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RESEARCH ARTICLE

Food-rich Environments: Is Food Security and the Sustainability of Mass Human Life Possible or Impossible?

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ABSTRACT

Problems in food security have been supported by Thai food-rich environment security. Sustainability of Thai people's lives: Agricultural Food Security Production Entrepreneurs, Food Industries, UNESCO, World Bank, etc. Food exporting investments are the concepts grounded in using the WHO Southeast Asian Region nutrient profile model to a variety. The results indicate wars affect conflicting opinions within the countries. These food crises are affected by food shortages and food production. Global climate change effects by the accounting Sunspot Circle with Plants' Dendrochronology are predicted by natural recording data, and the large rock salt basins absorb the agricultural lands to salinity food areas for intensifying food security problems further aggravating the global food famines. Conflict, economic shocks, and soaring fertilizer prices are combined to create a food crisis of unprecedented proportions. As many as 309 million people are facing chronic hunger in 72 countries. Rich-food Thailand has long been called "the kitchen of the world" by combining the Thai identity embedded in national cuisine in the process of abundant natural resources. Therefore, 42% of Thai farmers have access to water resources, creating a large inequality in access to their food resources that have still been poorly accounted for exactly 26.27%.

INTRODUCTION

The COVID-19 outbreak in 2019 was not just a global health crisis. But it also leads to an economic crisis, in society, and politics. Because no matter what region or country this contagious disease invades, it wreaks havoc on people worldwide. In terms of health, life, and property; the economic downturn and inflation; large economic groups collapsed. Public places or stores are economical sources of tourist attractions. Everywhere was empty and without people. The shutdown of businesses has left people unemployed. Events happened quickly, and unexpectedly. People's relationships in society are getting worse. There was a state of panic, fear, and conflict from a lack of resources needed for survival. The status of people is only hope and waiting amidst the scarcity of access to resources necessary for living.

The conflict between Russia and Ukraine has worsened the crisis of food shortages. It's a bigger problem than the energy crisis's inability to predict when it will end. Governments are spending a lot of time and resources trying to mitigate the soaring cost of energy following Russia's invasion of

Ukraine. The war has sown the seeds of an even bigger crisis and has not gotten, nearly the same amount of attention. A global food shortage is pushing food prices to record levels, with economic and political implications for developed countries and a threat of famine and debt distress in the emerging world much more must be done (Green, 2022). Russia's invasion turbocharged existing food insecurity. Ukraine and Russia account for over one-tenth of all calories traded globally. These supplies are under threat, with Russia suspending food and fertilizer exports, and Ukraine's farmers under extreme stress, fighting an invading army while tending to this year's crop. The unfolding crisis in Ukraine has roiled commodity markets and threatens global food security, increasingly (Glauber & Laborde, 2022).

An Israel Defense Forces (IDF) drone strike killed seven aid workers distributing food with the World Central Kitchen, USAID Director Samantha Power confirmed, what many humanitarian experts had claimed long prior in the northern Gaza Strip. Those import restrictions kept food items including dates, certain agricultural fertilizers, and materials critical to developing and maintaining infrastructure out of Gaza, the conflict has long and consistently intensified Gaza's food shortages (Lipkind, 2024). The current war is no exception to this phenomenon but its effects on Gaza's food supply are unprecedented. Israeli officials claim that they are not rejecting, anything (Keath, 2024). In 2022, 64.3% of Gaza's population was already classified as being moderately or severely food insecure, and 77% of residents reported that all of their family members had reduced the number of meals they consume per day. The result has been a humanitarian catastrophe for the territory's 2.3 million Palestinians (United Nations Common Country Assessment for Palestine, 2022).

Poor harvests in South America, strong global demand, and supply chain issues have reduced grain and oilseed inventories and driven prices to their highest levels since 2011-2013 (Glauber & Laborde, 2022). They produce 30% of world wheat exports as 60% of its sunflower oil. At least 26 countries rely on Russia' and Ukraine's people who consume more than half of their grains (Mundy, 2022). Poor harvests in the 21st-century world, the mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned, nearly three-quarters of the world's poor live. Even the hungry in the urban areas of developing countries are likely to be recent migrants from rural areas. Poverty is inherently associated with food insecurity – a state in which socially vulnerable people can't get enough nutritious and safe food (Food and Agriculture Organization of the United Nations (FAO), 2022).

