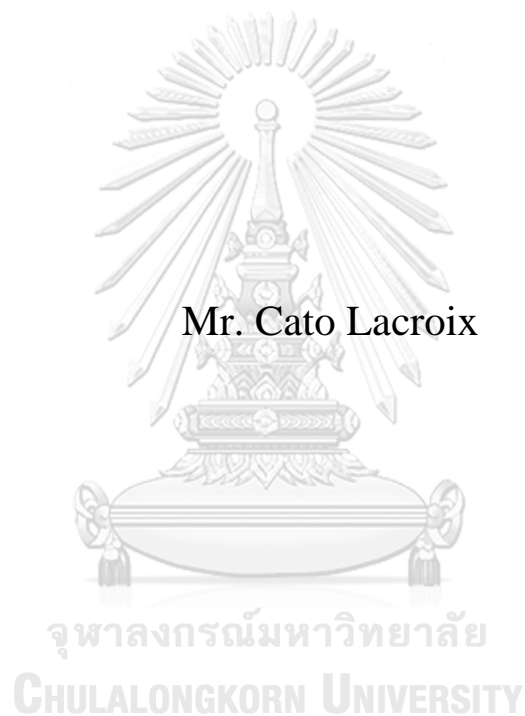


**A Psychometric Study of Thai Farmer's Risk Perception On
Agricultural Risks**



**A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts in Environment, Development and
Sustainability
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ความเสี่ยงทางการเกษตร เช่น แมลงศัตรูพืช โรค รา คาพิชผล หนี้สิน และภัยจากน้ำท่วมหรือภัยแล้งก่อให้เกิดภัยคุกคามต่อเกษตรกรเนื่องจากการดำรงชีพของเกษตรกรจะขึ้นอยู่กับผลผลิตนั้น การวิจัยนี้จึงมีวัตถุประสงค์เพื่อประเมินการรับรู้ความเสี่ยงของเกษตรกรผู้ปลูกพืชเศรษฐกิจ (ข้าว) และพืชมูลค่าสูง (ทุเรียน) ต่อความเสี่ยงทางการเกษตรตลอดจนความสามารถในการรับมือและจัดการกับความเสี่ยงเหล่านี้ในจังหวัดพระนครศรีอยุธยาและจันทบุรี เพื่อการวิเคราะห์ด้านการรับรู้เกี่ยวกับความเสี่ยงทางการเกษตรโดยใช้กระบวนการวิจัยเชิงจิตวิทยา ซึ่งงานวิจัยชิ้นนี้เป็นการศึกษาวิจัยชิ้นแรกของประเทศไทยที่ดำเนินการโดยการใช้วิธีดังกล่าว การศึกษานี้ได้ตั้งสมมติฐานว่าประเภทพืชผลพื้นที่เกษตรกรรมและปัจจัยทางเศรษฐกิจและสังคมที่แตกต่างกันอาจส่งผลต่อการรับรู้ความเสี่ยงที่แตกต่างกันในเกษตรกรทั้งสองกลุ่ม โดยงานวิจัยชิ้นนี้ ได้คัดเลือกเกษตรกรจำนวน 100 รายจากแต่ละจังหวัดโดยใช้เทคนิคการสุ่มตัวอย่างแบบคลัสเตอร์และแบบเจาะจงในการรวบรวมข้อมูลปฐมภูมิและใช้แบบสอบถามผลการวิจัยพบว่าชาวไร่ทุเรียนมีอายุน้อยกว่า โดย 35% มีอายุต่ำกว่า 30 ปี และ 65% ของชาวนาที่มีอายุ 50 ปีขึ้นไป ระดับการศึกษาแตกต่างกันอย่างมากเนื่องจากการศึกษาสูงสุดของชาวนา (83%) สำเร็จการศึกษาระดับมัธยมศึกษา ในขณะที่ 38% ของชาวไร่ทุเรียนสำเร็จการศึกษาระดับปริญญาตรีหรือสูงกว่า โดย 50% ของรายได้ครัวเรือนต่อปีของแต่ละกลุ่มมีรายได้ต่ำกว่า 100,000 บาท (ประมาณ 3,000 เหรียญสหรัฐ) โดยมีเกษตรกรผู้ปลูกทุเรียนเพิ่มขึ้น 10% สร้างรายได้มากกว่า 400,000 บาท (ประมาณ 11,000 เหรียญสหรัฐ) ข้อมูลแสดงให้เห็นว่าทั้งสองกลุ่มมองว่าศัตรูพืชและโรค รา คาพิชผล หนี้สินและน้ำท่วมหรือภัยแล้งเป็นความเสี่ยงหลักจากการสำรวจพบว่าเกษตรกรทั้ง 2 กลุ่มมีความรู้และระดับความหวาดกลัวต่อความเสี่ยงทางการเกษตรทั้งหมด การวิเคราะห์แบบถดถอยแสดงให้เห็นว่าอายุ การศึกษา รายได้ครัวเรือนต่อปี จำนวนที่ดินและทุนสำหรับธุรกิจการเกษตรที่มีนัยสำคัญทางสถิติและเป็นปัจจัยกำหนดการรับรู้ความเสี่ยงทั้งในกลุ่มเกษตรกรผู้ปลูกข้าวและผู้ปลูกทุเรียน การศึกษานี้สามารถช่วยให้อุ้ ก า ห น ด น โย บ บ า ย หน่วยงานที่เกี่ยวข้องด้านเกษตรกรรมและนักวิจัยสามารถนำผลการศึกษาเป็นข้อมูลในการออกแบบยุทธศาสตร์ เพื่อประสิทธิภาพสูงสุดในอนาคตในการช่วยเหลือเกษตรกร เช่น การสนับสนุนด้านโครงสร้างพื้นฐาน แผนการประกันพืชผลและการศึกษาเพื่อตอบสนองต่อภัยพิบัติ เป็นต้น



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Agricultural risks, such as pests and disease, crop price, debt, and floods and/or 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 agricultural risks, as well as their ability to cope and deal with these risks in Ayutthaya and Chanthaburi Province, Thailand.

To determine the perceptions on agricultural risk, the psychometric paradigm was used which is among the first study in Thailand to do so. 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 the 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 pests and disease, crop price, debt, and floods and/or droughts as major risks.

According to the survey results, both groups showed a high level of knowledge and dread for all agricultural risks. Regression analysis results determined age, education, annual household income, rais of land, and financing the farming business statistically significant as factors determining risk perception for both the durian and rice farmers. This study can provide policymakers, agricultural organizations, and future researchers information 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.

Field of Study:	Environment, Development and Sustainability	Student's Signature
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Chapter 1

INTRODUCTION

1.1 Rationale

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. 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.

Like other developing nations, Thailand relies heavily on their agricultural production which contributes to 10.5% of Thai GDP. With five important crops, in terms of cultivated area and value of production –rice, maize, sugarcane, cassava, and soybean, field crops altogether constitute more than 60 % of the agricultural GDP. 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. Furthermore, according to Bank of Thailand's Puey Ungphakorn Institute for Economic Research's (Pier), that same year 40% of farm households were living below the poverty line which is set at 32,000 baht per year. One of the prominent negative aspects that Thai farmers are currently facing, and one of the reasons for the low income, is the increase of number of farmers in debt along with the amount of debt. Out of the 7.1 million farming households, 3.8 million of those households are in debt, with rice farmers consisting of 1.1 million of that (see figure 2). To determine how to achieve the yearly income goal for Thai farmers, it would be of benefit to acquire the knowledge if debt has any influence in perceived risk levels and farm making decisions.

The sources of risks that Thai farmers face may vary depending on the region of the farming operation and the type of crop that is in production. These two factors can create differences on the perception of the risks between groups of farmers and the actions that follow when faced with certain risks. For example, cash crop farmers, who are looking for quick cash may grow certain crops that they know there is always a market for, and the total production window is smaller. These farmers may have a different perception of certain sources of than orchard farmers, whose crops are in production for a much longer time and more meticulous care is needed. Knowing the differences between how these two groups perceive risks can determine what is necessary for the particular group to achieve a more sustainable income and incorporate specific policies rather than an overall, one size fits all type system. Also, more in-depth knowledge of the characteristics of the activities for the particular groups of farmers can determine the approach the government can take to help manage agricultural risks and implement risk management strategies that can reduce the impact and severity of that risk. This study will compare cash crop and orchard farmers perception of certain sources of agricultural risks, with rice farmers the representative cash crop and durian farmers representing the orchards.

1.2 Risk

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. [16] 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”. [14] generally describes risk as "uncertainty that affects an individual's welfare and is often associated with adversity and loss." [13] lists three common interpretations of risk: the chance of a bad outcome, the variability of outcomes (i.e., the converse of stability), and the uncertainty of outcomes. Farming as a means of living holds many risks, due to constant confrontation with unfavorable outcomes, including lower yields and incomes, and has potential for catastrophic events such as financial bankruptcy, food insecurities, and human health problems [18]. The sources of risk, frequency, and severity can vary according to differing determinants such as

farming systems, geographic location, weather conditions, supporting government policies and farm types [1]. Farmers in developing countries have difficulties being able to access information such as farm input prices, product prices, and weather conditions, that might impact the farms in the future [25] [26] [27]. This furthers the impact that agricultural risk may have on a farmer's income and can create long lasting issues that can be a detriment to the quality of life for the individual and their family's future.

1.2.1 Agricultural Risks

Agriculture is increasingly confronted with risk and uncertainty stemming from a variety of sources which can be categorized into production, market and financial risks [13]. In addition, institutional and personal risks make up the five main types of agricultural risks that are generally concerned within research. These can be further categorized into business and financial risk. Business risks are any of the risk sources that can directly affect farm profitability and financial risk are those that correlate with the net cash flows to farmers equity [1]. [29] argued that both business and financial risk can have an effect on each other and should be considered when starting a farm operation. [24] argued that the sources of farm risk, especially business risk, may vary depending on farm type, farm size, the economic situation, political environment, time of the study and farm geographical location.

[18], define the sources of risk as follows:

1. **Production Risk** – Come from uncertain natural growth processes of crops and livestock, usually stemming from weather and climate (temperature and precipitation) and pests and diseases. Yield-limiting or yield-reducing factors also fall into this category.
2. **Market Risk** - Uncertainty with prices, costs, and market access. On a globalized scale, market risk may include international trade, liberalization, and protectionism.
3. **Institutional Risks** - Unpredictable changes in the policies and regulations that effect agriculture [14], with these changes stemming from formal or informal

institutions. Farmers are increasingly supported by and connected to institutions, especially as farm production becomes more market focused.

4. **Personal Risk** - specific to an individual and relate to problems with human health or personal relationships that affect the farm or farm household. Sources include death in the family, injury from farm machinery, affects from pesticide use.

5. **Financial Risk** - refers to the risks associated with how the farm is and is defined as the additional variability of the farm's operating cash flow. Risks include changes in interests' rates, credit availability, or changes in credit conditions.

The agricultural risks that farmers face can have sever implications on the farmer's livelihood. In order to be successful, farmers must be aware and knowledgeable about the risk itself and how to deal with it. Without proper education of the risks, the farmer can easily fall into debt, or they may be further exposed to potential risks that can hurt their business. Ultimately, their livelihood is dependent on the way they can manage and respond to these risks.

1.3 Risk Perception

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 [34]. 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 [1].

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 [33]. Judgements on levels of perceived risk and whether or not 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 [1] [3]. By allowing farmers to express their opinions about the risks they face and the problems that occur because of it, a deeper understanding of what actually needs to change and be implemented can lead to more sustainable income and less debt for farmers. A lot of the time, policy makers interpretation and view of certain risks differ from farmers, and they do not take farmers thoughts on issues into account, and this is creating a system that does not allow farmers to get out of easily.

