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## Paddy Farmers Perceived the Socio-Economic Impacts of Climate Change: A Case Study in Pasir Mas, Kelantan

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# Paddy Farmers Perceived the Socio-Economic Impacts of Climate Change: A Case Study in Pasir Mas, Kelantan

Muhamad Azahar Abas<sup>1\*</sup>, Asya Sabreena Mohd Fuad<sup>1</sup>, Amal Najihah Md Nor<sup>1</sup>,  
Mohamad Faiz Mohd Amin<sup>1</sup>, Nor Hizami Hassin<sup>1</sup>, Abdul Hafidz Yusoff<sup>2</sup>,  
Norrimi Rosaida Awang<sup>1</sup> and Seow Ta Wee<sup>3</sup>

<sup>1</sup> Faculty of Earth Science, Universiti Malaysia Kelantan, 17600 Jeli, Malaysia

<sup>2</sup> Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan, 17600 Jeli, Malaysia

<sup>3</sup> Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Malaysia

E-mail: azahar.a@umk.edu.my

**Abstract.** Agricultural activity is very crucial in the rural area because it provides households with food and revenue besides contributing approximately 7.3% to the national gross domestic product (GDP) in Malaysia. Agriculture is the third driver of Malaysia's economic growth. However, the phenomena of uncertain climate nowadays have caused agricultural activity such as paddy farming to be severely affected as the climate is the primary determinant of agricultural productivity. This study was conducted to identify the level of knowledge and awareness of the paddy farmers about climate change and its impact on the socio-economy in Pasir Mas, Kelantan. Besides that, the critical factors that influenced the awareness of the paddy farmers on the climate change impact also examined. A questionnaire was utilised as the primary research instrument, and the total number of respondents was 119. Descriptive and inferential analysis was adopted to analyse the primary data that was collected. The result shows that approximately 90% of the respondents have the knowledge and are aware of climate change and its impact on paddy plantation and production. This study also revealed that farming experience is the factor that influences the awareness of the paddy farmers about climate change. Besides that, the findings indicate that adaptation and mitigation measures are needed to avoid the future impact of climate change. Accordingly, the government as the policymaker and the local authority has the most crucial role in ensuring climate adaptation and mitigation at all levels of community.

## 1. Introduction

Agriculture plays a crucial role in the food and fibre supply process for humans. It has also become a significant economic, social and cultural activity besides contributing to a broad range of ecosystem services. At its early stage in Malaysia, the agriculture sector can be categorised into smallholders plantation [1]. Later, it has been classified into food and industrial products. The food sectors include paddy, fruits, vegetables, fish and meats.

The industrial commodities include rubber, cocoa and palm oil. After the post-independence, in the first few decades, it is observed that agriculture contributes to the Malaysian economic growth because of high agricultural export revenues such as rubber and palm oil [2]. In the early 90s, the government



of Malaysia decided to start investing heavily in the industrial sectors such as electricity, electronics and automobiles because they believed that these sectors could generate more revenues and have a greater impact on Malaysia's economic growth [3].

These sectors, however, had faced severe declines during the 1997 global economic and financial crisis, and the agriculture sector acted as the saviour of the Malaysian economy as it contributed to a GDP growth from RM17.1 billion in 1995 to RM18.2 billion in 2000 (8<sup>th</sup> Malaysia Plan). After the manufacturing and service sectors, agriculture is now known as the third driver of the economic growth [4].

## 2. Methodology

### 2.1 Study area

This study was conducted in Pasir Mas, Kelantan. Pasir Mas is one of the 10 territories in the great state of Kelantan, located in the north, bordering Tumpat territory, with Tanah Merah to the south, Sungai Kelantan and Kota Bharu territory to the east, and Sungai Golok, Thailand to the west.

