

The relationship of agricultural growth, price, wages and
poverty reduction of Thai Rice Farmers

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ในยุคปัจจุบันจำนวนประชากรของประเทศไทยได้เพิ่มขึ้นทุกๆปี จึงเป็นสาเหตุทำให้ความต้องการอาหาร
 เพิ่มมากขึ้นเช่นกัน แหล่งที่มาหลักของอาหารมาจากภาคเกษตรกรรม ผลผลิตทางการเกษตรเป็นตัวแปรที่ได้รับความ
 สนใจอย่างยิ่งจากนักเศรษฐศาสตร์ที่จะศึกษาเกี่ยวกับกระบวนการพัฒนาและการเจริญเติบโตทางเศรษฐกิจ ผลผลิตทาง
 การเกษตรในประเทศไทยที่น่าสนใจมีหลายชนิด การศึกษาในครั้งนี้เฉพาะเจาะจงข้อมูลเกี่ยวกับข้าว ซึ่งเป็นพืช
 เศรษฐกิจอันดับหนึ่งของประเทศไทยและมีพื้นที่เพาะปลูกใหญ่ที่สุด วัตถุประสงค์ของการศึกษาคือ เพื่อหา
 ความสัมพันธ์ของการเติบโตทางการเกษตร โดยพิจารณาความสัมพันธ์ของผลผลิตทางการเกษตร ว่าส่งผลอย่างไรต่อ
 ราคา ค่าแรง และความยากจนของชาวนาไทย โดยใช้การเปรียบเทียบข้อมูลทางสถิติเชิงพรรณนาควบคู่ไปกับทฤษฎี
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 ค่าแรงและความยากจนของชาวนาไทย ไม่มีข้อมูลทางสถิติที่เพียงพอต่อการสรุปความสัมพันธ์ของตัวแปรว่าเป็น
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In recent years Thai population has increased year by year, this would also increase the demand for food as well. The sources of those foods come from agriculture. Agricultural production has been a great interest to economists studying the process of development and growth. There are many types of agricultural productivity which are interesting, I would like to focus specifically on rice which is the major economic crop in Thailand and have the largest farm area. The objective of this study is to study the relationship of agricultural growth by considering the relationship between productivity with price, wage and poverty of rice's farmer in Thailand by comparing descriptive statistic including imply economic theory. The result of the study found that if considering the relationship from descriptive statistic for productivity with price, wages and poverty. There is not enough evidence with scientific number to make a conclusion about the positive or negative relationship of the variables. So, putting more variable related with these variables into the equation to make correlation and regression analysis is the suggestion for further study.



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1.Introduction

In recent years Thai population has increased year by year, this would also increase the demand for food as well. The sources of those foods come from agriculture. Agriculture is also one of the four pillars in Thailand 4.0 model. It is the main industry sector which is undergoing a major transformation, a stable agricultural sector ensures a nation of food security as the people have more concern especially during and after the crisis. Shortage of agricultural productivity will lead to impact of industrial production and effect to increase price level because during recession industrial production can be reduced or stop but agricultural production still has to continue. Agriculture is not providing only food but also fabrics, wood and leather which are the basic requirements for life. Agricultural industry is a significant portion of Gross Domestic Product (GDP), it shows how the economy is performing. Agricultural products are continuing to be important to the national economy, discovering the nations productive benefit in this sector is the fastest way to stimulate economic growth. It is not important to only national economy but also the source of earning the country foreign exchange, primary source of generating income, source of saving and crucial source of livelihood. In many developing countries, agricultural jobs help reduce high rates of unemployment cause by the fast-growing population. Agriculture drives innovation technology because healthy agriculture is so essential to a country's well-being. Through gene manipulation, artificial intelligence, blockchain software, scientists and farmers have been working out ways to increase crop productivity and reduce negative impacts on the environment. Agricultural production has been a great interest to economists studying the process of development and

growth (Eberhardt & Vollrath, 2018). If agriculture develops smoothly, imports will decrease, while exports will greatly increase. Development of agricultural sector is one of the keys to relief poverty, it would increase the purchasing power of farmer which in turn supports the growth of non-agriculture sector and also provides the market for production.

As there are many types of agricultural productivity which are interesting, I would like to focus specifically on rice which is the major economic crop in Thailand and have the largest farm area. The literatures substantially with the studies that analyze agricultural sector in many countries. The objective of this paper is to check the significance of GDP of agriculture and non-agriculture sectors. To study the relationship between agricultural growth, rural development and poverty reduction of Thai Rice Farmer by considering the relationship between productivity with price, wage and poverty of farmer. There are 3 hypotheses within this study. First is about price, increases agricultural productivity can change the relative prices of agricultural productivity as well as the costs of inputs to production. Second hypothesis is wage, increase in productivity may have a positive farmer's wage. Third is about poverty, increases in agricultural productivity generally have a larger poverty-reduction. The data for this study are about Gross Domestic Profit (GDP), rice farmer population, expenditure, income, farmer's land which collected from secondary data from National Statistical Office website and Office of Agricultural Economics, Rice Department of Ministry of agriculture and Cooperative. To test the hypothesis, I will use the simple descriptive statistic with expected that the result will conform to the hypothesis.

Business Outlook for rice industry

Rice is the staple food of more than half of the world population, with more than 700 million metric ton produced annually at a global level. Rice is the third-most common cereal crop after wheat and maize in the world. It has the most nutrition to human among wheat and maize because most of maize is for other purpose like feed not for human consume. Growth of rice market is expected to increase to 800 million metric tons in 2025. The biggest share in rice production in the world belongs to Asian countries as well as the exporting. From the figure 1 shown the rice market size of each continent in the world. The green color show high level of rice market which are Asia-Pacific and North America. Yellow color show medium level of rice market which are South America, Europe, Africa and Oceania.

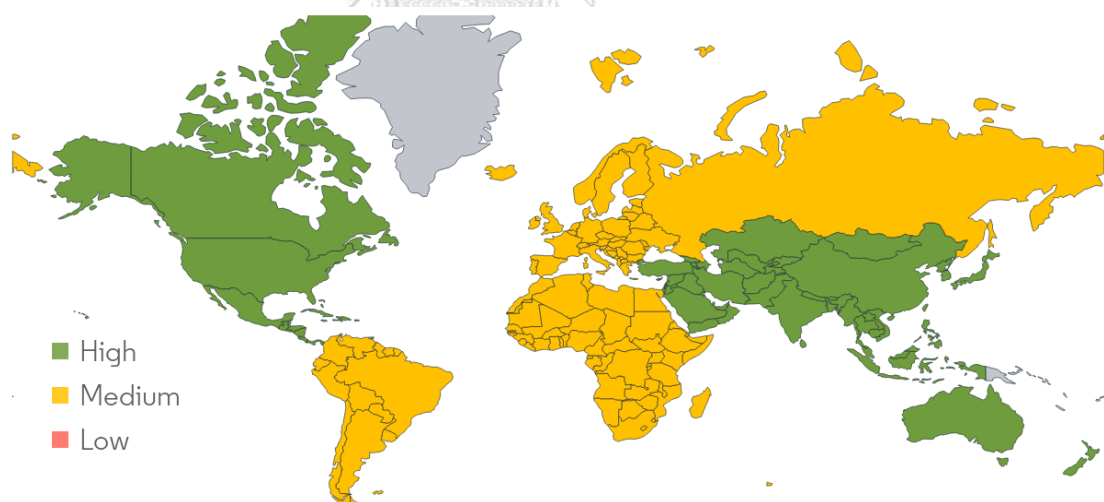


Figure 1: Rice Market – Market Size by Region, 2020

Source: Mordor Intelligence

The level of international trade in rice of the world is determined by degree of surplus production and the portion removed from domestic consumption. So, the exact amount of rice traded will fluctuate according to production and demand in producing

and exporting of each country. When global demand is increase and supply decrease, the price will increase.

There are many varieties of rice in the world; Basmati rice originated in India, Jasmine rice, Long Grain Rice and others. Preferences tend to vary regionally; the most common varieties are Basmati and Jasmine. The segmentation of rice market could be segregates by many types. One of them is by application which are for household, food services and food industry.