1.4 Thailand Agriculture

Thailand is a tropical country located in Southeast Asia, which is bordered by Myanmar to the west, Cambodia to the east, Malaysia to the South, and Laos to the north (Figure 1). Thailand is usually categorized into 4 different regions, North, Northeast, Central, and Southern, consisting of 77 different provinces total. Table 1 shows the different characteristics of each region. The northern region is mountainous. The central region is a low-lying area that shares land with the Chao Phraya River, the main river system of the country. This region is conducive to intensive cultivation. The north-east is the largest region which makes up about 45 per cent of the total area of the country. The south of the country consists of mountains as well as bordering the Gulf of Thailand and the Andaman Sea. [9] [15] [28]



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Figure 1: Map of Thailand

Source: <https://maps-thailand-th.com/img/1200/thailand-maps.jpg>

Table 1: Geography of Thai Agriculture

Region	Characteristics of Region
North	<ul style="list-style-type: none"> • Mountainous with low population density. • Larger percentage of farmers dealing with high value crops (fruits and vegetables).
Northeast	<ul style="list-style-type: none"> • Highest percentage of rural poverty. • Holds a majority of agricultural land with almost half of Thai farmers living in this area. • Less favorable growing conditions. • Smallest farms size per household.
Central	<ul style="list-style-type: none"> • Known as the “Rice Bowl of Thailand” • Holds the majority of irrigated land. • Largest farm size per household.
Southern	<ul style="list-style-type: none"> • More ideal agricultural growing conditions. • Rubber production is vast. • Low population density

Located near the equator, there are three main seasons throughout the year, without much fluctuation in temperature. The hot season is from February to May, followed by the rainy season from May to October, and the cool season from October to February. The average temperature range of the country is 26-28°C in the cool season and 28-32 °C in the hot season creating a tropical climate [9]. The months during the rainy season can bring heavy rains and monsoons throughout the whole country. The average annual rainfall throughout Thailand in 2016 was 1,718 mm, which was 130.4 mm (8%) above the 1981-2010 normal annual rainfall according to the Thailand Meteorological Department. The increase in climate change risks can bring too much rain or droughts that can halt agricultural production.

Farming no longer brings in the majority household income, as it contributes to just about 28% of Thai households’ income. This could be due to the fact that as Thailand continues to develop into a more industrialized-urbanized nation, more family

members are leaving the household to move to the more populated cities in search for more sustainable and greater income. Dependence on agriculture is particularly prominent in the rural areas of Thailand and serves as one of the main occupations for the poverty-stricken demographic. Out of the total population, approximately 43.5 million people live in rural settings.

The total amount of land in Thailand is close to 51.3 million hectares. The amount of undeveloped land is decreasing, but there still remains a substantial amount in the country. Thailand is a host of 5.9 million farms on 23.9 million ha agricultural land or 46.6 % of the total land area. Nearly 50% of the total agricultural land is cultivated for rice, 21.5 % for field crops, and 21.2 % for fruit or horticultural crops [23]. Agricultural land is split between irrigation and rain-fed areas. Many farmers who work in the rain-fed areas rely on the rainy season to bring enough rain for a successful growing season. Irrigated land is dispersed around the country, with some areas capable of the use of irrigation system and others not [40]. Lack of access to adequate water sources is one of the main reasons for this. Close to 6.42 million ha of agricultural land is irrigated, with rice cultivation taking up 75%. (FAO, 2015) [41]. Thailand is one of the largest fruit producers, as well as exporters in the world with 1.82 metric tons exported in 2014 [39]. Durian has become one of the most popular crops to grow as the average farm gate price remains high.

Table 2: Land Use in Thailand (2013-2017)

	Total Land (Million ha)	Forest Land (Million ha)	Agricultura l Land (Million ha)	Farm Size (ha/HH)	Number of Farms (Millions)
2013	51.3	16.3	23.9	4.04	5.90
2015	52.5	17.2	24.2	4.31	5.91
2017	52.3	17.2	24.1	4.31	5.96

Throughout the years, the farming system has been a prominent source behind the nation's economy, however that has also brought an increase in the number of farmers

going into debt. Farmer debt, mostly accrued by rice farmers, rose from 2.4 trillion baht in 2016 to 2.8 trillion baht in 2018 according to the National Statistical Office (NSO). The NSO has also stated that out of the 3.8 state funded loans, 1.1 million were given out to by farmers. Causes of debt range from high land prices, production costs market variability, and high interest rates. Furthermore, rice farmers borrow for reasons such as education, farming development, consumption, buying or renting land, other business, among other things. The total amount of debt varies between land holders depending on the region. The table below from the National Statistics Office's 2013 Agricultural Census shows the percentage of holders by the source of debt as well as the amount of debt for agriculture in each region.

Table 3: Percentage of Debt Holders and Amount of Debt

Item	Total	Central	Northern	Northeastern	Southern
1. Total number of holders	5,911,567	847,163	1,298,468	2,744,457	1,021,479
By being in debt of household	100.0	100.0	100.0	100.0	100.0
Not being in debt	178.9	47.4	36.4	32.9	62.2
Being in debt	228.1	54.2	65.1	66.9	41.9
For agriculture	187.0	46.2	55.9	54.2	30.7
For out of agriculture	14.9	3.8	3.1	1.2	6.8
For agriculture and out of agri.	25.3	6.1	6.2	9.8	3.2
2. Amount of debt for agriculture (Million Baht)	228,918	59,452	66,102	73,452	29,912
Average per household in debt (Baht)	69,194	133,242	76,632	46,829	88,982

The problem does not seem to be access of acquiring loans, in fact, a 2016 study by the Thailand Development Research Institute found that one-fourth of a farm debts are owed to state banks which can return benefits to almost 80%. The problem lies in that farmers borrow money from other sources as well, which puts them into further debt. The Thai government has tried to develop strategies to strengthen farmers abilities to cope with debt and acquire sustainable farm income, but to become debt

free, farmers must become more financially independent which can be attained through better policies and options.

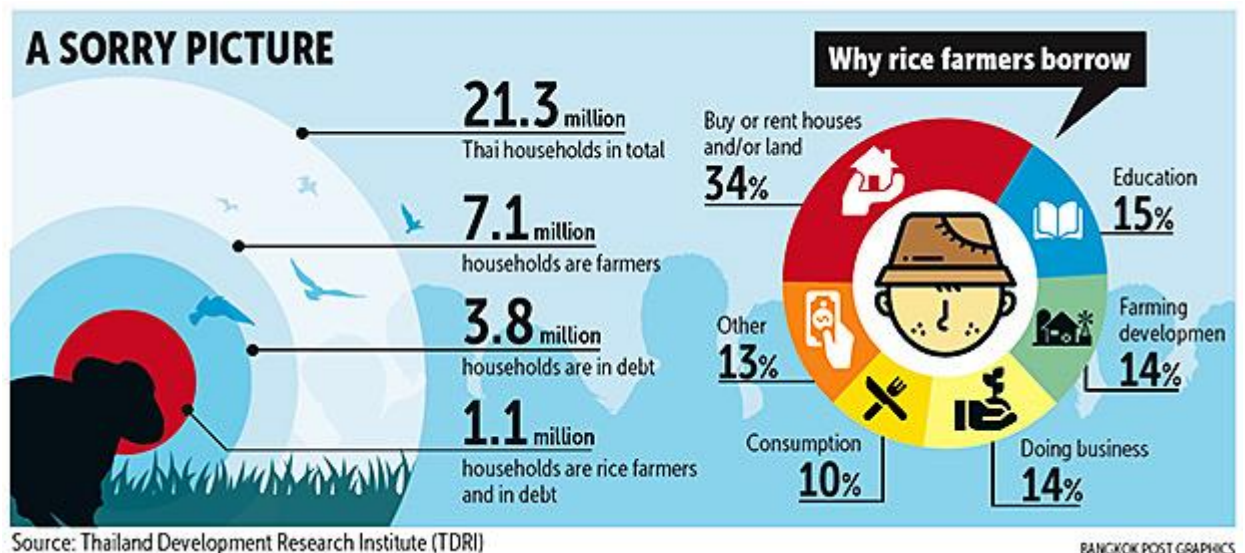


Figure 2: Infographic of Sources of Farm Debt

1.5 Research Objectives

Risk perception research on Thailand agriculture is limited, and there is a need to further understand the how risks are understood by farmers. As farmers continue to fall into further debt without the ability to pay it off, opportunities to do so becomes increasingly important. Past studies in Thailand have lacked focus on specific market and financial risks which are two risks faced by Thai farmers that can impact debt levels. 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:

- 1) To identify differences in perceptions of production, market, financial, and climate risks between Thai rice and durian farmers.
- 2) To compare factors influencing agricultural risk perceptions between two different farming groups - Thai rice (cash crop) farmers and Thai durian (orchard) farmers.

3) To provide consultants, policy makers, and government officials with current information on the risk perceptions of Thai Farmers regarding certain production, market, financial, and climate risks in order to create policies which benefit the farmer's livelihood through sustainable income, better information on risk management strategies, and availability to better loan/grant programs.

1.6 Research Questions

Main Questions

- 1) Do farming styles determine differences in the perception of production, market, financial, and climate change risks between Thai cash crop and orchard farmers?

Hypothesis 1 – Due to factors such as length of production, maintenance/care of the crops, materials and infrastructure needed pre/post-harvest, and overall labor there will be differences in risk perceptions.

- 2) Which factors influence the perception of agricultural risks between rice and durian farmers?

Hypothesis 2 – Socio-economic factors such as farmers age and farming experience, farm characteristics such as land size and ownership status, and farmer's financial profile such as loans and annual household income will influence perception of certain risks.

Sub Questions

- Which agricultural risks should be prioritized to ensure more sustainable income for farmers and develop solutions for proper risk management strategies and decision making on the farm?
- Is debt a factor in heightened or lessened perception of risk for Thai farmers?

Chapter 2

LITERATURE REVIEW

There have been many theories used in the past by researchers to study risk perception, but in particular, one that has consistently been chosen is the Psychometric Theory. Other research and theories on risk perception do not define what it is about the risk itself that can determine certain levels of perceived risk, either high or low. Also, other risk perception research does not separate the differences in perception between experts and common people. This is important due to the fact that the experts are the ones responsible for making policy decisions, however they are not the ones being directly affected by the risk. There should be more weight in the perception of the ones who are dealing with the risks in order to create the best strategies for them. This study on Thai farmers risk perception will utilize the psychometric framework.

2.1 Psychometric Theory

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 [38]. The most common approach to this goal has been the psychometric paradigm [10] [35], which uses psychophysical scaling and multivariate analysis techniques to produce quantitative representations of risk attitudes and perceptions. The framework for this psychometric way of determining risk perception is known as the psychometric paradigm.

The foundation of the psychometric paradigm was derived from the work of Chauncey Starr, who was one of the original researchers to explore risk perception in his study of "How Safe is Enough?" [37]. Starr sought to develop a method to measure technological risks vs. benefits, which assumed that members of the society have been content with a balance between the risks and benefits of certain activities. Past experiences, as well as current data, were factors in establishing present time patterns of risk-benefit acceptability, which can be referred to as "revealed

preference” [12]. As a result of Starr’s findings through researching a variety of industries and activities, he concluded that “(a) acceptability of risk from an activity is roughly proportional to the third power (cube) of the benefits for that activity and (b) the public will accept risks from voluntary activities (e.g., skiing) are approximately 1,000 times greater than it would tolerate from involuntary hazards (e.g., food preservatives) that provide the same level of benefit” [42]. Public involvement in voluntary activities is accepted although the risk of injury can be higher compared to some involuntary hazards. Risk perception is varied based on one’s opinion on the benefits of the activity and if the benefits outweigh the perceived risks, society will form the way that these certain hazards are seen and dealt with. As policy makers must make decisions on industries and activities, the way in which the public interact should be a driving force in the decisions that are being made and should benefit the public involved.