### 2.2 Research sampling

For sampling, a technique called quota sampling was used for this study. It is a non-probability sampling technique in which the assembled sample has the same proportions of individuals with respect to known characteristics, traits or focused phenomenon as the entire population [5]. In this study, 150 respondents were chosen from three *Pertubuhan Peladang Kawasan (PPK)* as the sample size. The three PPK are Kubang Sepat, Kubang Bunut and Alor Mas [6].

### 2.3 Research instrument

A questionnaire survey was used as the main research instrument in this study. The questions were divided into three parts, Section A, Section B and Section C. Section A comprised closed-ended questions that focused on demographic information of the paddy farmers including gender, age, education, income and etc., and it had multiple-choice answers. In Section B, the questions focused on the knowledge and awareness of the paddy farmers about climate change and its associated impacts. The questions can be answered by a simple 'yes' or 'no' as well as through multiple-choice answers. In Section C, the questions were focused on the preparation that was done by the paddy farmers in order to deal with climate change. In this section, the Likert Scale was used with 5 options that ranged from Strongly Disagree (1) to Strongly Agree (5), so that a holistic view of the paddy farmer's opinion could be obtained. The Likert Scale also included a mid-point (3) for those who were neutral on the subject matter. For this section, the Cronbach's alpha reliability coefficient is 0.814. The closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the items in the scale, where the coefficient normally ranges between 0 and 1 [7].

### 2.4 Data analysis

In the descriptive analysis percentage was used to measure knowledge, awareness and the level of preparedness of the paddy farmers towards climate change. Besides that, inferential analysis was used to determine the factors that influence the paddy farmers' knowledge and awareness of climate change. Chi-Square Test was used to test whether there is a relationship between two variables, i.e. dependent and independent variables.

The dependent variable would be the awareness of the paddy farmers about climate change, while the independent variables were the critical factors. The test begins by considering two hypotheses which are null hypothesis ( $H_0$ ) and alternative hypothesis ( $H_a$ ). Both hypotheses contain opposing viewpoints. According to Seow et al. [8], a null hypothesis is a hypothesis which shows no statistical significance between two variables in the experiment, while an alternative hypothesis is simply the inverse, the opposite of a null hypothesis. When the null hypothesis is rejected, it shows that there is relationship between the two variables.

$H_0$ : there is no significant relationship between the awareness and critical factors.

### 3. Result and discussion

#### 3.1 Respondent Profile

The sample size of this study consists of 97% males and 3% females, as shown in Table 1. The findings revealed that most of the paddy farmers (57.2%) were 50 years and above in age. This shows that most of them are aged farmers. Only 10.1% of them were of the younger generations who were interested in the agriculture sector. A total of 83.2% of the paddy farmers had a farm area of less than 10 acres, 15.1% of the paddy farmers' farm area was in the range between 10 and 49 acres, and 1.7% of them had an area of more than 50 acres.

**Table 1.** Respondent's profile (N=119)

Socio-Demographic	Group	Frequency/ (%)
<b>Gender</b>	Male	115 (96%)
	Female	4 (4%)
<b>Age</b>	< 20 years	3 (2%)
	20 – 29 years	12 (10%)
	30 – 39 years	13 (11%)
	40 – 49 years	23 (19%)
	50 – 59 years	34 (29%)
	> 60 years	34 (29%)
<b>Paddy field area</b>	< 10 acres	99 (83%)
	10 – 19 acres	7 (6%)
	20 – 29 acres	10 (8%)
	40 – 49 acres	1 (1%)
	> 50 acres	2 (2%)
<b>Education</b>	Primary school	26 (22%)
	Secondary school	72 (60%)
	Certificate/SPM/ST	17 (14%)
	PM	2 (2%)
	Diploma	1 (1%)
	Degree/Master/PHD	1 (1%)
	Others	
<b>Income of household (RM/month)</b>	< RM600	27 (23%)
	RM601 – RM1000	38 (31%)
	RM1001 – RM2000	29 (24%)
	RM2001 – RM3000	14 (12%)
	RM3001 – RM4000	8 (7%)
	> RM4001	3 (3%)
<b>Paddy farming experience</b>	< 5 years	21 (18%)
	6 – 10 years	34 (29%)
	11 – 15 years	22 (19%)
	> 16 years	42 (34%)