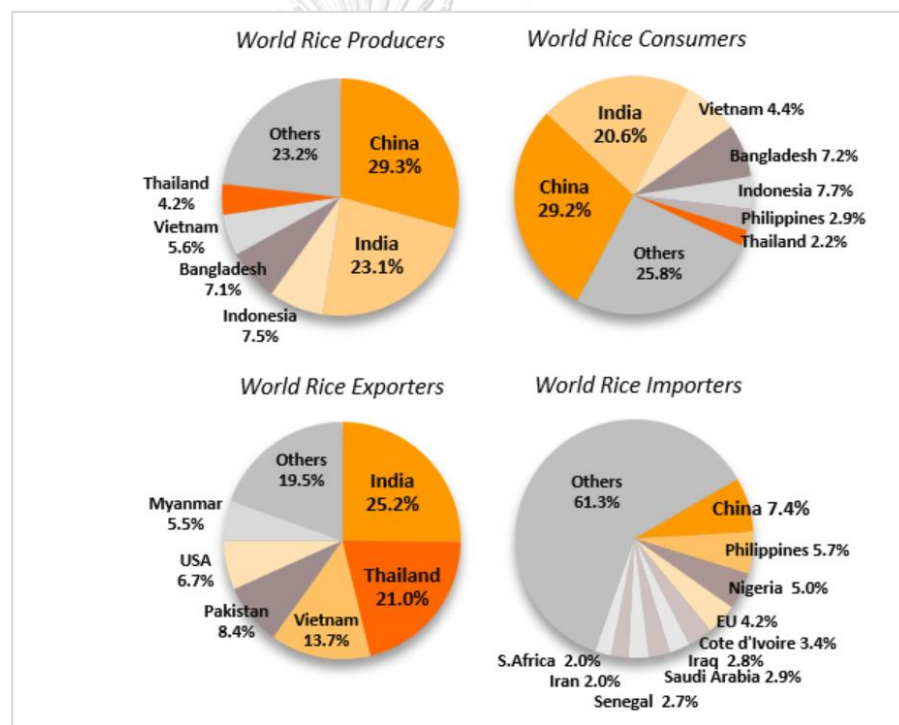


Figure 2: World Rice Market (2019-2020)
Source: U.S. Department of Agriculture (USDA)

Segmentation of the rice market also could be separated by Production (Volume), Consumption (Volume and Value), Import (Volume and Value), Export (Volume and Value). The player of each segmentation can be clarified as the figure 2. It shown about world rice producer, world rice consumers, world rice exporter and world rice importer. The biggest portion of rice producer is China which is China follow by

India, Indonesia, Bangladesh, Vietnam and Thailand with the percentage 29.3 percent, 23.1 percent, 7.5 percent, 7.1 percent, 5.6 percent and 4.2 percent respectively. Thailand ranked 7th in the world in terms of rice consumer coming behind China, India, Bangladesh, Indonesia, Vietnam and Philippines that consumed 29.2 percent, 20.6 percent, 7.7 percent, 7.7 percent, 4.4 percent, 2.9 percent and 2.2 percent of the world's rice respectively. Thailand is the important producer and exporter for a long time. Thailand is 2nd rank of rice's exporter after India. We have been facing competition from China (Sowcharoensuk, 2019).

There are many factors affect rice production such as geographic or location, weather and climate condition including temperature, land and soil, water supply, farming practices, good clean and healthy seeds, land preparation, diseases, pest and weed. Disease and pest might be outbreak in some year.

In Thailand, "Rice" is number one of major cash crop for both consumption and export. In our historical story, rice is the first product that Thai people in started free trade with rice with overseas. Therefore, rice is the important for Thailand's exporting activity since then. Rice plantation area covers 45.2 percent of all farm land area and total 4.3 million Thai households as rice's famer which is equal to 74.4 percent of total agricultural household.

During the crisis of COVID-19, comparing to other industries the impact and affect with the world market of rice has not been much significantly because the demand of rice still continues to increase as most of the people has more concern about food security. After the outbreak of COVID-19, all Thailand's rice export prices projected to rise almost by 20 percent which was nominally low in early 2020.

2. Literature review

Agricultural sector is an important sector for all over the world. Agricultural is playing as a vital role in increasing agricultural productivity and income of the rural households (Chandio et al. 2017). Emran and Shilpi (2018) mentioned that expanding food production and economic growth have often come at a heavy cost to the natural environment especially expansion in use of water and land including other natural resources for agricultural purpose.

The poorest region in the world like Sub-Saharan Africa, the GDP of agricultural sector be the largest share but the productivity is low and still lags behind other continents. There has been various lack of success in getting agriculture moving (Chauvin et al, 2012). In agricultural sector Leisinger et al. (2002) found that aging people has an affect with the production, saving and investment decreases. There is the high possibility to shift their activity to agricultural sector which use less workforce or stop doing agriculture due to health condition and could not apply new technology in order to boost up the productivity. These aging people in the developing-countries needs to rely on protection money from the government. The productivity of farmers appears to increase slightly and then decrease with age. (Tauer & Lordkipanidze, 2000). In consistent with Gray and Crockett (1998) mentioned that decreasing of worker in agricultural sector has the relationship with decreasing in modern technology farming. Same as Banister et al. (2012) found that labor force in agricultural sector does not have the highly efficient compare to other industries and the efficiency in agricultural sector will decrease when the country gets in to aging society in the future. Food traceability has the big impact with food security and these two things are more related with agricultural productivity. Gebbers and Adamchuk

(2010) explained that the common information could be allow to interchange between farmer, supplier, processor and shop. Using food traceability process will enable all the players in food chain to optimize the agricultural productivity without wasting time and cost.

Several studies have indicated the linkage between productivity with price, wages and poverty of various industry. Most of the studies found the negative relationship between productivity and price. Irz et al. (2001) found that when agricultural product increase, it can change the relative prices of agricultural product in both substitute or complimentary products to decrease, as well as the costs of inputs to production. Same as, Binuomote and Odeniyi (2013) said that “crude oil price actually has a negative and significant effect on agricultural production in Nigeria”, because agricultural product use for crude oil production, when agricultural product increases there is much supply to crude oil production and affect crude oil price decline. They also mentioned that price is the most important factor to agricultural production in short run while other factors like exchange rate, capital, labor and trend will be the major factors in long run. This has also been explored in prior studies by Thirtle et al. (2001) that the product price also has the direct benefit from promoting agricultural technology, when productivity increases it leads to lower food prices to all consumers. While other authors found negative relationship when consider the cause is productivity and the effect is price. In the opposite side, if consider price is the cause and productivity is the effect. Fulginiti and Perrin (1993) could find positive relation between these two factors; past output prices and current productivity. When the past output prices of one crop had increased, most of the farmer turned to grow that crop and all of the country will get high productivity.

The second factor, we would like to find the relationship between productivity with wages. It could be basic concept that wages are principally determined by productivity and there is positive relationship between these two factors. Jones et al. (1999) did the research about the discrimination of National Canadian Hockey player's wages. They concluded that wages differences originally defined by difference skill as these are measured by productivity differences. Lasco et al. (2008) found from their research that wages adjusting positively to the changing price of rice in the short-run with elasticity of 0.29 to 0.57. Emran and Shilpi (2018) mentioned in their study that they found a significant positive relation of rainfall shock effect on wages, crop yields, household expenditure per capita and labor supplied to market activities. But in contrast, negative significant of the effect on hired labor. Wages for non-agricultural labor always have the higher wages than worker in agricultural sector said by Gollin et al. (2014).