Risk perception research in the psychometric paradigm has displayed consistent results in that perceived risk is quantifiable and can be predicted. The paradigm focuses on people’s current interpretation of certain risks, rather than past experiences. This can be referred to as “expressed preference” [12]. This can help identify differences and similarities of perception between groups of people. Psychometric studies have also has shown that the definition of risk will vary between people. There is a substantial difference in judgements of risk perception between expert and non-expert opinion [36]. Expert judgment on risk perception tends to be based on more objective figures of annual fatalities. Lay people can base their perception off this as well if they are asked, however it is has been shown that their judgements are related more to other hazard characteristics, such as threat to future generations [38]. Due to these differences, implications dealing with risk may arise. [33] states that until there is a structured process in risk communication and lay people’s opinion on risks are seen as valid concerns. This is important to know because if the experts have differing understanding and interpretations of the risk, the policies that are implemented are based off of their judgments and not how the everyday, common people see the risks and are being affected.

There have been no risk perception studies in agricultural which focused on using the psychometric approach in order to look at the perception of risk for farmers and there has not been a study focusing on Thai farmers using this method as well. The knowledge of this research is a valuable addition to the existing research that focuses on farmers and their perceptions of agricultural risks.

2.2 Characteristics of Risk

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. Table 4 below shows the characteristics that 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” [12]. Past research has shown that non-expert risk perception and attitudes toward risk correlate with the positioning of the risk within the factor space. Dread risk has shown to be the most important in heightening perceived risk. The higher the perceived dread, the greater the perceived risk [38]. Non-experts often are not supportive to anything that categorizes as uncontrollable, catastrophic, or having fatal consequences. Also, if risks are seen as unknown, not observable, or delayed in their effects, the public want to see the risk reduced and policies for stricter regulation should be enforced. Risks that fall to the left in the factor space are seen as tolerable for the public and are not viewed as harmful or fatal to those exposed.

Table 4: Characteristics of Risks

Factor 1 - Dread		Factor 2 - Familiarity	
Uncontrollable	Controllable	Not observable	Observable
Not global catastrophic	Global catastrophic	Unknown to those exposed	Known to those exposed
Consequences not fatal	Consequences fatal	Effect delayed	Effect immediate
Not Equitable	Equitable	New Risk	Old Risk
Low risk to future generations	High risk to future generations	Risks unknown to science	Risks known to science
Easily reduced	Not easily reduced		
Risk decreasing	Risk increasing		
Voluntary	Involuntary		
Does not affect me	Affects me		

2.3 Farmer Risk Perception in Agriculture

There have been numerous studies conducted to understand the factors that contribute to risk perception of farmers which can be found in Table 5. Lacking in the literature is a psychological approach to understanding risk, as most agricultural risk perception studies focused on determining factors such as socioeconomic and other farm and farmer characteristics.

The scarce amount of information on farmers' risk perceptions and their risk behavior present a challenging task for policy makers and researchers who want to create a system that can effectively help farmers [11] [24]. Although the perception of risk on specific risk sources can vary depending on each variable and geographic location, these past studies have delivered insight on the types of agricultural risks that are generally seen as the most impactful on the farm operation and farmer.

In past research, some authors have focused on identifying the risk factors that were seen by farmers as the most important while others dealt with focusing on finding factors determining differences in the level of risk perception [4]. Empirical studies show that there is no agreement about the most appropriate methods to describe sources of risk and risk responses on farms. The Likert-scale rating method has been

frequently used in past research. In most of those studies, the respondents were asked to rate the sources of risk that affected their farm they used on a five or seven-point scale (where 1 is not particularly important and 7 is highly important).

[20] examined risk perceptions of smallholder famers in 178 farm households in the Eastern Highlands of Ethiopia. To provide insights into which factors determine perceptions of risk, a theoretical perspective through the psychometric paradigm, cultural theories or risk, and farm structure model was used. Based on other research, the main hypothesis of this study was that perceived risk will vary between various social and power groups, and local groups in the rural areas of this region due to factors such as human capital and household characteristics, access to resources, infrastructure, information, and environmental factors. Ultimately, asset endowments, locational settings, and livelihood diversification strategies were determinants of farmers' risk perceptions.

[21] conducted a study in Ilocos Norte, Philippines analyzing the risk perception and attitudes of farmers in rainfed lowland ecosystems who practiced different rice-based cropping patterns. To determine the farmers' risk perception, the Psychometric Theory was used. The study concluded that the main variables responsible for affecting risk perception were farm size and the amount of wealth. The highest risk sources were high fertilizer costs and environmental factors which are out of their control. Climatic condition variability was a high-risk source occurring during the rainy season.

[11] studied risk perceptions between organic and conventional dairy farmers in Norway. The purpose of this study was to determine any relationships between farm and farmer characteristics and risk perceptions. A total of 363 conventional and 162 organic dairy farmers took part in the research. Results showed that organic farmers were more concerned with institutional and production risks, such as uncertainty in government support payments, while conventional farmers considered input costs and animal welfare policy as high impact risks. The research suggested that researchers should focus more on institutional risks in order for strengthened policies that can give farmers long-term confidence.

[17] conducted another study in Norway researching organic and conventional crop farmers' perceptions of risk, along with risk management strategies. Out of 611 randomly selected conventional cash crop farmers and all of the 212 registered cash crop farmers with organic farmland, both farming groups perceived crop prices and yield variability as the most concerning risk, as well as institutional risks. Socio-economic variables, such as farming experience, were identified and linked to the perceptions. This study concluded the same as [11] in regard to considering more precise policy initiatives for farmers.

[22] states that "risk is an escapable fact or life, in particular in agriculture...". The authors agreed that in order to manage risks effectively, the perception of the risk must be understood first. The study looked at questionnaires of 731 livestock farmers in the Netherlands, to gain further insight into their risk perceptions. Out of 25 potential risk sources contagious animal diseases and meat and milk price scored the highest, determining price and production risks as the most important risk types.

2.4 Farmer Risk Perceptions in Thai Agriculture

It is evident that evaluating and understanding the risk perception of farmers can allow policy makers to make better informed decision, but there is a lack of this research in the context of Thai farmers. More substantial research can benefit the large number of farmers in the country.

[2] conducted a study on rice farmers perception of risk in Payao and Lampang provinces located in the northern region of Thailand. The results of the study showed that crop disease, pest damage, input cost variability, flooding, and shortage of water supply were the five major sources of risk that the farmers in Payao had to deal with. The farmers in Lampang faced the same sources of risk as in Payao, however low output prices and pests were in the top of their major risks.

[1] looked at farmers perceptions of risk and sought to determine if the perceptions were influenced by farmers characteristics. A total of 800 smallholder farmers from the central and northeast regions of Thailand were used to conduct the study using face-to-face interviews and survey data. The results showed that farmers from both regions perceived marketing risks, in the forms of unexpected variability of input and

product prices as the most important sources of risk. Additionally, the results show that in both regions, certain farm and farmer characteristics, such as gender, education, off-farm work, farm size, and farm location, significantly influence farmers' risk perceptions.

The main purpose of [6] study was to assess climate risk management in river-based tilapia farming in Northern Thailand. Using in-depth interviews, 662 fish farmers took place in the study and the main risk sources faced by the farmers were found. The results showed that many risks are determined by the season, river, and geographic location. Risk sources can vary substantially from one farm to another.

[30] focused on filling the gap in agricultural research by focusing their study on farmers risk perceptions between subsistence and market-oriented production systems and role of pesticides in farm operations. The goal of this research was to determine if varying levels of commercialization had any influence on different exposure to risk, thus forming different risk perceptions. Through data collected with 240 Thai farmers, comprising of ten different levels of commercialization, the results showed that farmer's risk perceptions were strongly associated with the levels of commercialization. High levels of pesticide use were not seen as an important risk on commercialized farms as farmers generally do not view pesticides as a health risk.

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. There has not been a study in Thai research determining risk perception of Thai farmers by using a psychometric approach, specifically the psychometric paradigm. This approach will help determine which risks are the most important as well as which risks farmers dread the most, which will give policy makers further insight on what is necessary for Thai farmers.

Table 5: Summary of Literature Review

Author	Area of Study	Type of Farming	Types of Risk	Measurement of Risk Perception
Legesse and Drake (2005)	Ethiopia	Crop and Livestock	PR, M, I, P	Human Capital and Household Characteristics
Lucas and Pabuayon (2011)	Philippines	Rice	PR, F	Amount of Farm Resources
Koesling, Ebbesvik et al. (2004)	Thailand	Rice	PR	Climate Change Data
Meuwissen, Huirne et al. (2001)	Thailand	Rice	PR	Farm Characteristics
Aditto (2011)	Thailand	Small Holder Crop Farming	PR, M, I, F, P	Farm and Farmer Characteristics
Riwthong, Schreinemachers et al. (2017)	Thailand	Commercialized Crops	PR, M, F, P	Commercialization of Farm
Akasinha, Ngamsomsuk et al. (2006)	Thailand	Rice	Pr, M	Farm and Farmer Characteristics
Chitmanat, Lebel et al. (2016)	Thailand	Aquaculture	PR, M, I, F, P	Socio-economic Variables

For types of risk: PR – Production / M – Market / I – Institutional / F – Financial / P – Personal

Chapter 3

RESEARCH METHODS

3.1 Conceptual Research Framework

This study followed the works of [37] and other risk perception researchers who have used the psychometric paradigm. The framework is based on a 2-factor diagram which measures the perception of risk. On the diagram, factor 1 is labeled as dread and factor 2 is labeled as familiarity. The basis of the framework is the greater the unfamiliarity and dread of a certain risk, there will be an increased sense of risk. The other end of the spectrum will show the opposite, as the more there is a sense of familiarity and low level of dread, the risk perception of that certain risk will be lessened. The conceptual framework is shown below in figure 3.1.