A majority of the paddy farmers have secondary education (60.5%), while 21.8% of the paddy farmers have primary education and only 2.5 of them have higher education. The result also shows that a majority of the paddy farmers' income level is in the range between RM601 and RM1000 (31.9%). As for farming experience, 35.3% of the paddy farmers have been involved in the

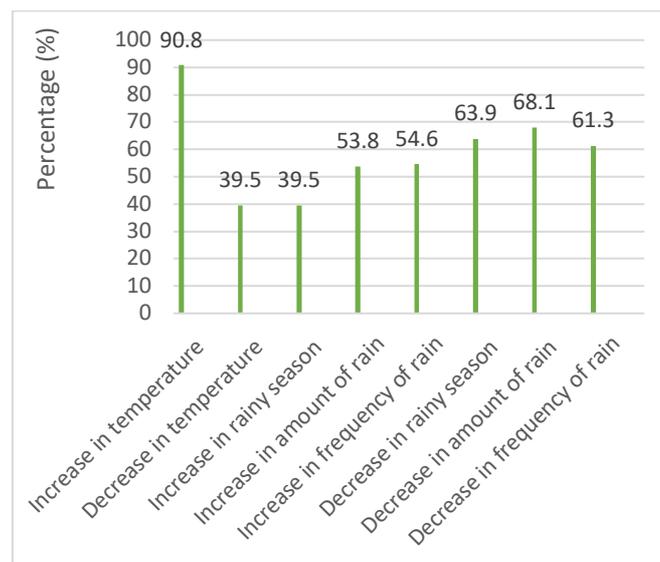
agricultural sector for more than 16 years and only 17.6% of them have experiences of less than five years.

### 3.2 Paddy farmer's knowledge on climate change

Most of the farmers in Pasir Mas, Kelantan know about climate change and 96.6% of them believe that climate change really exists. Even though they did not have higher level education but their experience as farmers might have help them in knowing about the issue since many of them have been involved in the agricultural sector for more than 16 years.

Figure 1 shows that almost 91% of the total of paddy farmers who are interviewed agree that there is an increase in temperature, and only 9% of them disagreed. When they were asked about the decrease in temperature, only 39.5% of them agreed with the statement and the rest did not agreed. From this, it shows that the paddy farmers only cognised the rise in temperature as the effect of climate change, and not both the rise and decrease in temperature.

As for the rainy season, only 39.5% agreed that there had been an increased since most of the paddy farmers had noticed the rise in temperature. For them, a rise in temperature is equal to the decrease in the rainy season, hence the 63.9%, was more than half of the total respondents. For the increase and decrease in the amount and frequency of rain, the number of paddy farmers who agreed to both were quite balanced. More than half agreed with the statement; the level of knowledge of the paddy farmers about climate change was moderate.



**Figure 1.** Paddy farmer's knowledge on climate change

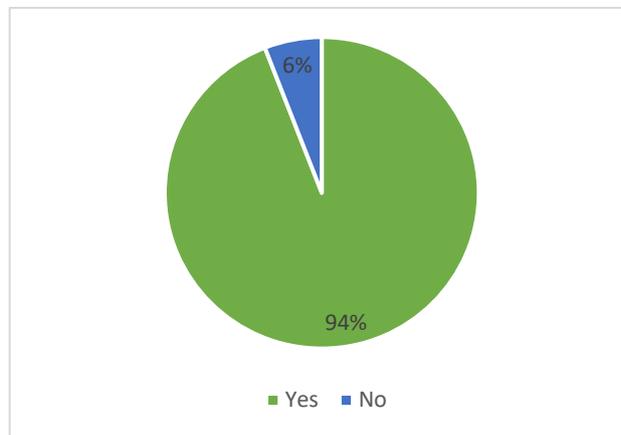
### 3.3 Paddy farmers perceived the impact of climate change on paddy plantation

Figure 2 shows that the majority of the total of paddy farmers who are interviewed in Pasir Mas, Kelantan are aware of the issue of climate change that will affect the paddy production.