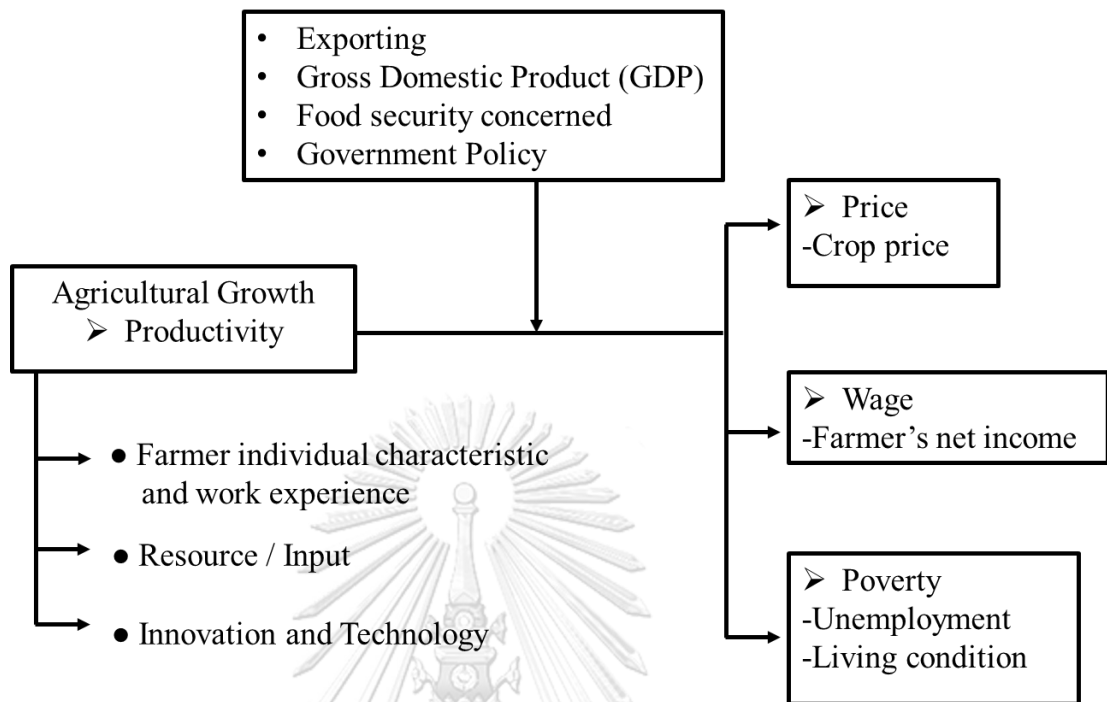
Several studies suggested that productivity growth is crucial to increase standard of living and affect to reduce poverty and should be the top priority for developing countries. Empirical studies support the idea that improvements in agricultural productivity are important for poverty reduction (Mellor, 1999). Minten and Barrett (2008) study about the linkage between agricultural performance and poverty reduction in Madagascar, their research is strongly recommended that improve agricultural production to get more productivity is the important factor to reduce farmer's poverty. Foster and Rosenzweig (2004) said that increasing in agricultural productivity by technological change is essential for poverty reduction from the global perspective. As well as Thirtle et al. (2003) mentioned about significant of

poverty reduction is the result of adequate productivity growth to give high rate of return which came from technological change in agriculture.

Not only in agricultural productivity but also in human productivity. Education, job training and experience are the engine of people development and productivity growth. They are reducing people's poverty (Sharpe, 2004). Similarly, to Hanmer and Naschold (2000)'s study showed that the higher ratio of agricultural to modern sector labor productivity, the greater is the reduction in poverty headcounts.



3. Conceptual Framework and Hypothesis



The above chart is conceptual framework of the study wherein relates with the relation of agricultural growth and poverty of Thai's farmer. How prices, wage and poverty of farmers respond to the changes in productivity. Agricultural growth is essential in the developing countries, it improves the living condition and has an impact on GDP growth. When measure agricultural productivity, there are many factors affect with such as farmer characteristic, work experience, resource or input, innovation and technology. Each farmer has individual characteristics means different age, gender or household leader and education which will be affected with their practice and plantation pattern. The selection of resource and input such as fertilizer, agrochemicals, seed variety, irrigation system etc. based on their work experience and budget. Innovation and modern technology adoption might be exogenous factor that farmer will select from their acceptance and knowledge. Most of Thai's farmer are aging, without proof they will not believe and accept new technology. There are three

variables related with; they are price, wage and poverty. Price is the trend about crop price, in this research is rice price. Wage is rice farmer's wages, in this research is net income of rice farmer. Poverty is the poverty of Thai rice's farmer.

From this study, beside the internal factor from farmer's themselves there are external factor which might affect with the interested variable; exporting, GDP, food security concerned and government policy. In case farmer request to sell the rice for exporting when demand of world market increases, the price of rice that farmer sell to rice exporter is increases and they could get the better price no matter how much the quantity of their productivity. In these days, as people have more concern about food security, it is the necessary factor to boost up productivity growth as well in order to serve demand of the market. In case government make a policy announcement to support such as pawn rice, set up the agricultural bank, promote to improve the quality and suggest using machine instead of human labor including manage irrigation system and land. It could help and guarantee that the farmer could also get more wages than no any support from the government.

The hypothesis of this study is the negative relationship between productivity and price, when productivity increase, price has to decrease and when productivity decrease, price has to increase. The positive relationship between productivity and wages. When productivity increase, wages should go with the same direction, means that farmer should get more wages. Finally, negative relationship between productivity and poverty, because when productivity is increase, farmer has more income to satisfy their essential needs and their poverty is decrease. In the other word, when the productivity decrease, their income also decreases and poverty increases.

4. Description of the Factor and Descriptive Statistics

Briefly the main area of this study is about productivity, price, wages and poverty. There are various data which also related with agricultural productivity; farmer characteristic and work experience including the location, income and expenditure, resource and input and technology and innovation. The external factors are gross domestic product (GDP) for Thailand, exporting market, concerned of food security and government policy. The data of this study initiate from many sources of secondary data. The description of each variable can be shown as follow;

4.1.1 Agricultural productivity

In this study is “rice productivity”. The measurement of agricultural productivity could do by the proportion of outputs to inputs. It is called as crop yield. Usually measure the final output of the product as the market value because there are various types of agricultural products. Individual products are usually measured by weight and compare to many different types of inputs such as land or labor. In this study, we focus on agricultural productivity for rice. The factor effect with rice productivity is farmer characteristic, seed variety, environment, budget of input and resources including technology. Total productivity in Thailand from 2011-2019 shown as below graph. From the graph, rice productivity is quite swing and not linear. Because rice is the seasonal product. And it takes time when growing rice, so the productivity will not equal every month like the industrial productivity which we could know exactly lead time and control the productivity. The highest peak will be around June to October because of the season of rice.



Figure 3: Rice Productivity in Thailand from Year 2011-2019
Source: Office of Agricultural Economics

Below table shown the productivity, harvesting area and productivity per area of each province in Thailand as of year 2019.

Province	Productivity (MT)	Harvesting area (Rai)	Productivity per area (Kgs)
Suphanburi	599,010	830,766	721.03
Nakornsawan	525,622	782,660	671.58
Ayutthaya	504,311	716,664	703.69
Pitsanulok	497,596	763,706	651.55
Pichit	444,055	707,051	628.04
Kampangphet	387,486	608,925	636.34
Chainat	346,450	521,118	664.82
Chiangrai	296,970	432,325	686.91
Sukhothai	265,615	439,516	604.34
Chachoengsao	202,937	291,429	696.35
Lopbuti	194,880	300,668	648.16
Pathumthani	194,498	268,545	724.27
Nakornpathom	192,190	254,471	755.25
Uttaradit	189,655	290,578	652.68
Kalasin	180,422	288,518	625.34
Ang-thong	167,741	250,756	668.94

Singhบุรี	166,838	253,359	658.50
Kanchanบุรี	133,263	180,982	736.33
Saraburi	128,755	195,715	657.87
Ratchaburi	125,523	174,001	721.39
Pethchaburi	108,634	152,315	713.22
Nakornnayok	104,670	159,693	655.45
Roi-et	101,636	172,936	587.71
Chaingmai	89,886	131,319	684.49
Prachinบุรี	87,302	135,295	645.27
Nakornratchasima	81,374	130,416	623.96
Ubonratchathani	73,604	153,918	478.20
Nonthaburi	67,341	93,626	719.26
Uthaitani	60,604	90,790	667.52
Bangkok	60,111	93,602	642.20
Sakonnakorn	46,517	91,608	507.78
Phayao	46,235	72,667	636.26
Chaiyabhum	43,747	71,196	614.46
Nongkhai	43,630	82,382	529.61
Yasothon	40,156	69,978	573.84
Srisaket	39,633	77,474	511.57
Nakornpanom	34,805	65,479	531.54
Songkhla	27,503	47,332	581.07
Chonบุรี	26,462	39,090	676.95
Surin	22,995	49,866	461.14
Prae	22,457	36,435	616.36
Lampang	21,230	37,341	568.54
Udonthani	20,970	43,688	479.99
Pattalung	16,942	31,459	538.54
Mahasarakarm	13,928	23,959	581.33
Khonkaen	13,687	24,910	549.46
Phetchabun	13,563	22,401	605.46
Samutprakarn	12,674	17,714	715.48
Pattani	11,037	19,105	577.70
Lumphum	10,302	14,810	695.61
Buriram	9,577	19,548	489.92
Tak	8,940	15,927	561.31
Nongbualumpoo	7,817	14,653	533.47
Prachuapkirikhan	6,532	10,482	623.16
Bungkarn	5,712	11,141	512.70
Sa-kaew	4,656	8,030	579.83