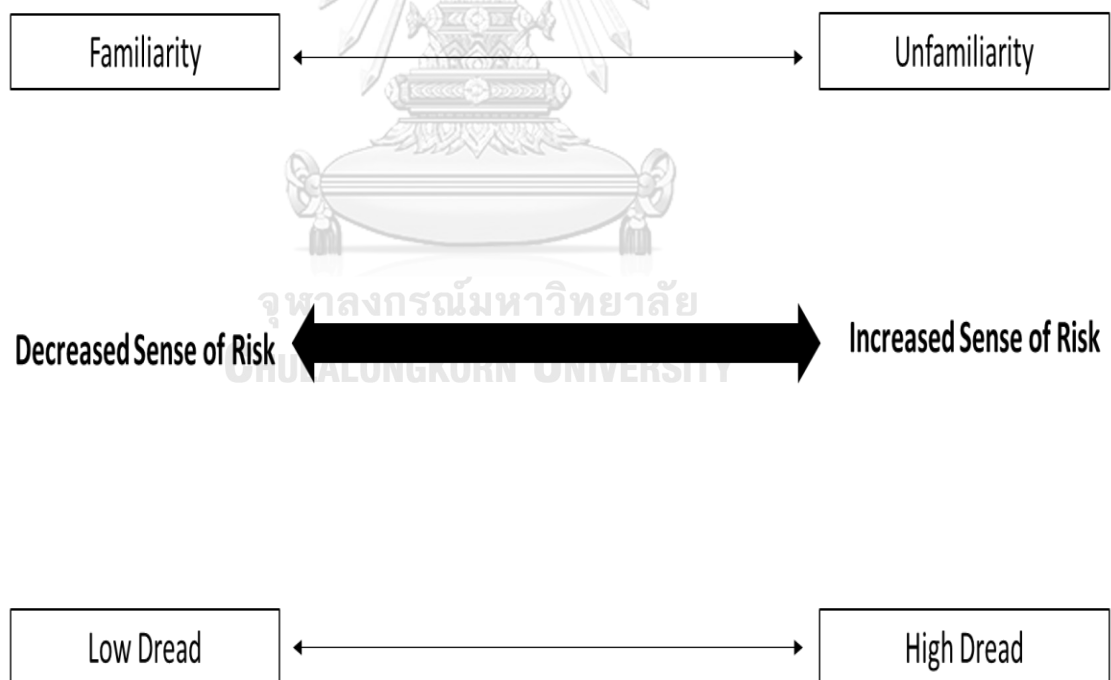


Figure 3: Conceptual Framework of Psychometric Paradigm Study

In past studies, the participants were asked to view the riskiness of certain technologies and activities and decide the level of risk and benefits based on potential death as the main indicator of dread [12]. This study focused primarily on agricultural risks and the impacts that it has on farmers and their farm operations. To accommodate this study to the context of Thai farmers, instead of using death as the variable for dread, the participants were asked to rate certain risks based on the potential for debt or increased debt. The goal of this was to determine which risks Thai farmer view as the greater risks in order for policy makers to decide changes that need to be made in order to keep debt levels low and protect the livelihood of the farmers. Farm and farmer characteristics have a role in the determination perceived risk level. Many of these determining factors can vary the severity, frequency, and exposure to agricultural risks which will then alter the perception. For example, rice farmers who have grown their crop in the same area, but have different levels of education and farm experience, may perceive the same risk differently. Another example may be an orchard farmer growing on 5 rai of land, may perceive certain production risk, such as pests, compared to another orchard farmer growing the same crop, but on 10 rai of land. The final framework for this study in

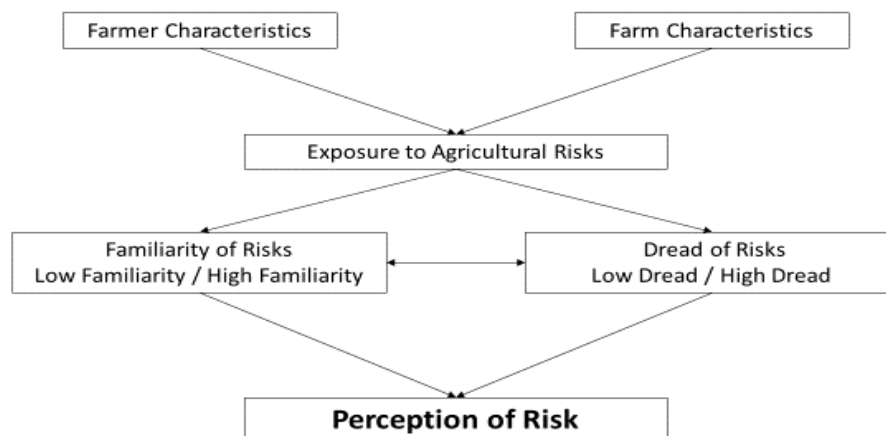


Figure 4: Conceptual Framework with Farm and Farmer Factors

Farm and farmer characteristics and how those factors (when exposed to certain financial, market, production, and climate-risks) can influence the dread and familiarity level which leads to their final perception of risk.

3.2 Study Area

The study area selected for this research was 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 [31]. Ayutthaya has abundant water sources which pass through the province from 4 rivers, the Chao Phraya, Lop Buri, Pa Sak, and Noi which helps with irrigation. 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. [5]

3.3 Research Design

The purpose of this study was to gain a deeper understanding of perception of agricultural risks between cash crop and orchard farmers. Rice was established as the main cash crop being focused on due to it being the largest agricultural export in the country of Thailand. To determine which orchard crops would be beneficial for this study, secondary data was first acquired through the Office of Agricultural Economics statistics. Yearly, quarterly, and monthly farm gate prices from the past 10 years were looked at in order to see which fruit crop showed the greatest price fluctuation, with years being the determining factor. After examination through this process, Durian was seen as the most prominent orchard crop grown in Thailand with a high average farm gate price as well as export demand.

Durian has earned the name “The King of Fruits” and is a highly sought-after product both domestically and internationally. The name comes from its flavor, smell, and marketing power. The nation is the largest durian producer and exporter in the world market and is considered the most important fruit crop in Thailand. The tropical climate and suitable land to cultivate tropical fruits allows the production of the crop to be prominent. Typically, durian is a higher value crop than rice farming. Around

85% of durian is produced for the local market, while 10% is for export and 5% used for processing.

Along with durian, rice was chosen to be studied as well. The production of rice in Thailand has played a large role in the socio-economic development which has made the country the world's largest exporter for rice in the past 30 years. It is one of the most important crops grown in Thailand, both as a staple food in the diet of Thai people and food security, as well as a major source of income for thousands. The temperate climate makes the region a suitable area for rice production, particularly in the central and northern regions.

The risks to be examined were chosen from past studies of farmer risk perception of agricultural risks. There were many risk sources determined by farmers from the five major risk types that agriculture will face. Additionally, past studies in Thai agriculture have studied some of these risks, but to fill the gap in agricultural risk perception in studies and to give further knowledge on certain risks, market, financial, climate, and production risks was examined in this study.

This study will use both qualitative and quantitative methodology. Qualitative methodology was used for the data collection to understand and perception of certain agricultural risks between cash crop and orchard farmers. Qualitative approach is defined as —a mean for exploring and understanding the meaning of individuals or groups attributed to a social or human problem, while quantitative approach includes testing objective theories by examining the relationship among variables (livelihood and income) [8]. Quantitative methodology was used during the data analysis to quantify the data in order to measure it numerically and determine the most useful numbers in the results. The most significant values were shown to give the greatest representation of the data.

3.4 Sampling Technique

This research implemented both probability and non-probability sampling in order to determine the groups for data collection. For the probability sampling, the method chosen was the cluster sampling method. This method was chosen due to the naturally occurring groups in which are being studied [32]. 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 that the cluster sampling technique was chosen. In Ayutthaya, there was a total of 16 clusters and for Chanthaburi there was a total of 10 clusters. Using non-probability sampling, purposive sampling was used 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 Krejcie and Morgan was used [19]. The formula $s = \frac{X^2NP(1-P)}{d^2(N-1) + X^2P(1-P)}$ was used in which:

- s = required sample size
- X^2 = table value of chi-square for one degree of freedom at the desired confidence level
- N = the population size
- P = population proportion
- d = degree of accuracy expressed as a proportion (.05)

[7]

Table 6 shows the result of the sample size equation for this research. The confidence level is at 95% with a margin of error at 5.

Table 6: Sample Size Calculation

Province	District	Number of Households	Sample Size Results
Chanthaburi	Tah Mai	3038	71.298
	Khao Khitchakut	2509	70.951
	Total	5547	72.052
Ayutthaya	Bang Sai	3316	71.436
	Sena	3763	71.617
	Total	7079	72.252

Based on the results of the sample size calculation, the minimum number for the sample size was 144 participants. There was 72 samples Chanthaburi Province, more specifically the districts of Tah Mai and Khao Khitchakut. There were also 72 samples needed from the province of Ayutthaya, with the specific research districts being Bang Sai and Sena. To gather better results, the study raised the sample size to 200 participants with 100 from each group of farmers and a total of 120 samples from each location was completed.

3.5 Data Collection

Both primary and secondary data was used in order to conduct this study and acquire information necessary for results. The primary data was conducted during field visits to the farms. This was collected through survey data taken by the farmers participating in the study, as well as open discussions that occurred during the visits to further understand the mindset of the farmer and add to the results of the research to determine risk perception. The secondary data was gathered through published articles and public information from different agencies and government organizations for pre-existing national agricultural statistics and other baseline data. These organizations and departments include FAO, Office of Agricultural Economics, Thailand Development Research Institute, Thai Meteorological Department, etc. This data was necessary to understand the current state of Thailand Agriculture as well as the geography of where the crops are being grown because they are two large factors in determining risk perception.

The target sample groups were rice farmers in Ayutthaya Province and durian farmers in Chanthaburi Province. Individuals who were eligible to participate in the study were those who currently working on a rice or durian farm in the specific districts stated. The farmers may be landowners, lease land to farm, or are employed to a farm in which one of the crops are grown.

There were field visits in order to gain the information needed to conduct this study. Proper Covid-19 protocol was strictly enforced to keep both the interviewer and interviewee safe. Translators aided in conducting the interview by travelling to the designated provinces/districts. The translators hired for this study were students of Chulalongkorn University and researchers from the Environmental Research Institute

at Chulalongkorn University. The translators have a background in agriculture, either academically, past projects, or in their family. Due to their existing connection to agriculture and academic pedigree, the translators were qualified individuals to assist with this project. Prior to the field study, an orientation took place where the translators were briefed on how to properly conduct the study.

A consent form with the interviewee was reviewed prior to beginning. The consent form was to allow the interviewee to understand that they have joined the study voluntarily and they were allowed to stop the interview at any time if they choose.

The consent form was also to address any privacy concerns that they may have had. Any information from the study was not shared with anyone else and the results of their particular questionnaire were discarded once the results of the study were published. All participants had the right to their privacy and there was not anything to compromise this. Once the research was completed, the results from their questionnaire were discarded and unavailable for use.

The questionnaire was created based on past agricultural risk perception studies and psychometric risk studies. The questionnaire was first written in English and then translated to Thai by a bilingual translator. If any revisions were needed to be made, they were made in the English version and then the Thai version made the necessary translation revision based on that. The questionnaire was translated into Thai to accommodate the Thai farmers and a translator was present to assist in anyway where Thai language will need to be spoken or understood.

The first section of the questionnaire is a general farm information and household survey. This was conducted to collect socio-economic data for basic information about the farmers. This survey was taken from [1] study on Thai 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. This study determined factors that can influence the perception of risk.

Secondly, a questionnaire survey was distributed to farmers to measure their judgments on four different agricultural risks. The risks examined were floods and

droughts to represent climate risks, debt to understand perception of financial risk, crop price variability for market risks, and pests and diseases to look at production risks. For each of the designated risks, the farmers were asked to rate their perception of each on a Likert Scale ranging from 1-5. There were eight questions for each risk, which will be judged based on risk characteristics which can determine both dread and familiarity level. Each data set consisted of four questions to measure dread and five questions to measure familiarity of the specific risk.

In order to determine the internal consistency of the questionnaire, a reliability test was taken prior to the data collection. The test was taken multiple times as revisions were necessary in order to have an acceptable Cronbach Alpha score. The changes to the questions were to simplify the wording so there was less confusion, and the statements were stated clearer and more direct. The final results of the reliability test showed with a sample of 25 respondents, there was an acceptable Cronbach Alpha score of .788, thus allowing the data collection to take place.

Table 7: Reliability Test Results

	N	%
Number of Samples	25	100.0

Cronbach's Alpha	N of Items
.788	25

There was no harm or potential risks to the individual or community where the interview took place. The purpose of the data collection was to gain knowledge of the farmer's point of view on risks. The benefits are that with this knowledge, there may be something that can be done to help better decision making on the farm in order for a more sustainable livelihood for the farmer.

3.6 Data Analysis

Descriptive statistics was used to explain the farm and farmers characteristics and analyze the Likert-scale data that was acquired through the survey. The data results were presented by texts, tables, and figures. Excel was used to input the information and to calculate means and standard deviations.

