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CLIMATE RISK PERCEPTIONS AMONG THAI FARMERS: CASE OF RICE AND DURIAN FARMERS

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Abstract: Climate risks, such as floods and droughts, pose a threat to farmers as their livelihood relies on their crop yields. The purpose of this research is to evaluate cash crop and high-value crop farmers' risk perception towards climate risks, as well as their ability to cope and deal with these risks in Ayutthaya and Chanthaburi Province, Thailand. This study hypothesized that different crop types, farming regions, and socio-economic factors, may play a role in differing risk perceptions in the two groups of farmers. A sample of 100 farmers were chosen from each province via a cluster and purposive sampling technique. Quantitative analysis was used to collect primary data using questionnaires for each group. The findings showed age of durian farmers being younger, with 35% under the age of 30 and 65% of rice farmers 50 or older. Education levels varied greatly as 83% of rice farmers' highest education completed secondary school, while 38% of durian farmers obtained a bachelor's degree or higher. Over 50% of each group's annual household income was under 100,000 baht (~3,000 USD), with 10% more durian farmers making over 400,000 baht (~11,000 USD). Data showed that both groups perceive floods and droughts as major risks. According to the survey results, high knowledge and dread level of climate risks were indicated. Regression analysis results determined age and education statistically significant as factors determining risk perception. This study can provide policymakers, agricultural organizations, and future researchers to be able to implement the most effective strategies to protect the farmer, such as infrastructure grants, crop insurance protection plans, and disaster response education.

Keywords: Agriculture, Climate Risks, Risk Perception, Floods, Droughts, Rice Farmers, Durian Farmers

Introduction

For many years, agriculture has been an integral part of Thailand's growth in both economic and societal development, as well as being one of the main sources of occupations for its people. With a population of over 65 million people, agriculture is the largest source of employment to Thai population, even with employment declining- from 64 % in 1990 to 48.8 % in 2000 and then even further to 39.9 % currently. (National Statistics Office, Thailand [TNSO], 2018). The agricultural sector is innately risky as farmers must deal with risks on an everyday basis, which can hold a much greater negative impact on their livelihood, compared to other business and industrial sectors. Thailand relies heavily on their agricultural production which contributes to 10.5% of Thai GDP (TNSO, 2020). Thailand relies heavily on their agricultural production which contributes to 10.5% of

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Thai GDP (TNSO, 2020). With five important crops, in terms of cultivated area and value of production –rice, rubber, sugarcane, cassava, and soybean, field crops altogether constitute more than 60 % of the agricultural GDP (OAE, 2015). Even with such a large contribution to the Thai GDP, income for Thai farmers not only fluctuates greatly, but is comparatively low from other occupations. With the Thai government's goal of an average yearly income of 60,000 baht by the year 2021, the average yearly farmer income in 2017 was under the goal at 57,032 baht per household (Bangkok Post, 2018).

To determine the response to certain risks, it is important to understand the way that is it is perceived by the individual. Furthermore, the factors in which create the perception of the risk can give a better understanding of the actions that take place after a risk occurs on. Although the same groups of people can face the same sources of risk, individual perceptions of risk, differs from one person to another (Slovic, Fischhoff, & Lichtenstein, 1982). The same risk source can be viewed differently due to many factors such as geographic location, farm size, farmer characteristics, etc. Awareness that farmers from various countries live within different climatic and institutional conditions, thus the differences of risk perception can be a result of a mixture of different risk factors or mentality and awareness. (Aditto, 2011)

Risk perception does not always stem from direct scientific evidence or statistical data. Other factors such as emotions and cognition have an impact on the formation of perceptions for certain risks. (Slovic, 1987) Judgements on levels of perceived risk and whether a certain hazard is indeed risky are subjective opinions that can affect the way that farmers conduct their farm business.

Understanding risk perceptions can give policy makers the information that can lead to proper mitigation measures. Also, understanding how the agricultural risks are perceived at the farm level will benefit policy makers who develop the appropriate strategies that can help farmers overcome the risks their occupation entails (Aditto, 2011, Asravor, 2018).