Table 2 shows the changes that are felt by the paddy farmers in 30 years. 58% of the paddy farmers agree that climate change has changed the time and distribution of rainfall while 34.5% of them do not feel that way. For the sudden changes in the harvest season, a total of 73.1% of them agree with that statement and the rest seems to disagree. 60.5% of the paddy farmers agree that the reduction of crop yield is one of the changes due to climate change, while 31.9% of them disagree with that.

Most of the paddy farmers (64.7%) seems to agree that climate change has increased the frequency of drought and only 27.7% of them do not agree with the statement. Contrary to the increased of the drought's frequency, only 31.9% agree that climate change increases the frequency of floods since most of them seems to disagree. Concerning the damage of harvest as the change due to climate

change, 65.5% of the paddy farmers agree with the statement, and only 26.9% disagree with it. 52.9% of paddy farmers do agree that climate change has increased the rate of pesticide irritation, while the rest of them disagree.



**Figure 2.** Paddy farmer aware on the impact of climate change on paddy plantation

For prevalence of plant disease, climate change has indeed increased them and 57.1% of paddy farmers agree with that. Only 35.3% of the paddy farmers seem to disagree. 45.4% of the paddy farmers agree that climate change has caused soil erosion, while 47.1% of them disagree. A total of 61.3% of the paddy farmers agree that climate change has increased the cost of crop management, while the rest disagree. 48.7% of the paddy farmers agree that climate change has damaged the junction at the ranches, while 43.7% disagree. Last but not least, a total of 56.3% of the paddy farmers agree that climate change has caused water pollution in ranches while only 36.1% of them disagree.

**Table 2.** The impact of climate change in the past 30 years

Impact of Climate Change	Yes	No
Change the time and distribution of rainfall	69 (58.0%)	41 (34.5%)
Sudden changes in harvest season	87 (73.1%)	23 (19.3%)
Reduction of crop yield	72 (60.5%)	38 (31.9%)
Increased frequency of drought	77 (64.7%)	33 (27.7%)
Increased frequency of floods in ranches/fields	38 (31.9%)	72 (60.5%)
Damage of harvest	78 (65.5%)	32 (26.9%)
Increased the rate of pesticide irritation	63 (52.9%)	47 (39.5%)
Increased the prevalence of plant disease	68 (57.1%)	42 (35.3%)
Soil erosion in ranches/fields	54 (45.4%)	56 (47.1%)
Increased cost of crop management	73 (61.3%)	37 (31.1%)
Damage of junction at the ranches/fields	58	52

	(48.7%)	(43.7%)
Water pollution in ranches/fields	67 (56.3%)	43 (36.1%)

The most obvious changes that are felt by the paddy farmers in 30 years are the sudden changes in the harvest season where 73.1% of them agree on this. In Peninsular Malaysia, most farmers plant and harvest rice more or less in the same period, where for the main season, the planting is between September and October, and harvesting is from December until March, while for the second season, planting is between March and April, and harvesting is from June to August [9]. However, the changing climate nowadays has already altered the length and quality of the growing season as well as the harvesting season since the weather has become unpredictable- it had worsen to the point where it could affect the crops.

Next, the damage of harvest where 65.5% of the paddy farmers agree with this statement. Climatic factors such as temperature, rainfall, atmospheric CO<sub>2</sub> and solar radiation play an important role in the production of rice [10]. A temperature above the threshold decreases the crop duration of rice and it also results in an increased in spikelet sterility [11], reduced grain filling duration [12], increased respiratory rate [13] and lowered the quality of rice grain [14]. Changes in temperature, atmospheric carbon dioxide (CO<sub>2</sub>), and the frequency and intensity of extreme weather could have significant impacts on crop yields [15] as agreed by the paddy farmers.