The data collected from the Likert-scale survey was quantified. These numbers show the perceived risk ratings with the mean score and standard deviation. These scores will show numerically which risks were perceived high and low. The Likert-scale ranged from 1-5, with 1 (not at all), 2 (a little bit), 3 (indifferent), 4 (much), 5 (very much). These numbers were also used to gain further insight into risk perception.

Simple multiple regression analysis was performed on the collected data. In order to determine if debt has influence on certain risks, the regression analysis determined correlation and significance between variables among the data. Excel was the statistical program used for this analysis. When analyzing, the dependent variables were the agricultural risks in which the perception is being asked. They are production risks, market risks, financial risks, and climate risks. The independent variables used in the study were the socio-demographic information of the farmers. They are age, education level, years farming, number of people in the household, and household annual income.

Chapter 4

RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Farmers

Table 8 shows the socio-economic characteristics such as gender, age, years farming, highest education level completed, rais of land on the farm, ownership status, household members, annual household income, if the farmer worked off-farm, and the net-off farm income in the last 12 months. In this study, there were 200 total respondents, with 100 farmers representing the durian group and 100 farmers for the rice group.

The durian group was even with half of the respondents being male and the other being female. The rice group had more males than females, however it was close with 54% of the farmers being male and 46% being female. This was beneficial as the responses were not represented more by a specific gender and created equality between the two groups. There could be a difference in the way that genders perceive risk and depends on what their role on the farm operation is.

There were some differences in the ages of the farmers between the two groups. The durian farmers had more youth in their group as 23% of farmers were under the age of 30, compared to the rice farmers with just 9%. Both groups were similar in the 31-50 age range with 27% of respondents from the durian group and 25% from rice. The rice farmers were generally older with 66% of the respondents older than 51 with 64% between ages 51 – 65. Durian had 38 respondents in the 51-65 age group and 12% were above the age of 65. Age can have an influence in the perception of risk as with age comes more experience, responsibilities, and priorities. As farmers get older and begin to have families, work to take care of themselves, and have financial obligations to deal with, the way in which their mindset is from ages 25-65 can vary greatly and this can have a direct impact on how they view certain risks.

Table 8: Socio-demographic Descriptive Statistics

Socio-Economic Characteristics	Durian %	Rice %
Gender		
Male	50	54
Female	50	46
Age (Years)		
<30	23	9
30-50	27	25
51-65	38	64
>65	12	2
Years Farming		
<10	30	22
10-30	41	60
>30	29	18
Education Level		
Primary	29	42
Secondary	18	41
Vocational	15	6
Bachelor's	34	10
Post Grad	4	1
Rais of Land on Farm		
0-15	44	29
16-30	24	14
31-40	12	22
>40	20	35
Ownership Status		
Owner	92	40
Lease	8	60
Household Members		
1-2	28	22
3-4	43	36
4+	29	42
Annual Household Income (Baht)		
<100,000	10	45
100,000-250,000	21	39
250,001-450,000	18	10
>400,000	51	6
Off-Farm Work		
Yes	46	47
No	54	53
Net Off-Farm Income in Last 12 Months (Baht)		
<100,000	23	42
100,000-250,000	11	4
250,001-400,000	6	0
>400,000	6	1

Overall, the rice farming group had 78% of farmers with farming experience between 11 – 30 years and more than 30 years. 60% of rice farmers have been farming between 11 – 30 years compared to the durian group with 41%. The durian group however had 29% of the respondents with 30 or more years of experience compared to 18% of the rice group. The lack of farming experience is highlighted in the durian group with 30 respondents with less than 10 years of experience compared to 22% of the rice farmers. Farming experience can have an impact on the perception of risks because the more years on the farm, the more they are exposed to agricultural risks. Each year, new risks can occur, and the farmers will have to face these challenges throughout their farming careers. The more a farmer is in a situation when a risk occurs, they are able to learn from what has happened or be more prepared to handle the challenge that their farm is dealing with. This can shift and shape their perceptions on the risk as if they are exposed and able to get through it, they will know what to do if it happens to them again in the future. They will also be more conscious of these risks occurring and make any necessary adjustments to deal with them so that their farm operation and livelihood are not compromised.

There was a vast difference between the two groups in regard to the highest education level completed. Eighty three percent of the rice group had completely secondary school before starting their farming careers compared to 47% of the durian farmers. Thirty four percent of the durian farmers completed their bachelor's degree with 4 respondents having either a master's or doctorates degree. This is compared to the rice group with whom 10% completed their bachelor's degree and 1 respondent getting their master's degree or doctorate. Vocational school, which is more specialized and have more technical learning opportunities was also an option for farmers in both groups with 15% of durian farmers choosing to go to this type of school compared to 6% of rice farmers. The education level can have an impact on risk perception as the farmers who pursued higher education can learn more regarding to off-farm agricultural risks such as financial and market risks. This can help them be better prepared to run their farming business and optimize profit and if faced with one of these risks they may have more of the knowledge as to why these risks can occur, not just that they potentially may happen.

The farm operation data of both groups in terms of the size of their farm and the ownership of the land that they grow their crops on. The size of land that they operate on can have an influence on the perception of risks as the more land that they operate on, the volume of crops produced is increased. This means that they are in a position of more loss if an agricultural risk such as production or climate risks occur, and they also have to be more conscious of market risks to make sure that they are growing enough to be able to sell what they need to in order to take care of themselves financially. In this study, 44% of the durian farmers were operating on 15 rais or less compared to 29% of rice farmers. 24% of the durian group were between 16 – 30 rais and 12% were operating on 31 – 40 rais. There were more rice farmers operating on larger plots of land with 30% of farmers on more than 40 rais, compared to 20% of the durian farmers.

In this study, the participants were asked about their ownership status of the land, either owning it completely or leasing it for their farm use. Leasing their land meant that they were paying someone else to use their land to grow their crop and had to make payments in order to keep farming in that area. There was a substantial difference between the two groups as it pertains to owning and leasing. Ninety two percent of the durian farmers were owners of their farm operation compared to 40% of the rice group. In contrast, 8% of the durian farmers leased their land with 60% of the rice group with a 12-month lease. If you own your land outright, you can be the decision maker and whatever happens to the land is your responsibility. If you do not own the land and rent it from somebody else, you may be able to farm the way that you like however if something goes wrong there are more repercussions. Leasing the land from someone may also have some restrictions on what you can do to the land and have to follow the rules set by the owner. This could mean that some farming techniques, such as using chemical pesticides or herbicides may not be allowed and could affect the yield of the crop.

The number of people living in their household, the annual household income, if the respondent had work outside of their farming operation, and the off-farm income from the past 12 months. Overall, the durian group had less people living in their household compared to the rice farmers. The largest difference was with the rice group having

42% of respondents with 4 or more people living in their homes compared to 29% of the durian group. Both groups were similar in the 1 – 2 range with 28% for durian and 22% for rice and 43% of durian having 3 – 4 people compared to 36% of rice. With more people living in their homes, the perception of risk may be greater due to more people's livelihoods at stake.

One of the most significant differences is in the annual household income between the two groups. Just under half of the rice farmers acquire less than 100,000 baht at 45%. The durian group had just 10% with less than 100,000 baht per year. With the poverty line set at 32,000 baht per year, this is something that should be highlighted. In contrast, over half of the durian farmers acquired more than 400,000 baht at 51% with just 6 rice farmers in this category. Thirty nine percent of the rice farmers were between 100,000 to 250,000 baht and 10% between 250,001 to 400,000 baht. Durian farmers came in at 21% and 18%, respectfully. Annual household income can have implications on risk perception as the less you make, the more fearful of risks occurring and either damaging crops or lowering their yield can cause them to make less money.

Less than half of the respondents had off-farm work to make additional income, but it was close to half with 46% of durian farmers with additional work and 47% of rice farmers doing something else as well. Most of the additional income was less than 100,000 baht with 23% of durian farmers falling into this category and 42% of the rice farmers. The durian group showed that the respondents who have off-farm work make more income with 6% making between 250,001 – 400,000 baht and 6% making more than 400,000 baht compared to just 1 respondent from the rice group making over 400,000 baht.

Farmers borrow money for a variety of different reasons, are there are currently over 1 million farmers in debt. The debt level can affect their perception of risks as being in debt means that you owe money and if something were to occur on their farm operation, they may not be able to make the payments they need which will keep them in the debt cycle. If farmers are not able to attain the yield that they plan for and sell their crop at the appropriate price, they will not be able to pay off the source of loan and this will continue to have negative consequences on their livelihood.

Table 9 shows the farmers who financed their farm operation, the duration of their loan, and the outstanding balance if they have one. In each group, less than half of the farmers financed their land, but the rice had more at 49% compared to 28% of the durian farmers. The length of their loan varied, with 19% of rice farmers with a loan that must be paid under 1 year, 14% between 1 – 2 years, 10% between 2 – 3 years, and 6% more than 3 years. This is compared to the durian group which has 7% to pay off their loan in less than a year, 6% between 1 – 2, 11% between 2 – 3, and 4% having more than 3 years. The biggest differences are seen in the outstanding balance of their loan, with 29% of the rice farmers to pay off more than 90,000 baht compared to 12% of durian farmers.

Table 9: Farm Loan Data Summary

Farm Loan Data	Durian %	Rice %
Financed Farm Operation		
Yes	28	49
No	72	51
Duration of Loan (Years)		
None	72	51
<1	7	19
1-2	6	14
2-3	11	10
>3	4	6
Outstanding Loan Balance (Baht)		
None	72	51
<30,000	2	6
30,000-50,000	3	8
50,001-90,000	3	1
>90,000	12	29
Fully Paid	8	5

Figure 5 shows the sources of loans for each group. The options were The Bank for Agriculture and Agricultural Cooperatives (BAAC), cooperatives, relatives, and informal loans. The most used source of loan is the BAAC with 19% of the durian farmers who sought out a loan is utilizing their resources and 33% of the rice farmers. Other cooperatives were popular amongst the rice farming group with 12% receiving

their loan from them with just 3% of the rice farmers. Relatives and informal loans were also used by both groups; however, this number was very few.

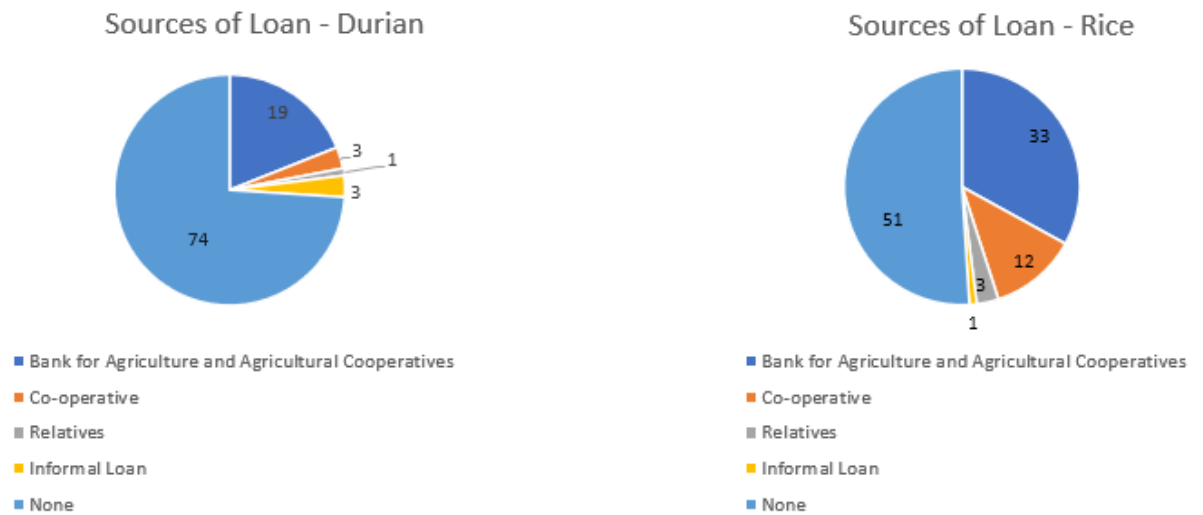


Figure 5: Sources of Loans

4.2 Agricultural Risk Perception

In order to determine the research objective of identifying differences in perceptions of production, market, financial, and climate risks between Thai rice and durian farmers, mean scores were calculated to indicate the level of dread and knowledge that the farmers have for certain agricultural risks such as production, financial, market, and climate risks. For each risk, subcategories were chosen to measure:

production risk – pests and disease

market risk – crop price

financial risk – debt level

climate risk – floods and/or droughts

The questions created were to determine the risk perception on two scales: dread and knowledge. The higher the dread level and lower the knowledge level indicates a high level of perceived risk, as the lower the dread level and high the knowledge indicates a low level of risk perception.