Nakornsrihammarat	4,408	11,080	397.83
Nan	4,202	7,219	582.08
Rayong	2,000	3,691	541.86
Samutsakorn	1,930	2,831	681.74
Suratthani	1,928	3,839	502.21
Amnardcharoen	1,529	3,068	498.37
Trat	1,406	2,553	550.72
Samutsongkram	1,079	1,569	687.70
Chumporn	500	992	504.03
Mukdaharn	202	423	477.54
Loei	167	387	431.52
Yala	81	180	450.00
Trang	70	147	476.19
Maehongson	70	120	583.33

Table 1: Productivity, harvesting area and productivity per area of each province in Thailand as of year 2019

Source: Office of Agricultural and Economics

There are 4 parts where are the main area of rice field; Central part, Northern part, North- Eastern part, and Southern part. The land in Central Part and North Eastern part are the low land area. In Northern part, farmer plants in the low land between hill or upland on the hill. Southern Part where the land in this area is low land along the seaside and low land between the mountain In Southern part, they always use the rainfall for rice plantation. North Eastern Part which is the biggest area of rice plantation.

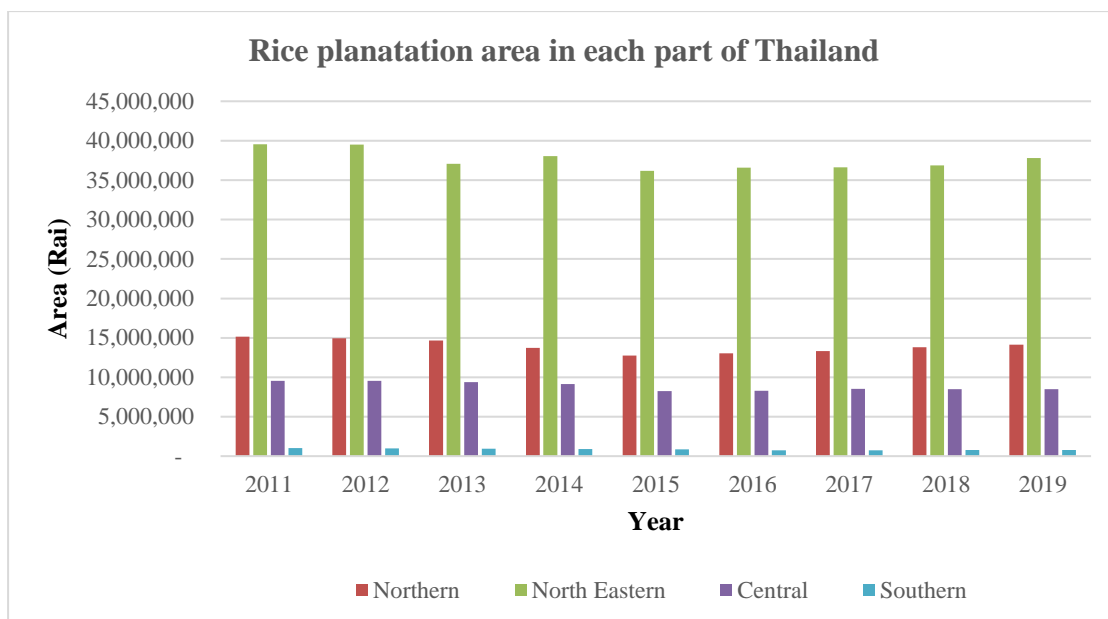


Figure 4: Rice plantation are in each part of Thailand
Source: Office of Agricultural Economics

In 2016, there are information about the plantation area for each type of rice as following table.

Rice Variety	Plantation Area (Rai)	Ratio (%)
1. Jasmine Rice	25,702,802	53
2. The Pathumthani Fragrant Rice	1,049,794	2.16
3. Normal Rice	8,700,688	17.94
4. Sticky Rice	12,993,628	26.79
5. Others (Organic rice etc.)	49,123	0.1
Total	48,495,315	100

Table 2: Plantation area for each type of rice
Source: Rice Department, Ministry of agriculture and Cooperative

4.1.2 Farmer Characteristic

As agricultural sector still be the back bone of Thailand, the major occupation of Thai people is farmers which is equal to 70 percent of total population. Total agricultural workers in Thailand who graduated at least upper secondary school increased from 12.1 percent in 2003 to 21.5 percent in 2013 (United Nations Thailand, 2020). In Thailand, there are two types of the farmer; who have their own land and rent the land

from others. In advanced economy country, most of the farmer own their land. There are the data related with individual characteristic and work experience of Thai's farmer such as the number of rice's farmer, their income and expenditure, rice plantation area.

(a) Population of Thai rice's farmer

For the understanding about the sizing of Thai's rice farmer in Thailand. The Office of Agricultural Economics census collected every ten years. There are the data shown as below;

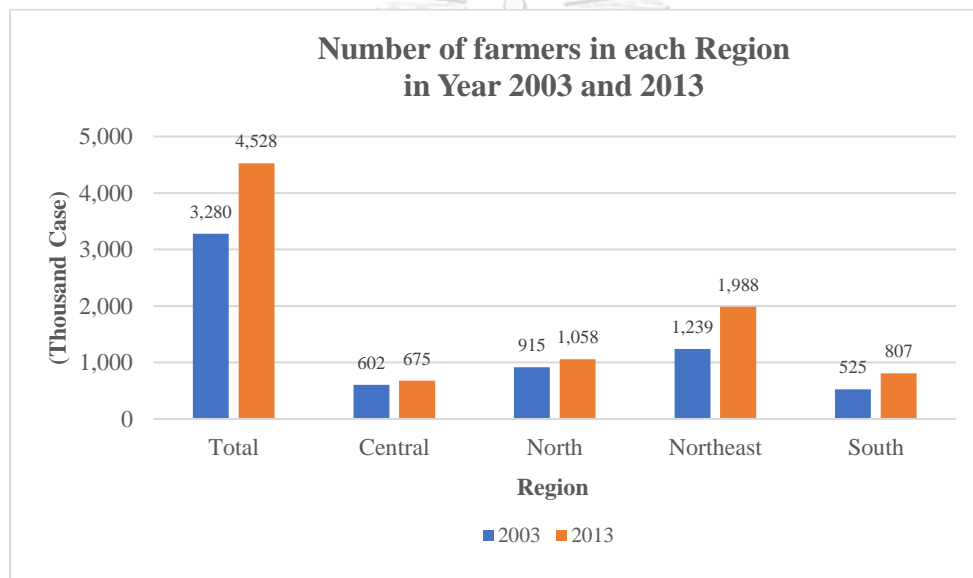


Figure 5: Number of Thai rice's farmers in each region in Year 2003 and 2013
Source: Office of Agricultural Economics

As the figure 5 shown the number of Rice's farmer in each part of Thailand in 2003 and 2013, 38 percent increase. The region with has the most farmer is Northeast part follow by Northern part, Central part and Southern part respectively. However, the information from office and agricultural economics mentions that more than 37 percent of Thai farmers do integrated agriculture not only planting but also livestock in order to reduce the risk from the planting. Thai farmer has wide range of age,

currently most of the farmer are aging people because new generation abandon their hometown and turns to work in urban area. Regarding the rice variety, there are various type of rice planting in Thailand. In 2016, there are information about farmer who registered as a rice's farmer with the government as following table;

Rice Variety	Farmer (Household)	Ratio (%)
1. Jasmine Rice	1,907,678	47.9
2. The Pathumthani Fragrant Rice	61,889	1.55
3. Normal Rice	438,769	11.02
4. Sticky Rice	1,567,813	39.37
5. Others (Organic rice etc.)	6,285	0.16
Total	3,741,346	100

*Table 3: Ratio of tice farmer by rice variety
Source: Rice Department, Ministry of agriculture and Cooperative*

(b) Income and Expenditure

Net income of rice's farmer is the money that they get after selling the agricultural productivity and minus with their cost and expenditure. The information from Office of Agricultural and Economics in year 2019 mentioned about expansion rate of income and expenditure of farmer that net income from agricultural sector increases 9.49 percent. In the real life, farmer's income is not limited only from selling the agricultural product, they also get an income from other activities for example; with the expansion rate 6.07 percent farmer get interest and support from government, get from hire oneself out as planting rice this portion increasing 5.05 percent and some cash get from their relatives with decreasing rate 1.53 percent.