Post-harvest losses are either an on-farm or off-farm problem. In Africa, on-farm losses are caused by improper harvesting stages, excessive field heat, improper harvesting containers, poor farm sanitation, and improper packaging materials (Arah, 2015). The causes of famine are complex and often interlinked with numerous other world events. Ongoing conflict, climate change, extreme poverty, displacement, and political instability can create conditions that ultimately lead to famine. high levels of social vulnerability in the country linked to food insecurity. Over 20.6% of the South Africans in our sample were socially vulnerable, and 20.4% were food insecure. This amounts to about 7.8 million people out of our sample of 39.6 million people. Conflict is often the main catalyst for famines, when war and violence occur, communities suffer (Longari, 2023). An estimated 27.4 million people in southern Africa face food insecurity in the next six months, the Food and Agriculture Organization (FAO) and the United Nations World Food Programme (WFP) warned today, announcing the expansion of their operations to respond to the challenge, caused by poor harvests across the region (The United Nation News, 2023).

According to the UN Food and Agriculture Organization, the war will leave 20-30% of Ukraine's farmland unplanted or unharvested for the 2022 season (Albery, 2022). Grains already harvested are stranded because Ukraine's ports have been blocked by Russia's policy to export, the focus of a recent G7 foreign ministers meeting. While Russian farmers can still produce, exports have been hampered

by sanctions announced an export ban (Chazan, 2022). Exports from Belarus, nominally allied with Russia, have had sanctions imposed on them (Elkin, 2022). China imposed an export ban on fertilizer, leading farmers to rotate crops or use fewer nutrients, likely leading to lower yields (Peterson Institute for International Economy, 2022). Food prices have exploded, up almost 30%, according to the FAO food price index (Food and Agriculture Organization of the United Nations, 2022). Food purchases account for at least half of totalized household expenditures in low-income countries, and many emerging market governments provide food subsidies. The countries most exposed to price swings on international markets were typically poor and food importers (Food and Agriculture Organization of the United Nations, 2023).

The world's poorest countries tend to be food-importing countries and food accounts for at least half of the total expenditures of households in low-income countries (Malpass, 2022). An estimated 37.2 million people across 47 countries will be in emergency or worse levels of acute food insecurity in 2024, and require immediate emergency assistance to save lives and livelihoods (Global Network Against Food Crisies, 2024). Many households pawned family valuables to buy food. Some research studies showed schooling students drop-out rates of as much as 50% among children from the poorest households (Cimene et al., 2023). A decade ago, most notably, they exacerbated the global food crisis, driving up wheat prices by a whopping 30% (Malpass, 2022). 20 years ago, Sudan's war shattered millions of lives created the world's largest displacement crisis, and was the world's largest hunger crisis and the world rallied to respond. But today, the people of Sudan have been forgotten. Millions of lives and the peace and stability of an entire region are at stake (World Food Programme (WFP), 2024).

Climate change affects food security at the global warming, regional, and local levels. Climate change can disrupt food availability, reduce access to food, and affect food quality. For example, projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity (Clancy, 2022). Increases in the frequency and severity, of extreme weather events can also interrupt food delivery, and resulting spikes in food prices after extreme events are expected to be more frequent in the future of food security. Increasing temperatures can contribute to spoilage and contamination (The United States Global Change Research Program, 2015).

Generally, in pairs, with opposite magnetic polarities. In half the solar cycles, the "leading" spot (in the direction of the Sun's rotation) will always have an N polarity, and the "following" spot is an S polarity, then, in the following cycle, polarities are always reversed. The original "sunspot" theory of business cycles of William Stanley Jevons, is much more influenced by weather than humid/semi-humid areas (Kuester & Britton, 2013). Jevones and Jevones (1910) argued and believed that sunspots affected weather on Earth since weather economies in old times were heavily dependent on agriculture changes in climate conditions caused by sunspots created fluctuations in agriculture output. They consist of a central darker region known as the umbra, and a surrounding region, known as the penumbra. The total number of sunspots' decay and inform has long been known to vary surrounding an approximately 11-year repetition known as the solar cycle. The peak of sunspot activity is known as solar maximum and the lull is known as solar minimum. Solar cycles started being assigned consecutive numbers.

