefore, understanding the influence of climate change on agriculture is urgently needed as it provides useful information for the development of potential solutions and policies that may help to tackle the problem. This is especially true for developing countries, as studies suggest that climate change has huge and adverse effects on economic growth in developing nations (Dell, Jones, & Olken, 2009; Mendelsohn, Dinar, & Williams, 2006). Many developing countries have agriculture-based economies, and solely depend on this sector as their main source of income. Hence, it is reported that farmers, especially those in developing countries, are more exposed to climate variability (IPCC, 2007; Mokhtar, 2010).

Malaysia, as one of the developing countries, is facing serious problems in its agricultural sector. Between 1960 and 2017, the contribution of the agricultural sector towards Malaysian GDP dropped from 43.7 percent to 8.8 percent (World Bank Group, 2019). This is not reasonable, since the agricultural land of the country increased over the past decades from 9.4 percent of the total land area in 1961 to 26.3 percent in 2015 (World Bank Group, 2019). These contradicting statistics imply serious hidden problems, and it clearly indicates that the agricultural sector of Malaysia has not been productive. One reason is that, in order to achieve its economic goal of the Vision 2020 Plan that aims to promote the nation as a high-income economy, Malaysia has made urban development the top priority rather than developing its agriculture industry. In fact, the urbanization rate is growing so rapidly, that by 2017 more than 75 percent of the population live in urban areas, which means that less than 25 percent of the population live in rural areas (World Bank Group, 2019). The sole focus on economic growth, while ignoring the deterioration of agricultural productivity, may be attributed to the reason that the country has not yet suffered from food shortages or starvation (Lee & Baharuddin, 2018).

However, Malaysia is not self-sufficient in food, and overcomes this problem by importing from abroad. In 2017, the total import for agro-food amounted to RM51.3 billion, and in 2018 it exceeded RM52 billion (Tzin, 2019). This dependence on imported food could be very risky for the country. If there is a sudden drop of supplies in the international food market due to extreme weather events or crop disease, then Malaysia will encounter a food crisis. Therefore, Malaysia, as one of the countries that is most vulnerable to climate change due to its location in a tropical area, should pay extra attention to its agricultural sector. Studies by Zainal et al. (2014) found that climatic variation is directly and indirectly affecting Malaysia's yield by accelerating the growth of fungi and diseases. Moreover, Vaghefi et al. (2011) predicted that if the temperature increases by 2 degrees Celsius, and the carbon dioxide concentration rises from 383 ppm to 574 ppm, the annual economic loss of Malaysia's rice production will reach RM229.145 million. It is estimated that over the next three to four decades, the temperature in Malaysia may increase by 2.6 degrees Celsius (IPCC, 1995).

Therefore, climate change presents a major challenge for Malaysia in sustaining agricultural productivity. This is further compounded by the fact that many small-scale farmers depend mainly on rice production as their main source of income. In Malaysia, the current rice yield is 3–5 metric tons per hectare, although the possible yield is 7.2 tons (Toriman, Lee, Jali, Mokhtar, & Ahmah, 2013). As a result, agricultural productivity is diminishing, which has affected farmers' livelihoods. Downing, Ringius, Hulme, & Waughray (1997) argue that in the current climate change scenario, adaptation policies will play a vital role in helping vulnerable groups, and avoid social disruption, dislocation, and even morbidity and mortality. Therefore, to ensure food security and protect livelihoods, the

agricultural sector should be at the forefront for adaptation priorities given its inherent vulnerability to climate change (Hossain & Paul, 2019). Appropriate adaptation strategies to combat climate change should be promoted to reduce the adverse effects and realize the benefits of adaptation in Malaysia. However, very few efforts have been made to provide empirical evidence to portray farmers' understanding of climate change, their selection of appropriate adaptation methods as well as their identification of barriers that could affect climate change adaptations. Moreover, there is a deficiency of empirical evidence on how farmers choose specific strategies to minimize the adverse effect of climate change on agriculture to protect their livelihoods. Therefore, this study attempts to evaluate what the key determinants are for farmers when choosing adaptation strategies that suit the local climate.