Expenditure for non-agricultural portion has the expansion rate 7.42 percent. Cash for daily eating 10.23 percent increasing rate and cash for the other consume 6.10 percent increasing. Remaining net income before paying the debt is 13.92 percent increasing. The amount of debt is also increasing 15.90 percent.

In term of the figure in Thai Baht. Net income of Thai's farmer is 269,449 THB/household/year which are cash from agriculture 78,604 Baht (30 percent) and cash from non-agriculture 190,845 Baht (70 percent). Debt of farmer household is 221,490 THB/household/year, 55 percent they make a loan for agriculture purpose and 45 percent for non-agriculture purpose. The trend is increasing especially making a loan for resident, land and another asset. In addition, farmer could easily access to the credit in order to make an investment. When deduct their expenditure for daily life and utility 182,034 THB/household/year, farmer's household still have cash 87,4141 THB/household/year. Thus, most of the farmer still have enough money to pay debt but they may not have much money for saving. Below table shown the data from year 2015-2019 to summarize income and expenditure of the Thai's farmer (not only for rice).

Unit: THB/Household

List	2015	2016	2017	2018	2019	Percentage Increasing and decreasing Year 2018-2019	Expansion rate from 2015-2019
Income from agriculture	148,390	157,373	160,932	197,373	204,066	3.39	9.02
Crop	114,173	111,640	117,851	145,969	154,675	5.96	9.15
Livestock and fishery	28,667	39,789	36,446	47,279	43,308	-8.40	10.49
Others	5,550	5,944	6,634	4,125	6,083	47.45	-1.80
Expenditure for agriculture	91,326	100,281	101,957	122,890	125,462	2.09	8.75
Crop	64,231	65,377	66,631	79,094	82,116	3.82	7.06
Livestock and fishery	12,873	21,691	21,342	29,789	29,381	-1.37	21.75
Others	14,233	12,213	13,984	14,008	13,965	-0.31	0.22
Net income from agriculture	57,063	57,091	58,975	74,483	78,604	5.53	9.49
Net income from non-agriculture	134,869	143,192	148,347	172,667	190,845	10.53	9.22
Hire oneself out	26,902	31,702	35,724	31,977	34,274	7.18	5.05
Salary	44,938	48,384	50,126	76,294	79,824	4.63	17.40
Receive from relative	14,733	18,219	18,874	13,941	15,590	11.83	-1.53
Others	48,296	44,886	43,622	50,455	61,157	21.21	6.07
Net income of agriculture household	191,932	200,284	207,321	247,150	269,449	9.02	9.29
Expenditure for non-	138,502	147,889	141,221	175,094	182,034	3.96	7.42

agriculture							
Consuming	43,383	44,719	40,079	59,977	60,971	1.66	10.23
Other utility	95,119	103,170	101,142	115,117	121,062	5.16	6.10
Net cash before paying debt	53,430	52,395	66,100	72,056	87,415	21.32	13.92
Amount of debt at end of the year	117,346	122,695	123,454	150,636	221,490	47.04	15.90

Table 4: Income and expenditure of the Thai's farmer year 2015-2019

Source: Office of Agricultural and Economics

4.1.3 Resource and Input

When planting the crop, to get high yield is the most expectation of all the farmer.

There are many factors of resource and input related with level of productivity.

Starting from preparing the soil, concern the physical of soil and use material to help the plentiful of soil. Next is the selection the rice seedling or sprout, choose the proper period of time and determine lead time. After planting, fertilizer applying and agrochemical to eliminate pest and disease are also important. The decision of each farmer to select the resource depend on their budget and experience.

4.1.4 Technology and Innovation

Technology and innovation are also the significantly factors but less of the Thai's farmer has deep knowledge about it. The meaning of technology and innovation is any machine or platform which help to save the labor and time of the farmer. For instance, rice planting machine, drone or helicopter for spraying fertilizer and agrochemicals. High-tech camera working with sensor to capture the satellite image and those data will help to analyze the soil moisture etc.

4.1.5 Thailand's Gross Domestic Product (GDP)

GDP is a monetary measure which calculate from the product produced within a country no matter what the nationality produce. GDP is an economic instrument which use to compare the economic growth of each country. Bank of Thailand is

responsible to estimate the GDP in advance and make an announcement by quarter. GDP measurement calculate the data from circulating fund of income and expense of household, business sector and government sector. In the meaning that people work and get the money, they can spend their money for goods and services, pay tax to government. Some of their money will deposit to the bank or invest in funds and stock exchange. Business sector invests their money to produce the product and service in order to sell to all the people. They pay the interest, wages and cost of production to the industry as well as pay tax to government. While income of government sector comes from tax paid by people and business sector and spend the money for public utility and also support the household and business to generate income. GDP is positive or equal to the estimation means that the economy attracts more money from the investor to invest in our country but we have to be careful about the inflation because it will effect with the rising price of goods and services. When GDP is negative means that economy of the country disrupted and slow down. The employment rate might be lower than the forecast, investment in industrial sector is decreased and the population consumption also decrease. Thus, the investor will turn their money to the country where the market or economy more stable. The affect when the economic illiquid, the government has to put some money to assist the economic system and makes the budget incline. For example when agricultural sector decline, government will control the product price in order to support the whole sector but the private sector producer will get lower profit because of this method from government and needs to reduce the production by lay off the labour. That is the reason of unemployment in the labour system and finally the people lessen their spending (Radars Investor, 2016).

In Thailand, GDP divided into two parts; non-agriculture sector and agricultural sector shown as below graph.

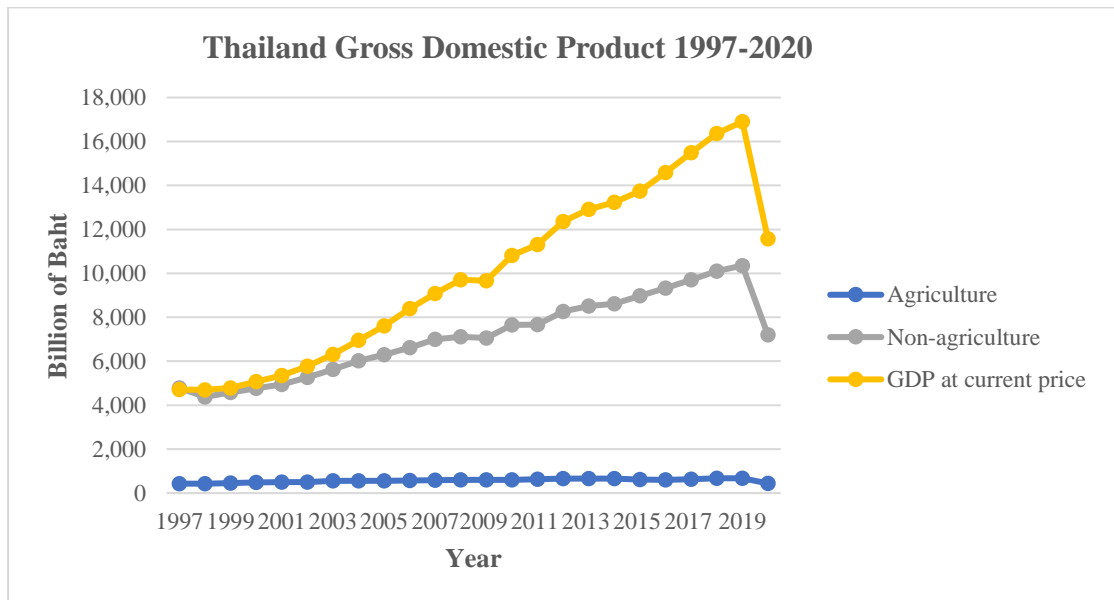


Figure 6: Thailand Gross Domestic Product 1997-2020

Source: Bank of Thailand Website

Above graph shows the GDP of Thailand since 1997 to 2020, there are three line of graph; Agricultural sector, Non-agricultural sector and Total GDP at current price. In the past twenty three years from 1997 to 2019, trend of total GDP at current price has been slightly increasing year by year, it showed that economic of our country has been growing up. But in 2020, total GDP sharply decrease. We could understand the main reason comes from the pandemic of COVID-19. It effects with the growth of economic system in Thailand. No any tourist to stimulate the economic. Meantimes, less of the production and unemployment increase. Thus purchasing power has been decreased a lot.