The study used a scale to answer the questions ranging from 1 to 5.

Table 10: Risk Perception Mean Scores

Agricultural Risk Perception	Dread				Familiarity			
	Durian		Rice		Durian		Rice	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Production Risk								
Pests and Disease	3.68	0.197	3.73	0.379	3.35	0.463	3.13	0.549
Financial Risk								
Debt Level	3.00	0.147	2.99	0.402	3.22	0.442	2.69	0.502
Market Risk								
Crop Price	3.58	0.598	3.64	1.043	3.04	0.878	2.72	1.117
Climate Risk								
Floods and/or Droughts	3.54	0.316	4.19	0.363	3.27	0.700	3.40	0.930

Among the five scales, depending on where the mean score of the risk perception falls will determine if there is a high, low, or neutral risk perception found in Table 4.3. For scores ranging from 0.00 to 2.25, the farmer will show a low level of dread and low level of familiarity. Scores ranging from 2.26 to 3.25 will show a neutral perception of risk. Lastly scores ranging from 3.26 to 5.00 will show a high level of dread and high level of familiarity. The combination of dread and familiarity will determine the heightened or lessened perception of dread of the farmer for agricultural risks [36].

4.2.1 Production Risk

Both groups showed high levels of dread and that they are worried about pests and diseases destroying their farm with mean scores of 3.68 for durian and 3.73 for rice. This is similar to [21] which found that disease was perceived as the most major source of risk for their product and on their farm income out of 731 farmers.

Familiarity with pests and disease was neutral with mean scores of 3.35 for durian and 3.13 for the rice group. [11] also showed that disease prevention was of high importance for the farm operation and was perceived as one of the most important risk management strategies.

4.2.2 Financial Risk

For financial risk in terms of debt level, each group was similar in that they did not have either high or low levels of dread or knowledge which indicates that they feel neutral about this. The dread level for durian was 3.00 and for rice it was 2.99. This shows that both groups are neutral and do not have any perception of fear for debt.

The familiarity of debt was 3.22 for durian and 2.69 for rice showing that they were neutral in terms of their understanding of debt. This may suggest that either the two groups are not concerned with becoming further in debt, or fall into debt at all, as well as they may not know the severity of the consequences of paying off loans properly.

[11] showed that debt management was of high importance. The results are interesting in that it seems if a Thai rice or durian farmer is in debt, it does not affect

them in terms of how they operate their farm and getting out of debt or falling more into debt is not a concern for them. With a greater amount of rice farmers in debt and with a greater amount of outstanding balance on the loans, this shows that there is a gap in rice farmers knowledge regarding debt and their ability or access to be debt-free.

4.2.3 Market Risk

Crop price changes can occur at any time and can have serious implications for the farmer and their farming operation. Both groups show that there is high dread for crop price variability with mean scores of 3.58 for durian and 3.64 for rice. This showed both groups are fearful of the price for their crop changing.

Price risks were perceived as the most important risk in their study and that the farmers were producing their products without any guarantee of sales price. In addition, a number of studies have found that price risk for agricultural products were perceived as a major risk [21]. Changes in crop prices have caused major losses for their farmers. These results indicate that crop prices are something that impact that impacts the risk perception of the farmers and in order to lessen the perceived risk something should be done to help them have a set crop price that does not have any variability. This is difficult as the crop price is dependent on the market's supply and demand and if the farmer does not have access to technology, they may not have much awareness of what is going on in the market and the necessary steps that need to take place if crop prices change.

4.2.4 Climate Risk

Both groups showed very high dread levels of floods and/or droughts occurring. This is similar to [11] which identified droughts as one of the most important risk factors. In [21], farmers considered weather variability as a major source of risk in farming.

By looking at this data, the research objective of identifying differences in perceptions of production, market, financial, and climate risks between Thai rice and durian farmers is achieved. Overall, the durian farmers had less dread of the agricultural risks and more familiarity with the ones observed. It was the opposite with the rice farmers, as in regard to the risks the group had a higher dread level and lower levels of

familiarity. This is highlighted with the rice group showing higher levels of dread for production, financial, and climate risks compared to the durian farmers.

4.3 Comparison of Factors Affecting Risk

To determine the research objective of understanding the determinants of risk perception between Thai rice and durian farmers, simple multiple linear regression analysis was used to indicate any significance in farm or farmer characteristics and the perceived level of risk. Seven explanatory factors were used as independent variables to determine the significance against each risk: age, education level, years farming, rais of land, ownership of land, annual household income, and if the farm was financed. The significance can give an understanding what forms the perception of risk and can lead to future research on the decision-making process after the perception is formed. The analysis provided p-values which indicated that it was significant in the dread or knowledge perception amongst the risk at a 90%, 95%, or 99% confidence level. If the p-value was $<.05$ then the null hypothesis was rejected, and this showed that the variable was significant in the perception of risk.

[4] focused on finding factors determining differences in the level of risk perception. They concluded that these differences are determined by the socio-economic features of the farmers and the characteristics of their farms. There should be awareness of the fact that farmers from various countries live within different climatic and institutional conditions, therefore the differences of risk perception can be a result of either different probabilities of certain risk factors, or different farmers' mentality and awareness, or a mixture of both.

In this study, out of the seven explanatory factors used to determine risk perception, age, rais of land, annual household income, and financing the farm operation all showed significance within the agricultural risks at either a 90% or 95% confidence level.

4.3.1 Production Risks

Table 11 shows annual household income as the only significant for production risks for durian farmers and Table 12 shows rais of land for production risks for the rice group. Pests and diseases can cause a lot of damage to the farm and crops. Annual

household found to be the only factor associated with higher levels of perception of production risk for durian farmers. The results suggest that as the annual household income increases, the perception of production risk will decrease. Income may be significant because with more income, the loss associated with any damage from pests and diseases does not hold as much of a negative impact as farmers with a low annual household income. Rais of land was the only significant variable for the rice farmers. The results show that as the area of land increases on the farming operation, the higher perception of risk there is for pests and diseases. The amount of land used for production may also be significant due to the number of crops that are grown and potentially can be affected by pests and diseases. With more land, there has to be more preventative maintenance to protect themselves from pests and disease and if production risks occur, their crop yield may suffer and thus resulting in less income for the year.

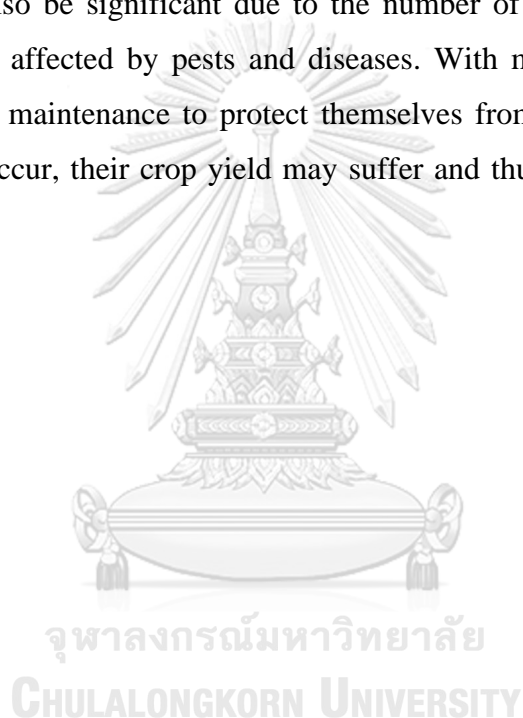


Table 11: Durian Production Risk Regression

Durian Production Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	-0.1741293	0.1310914	-1.32	0.187
Education	0.0807029	0.0602047	1.34	0.183
Years Farming	0.0666166	0.1059603	0.62	0.531
Rais of Land	-0.0322443	0.0607132	-0.53	0.596
Ownership of Land	-0.1988576	0.4235241	-0.46	0.639
Annual HH Income	-0.1738722	0.0736311	-2.36	0.020**
Financed Farming Business	-0.018996	0.1503123	-0.12	0.899

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

Table 12: Rice Production Risk Regression

Rice Production Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	3.2080151	0.3802503	8.43	0.930
Education	0.0052970	0.0606637	0.08	0.249
Years Farming	0.059275	0.0511988	1.15	0.873
Rais of Land	0.0074949	0.0468577	0.15	0.038**
Ownership of Land	0.1806399	0.0382643	4.72	0.477
Annual HH Income	-0.0766615	0.1074517	-0.71	0.427
Financed Farming Business	-0.0491537	0.0617024	-0.79	0.181

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

4.3.2 Market Risks

Table 13 shows rais of land and age significant (at $p < .10$) for market risks for the durian farmers and Table 14 shows rais of land significant for the rice farmers. Rais of land may show to be a significant factor due to the greater loss that can affect the farming operation if the crop price changes. The results indicate that as the amount of land increases, there is a heightened perception of risk for crop price variability. Most often, the larger the land of production, the more crops are grown and therefore sold. When planning for the season, farmers consider the projected yield they will receive with the market price of their crop. If they are expecting to yield a certain amount and the crop price varies by the time of harvest, they are at a loss for income that was projected and may not be able to fully support their household or farming operation. The results show that as age increases, there is a heightened perception of market risk. Age may be a factor as with age comes experience. The durian group overall had a younger farming group in terms of age and without the experience, market price may be a subject that they are not too knowledgeable about and they may not have enough farming seasons completed to know just how much market risks can affect their farming operation. The results showed for the rice group that as the annual household income increases, there is a lower perception of market risk. This could be due to having a sufficient amount of income that if the price of the crop were to change, there will not be a large negative impact.