Risks are inevitable in the daily lives of humans and the concept of risk can hold a different meaning for different groups and individuals. Those who are rely on agriculture for their livelihood are faced with risks on an everyday basis. (Knight, 1921) defined risk as "the case where the distribution of outcomes is known either a priori or statistically through experience, and uncertainty as the case where probabilities cannot be quantified". (Harwood, 1999) generally describes risk as "uncertainty that affects an individual's welfare and is often associated with adversity and loss." Agriculture is increasingly confronted with risk and uncertainty stemming from a variety of sources which can be categorized into production, market and financial risks (Hardaker, 2000). In this study, risk perception on farmers is focused on climate risks, which fall under the production category. Floods and droughts are two climate risks that may affect farmers both in the present and future as climate change phenomena become more prevalent across the world. Past research on farmer risk perception in Thailand has showed that, in addition to climate-change risks Thai farmers perceive marketing and production risks as the most important sources of risk. The studies explored factors that influence perception in order to gain further insight into risk perception. Common variables seen to influence Thai famers risk perception are gender, education, and the location of the farm (Aditto, 2011, Chitmanat et al., 2016).

A way to better understand risk perception is to create classifications for hazards to gain further knowledge on the responses to certain risks. This could help explain people's aversion to some hazards, indifference to others, and any differences in these and expert opinions (Slovic & Weber, 2002). The most common approach to this goal has been the psychometric paradigm (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978) (Slovic, Fischhoff, & Lichtenstein, 1984). The framework for this psychometric way of determining risk perception is known as the psychometric paradigm.

Risk itself must be judged on certain qualitative characteristics that will show the perceived severity of various risks. Through the psychometric paradigm research, people are asked to give their subjective judgments based on the characteristics that have been assigned to determine the risk perception. Certain characteristics contribute to two factors which form the risk dimension, dread, and familiarity. A risk dimension can be defined as a "set of parameters that together describe a notion of risk" (Gabriel & Nyshadham, 2008). Dread risk has shown to be the most important in heightening perceived risk. The higher the perceived dread, the greater the perceived risk.

Risk perception research on Thailand agriculture is limited and there is a need to further understand the how risks are understood by farmers. A better understanding of agricultural risks will aid policy makers in creating regulations and solutions that can help farmers deal with the risks they face and make them more financially independent. The objectives of this study are as follows: to understand the determinants of Thai farmers' perception of climate risks, to identify differences in perceptions of climate risks between Thai rice and durian farmers, and to compare factors influencing climate risk perceptions between Thai rice and durian farmers.

Material and Method

The study area selected for this research is located in two Thai provinces, Ayutthaya and Chanthaburi. Firstly, the central region of Thailand is a very well-known area for rice cultivation. From the total area of 1,597,900 rai, the agricultural area was 1,126,459 rai in 2006. Rice is the major crop, covering an area of 1,074,861 rai (Sarapirome & Charungthanakij, 2012). Chanthaburi is one of the largest production areas of durian in Thailand. According to the Center of Agricultural Information and the Office of Agricultural Economy, Chanthaburi led Thailand in durian plantation area with 192,591 rai and 242,686 tons produced in 2014 (Cheychom, Sindhuphak, & Ratanaolarn, 2019)

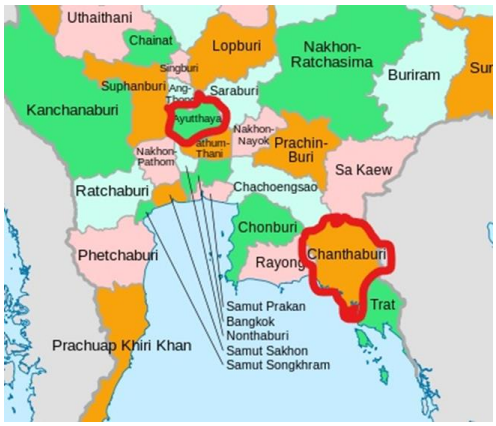

Figure 1: **Chanthaburi and Ayutthaya Map of Thailand**

For both rice and durian, the study area was split into two different provinces. Within these provinces are districts which people live. These districts are the naturally occurring groups or clusters. The cluster sampling technique was chosen. In Ayutthaya, there are a total of 16 clusters and for Chanthaburi there are a total of 10 clusters. Using non-probability sampling, purposive sampling was implemented in order to narrow down the sample size. It was determined to take the top 2 districts within each province with the greatest number of households, as representative clusters. In order to determine the most efficient sample size to

represent the two clusters, the formula by Krejie and Morgan was used (Krejcie & Morgan, 1970). The results using the formula $s = X^2NP (1-P)/ d2(N-1) + X^2P(1-P)$ determined there would be 72 samples Ayutthaya Province, more specifically the districts of Tam Mai and Khao Khitchakut. There will also be 72 samples needed from the province of Chanthaburi, with the specific research districts being Bang Sai and Sena. In case of invalid results, 120 farmers were chosen from each district, with the final number of farmers conducted in this study being 100 from each province.