2. LITERATURE REVIEW

The effects of climate change on agriculture and people's livelihoods have been identified as one of the major concerns of scientists and policymakers around the world. As Pearson et al. (2011) stated, the agricultural sector is the most exposed to the effects of climate variability. In addition to the agricultural sector, climate change is a threat to livelihoods and food security of any nation (Thompson & Scoones, 2009). For instance, in sub-Saharan Africa, drought prevents farmers from producing crops and fostering livestock, and producers will need to adjust to changing water management systems to preserve their food security and well-being (Kebede, Hasen, & Negatu, 2010; Songok, Kipkorir, & Mugalavai, 2011). Brown and Funk (2008) argue that food insecurity, such as food availability, access to food, food use and food supply, is increasing due to climate change (Schmidhuber & Tubiello, 2007). Variability of rainfall and temperatures have a harmful effect on food security in Malaysia (Felix & Romuald, 2014; Generoso, 2015; Milan & Ruano, 2014; Solaymani, 2018). Badolo and Kinda Somlanare (2014) and Rademacher-Schulz and Mahama (2012) stated that this seriously affects countries that are more vulnerable to food price shock. This is a threat to people's livelihoods, especially those who directly rely on agriculture, such as merchants (Badolo & Kinda Somlanare, 2014). For instance, Nhemachena (2009) found that climate change also negatively affects households' incomes from agriculture and livestock in Africa. Apart from the agricultural sector, climate variability also negatively affects the labor market in rural areas, which leads to a reduction in households' earnings (Sen, 1982). Climatic variability contributes to a rise in food prices, which leads to child malnutrition in sub-Saharan Africa (Ringler, Zhu, Cai, Koo, & Wang, 2010). It also can decrease the level of agricultural production and growth capacity of the economy by reducing products available for export (Jones & Olken, 2010). There are some countries that depend on weather conditions for agricultural production, and these countries are suffering in terms of food production due to climate variability (Badolo & Kinda Somlanare, 2014).

Therefore, to develop policies to fight climate change, it is essential to have empirical evidence that portrays farmers' understanding of climate change, their selection of adaptation methods, and identification of barriers that could affect the implementation of new processes. Maddison (2007) stated that to be able to develop measures to combat climate change, farmers should first comprehend the issue of climate change. This understanding will increase their ability to implement the necessary strategies to minimize the destructive effects of climate change on farming (Mabe, Sarpong, & Y., 2012). It has been shown that climate change adversely affects Malaysia, and adaptation, therefore, should be a priority. To minimize the possible adverse effects of climate change on the agro-food system, people should be educated on this topic, and economic systems need to adapt to the changing climate (Fadina & Barjolle, 2018).

The progress of adaptation methods should be considered for future socio-economic and climate change scenarios. Farmers need to comprehend the importance of adapting to a future climate for a future society, instead of focusing only on the current situation (Grasso & Feola, 2012). Identifying appropriate coping tactics is a difficult challenge, and policymakers need to realize that climate change adaptation policies cannot offer the same benefits to all neighborhoods and cultural groups. Farmers, especially those in emerging nations like Malaysia, require

adaptation to climate change to reduce the negative impacts and increase the benefits. In Malaysia, changing practices to accommodate climate vulnerability relies heavily on a sense of common responses (Toriman et al., 2013). In the current scenario, adaptation strategies are very important for vulnerable groups, and a gap could lead to deprivation, social disruption, displacement of the population, and increase morbidity and mortality (Downing et al., 1997). However, there are some key determinants that drive farmers to choose specific adaptation strategies, such as gender and age (Belay, Recha, Woldeamanuel, & Morton, 2017; Fadina & Barjolle, 2018), education level (Denkyirah, Okoffo, Adu, & Bosompem, 2017; Kumari, Kumar, & Rao, 2014), farming experience (Fadina & Barjolle, 2018; Sani & Chalchisa, 2016), farmers' income (Belay et al., 2017; Mulatu Debalke, 2011), farm size, and ownership of farms (Belay et al., 2017; Fadina & Barjolle, 2018).