GDP for Agriculture sector

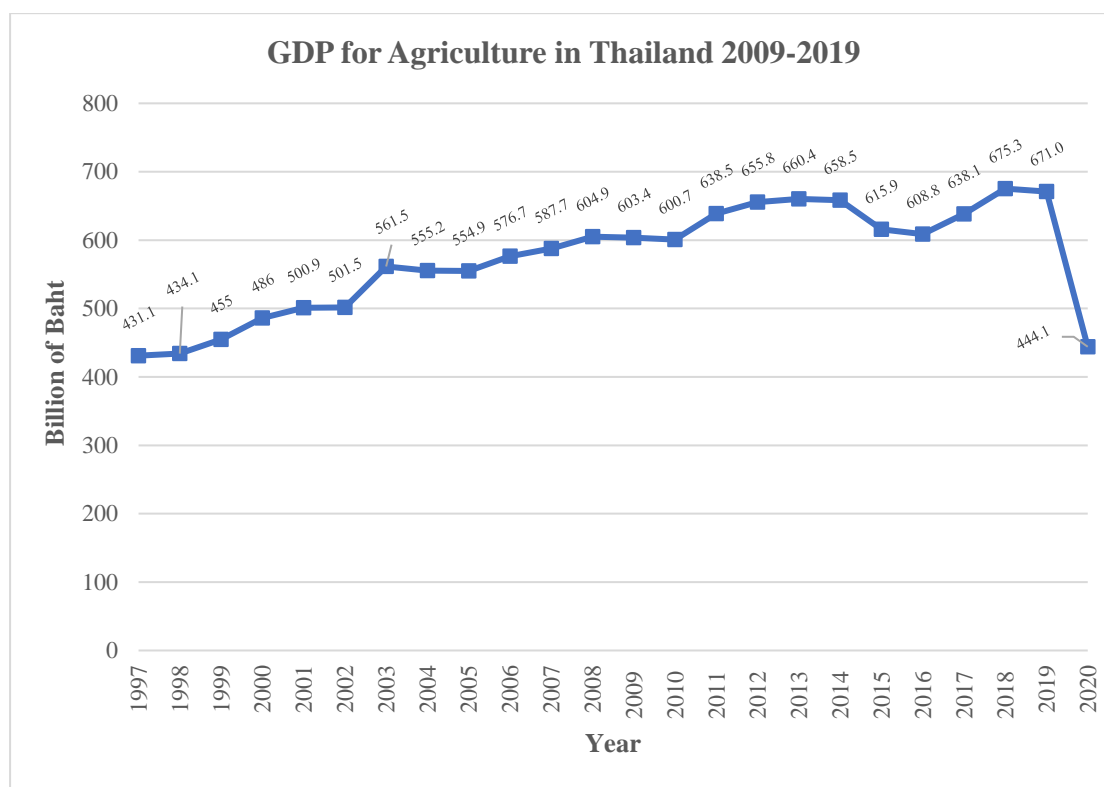


Figure 7: GDP for Agricultural sector in Thailand 2009-2019

Source: Bank of Thailand Website

GDP for agriculture in past twenty three years was between four hundred thirty one billion Bath to six hundred sixty billion Baht which is around 10 percents of total GDP. GDP for agriculture is calculated from agricultural productivity which consist of crop, livestock, fishery, agricultural services and forestry. It is the sum of the value of all agricultural productivity and agricultural services minus cost of production (seed, animal, fertilizer, chemical, feed and fuel oil except labor wages. Due to unit of agricultural productivities are difference, the calculation is based on product value occurs at each period of time; quarterly or annually. It might affect from changing of pricing and quantity. Therefore, the effect of pricing change or inflation must be eliminated to reflect the potential growth of the real agricultural sector or the actual

amount of agricultural production and agricultural services of the year. Quarterly GDP growth rate of agricultural sector, consider from high value crop for example sugarcane, rubber, cassava and rice. In case these products have higher productions and pricing or the total production quantity increase more than the decreasing prices while the cost of production does not change much. Indeed, the GDP of the agricultural sector tends to be positive. Annual GDP growth rate of agriculture will consider from trend price of yield, cost of production of major agricultural products in each year. In last 23 years ago, trend of agricultural GDP is quite same as total GDP of Thailand. It has been increasing year by year and decrease a little bit in some year. But in 2020, it dramatically drop mainly because of pandemic of COVID-19. Less demand for agricultural productivity within the country due to less tourist visited during 2020 as well as exporting portion also decrease because destination country has been closed.

5. Methodology

In this study, the secondary data collection is used and analyze those data by finding the relationship of the interested variable by descriptive statistic and imply economic theory. Compare the figure and trend of each variables; productivity of rice with price, wages and poverty of rice's farmer.

6. Result from the study

(a) Productivity and price

The secondary data from Office of Agricultural Economic about rice productivity and price of rice from Year 2011-2019 shown as below graph. The productivity of rice is fluctuated. As mentioned before, to get agricultural productivity as rice, the production process takes time and the figure is not equal all the year. So, the data that use to plot graph is the average of both productivity and price of each year.

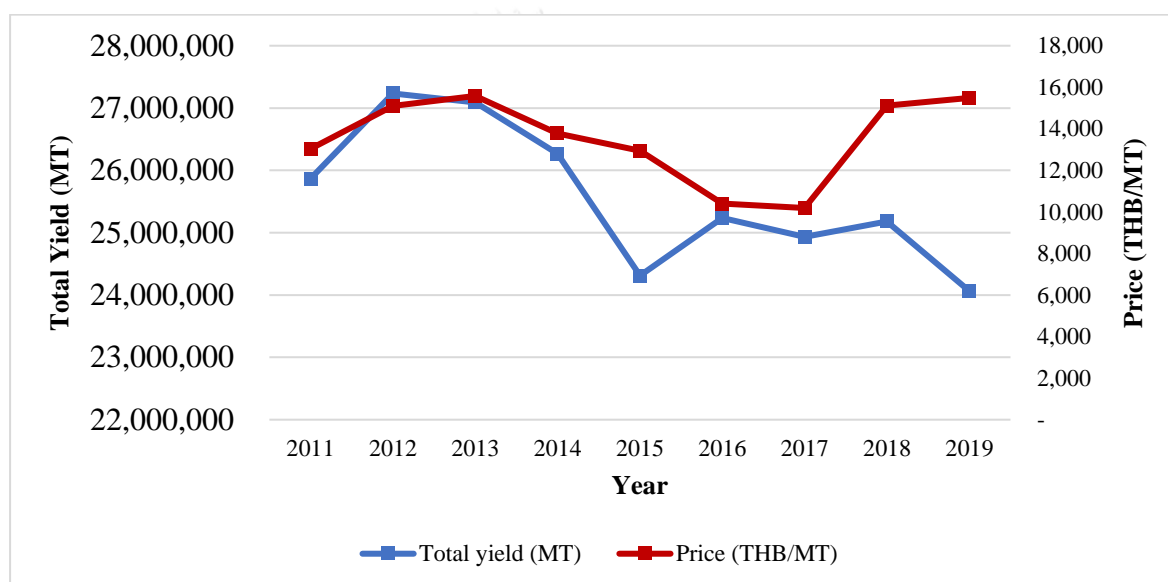


Figure 8: Yield and price of rice from Year 2011-2019
Source: Office of Agricultural Economics

When comparing two variable which are productivity and price. The most common theory is supply and demand theory; changing in demand and supply. It affects with price changing. If demand increase, productivity decrease and effect to increasing in price. And if demand decrease, productivity increase and effect to decreasing in price. If consider only this theory, it could prove clearly for the data only in some year such as Year 2015, 2018 and 2019 which the gap between two variables is widely. But the data of other years does not align with this theory. Thus, in some periods the Cobweb theory could be apply. The meaning of Cobweb theory is production yield in each

period of time is depending on the price in previous period. There is the opportunity that rice producer adjust their productivity after they have an experience about the price in previous period. By the way, considering of only productivity and price are not enough to conclude the relationship between these two variables as they are implicit function. To find the correlation of these two variables by including other related factor is the better option for further study. The example of suggestion variable are volume of rainfall and climate in each area.