A pilot study was conducted prior to receiving completed questionaries that was used for the study. This was to ensure that the questions were being answered accurately and checked for reliability within the questions. A sample of 32 surveys was taken and Cronbach Alpha was used to check for reliability. The Cronbach Alpha was calculated using SPSS with the results showing .744 indicating an adequate level of reliability.

The questionnaire used in the data collection had two sections. The first section of the questionnaire collected general farm and household information. This was conducted to gather socio-economic and demographic data for basic information about the farmers. The contents of this survey highlighted the farmer's past and present characteristics, as well as the current farm operation characteristics. Depending on certain farm and farmer characteristics, the perception of certain risks may differ from one farmer to the other.

Secondly, a questionnaire survey was distributed to farmers to measure their judgments on climate risks, particularly floods and droughts. The farmers were asked to rate their perception of risk a Likert Scale ranging from 1-5 (1 – Not at all, 2 – A little 3 – Indifferent, 4 – Much, 5 – Very Much). Each data set consisted of two questions to measure dread level and two questions to measure familiarity of the specific risk.

The dependent variables used in this study were statements to measure the risk perception of the farmer. The following were the dependent variables, "As a farmer, I worry about floods and/or droughts", "After a flood and/or drought occurs, my farm is severely damaged", "I have knowledge about how floods and/or droughts an affect my farm", and "The risk of floods and/or droughts are new to me and my farm". The independent variables measured in this study were the age of farmers, the annual household income, and the highest level of education completed.

Results and Discussion

For this study, general farm information was taken to determine any differences between the two groups. There was a significant difference in the age groups. Overall, the data in figure 2 shows that the rice farming group was generally older, with 64% of respondents between the ages of 51-65. The durian group had more youth, with 23% of the farmers less than 30 years old compared to just 9% from the rice group.

Figure 3 shows the highest educational level completed by the farmer. The categories were primary school, secondary school, vocational school, bachelor's degree, and postgraduate degree. There were some significant differences between the two groups. Out of the 100 respondents in the rice group, 83% had completed either primary or secondary school and then entered farming. 10 respondents received a bachelor's degree, compared to the durian group which had 34 respondents completing their undergrad and 4 respondents receiving post graduate degrees.

The annual household income was measured shown in Figure 4. The income was based on earnings from all the members living in the household. The data shows that 84% of the rice farming group had an annual household income of 250,000 baht (~7,160 USD), with 45% of those respondents in the less than 100,000-baht (~2865 USD) range, compared to the durian respondents which made up 10%. The durian farmers overall had a higher yearly earning with 51% of respondents generating over 400,000 baht (~11,450 USD), compared to just 6% of the rice farmers who were in the same category.