3. CONCEPTUAL FRAMEWORK

Based on the above literature review, this study attempts to draw the following conceptual framework. In order to minimize the adverse effects of climate change on agriculture, a specific adaptation strategy should be chosen from common practices in the agricultural sector. However, to choose appropriate strategies, influences by factors that mentioned in section 2 and these are shown in Figure 1. The proposed framework indicates how socio-demographic factors affect the farmers' specific adaptation strategies.

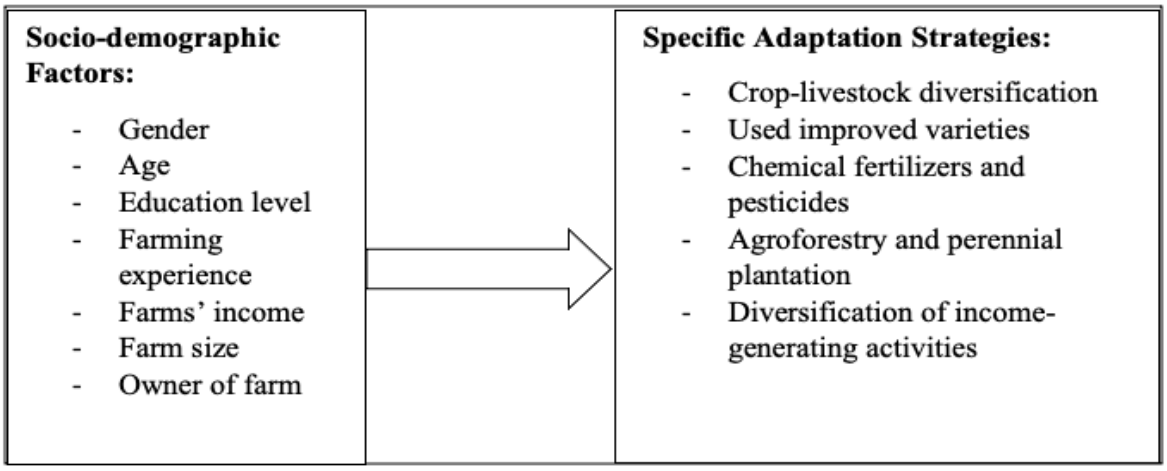

Figure-1. Conceptual Framework of the Study

4. RESEARCH METHODOLOGY

4.1. Population and Sample size

The MADA region of Kedah in Malaysia was considered for conducting this research. This region was chosen because it is called the rice bowl of Malaysia and contributes to 75 percent of Malaysia's rice production. MADA is the location of the Muda irrigation system comprising 27 peasant organizations (called *Pertubuhan Peladang Kawasan* (PPK) in Bahasa) with 55,000 farmers. Since it was quite difficult to cover the entire population in this study due to time and budget constraints, G-Power version 3.1 was used to select an appropriate sample size. With the effect size of 0.15, the G-Power software suggested a sample size of 160 to test the proposed research model with six constructs. However, this study collected data from 397 respondents, which exceeded the minimum recommended sample size.

4.2. Data Collection and Questionnaire Design

Data was collected using a questionnaire that we distributed to the respondents through face to face interaction and explained the main objective of the study. The questionnaire was divided into three sections. The first section

contained questions to capture the socio-economic characteristics of the respondents, the second section contained questions regarding common adaptation practices to address climate change, and the third section contained questions on the visible effects of climate change on agriculture and livelihoods.