(b) Productivity and wages

Wages in this study will consider as “net income” of farmer. Net income is their total income minus cost of spending. It is heavily depending on their productivity. Below chart is a proportion of the cost of farmer for one rai. Example from the farmer in Hankha, Chainart Province in Year 2018. The spending cost are rental land, fertilizer, pesticides, seeds, plough, hiring labor, harvesting machine, transportation cost and others. Most of the rice farmer in Thailand, they do not own the land and the cost of land rental is the biggest proportion of cost.

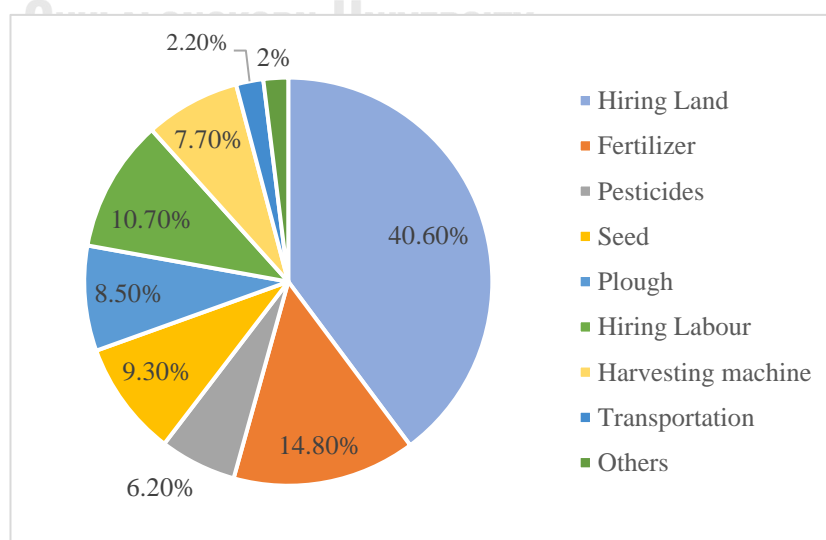


Figure 9: Cost of the farmer per one rai

Source: Office of Agricultural and Economics

Below table shown the data of year 2018 which is summarize income and expenditure of the Thai's rice farmer compare with average of country means average of all crops. We found that net income of rice's farmer equal to 59,071 THB/Household/Year is lower than average of the country which equal to 74,483THB/Household/Year. But it does not mean that the figure will be like this every year because the productivity price of each crop in each year also difference.

Unit: THB/Household/Year

List	Average of country	Rice farmer household
1. Income from agriculture	197,373	159,792
1.1 Plant	145,969	132,444
Rice	56,123	95,773
Field Crop	32,072	18,153
Vegetable and Herbs	10,544	5,303
Fruit	46,854	12,482
Others	376	734
1.2 Animal	47,279	24,312
Livestock	21,204	7,772
Aquatic Animals and fishery	26,076	16,540
1.3 Others	4,125	3,036
2. Expenditure for agriculture	122,890	100,721
2.1 Plant	79,094	67,814
Labor	37,976	32,397
Equipment	41,118	35,417
2.2 Livestock and Fishery	29,789	18,786
Labor	4,013	1,704
Equipment	25,776	17,082
2.3 Others	14,008	14,121
3. Net income for agriculture	74,483	59,071

Table 5 :Income and expenditure of rice farmer compare with average of all farmer in the country
Source: Office of Agricultural and Economics

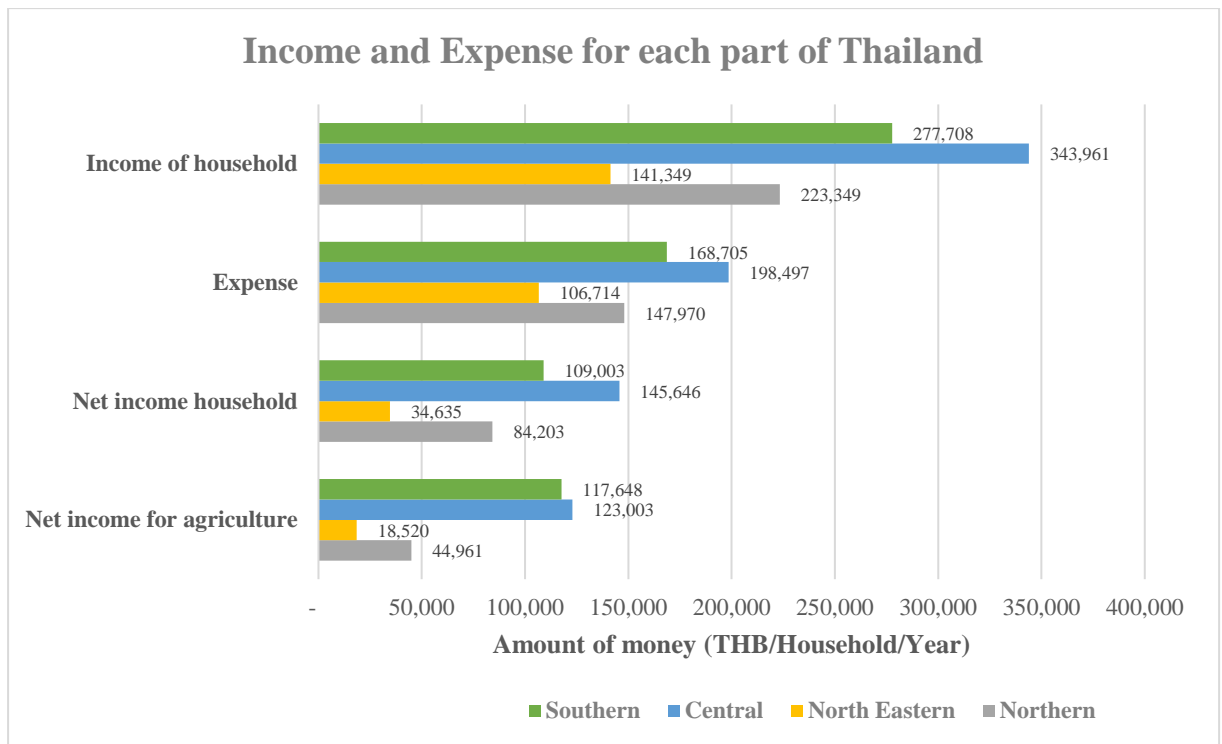


Figure 10: Income and Expense for each part of Thailand year 2019
Source: Office of agricultural and Economics

From figure 10, it shown the income, expense and net income of rice's farmer in 2019 separated for each part of Thailand. We could find that income of rice's farmer in each part of Thailand more than their expense. Therefore, their net income is positive. Rice's farmer in Central part of Thailand has the biggest amount of net income for agriculture which equal to 123,003Baht/household/year. Follow by Southern part, Northern part and North Eastern part with amount 117,648 Baht, 44,961 Baht and 18,520 Baht respectively.

Next, figure 9 shown about rice productivity for each part of Thailand in year 2019. The biggest quantity is 3,441,193 Metric ton in Central part followed by Northern part, North Eastern part and Southern part with the quantity 2,884488 Metric ton, 782,108 Metric ton and 62,469 Metric ton respectively.