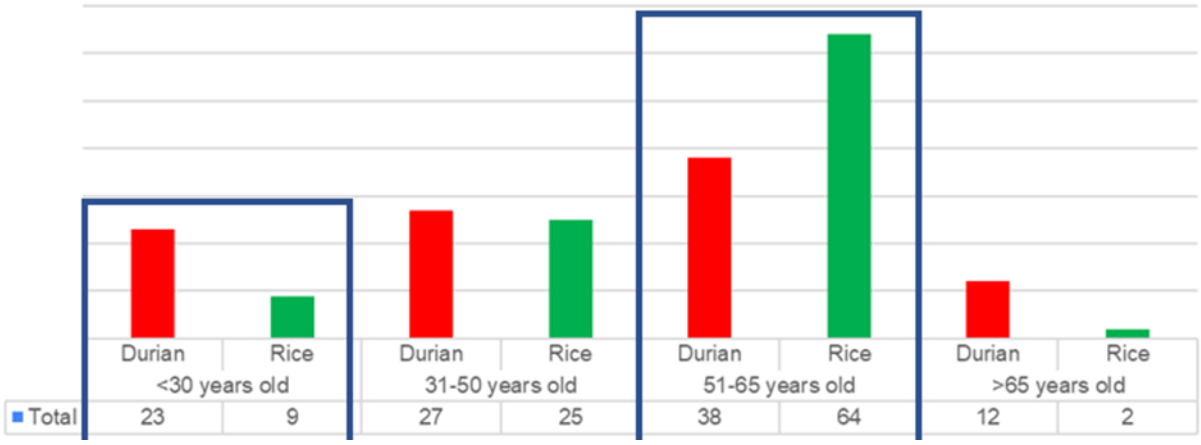

Figure 2: **Age of Farmers**

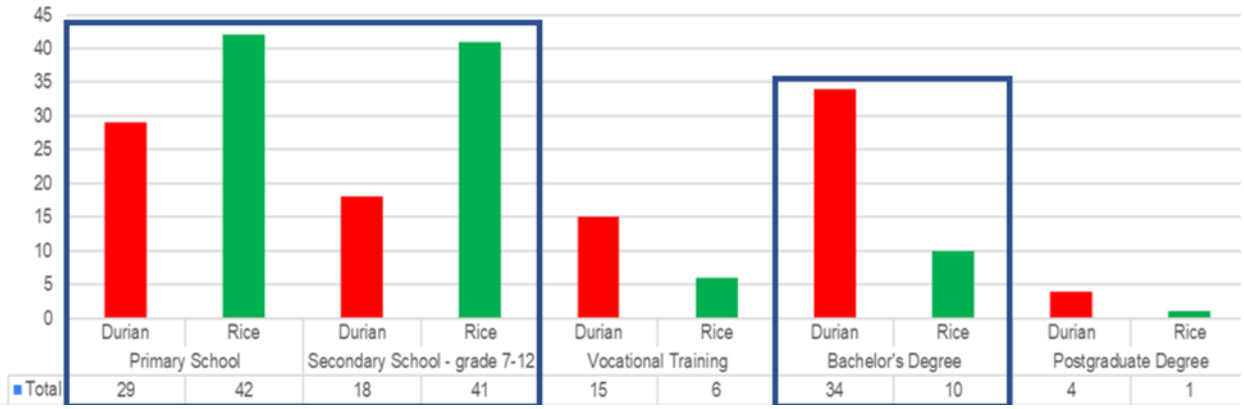

Figure 1: **Highest Education Level Completed**

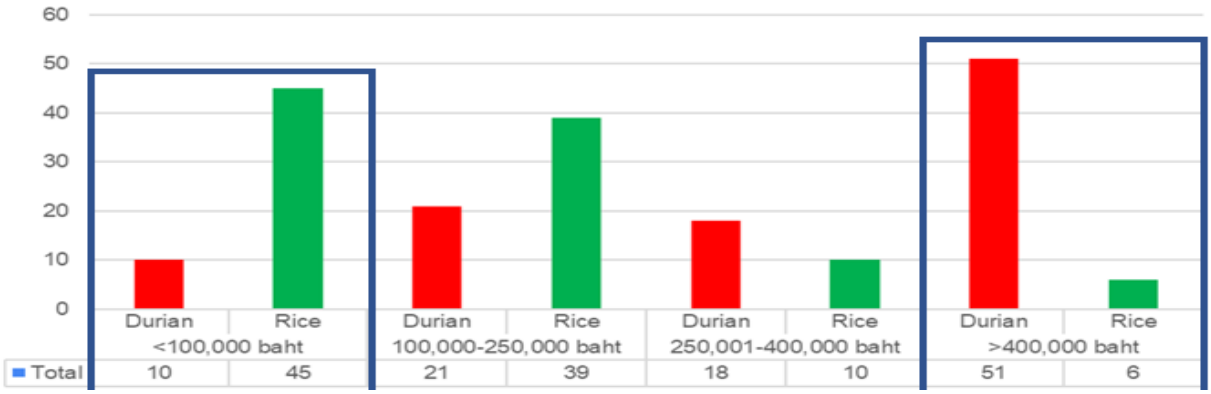

Figure 3: **Annual Household Income**

The Likert-scale survey asked the two groups' questions to determine their perception of floods and droughts, focusing on their knowledge and dread level of the risks. The scale used ranged from 1 to 5: 1 – Not at all, 2 – A little, 3 – Indifferent, 4 – Much, 5 – Very Much. The mean score is shown in the row with the Avg. The tables below show the questions relating to their knowledge or familiarity of each risk, as well as the number of respondents to the appropriate scale.