4.3. Data Analysis Technique

Statistical package for social sciences (SPSS) was employed for data analysis. To see the socio-demographic backgrounds of the respondents, descriptive statistics were calculated. To identify the key determinants that affect farmers' choices of a specific adaptation technique, the binary logistic model was tested. The binary logit (binary logistic regression) model is suitable for testing "the relationship between a binary-dependent variable and a set of independent variables" (Fosu-Mensah, Vlek, & MacCarthy, 2012; Muzamhindo, Mtabheni, Jiri, Mwakiwa, & Hanyani-Mlambo, 2015). Thus, the dependent variable was dichotomous (two-fold) in the following model:

$$ADB = f(X_1, X_2, \ldots, X_7) \quad (2)$$

ADB refers to the adaptation strategies (1 = adaptation, 0 = no adaptation). To identify the determinants that impact the decisions of farmers to implement a specific strategy, the multinomial logit model was tested. In the following model, the dependent variable was multinomial in some categories:

$$ADBi = f(X_1, X_2, \ldots, X_7) \quad (3)$$

ADBi refers to the polychotomous dependent variable (multiple adaptation methods selected by farmers), and X_1 to X_7 are the independent variables. Following the data collection, the adaptation strategies are commonly practiced by agricultural farmers, the dependent variable (ADBi) is coded as follows: 1 = no adaptation; 2 = crop–livestock diversification; 3 = use of improved varieties of crops, chemical fertilizers and pesticides; 4 = agroforestry and perennial plantation; 5 = diversification of income-generating activities; and 6 = multiple coping strategies. The independent variables are coded: X_1 = gender, X_2 = age, X_3 = education level, X_4 = income level, X_5 = farm size, X_6 = farming experience, and X_7 = ownership of farm.

5. RESULTS

5.1. Socio-Demographic Profile of the Respondents

The statistics showed that respondents were 91 percent male and only 9 percent female. According to the age distribution of the respondents, 82.35 percent of the respondents were between 50 and 65 years of age, while 14.12 percent were between 46 and 50 years of age. It indicated that the majority of rice farmers in the study area are middle-aged. This age group should have considerable experience of the effects of climate change on farming sectors, and this study will help them to take appropriate steps towards adapting to climate change. The level of education results revealed that 91.17 percent of respondents had formal education including primary education at 33.82 percent, lower secondary education at 30.88 percent, higher secondary education at 26.18 percent, and diploma-level education at 0.29 percent, while 8.82 percent had no formal education. The monthly income of respondents showed that 61.76 percent had an income of less than RM2000, 32.94 percent had an income of between RM2001 and RM4000, 4.71 percent had an income of between RM4001 and RM6000, and only 0.6 percent of farmers had a monthly income ranging from RM6001 to RM8000. Regarding farm size, the results showed that 34.41 percent of farmers have a farm size of less than 1 ha, 26.47 have 1–2 ha, and only 4.41 percent have more than 5 ha. The results also showed that 33.82 percent of farmers have more than ten years of experience in farming activities, while only 9.41 percent of farmers have fewer than five years of experience in the farming sector. This study also found that around 30 percent of farmers have their own farm, 34 percent have owner tenant(who own land), and 36.47 percent are tenant farmers, as shown in Table 1.

Table 1. Socio-demographic information of respondents.

Basic Information	Group	Frequency	Percentage
Gender	Male	310	91
	Female	30	9
Age	1 = 25 years or younger	0	0
	2 = 26–30 years	4	1.18
	3 = 31–45 years	8	2.35
	4 = 46–50 years	48	14.12
	5 = 50–65 years	280	82.35
Education Level	No formal education	30	8.82
	Primary	115	33.82
	Lower secondary	105	30.88
	Higher secondary	89	26.18
	Diploma	1	0.29
	Bachelor	0	0
	Postgraduate	0	0
Household income (RM per month)	RM2,000 and under	210	61.76
	RM2,001 – RM4,000	112	32.94
	RM4,001 – RM6,000	16	4.71
	RM6,001 – RM8,000	2	0.6
Farm size	1 = less than 1 ha	117	34.41
	2 = 1 to 2 ha	90	26.47
	3 = 2 to 3 ha	60	17.65
	4 = 3 to 4 ha	33	9.71
	5 = 4 to 5 ha	25	7.35
	6 = above 5 ha	15	4.41
Farming experience	1 = less than 5 years	32	9.41
	2 = 6 years	53	15.59
	3 = 7 years	55	16.18
	4 = 8 years	85	25
	5 = more than 10 years	115	33.82
Ownership of farmland	1 = owner farmer	101	29.71
	2 = owner tenant	115	33.82
	3 = tenant farmer	124	36.47
Total		340	100