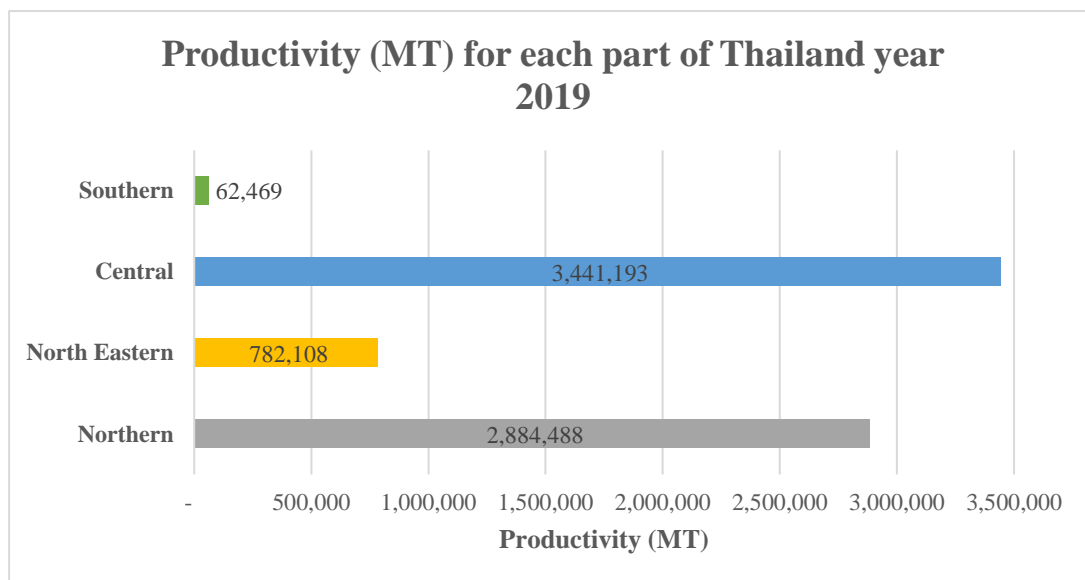


Figure 11: Productivity (MT) for each part of Thailand year 2019

Source: Office of Agricultural and Economics

Reconsider from figure 10 and figure 11 found in order to compare productivity and net income of rice's farmer in each part of Thailand found that the result of these two variables is not relative. Some part gets high productivity but low net income than the part where get low productivity. Therefore, there is not enough evidence to confirm the relationship of only two variables. To confirm their relationship, more factors are needed for further study.

(c) Productivity and poverty

Poverty is a condition of people or community who lack of the basic needs, money or financial resources and crucial things to satisfy their minimum standard of living. Poverty Line is the criteria to clarify who is poor. It consists of Food Poverty Line and Non-Food Poverty Line. The unit is Thai Baht/people/month.

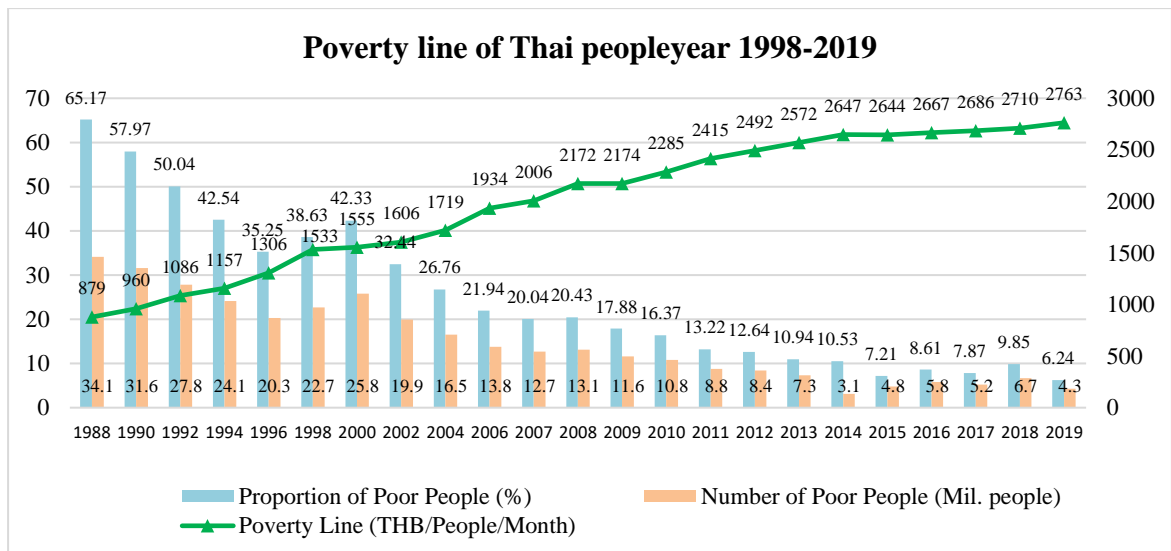


Figure 12: Poverty line of Thai people between 1998 to 2019
Source: Bank of Thailand

From above graph, it showed the proportion and number of poor people from 1988 to 2019. We could see the trend that it has been increased year by year. It means number of poverties has been decreased. The reason mainly came from the education which help to improve and enhance the level of the people. Level education of head of household strongly effect to the poverty of that household. Comparing with in the past found that the characteristic of the people who can define as a poor people are low education. Worker in agricultural field has a chance to define as a poor people two times more than worker in other industry. But not all worker in agricultural are poor. Considering only productivity could not judge the poverty of rice's famer. There are more factors effect with poverty of agricultural household such as location, irrigation system area, age of household leader, education level of household leader, number of the member in the household, farming area, net asset of household and amount of debt of the household. For poverty reduction, the government should emphasize and support the education to every level of people especially gave the chance of education to agricultural household leader. Let the household leader gets into the university

which more demand of labor market. Support fund and scholarship for the education or approaching the education to rural area. Improve the ability of those people and build the opportunity of generating income. However, the proportion of the poor people tend to decrease, but maintaining the proportion of poor people as low level might be harder, need to keep an eye on the situation especially in agriculture because severe of pandemic of COVID-19 in 2020 which affect with economic and employment in the country. Uncertainty situation still continue which no know what will be the end.

Office of Agricultural and Economics also reports the poverty of rice's farmer household in each part of Thailand in year 2019 that Northeastern part the poverty rate is 55.99 percent, follow by Northern part 27.37 percent, Central part 14.30 percent. and Southern part 2.34 percent. Consider these data together with productivity data in figure 9, the result of this variable is not related with productivity because Southern part get the lowest productivity but their poverty rate is also lowest. It opposes with the hypothesis. While the Northern part has the highest poverty percentage but their productivity is not the 1st rank. In conclusion, only productivity and poverty themselves could not proof the hypothesis. More factors related with these variables should be include into the regression and correlation analysis for further study.

7. Conclusion and Suggestion

This paper uses a basic descriptive statistic to study the relationship of the variable; productivity with price, wages and poverty. If consider only the variable itself, productivity with price and analyze by using supply and demand theory and Cobweb theory. There is not enough scientific number of evidences to conclude the relationship between these two variables. But as they are implicit variables, needs to check the correlation between two variable first and include more variable related into the equation. For productivity and wages, generally, it is easy to understand that when your productivity is increase, your net income would also increase too but for Thai's farmer sometimes is not. Their income could not cover their spending cost including debt. Losses during the plantation are not really reflect to the real cost due to some of the farmers do not have enough information and make the record properly. From the scope of this study which focus only two variables; productivity and wages, there is not enough evidence to confirm the relationship of this hypothesis too. About productivity and poverty, same as price and wages. There is not enough evidence to confirm the hypothesis. For further study, more related variables are needed to include or making a survey in details to study deeper and gain more concrete result to conform the hypothesis.

The suggestion from this study, in order to reduce the poverty, the main factors should focus first is education of the people or education of the household. Once the farmers have the high education, they could have a knowledge to experience their activity. In order to improve the quality and get more quantity of agricultural productivity, modern technology and innovation is the interesting option for the rice farmer, at the present the price and accessibility could be reach to them easily. There are also many

factors related such as financial institutions which farmers are facing; limitation of credit information and risk of loan recovery etc. As agricultural still be the essential. So, the movement of this sector could not be ignorance by the world.



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