In table 1, the two statements are designed to measure the perception of knowledge or awareness of the climate risks. Statement 1 indicates both groups have an understanding that floods and/or droughts may cause damage to their farms. The durian group had a mean score that was slightly higher, however both groups had a majority of the responses "much" and "very much". Statement two shows that both farming groups are aware that flood and/or droughts can occur, or they have experienced them on their farm in the past, with many of the responses being "not at all" or "a little" with the newness of the climate risk.

Table 1: Mean scores of knowledge and awareness statements

Statement 1 - I understand that floods and/or droughts can cause damage to my farm			**Statement 2** - The risk of floods and/or droughts are new to me and my farm		
	Rice	**Durian**		**Rice**	**Durian**
1	0	2	1	36	39
2	5	3	2	30	37
3	6	9	3	18	10
4	41	45	4	6	10
5	48	41	5	10	4
Avg.	4.2	4.32	Avg.	2.2	2.03

Table 2: Mean scores of perceptions of dread statements

Statement 3 - After floods and/or droughts occur, my farm is severely damaged			**Statement 4** - I am worried that floods and/or drought will damage my farm		
	Rice	**Durian**		**Rice**	**Durian**
1	12	0	1	7	3
2	12	1	2	8	0
3	24	10	3	13	5
4	30	36	4	22	33
5	22	53	5	50	59
Avg.	3.38	4.41	Avg.	4.0	4.45

1– Not at all 2 – A little 3 – Indifferent 4 – Much 5 – Very Much

Table 2 is measuring the perception of dread for the two groups. Statement 3 shows that the durian group had a greater average of respondents indicating that floods and/or droughts are responsible for more severe damage than the rice group has experienced. 89% of the durian farmers, compared to 52% of the rice farmers have dealt with damages in the past. Both groups have "much" or "very much" worry that floods and/or droughts may cause damage to their crops with roughly an even amount stating this. Statement 4 shows that the durian group had a higher mean score due to more respondents in the rice group answering, "not at all" or "a little".

Regression analysis was used to determine if there was any statistical significance between the dependent and independent variables. If the P-value is <.05 then the null hypothesis is rejected, and the variable is significant. This would show that there may be an influence on the risk perception based on certain factors. The independent variables for both groups were age, education, and household income. The dependent variables were the statements that were responded to in the Likert-scale survey.

Table 3 shows the results of the statement "I am worried that floods and/or droughts will damage my farm". For durian, the P-value for age resulted in 0.02, thus showing that it is statistically significant for this group. The results from the rice indicated that education has significance with a P-value of 0.04. Table 4 shows that none of the factors are significant regarding the statement "I understand that floods and/or droughts can cause damage to my farm". Table 5 are the results of the statement "After floods and/or droughts occur, my farm is severely damaged". There was only significance in the durian group, with age having a P-value of 0.02 and annual household income having a P-value of 0.02. There were no significant results in Table 6 for the statement "The risks of floods and/or droughts are new to me and my farm."

Table 3: Regression Results for "I am worried that floods and/or droughts will damage my farm."

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.549490162	0.740520297	6.143640058	1.82623E-08
Durian Age	-0.296588216	0.130993774	-2.264139787	0.025815816
Durian Education	0.18605666	0.185043021	1.005477856	0.31719447
Durian Household Income	-0.105842831	0.120665045	-0.877162322	0.382588319

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.04041519	0.413186457	9.778672858	4.44495E-16
Rice Age	0.053631139	0.127494258	0.420655334	0.674946955
Rice Education	0.18753866	0.09433498	1.988007627	0.049658972
Rice Household Income	-0.046116423	0.105574844	-0.436812609	0.663228193

Table 4: RegressionResults for "I understand that floods and/or droughts can cause damage to my farm."

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.602581582	0.512908898	8.9734875	2.38495E-14
Durian Age	-0.06082714	0.090730629	-0.670414618	0.504203136
Durian Education	-0.229961609	0.128166928	-1.79423516	0.075923451
Durian Household Incon	0.111385387	0.083576609	1.332733987	0.185773673

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.057344433	0.394899425	10.27437412	3.8327E-17
Rice Age	-0.014883351	0.121851547	-0.122143307	0.903040848
Rice Education	0.107977823	0.090159851	1.197626461	0.234011163
Rice Household Income	0.056345433	0.100902255	0.558415996	0.577860477

Table 5: Regression Results for "After floods and/or droughts occur, my farm is severely damaged."