5.2. Farmers' Choice of Adaptation Strategies for Climate Change

Adaptation practice is indispensable in tackling the effects of climate change. To discover the adaptation practices used and their significance among farmers, this study listed several common practices in the questionnaire, such as crop–livestock diversification, use of improved varieties of crops chemical fertilizers and pesticides, agroforestry and perennial plantation, and diversification of income-generating activities adopted from Fadina and Barjolle (2018), see Figure 2.

The findings showed that 47 percent of farmers used improved varieties and chemical fertilizers and pesticides, to minimize the negative effects of climate change, 36 percent of respondents adopted an agroforestry and perennial plantation strategy, 28 percent used crop and livestock diversification as an adaptation strategy, and diversification of income generating activities was applied by 15 percent of respondents to secure their agricultural income.

5.3. Key Factors of Farmers' Choices of Adaptation Strategies

To identify the key determinants of farmers' choices of adaptation strategies, the binary logistic regression was used. The model was statistically significant at a level of 5 percent ($p < 0.05$) as presented in Table 2. The model shows that 58.2 percent (Pseudo R^2) of the variance in farmers' choices to adapt to climate change and categorized 58.2 percent of their decisions. The findings revealed from the binary logistic regression model that income level, education level and experience have a positive and significant influence on farmers' choices. The findings also

revealed that only the well-educated, wealthy and most experienced farmers are capable of adjusting their methods to climate change (see Table 2).

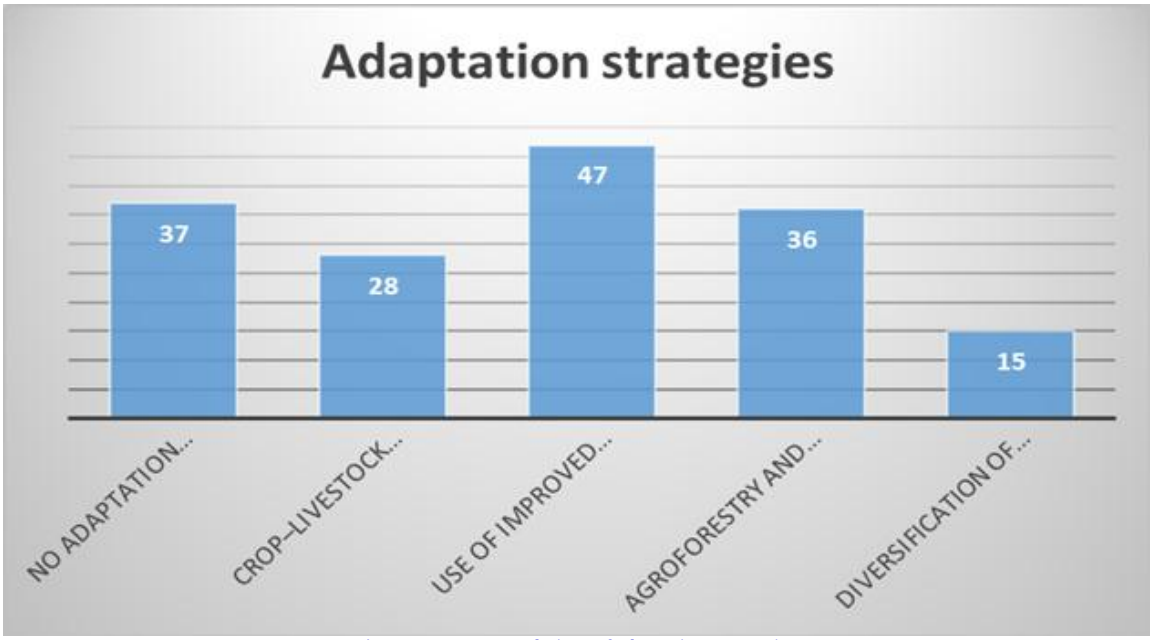

Figure 2. Farmers' choices of adaptation strategies.