Table 13: Durian Market Risk Regression

Durian Market Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	3.6095224	0.648084	5.56	0.091*
Education	-0.1997067	0.1171446	-1.70	0.146
Years Farming	0.0794360	0.054200	1.46	0.200
Rais of Land	0.1240840	0.0962724	1.28	0.048**
Ownership of Land	-0.1064345	0.0532079	-2.00	0.744
Annual HH Income	-0.1443622	0.4419267	-0.32	0.189
Financed Farming Business	-0.085974	0.0649968	-1.32	0.196

***, **, * shows significance at 99% (p < .01), 95% (p < .05), and 90% (p < .10), respectively

Table 14: Rice Market Risk Regression

Rice Market Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	2.9023419	0.3283857	8.83	0.392
Education	0.0450155	0.0523894	0.85	0.464
Years Farming	0.0324534	0.0442150	0.73	0.230
Rais of Land	0.0488497	0.0404665	1.20	0.138
Ownership of Land	0.0494311	0.0330452	1.49	0.733
Annual HH Income	-0.0316526	0.0927957	-0.34	0.060*
Financed Farming Business	-0.1013035	0.0532865	-1.90	0.518

***, **, * shows significance at 99% (p < .01), 95% (p < .05), and 90% (p < .10), respectively

4.3.3 Financial Risks

Table 15 shows annual household income and financing farming business significant (both at $p < .10$) for financial risks in the durian group, while only financing the farming business was significant for the rice farmers in Table 16. Being in debt means that you are using capital that doesn't belong to you and you have to pay it back. The results show for the durian group that as the annual household income increase, there is a lesser perceived risk of debt. If they are able to acquire a sufficient yearly salary, the impact of debt will not be so negative. The lower the annual household income a farmer has, the less debt they should want to be in because some of the money they receive will have to go to their source of loan. Interest rates on loans may also be high and the farmers who finance their farms are most likely more aware of financial risk and what can put them in debt. For both groups, the results indicate that financing the farming business will lessen the perception of debt. This could be that the farmers may feel protected by the source of loan, even though they will owe money and have to pay it back.

Table 15: Durian Financial Risk Regression

Durian Financial Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	-0.0630949	0.1371509	-0.46	0.646
Education	0.0631842	0.0634564	0.99	0.322
Years Farming	0.1334595	0.1127141	1.18	0.239
Rais of Land	-0.0284863	0.062294	-0.45	0.648
Ownership of Land	0.2068630	0.5174001	0.39	0.690
Annual HH Income	-0.1342629	0.0760971	-1.76	0.080*
Financed Farming Business	-0.2606646	0.1541613	-1.69	0.094*

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

Table 16: Rice Financial Risk Regression

Rice Financial Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	0.0461179	0.0922136	0.50	0.618
Education	0.1070052	0.0778262	1.37	0.172
Years Farming	0.0111201	0.0712272	0.15	0.876
Rais of Land	0.0319211	0.0581647	0.54	0.584
Ownership of Land	0.0944433	0.1633349	0.57	0.564
Annual HH Income	0.0366247	0.0937925	0.39	0.697
Financed Farming Business	-0.2778220	0.1418864	-1.95	0.053*

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

4.3.4 Climate Risks

For climate risk, the durian farmers had no significant factors in Table 17 for climate risks and Table 18 shows age significant at $p < .10$ for the rice group. Due to the rise in climate change, it could be that the durian group may be more educated on climate risks and therefore nothing is significant in forming their risk perception. This is highlighted by the higher level of education completed compared to the rice farmers. The results show that for the rice group, as the age increases there is a decrease in the perception of floods and/or droughts. For age to be significant, with age may come with experience and if the rice farmers had experienced climate risks in the past, this could have a big influence in their perception of the risks and the damages that occur if they happen. Having been affected by floods and/or droughts in the past, the rice farmers may be more wary of what could potentially happen to their farm if faced with these issues.

Table 17: Durian Climate Risk Regression

Durian Climate Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	-0.0023936	0.1408641	-0.01	0.986
Education	0.0247082	0.0651744	0.37	0.705
Years Farming	-0.0414053	0.1157658	-0.35	0.721
Rais of Land	-0.0703291	0.0639815	-1.09	0.274
Ownership of Land	0.0528794	0.5314084	0.09	0.920
Annual HH Income	-0.0696167	0.0781574	-0.89	0.375
Financed Farming Business	0.1899785	0.1583352	1.19	0.233

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

Table 18: Rice Climate Risk Regression

Rice Climate Risk				
Explanatory Variables	Coefficients	Std. Error	t	P-Value
Age	-0.1120970	0.0596232	-1.88	0.063*
Education	0.0832327	0.0503206	1.65	0.101
Years Farming	-0.0085772	0.0460539	-0.18	0.852
Rais of Land	0.0045269	0.0376080	0.12	0.904
Ownership of Land	0.0241601	0.1056086	0.22	0.819
Annual HH Income	-0.0795752	0.0606441	-1.31	0.192
Financed Farming Business	-0.1082454	0.0917405	-1.17	0.241

***, **, * shows significance at 99% ($p < .01$), 95% ($p < .05$), and 90% ($p < .10$), respectively

[21] found that farm size and wealth were influential factors affecting the farmer's risk perceptions. This could be due to the fact that with a larger farm size, there are more inputs necessary and have a wider exposure to risk. [1] results showed annual household income and size of farm significant and influenced their perception of agricultural risks. The author also suggests that farmers who are financing their farm operation are more likely to pay attention to changes to their farm financial situations, with level of debt in particular.

[20] said that risk has different meanings between different social and power groups. This matches the results as social and power status is correlated to wealth and assets (size of land).

In this study, education, years farming, and ownership of land did not show any significance at any confidence level. [21] found that age, education, total farm income, and availability to credit were not significant in their results.

The variables that were not significant in this study could be for a variety of reasons. One reason could be that the sample size in this study was not large enough. This study focused on just two districts in each respective province. Future research can use a larger sample size in order to determine if the non-significant variables are significant amongst the two groups. This study had an almost equal number of men and women which could have some effect on the results as they may possess different judgments.

4.4 Multicollinearity Testing

To check the validity of the reported t-values and p-values of the regression results, multicollinearity testing was performed. Theoretically, the higher the t-value the lower the p-value, however in the analysis there were instances of the opposite. To determine this, VIF statistics were tested against the regression analysis. The VIF values resulted in less than 10 showing acceptable multicollinearity levels and the absence of multicollinearity which can be found in Tables 19 and Table 20.

Table 19: Durian VIF Results

Explanatory Variables	Coefficients	Std. Error	t	P-Value	VIF
Age	-0.00239	0.140864	-0.01699	0.9865	3.867844
Education	0.024708	0.065174	0.37911	0.7054	1.522317
Years Farming	-0.04141	0.115766	-0.35766	0.7214	3.980479
Rais of Land Ownership of Land	-0.07033	0.063982	-1.09921	0.2754	1.129422
Annual HH Income	0.05288	0.531408	0.099508	0.9209	1.150337
Financed Farming Business	-0.06962	0.078157	-0.89072	0.3754	1.409208
	0.189979	0.158335	1.19985	0.2332	1.050406

Table 20: Rice VIF Results

Explanatory Variables	Coefficients	Std. Error	t	P-Value	VIF
Age	-0.112097	0.059623	-1.88009	0.0632	1.019130
Education	0.083232	0.050321	1.65404	0.1015	1.336705
Years Farming	-0.008577	0.046054	-0.18624	0.8527	1.207037
Rais of Land Ownership of Land	0.004526	0.037609	0.120372	0.9045	1.185314
Annual HH Income	0.024160	0.105609	0.22877	0.8196	1.482568
Financed Farming Business	-0.079575	0.060644	-1.31217	0.1927	1.501441
	-0.108245	0.091741	-1.17991	0.2411	1.164913

4.5 Limitations of the Study

There were a few limitations to this study. The first is that the researcher does not have fluency in the Thai language. With only basic speaking, reading, and writing skills, all documents had to be translated from English to Thai and then back to English. Somewhere among the translation, the meaning of what was meant to be said

could have been changed and therefore maybe does not mean the same thing. The researcher was not able to be certain that what was translated in Thai was exactly how the researcher meant it to be when written in English. The researcher was also not able to speak directly to the farmers and ask or answer any type of question. Having needed the assistance from translators, again, the meaning of what was being said through the translation could have led to different data.

The sample size may have an effect on this study as well. Future research may need more respondents in their study to get a broader range of data. There also could have been additional districts or provinces if possible. The type of farm could be more specific as well, particularly for the rice group and looking at irrigated vs non irrigated land. More specifics of farm characteristics could lead to different results.

Lastly, the lack of prior research studies on this topic may have been a limitation. There are studies on risk perception of farmers, however there is very few in Thailand and even less more specific to rice and durian. Having more knowledge of this topic for Thai farmers, the scope of the research could have been larger and different sources of risk or characteristics of the farm and farming operation could have been looked at.

Chapter 5

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, years farming, rais of land, ownership of land, household income, and the financing status of the farm are all determinants of Thai rice and durian farmers' perception of climate risks. This study is amongst the first to use the psychometric analysis to determine the risk perception of Thai farmers.

The key similarities between the two groups are that the rais of land that the crops are produced on, the annual household income, and the financing status of the farming business are all highly significant in the perception of agricultural risks. Knowing this, farmers who are growing their crops on larger pieces of land should know what they are able to do in order to protect themselves from agricultural risks and prevent larger crop yields from becoming damaged or optimize the land in which they produce on in order to achieve their yearly targets as the crop price may change. As annual household income and financing are prevalent in the perception risk, ways in which the farmer doesn't feel the financial burden may be introduced in order for them to operate their farm without fearing they will not acquire enough income to support the members of their household or pay off the loan that they applied for. Interest rates and affordable loans, as well as being flexible with the farmer may help with the ability to operate their farm to achieve maximum results.

The variables that were not significant in this study could be for a variety of reasons. One reason could be that the sample size in this study was not large enough. This study focused on just two districts in each respective province. Future research can use a larger sample size in order to determine if the non-significant variables are significant amongst the two groups.

5.1 Policy Recommendations

Focusing on my third research objective, agricultural 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 any risk that the farmers may have to deal with. Agricultural and government agencies to run workshops for farmers to educate them on all of the agricultural risks they may face. This can be both technical learning, focusing on on-farm techniques such as a demonstration on implementing irrigation systems if faced with droughts, preventative maintenance to protect them from floods, and crop rotation to plant their crops on specific areas of land and then the next planting season use different plots to help with pests and diseases. Consultants can be brought in to show how they can track the market price for their crop and see any trends of variability for the farming season. Lastly, financial advisors can be provided to assess the farmers debt situation and establish budgeting plans so that they are able to have a consistent income to provide for themselves and their families while paying off the loan to the source they are receiving it from.

5.2 Future Research

Future research should be conducted by studying the willingness to take risks based off the perception of the certain agricultural risks. The perception will be a determinant in the farmers' preparedness followed by their actions in regard to pests and diseases, crop price, debt, and floods and/or droughts. By learning the factors that influence risk perception, as well as the willingness of the farmers to take risk, further knowledge of farm making decisions can be provided for the farmers to prepare themselves for risks and prevent risk from doing further damage to their farms and households.

It is important that if the farmers are affected by agricultural risks, agricultural policies should be used to help with the farmers ability to deal with the risks after they happen. The government should create an agricultural credit policy to help with the issues that farmers face.

The research can be used to help farmers be resilient when faced with agricultural risks, as well as develop improved systems to protect them if a certain agricultural risk occurs. Agricultural organizations can develop educational opportunities to assist

the Thai 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.