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.639952264	0.744246178	6.234432099	1.21021E-08
Durian Age	-0.294348149	0.131652861	-2.235789987	0.027682133
Durian Education	0.107312786	0.185974053	0.577030959	0.565269259
Durian Household Income	-0.2701999	0.121272163	-2.22804552	0.028212089

	Coefficients	Standard Error	t Stat	P-value
Intercept	4.665151703	0.350812257	13.29814342	1.68597E-23
Rice Age	-0.054028998	0.108247856	-0.499123027	0.618834594
Rice Education	0.056770917	0.080094269	0.708801232	0.480165556
Rice Household Income	-0.124156691	0.089637375	-1.38509958	0.169232265

Table 6: Regression Results for "The risks of floods and/or droughts are new to me and my farm."

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.997043539	0.762393232	3.931099353	0.000159601
Durian Age	0.098538009	0.13486297	0.730652817	0.466770701
Durian Education	-0.240974684	0.190508683	-1.264901315	0.208968637
Durian Household Income	-0.116514745	0.124229158	-0.937901747	0.350648575

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.475216285	0.554565484	4.463343565	2.1979E-05
Rice Age	-0.122032653	0.171118665	-0.713146363	0.477485185
Rice Education	0.079563539	0.126613356	0.62839768	0.531235677
Rice Household Income	-0.154957374	0.141699138	-1.0935661	0.276881774

Based on the results, both the durian and rice groups perceive floods and/or droughts as major climate risks. As stated before, the differences in the age groups were significant. There were more rice farmers in the older age categories and the durian group had a greater amount of younger people. The regression results show that age is significant in the durian group when looking at the worry that floods and/or droughts may occur, as well as the severity of damage that occurs on the farm if faced with these climate risks. This difference may infer that age may have an impact on the experience of the farmer has dealing with climate risks and also may not have the appropriate infrastructure on their farms to protect themselves from the damages of a flood and/or drought. With a greater amount of rice farmers being of older age, farming experience may have an impact on their lower perceived risk because they may have had to deal with these climate risks in the past and know what they will do if it were to occur. This is similar to Koesling et al. (2004) which concluded that farming experience was linked to the perceptions of risk.

Education showed to be significant in the rice farming group regarding the worry that climate risks may cause damages to their farm, and not for the durian group. This is similar to the findings in Aditto (2011) which showed that education had a significant influence in smallholder farmers' risk perceptions in the central and northeast regions of Thailand. Mean scores showed that the rice group scored lower, indicating that overall, they were less concerned with the occurrence of floods.

Household income was significant in the durian group regarding the severity of damage after floods and/or droughts occur. Orchard crops are produced with more precision from the grower and different on-farm infrastructure is used. There are more technical elements involved in the production of durian compared to rice. This may have an effect on the number of damages that can occur.

Conclusion

Risk perception is important in order to gain a deeper understanding of the daily decision-making processes on the farm and also the quality of livelihood for the farmers. Overall, this study showed that age, education level, and household income are all determinants of Thai rice and durian farmers' perception of climate risks. The key differences in the risk perception of floods and/or droughts between the two groups is that age and household income for the durian farmers have a significant influence in the perceived severity of damages when these climate risks occur and that durian age and the education level of rice farmers have significance in the worry that these risks will cause damages to their farms.

As climate risks may continue to become more frequent and severe in the future, farmers are in danger of on-farm and household loss of crops, finances, and personal assets. More knowledge of the risk perception can give more confidence to the farmer, knowing that they will be able to implement preventative measures to help reduce damages to their crops, as well as being resilient to these climate risks. Future research may develop this research more by studying the willingness to take risks based off the perception of the climate risk. The perception will be a determinant in the farmers' preparedness followed by their actions in regard to floods and droughts.

The research can be used to help farmers combat climate risks, as well as develop improved systems to protect them if the climate risks occur. Agricultural organizations develop educational opportunities to assist the farmers in disaster response, farm investments, diverse knowledge on crop insurance protection plans, and implement the most effective strategies to protect the farmer and their livelihood.

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