Table 2. Factors affecting choice of specific adaptation strategies.

Variables	Odds Ratio	Std. Err.
Age	0.432	0.621
Gender	1.009	0.042
Education	8.362***	8.052
Level of income	4.342**	0.25
Farm size	3.240***	2.102
Farming experience	1.553***	2.502
Owner of farm	2.321***	3.512
Constant	0.002	0.003
Number of respondents = 397 Prob > Chi² = 0.0000 Log likelihood = 15.7674103 Pseudo R² = 58.2 % of correct prediction = 0.76%		

Note: **, *** = Significant at 5% and 1% level respectively.

The multinomial logistic regression was used to identify the factors that influence farmers' decisions to use a particular climate change adaptation method, and revealed that level of education, level of income and agricultural experience influences the application of diverse methods of adaptation (see Table 3). Level of education positively and significantly impacts choosing appropriate adaptation strategies. It can be said that educated farmers can acquire more information and make decisions based on their preferences and level of understanding. The results also revealed that income level significantly and positively influenced the decision to use different adaptation methods. This is because a higher income indicates that the respondents have more financial security and can afford to implement various adaptation strategies. The results also showed that agricultural experience has a positive and significant effect on the choice of all adaptation strategies, with the exception of diversification of income-generating activities. The size of farms also has a significant and positive effect on strategy choice. The farmers who own the biggest farms chose a combination of adaptation strategies such as: agroforestry and plantations, diversification of crops and livestock, improved varieties, etc. The results imply that all strategies have a significant influence on adaptation except crop diversification and multiple coping strategies. Due to the ownership of farms farmers can choose different strategies without any obstacles.

6. DISCUSSION

The main objectives of this paper could be divided into two parts; first, investigate the impact of climate change on agriculture and livelihoods of smallholder farmers in Malaysia, and second, identify which determinants influence farmers' choices of specific adaptation strategies to minimize the adverse effects of climate change. The study found that crop yields are decreasing due to adverse effects of climate change. This result is consistent with the study by Toriman et al. (2013), who found that rice yield in Malaysia varies from 3 to 5 metric tons per hectare, although the possible yield is 7.2 tons. Alam, Siwar, Murad, Molla, and Toriman (2010) also indicated that rice production has decreased in Malaysia over the years due to a shortage of cultivated areas, negligible productivity gains, a continued increase in production costs, and a decline in productivity due to climate variability. This is a threat to Malaysia's level of self-sufficiency for rice cultivation (Masud, Rahman, Al-Amin, Kari, & Leal Filho, 2014). Climate change also affects the livelihoods of human beings, particularly farmers' livelihoods, which are more vulnerable due to the effects that climate change has on agriculture. The study found that climate change affected livestock, land degradation, increased food costs and increased rural–urban migration. This negative effect of climate change on ecosystems, agricultural production and livelihoods could be a challenge for Malaysia to overcome in order to achieve sustainable agricultural development.