Appendix

Measure	Question	1 Not at all	2 A little	3 Indiffe rent	4 Much	5 Very Much
1	Production Risks					
1.1 Common - Dread	As a farmer, I worry about pests and diseases.					
1.2 Severity of Consequences	After pests and disease occur, my farm is severely damaged.					
1.3 Personal Exposure	My farm is affected by the risk of pests and diseases.					
1.4 Ease of Reduction	I am able to lessen the damages from pests and diseases after they occur.					
1.5 Knowledge	I have knowledge about how and which pests and diseases that can affect my farm.					
1.6 Control	I have control over the negative impacts of pests and diseases.					
1.7 Newness	The risk of pests and disease are new to me and my farm.					
1.8 Immediacy	When pests or diseases occurs, I can see the damages right away.					
2	Market Risk					
2.1 Common - Dread	As a farmer, I worry about crop prices changing.					
2.2 Severity of Consequences	After crop prices change, my farm is financially at risk.					
2.3 Personal Exposure	My farm and household are affected by the changing of crop prices.					
2.4 Ease of Reduction	I have influence on reducing the frequency of the change					

	in crop price.					
2.5 Knowledge	I understand the risk of that the price of my crop can change.					
2.6 Control	I have control over the changing of crop prices.					
2.7 Newness	The risk of crop price changing is new to me and my farm.					
2.8 Immediacy	When the crop price changes, I believe my farm is impacted right away.					
3	Financial Risk					
3.1 Common - Dread	As a farmer, I worry about being in debt.					
3.2 Severity of Consequences	When farm debt occurs, I think my farm and livelihood will be impacted negatively.					
3.3 Personal Exposure	My farm is affected by increasing debt levels.					
3.4 Ease of Reduction	It is easy for me to get out of debt.					
3.5 Knowledge	I am aware of what will put my farm into debt and how I can get out of it.					
3.6 Control	I have control over the level of debt of my farm.					
3.7 Newness	The risk of debt is a new risk for me and my farm.					
3.8 Immediacy	When debt level increases, my farm and livelihood are affected right away.					
4	Climate Risk					
4.1 Common - Dread	As a farmer, I worry about floods and/or droughts.					
4.2 Severity of Consequences	After a flood or drought occurs, my farm is severely damaged.					
4.3 Personal Exposure	My farm is affected by the risk of floods and/or droughts.					
4.4 Ease of Reduction	I am able to lessen the damages from floods and/or after they occur.					
4.5 Knowledge	I have knowledge about how floods and droughts can affect my farm.					
4.6 Control	I have control over the negative impacts of floods and droughts.					
4.7 Newness	The risk of floods and/or droughts are new to me and my farm.					
4.8 Immediacy	When a flood and/or occurs, I can see the damages right away.					

ส่วนที่ 3 ความคิดเห็นและทัศนคติเกี่ยวกับความเสี่ยงจากการบริหารจัดการฟาร์มในเกษตรกร

ลำดับ	คำถาม	1 เห็นด้วย น้อยที่สุด	2 เห็นด้วย น้อย	3 เห็นด้วย ปาน กลาง	4 เห็นด้วย มาก	5 เห็นด้วย มากที่สุด
1	ความเสี่ยงด้านการผลิต - โรคและศัตรูพืช					
1.1 ระดับความกลัว ทั่วไป - ความกลัว	ในฐานะเกษตรกร ท่านคิดว่าท่านมีความกังวลเกี่ยวกับโรคศัตรูพืชอยู่ในระดับใด					
1.2 ระดับความรุนแรงของผล ที่ตามมา	หลังจากเกิดปัญหาโรคและศัตรูพืช นา/สวนของท่านมักได้รับความเสียหายอย่างรุนแรง					
1.3 ระดับความเสี่ยงส่วนบุคคล	นา/สวนของท่านมักได้รับผลกระทบจากความเสี่ยงด้านโรคและศัตรู พืช					
1.4 ระดับความสามารถในกา ลดความเสี่ยง	ท่านสามารถบรรเทาและจัดการความรุนแรงที่เกิดจากปัญหาโรคและ ศัตรูพืชได้เอง					
1.5 ระดับความรู้	ท่านมีความรู้เกี่ยวกับโรคและศัตรูพืชที่สร้างความเสียหายต่อนา/สวน ของท่านเป็นอย่างดี					
1.6 ระดับการควบคุม	ท่านสามารถควบคุมผลกระทบ ความเสียหาย ที่เกิดจากโรคศัตรูพืชได้					
1.7 ระดับความแปลกใหม่	ท่านคิดว่าโรคและศัตรูพืชที่เกิดขึ้นเป็นสิ่งใหม่ต่อนา/สวน และตัวท่านเอง					
1.8 ระดับความอับพลัน	เมื่อโรคและศัตรูพืชเกิดขึ้นในนา/สวนของท่าน ท่านสามารถสังเกตเห็นความเสียหายได้ทันที					
2	ความเสี่ยงด้านตลาด - ความผันผวนของราคาพืช					
2.1 ระดับความกลัว ทั่วไป - ความกลัว	ในฐานะเกษตรกร ท่านคิดว่าท่านมีความกังวลต่อราคาพืชผลที่มีความผันผวนอยู่ในระดับ ใด					
2.2 ระดับความรุนแรงของผล ที่ตามมา	นา/สวนของท่านมักเกิดความเสี่ยงทางการเงินหลังจากเกิดการผันผว นของราคาพืชผล					
2.3 ระดับความเสี่ยงส่วนบุคคล	การผันผวนของราคาพืชผลมักจะส่งผลกระทบต่อনা/สวน และครอบครัวของท่าน					

2.4	ระดับความสามารถในการลดความเสี่ยง	ท่านคิดว่าท่านมีความสามารถในการลดความเสี่ยงของการผันผวนของราคาพืชผล					
2.5	ระดับความรู้	ท่านมีความเข้าใจถึงความเสี่ยงของการผันผวนของราคาของพืชผลที่สามารถเกิดขึ้นและส่งผลในนา/สวนของท่านได้					
2.6	ระดับการควบคุม	ท่านสามารถควบคุมการผันผวนของราคาพืชผลได้					
2.7	ระดับความแปลกใหม่	ท่านคิดว่าความเสี่ยงจากการผันผวนทางราคาเป็นเรื่องใหม่ที่เกิดขึ้นต่อผลผลิตจากนา/สวน และตัวท่าน					
2.8	ระดับความฉับพลัน	เมื่อราคาพืชผลมีการเปลี่ยนแปลงผันผวน ท่านคิดว่านา/สวนของท่านจะได้รับผลกระทบในทันที					
3	ความเสี่ยงทางการเงิน - ระดับหนี้สิน						
3.1	ระดับความกลัวทั่วไป - ความกลัว	ในฐานะเกษตรกร ท่านมีความกังวลเรื่องหนี้สินอยู่ในระดับใด					
3.2	ความรุนแรงของผลที่ตามมา	เมื่อเกิดหนี้สินจากการทำการเกษตร ท่านคิดว่านา/สวน และความเป็นอยู่ของท่านจะได้รับผลกระทบในเชิงลบอย่างแน่นอน					
3.3	ระดับความเสี่ยงส่วนบุคคล	นา/สวนของท่านมักได้รับผลกระทบจากภาระหนี้ที่เพิ่มขึ้น					
3.4	ระดับความสามารถในการลดความเสี่ยง	ฉันคิดว่าภาระหนี้สินเป็นเรื่องที่ทำได้ง่าย					
3.5	ระดับความรู้	ท่านตระหนักถึงสาเหตุที่ทำให้ท่านเกิดหนี้สินและท่านสามารถหลีกเลี่ยงไม่ให้เกิดหนี้สินได้					
3.6	ระดับการควบคุม	ท่านสามารถควบคุมระดับหนี้สินที่เกิดจากการทำนา/สวนได้					
3.7	ระดับความแปลกใหม่	ความเสี่ยงเรื่องหนี้สินเป็นเรื่องใหม่ต่อท่านและนา/สวนของท่าน					
3.8	ระดับความฉับพลัน	เมื่อระดับหนี้สินเพิ่มขึ้น นา/สวน และความเป็นอยู่ของท่านมักจะได้รับผลกระทบในทันที					
4	ความเสี่ยงจากสภาพภูมิอากาศ - น้ำท่วมและภัยแล้ง						
4.1	ระดับความกลัวทั่วไป - ความกลัว	ในฐานะเกษตรกร ท่านมีความกังวลเกี่ยวกับน้ำท่วมและภัยแล้งในระดับใด					
4.2	ความรุนแรงของผลที่ตามมา	ส่วนใหญ่แล้วหลังจากเกิดภัยพิบัติน้ำท่วมและภัยแล้ง นา/สวนของท่านมักได้รับผลกระทบและความเสียหายอย่างหนักทันที					
4.3		นา/สวนของท่านมักได้รับผลกระทบจากน้ำท่วม และ/หรือภัยแล้ง					

ระดับความเสี่ยงส่วนบุคคล						
4.4 ระดับความสามารถในการลดความเสี่ยง	ท่านสามารถบรรเทาและจัดการความเสียหายที่เกิดจากภัยพิบัติน้ำท่วม และ/หรือภัยแล้งได้เป็นอย่างดีภายหลังเกิดภัยพิบัติ					
4.5 ระดับความรู้	ท่านมีความรู้ว่ภัยที่เกิดจากน้ำท่วมและภัยแล้งจะก่อให้เกิดความเสียหายต่อนา/สวนของท่านได้อย่างไรบ้าง					
4.6 ระดับการควบคุม	ท่านสามารถควบคุมและจัดการผลกระทบเชิงลบที่เกิดจากภัยพิบัติน้ำท่วมและภัยแล้ง					
4.7 ระดับความแปลกใหม่	ความเสี่ยงและปัญหาที่เกิดจากภัยพิบัติน้ำท่วมและ/หรือภัยแล้งเป็นเรื่องใหม่ที่เกิดขึ้นกับนา/สวนของท่าน					
4.8 ระดับความซับซ้อน	เมื่อเกิดภัยพิบัติน้ำท่วม และ/หรือภัยแล้งขึ้น ท่านสามารถสังเกตและคาดคะเนความเสียหายที่เกิดขึ้นได้ในทันที					





The Research Ethics Review Committee for Research Involving Human Research Participants,
Group I, Chulalongkorn University
Chamchuri 1 Building, 2nd Floor, 254 Phayathai Road, Pathumwan, Bangkok 10330 Thailand
Telephone: 02-218-3202, 02-218-3049 Email: eccu@chula.ac.th

COA No. 136/65

Certificate of Approval

Study Title No. 650009 : A PSYCHOMETRIC STUDY OF THAI FARMER'S PERCEPTION OF AGRICULTURAL RISKS

Principal Investigator : Mr. Cato LaCroix

Place of Proposed Study/institution : Graduate School, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University, Thailand, has approved constituted in accordance with Belmont Report 1979, Declaration of Helsinki 2013, Council for International Organizations of Medical Sciences (CIOM) 2016, Standards of Research Ethics Committee (SREC) 2017, and National Policy and guidelines for Human Research 2015.

Signature *Prida Tasanapradit*
(Associate Prof. Prida Tasanapradit)
Chairman

Signature *Raveenan Mingpakaneer*
(Assistant Prof. Dr. Raveenan Mingpakaneer)
Secretary

Date of Approval : 29 June 2022

Approval Expire date : 28 June 2023

The approval documents including:

1. Participant Information Sheet and Consent Form
2. Research proposal
3. Researcher
4. Research instruments/tools

Conditions

The approved investigator must comply with the following conditions:

1. It is unethical to collect data of research participants before the project has been approved by the committee.
2. The research/project activities must end on the approval expired date. To renew the approval, it can be applied one month prior to the expired date with submission of progress report.
3. Strictly conduct the research/project activities as written in the proposal.
4. Using only the documents that bearing the RECCU's seal of approval: research tools, information sheet, consent form, invitation letter for research participation (if applicable).
5. Report to the RECCU for any serious adverse events within 5 working days.
6. Report to the RECCU for any amendment of the research project prior to conduct the research activities.
7. Report to the RECCU for termination of the research project within 2 weeks with reasons.
8. Final report (AF 01-15) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project.
9. Research project with several phases: approval will be approved phase by phase, progress report and relevant documents for the next phase must be submitted for review.
10. The committee reserves the right to site visit to follow up how the research project being conducted.
11. For external research proposal the dean or head of department oversees how the research being conducted.



Digital Certificate

Study Title No. 650009
Date of Approval 29 Jun 2022
Approval Expire date 28 Jun 2023

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