Almost 65% of the paddy farmers agreed that climate change had increased the frequency of drought. According to the Center for Climate and Energy Solutions [16], the effect of drought can be exacerbated by warmer temperature, where the increased temperatures increased soil evaporation, making periodic droughts worse than in cooler conditions. Almost 91% of the paddy farmers said that there had been an increased in temperature, and for them that will eventually lead to drought.

### 3.4 Critical factors influence paddy farmers perceived

To determine the factor that influencing the paddy farmers' awareness of climate change, chi-square test of independence is conducted to see whether there is a relationship between two categorical variables. Table 3 shows farm experience is the only critical factor that influence the paddy farmers perceived the impact of climate change.

There is no significant relationship between the age of the paddy farmers and awareness of climate change,  $\chi^2 (5, N = 119) = 6.995, p > 0.05$ . Hence, age does not influence the awareness towards climate change even though the percentage of age shows a high number. This might be due to the lack of experience in the agricultural sector. Most of them are aged farmers. However, some of them have started to be involved in this sector quite late, hence they are lacking in experience and thus are not very well aware of climate change.

There is no significant relationship between the income of the paddy farmers and awareness of climate change,  $\chi^2 (5, N = 119) = 8.137, p > 0.05$ . Hence, income does not influence the awareness of climate change. A higher income means a better access to climate information [17] as they can afford to obtain accurate and relevant climate information, which will enhance their awareness of climate change [18].

There is no significant relationship between the education of the paddy farmers and awareness of climate change,  $\chi^2 (5, N = 119) = 2.829, p > 0.05$ . Hence, education does not influence the awareness of climate change. A majority of the paddy farmers have only a secondary education and they are not able to develop a better understanding about climate change. In creating awareness, education plays an important role because educated people are better equipped to source information [19]. Moreover, there is no significant relationship between the farm size of the paddy farmers and awareness of climate change,  $\chi^2 (4, N = 119) = 1.510, p > 0.05$ . Hence, farm size does not influence the awareness towards climate change.

There is a significant relationship between farming experience of the paddy farmers and awareness of climate change,  $\chi^2 (3, N = 119) = 9.284, p < 0.05$ . Paddy farmers with more than 10 years of

experiences are more likely to be aware of the climate change than those with less than 10 years, based on the percentage of farming experience. Hence, farming experience does influence the awareness of climate change since the farmers are supposed to have a high level of local climate awareness due to their long-term farming experiences. A regression test in the study by Ado et al. [17] reveals that an increase in farming experience by one year increases the likelihood of awareness by one unit. This means that the higher the farming experience, the better the chance are that the paddy farmer will be aware of climate change. The interpretation of the results is based on the coefficients of the regression and ratios of probabilities. A positive sign indicates that the higher value of the variables increases the awareness likelihood, while a negative sign indicates a decrease in awareness probability.

**Table 3.** The factors influence paddy farmer perceived

Socio-demographic	P-value	Significant
Age	0.221	Non- Significant
Income	0.149	Non- Significant
Education	0.726	Non- Significant
Farm size	0.825	Non- Significant
Farming experience	0.026*	Significant

\*significant at p-value <0.05

#### 4. Conclusion

The results of the study show that most of the farmers perceive about the issue of climate change and are aware of what is happening around them as well as the changes that are brought by climate change that will affect their paddy plant. This study has also revealed that farming experience is the most significant factor in influencing the awareness of paddy farmers towards climate change while farm size is the factor that influences the preparation that is done by the paddy farmers in order to deal with climate change. Farming experience indicates that the farmers have more knowledge about farming and its environment. The more experiences they have, the more likely they are to be aware of climate change. However, this study is only limited to Pasir Mas, Kelantan Paddy Farmer. Further study need to be conducted at other paddy area like Kedah.

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