Kumari et al. (2014) stated that climate change has adverse effects on the health of both humans and animals. To minimize pests and agricultural diseases, some farmers adopt more sustainable agricultural practices, such as natural farming. The long-standing impacts of agriculture are soil degradation, water pollution, shortage of fresh water and loss of biodiversity. In particular, the agricultural sector is naturally sensitive to climate change, which will pose many challenges in the future. Malaysia needs to provide communal funding for adaptation, as this is commonly missing in ASEAN (Association of Southeast Asian Nations) countries. An important approach is to generate communal funding for adaptation by involving small-scale farmers in the adaptation development procedure. It has been reported by Fadina and Barjolle (2018), Gebreeyesus (2017) and Assoumana, Ndiaye, Puje, Diourte, and Graiser (2016) that farmers adopt several common coping strategies, such as use of improved varieties and chemical fertilizers and pesticides, agroforestry and perennial planting, crop-livestock diversification and diversification of generating incomes, while Malaysian farmers are no exception. Most rice farmers use adaptation strategies of this type, as shown in Figure 2.

Table 3. Farmers' decisions to apply climate change adaptation strategies.

Explanatory Variables	Crop–livestock diversification and other good practices (mixed cropping, crop rotation, organic fertilizer)		Use of improved varieties, chemical fertilizers and pesticides		Agroforestry and perennial plantation (palm oil, rubber, and tree species)		Diversification of income-generating activities		Multiple Coping Strategies	
	β (coef)	Sig(p-value)	β (coef)	Sig (p-value)	β (coef)	Sig (p-value)	β (coef)	Sig (p-value)	β (coef)	Sig (p-value)
Age	1.367	0.328	15.074	0.986	0.451	0.415	-0.293	0.641	-11.710	0.992
Gender	13.832	0.987	0.882	0.889	15.450	0.983	13.104	0.998	15.868	0.991
Education	3.008	0.016*	1.357	0.003*	0.582	0.005*	1.910	0.071*	0.751	0.061*
Level of income	0.771	0.006*	1.771	0.084**	-16.800	0.993	-0.230	0.795	-16.575	0.999
Farm size	1.408	0.998	1.408	0.998	-15.743	0.997	0.113	0.082**	2.353	0.102**
Farming experience	1.734	0.012**	1.508	0.046*	1.179	0.099**	-0.161	0.804	2.657	0.092**
Owner of farm	0.552	0.601	0.2697	0.001*	1.815	0.018*	1.793	0.017*	11.693	0.998
Constant	14.663	0.998	1.045	0.998	31.302	0.993	13.587	0.998	8.473	0.998
Base category	No adaptation									
Number of respondents	397									
LR Chi²	325.081									
Log likelihood	-797.658									
Prob > Chi²	0									

Note: * = 5% significant level and **=10% significant level.

Agricultural experience can help to identify and implement adaptation strategies. This result is consistent with findings by (Chalchisa, 2016; Fadina & Barjolle, 2018). This is consistent with findings by Belay et al. (2017) and Mulatu Debalke (2011), who found that income has a positive relationship with soil conservations, changes in planting date and use of crop diversification. The size and owner of the farm determine the policies to implement to deal with climate change. This result is similar to that of Belay et al. (2017); Fadina and Barjolle (2018); Bryan, Deressa, Gbetibouo, and Ringler (2009) and Maddison (2007), who argued that land scarcity is an obstacle to adapting to climate change, which implies that farmers with large farms are more likely to adapt.

7. RECOMMENDATION AND CONCLUSIONS

The study revealed that due to climate change, crop and livestock pests and diseases, land degradation and food costs have increased, and rice production has declined. Adaptation practices are essential to minimize the negative effects of climate change. It is essential to develop farmers' awareness and knowledge to enable them to implement suitable strategies to reduce the effects of climate change. If we use examples from other countries, such as Indonesia, one suggestion is to establish a school that focuses on adaptation to climate change, demonstrates relevant methods of cultivating climate-resilient crop varieties, and develops a knowledge-sharing team to help farmers support each other. As adaptation is area-specific, and local facilities need to be built, it is important that these funding opportunities are made available to local community groups and civil society organizations. Policy makers should ensure that all the necessary information is available to farmers and an evaluation management team should be available to help farmers to choose the best strategies to move forward. In order to develop a corrective policy framework in the agricultural sector and to influence adaptation options, the government and policy makers should bring in initiatives to train farmers to adopt appropriate adaptation strategies.

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