They used to predict the sunspot cycle would be weakened somewhat in retrospect. "…there is more or less evidence that trade reached a maximum of activity in or about the years 1701, 1711, 1721, 1732, 1742, 1753, 1763, 1772, 1783, 1793, 1805, 1815, 1825, 1837, 1847, 1857, 1866," actually. They confirmed that the corresponding droughts and bumper crops, which may result in most astronomers, the sunspot cycle does indeed approximately 11.11 years. Sunspot is a mutant whose cells can absorb solar energy and convert it for use as physical strength. It can create thermal updrafts for flight producing heat, light, and a concussive blast of increasing solar energy. This means that

more sunspots deliver more solar energy to the atmosphere so global temperatures should rise. According to current theory, sunspots occur in pairs as magnetic disturbances in the convective plasma near the Sun's surface (Hardaway, 2014) (see Figure Caption 1).

This research study focuses on the environment of Thai's rich food and agriculture production systems, which are facing unprecedented challenges from increasing demand for food for a growing population, rising hunger and malnutrition, adverse climate change effects, overexploitation of natural resources, loss of biodiversity, and food loss to be sustainable, agriculture must meet the needs of present and future generations while ensuring profitability, environmental health, and social and economic equity. Sustainable food and agriculture (SFA) contribute to all four pillars of food security: availability, access, utilization, and stability which are the dimensions of sustainability (environmental, social, and economic). The policy of the Ministry of Agriculture and Cooperatives of Thailand promotes SFA to help Thailand and overseas countries worldwide achieve Zero Hunger under the policy, that Thailand is the world's food kitchen.

MATERIALS AND METHODS

Creative qualitative methods use non-numerical data, such as words, images, sounds, or behaviors, to generate rich and detailed descriptions and insights. Some common qualitative methods in food science research are interviews, focus groups, observations, case studies, and content analysis. This research study was to describe and investigate exploring and promoting the context, culture, values, preferences, and motivations of food consumers, producers, and stakeholders to generate new ideas with the concept of a food-rich environment through the food security and sustainability of people's life in their daily living under the affecting problems of the world. This research article will explore five commonly used qualitative analysis methods: content analysis, narrative analysis, discourse analysis, grounded theory, and thematic analysis. However, soil is one of the most important natural resources for human life, most people use soil for agriculture.

Research objective

To investigate and describe the Thai food-rich Environment Security and Sustainability of Thai People's Life and the Thai Kitchen Food World to export for support the world people

Research frameworks

This research article will explore five commonly used qualitative data methods: content analysis, narrative analysis, discourse analysis, grounded theory, and thematic analysis. The research frameworks as designed in Figure 1.

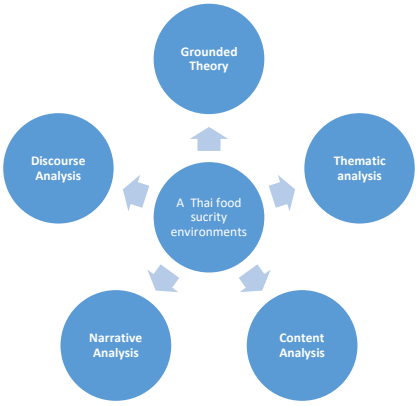
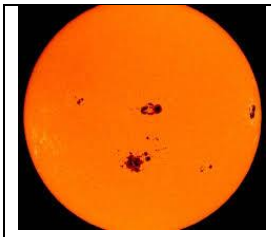
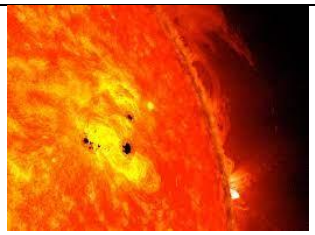


Figure 1: The research framework of Thai food-rich Environment Security and Sustainability of Thai People's Life and the Thai Kitchen Food World to export for supporting the worldwide people

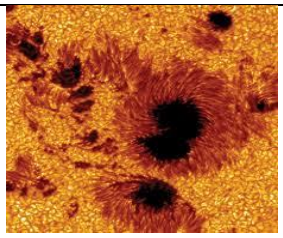
Step 1: Content analysis: It involves identifying patterns, frequencies, and relationships in the content, which can be textual, visual, or auditory in the context of the Thai food-rich Environment Security and Sustainability of Thai People's Life and the Thai Kitchen Food World to export for supporting the worldwide people. Thailand has long been called "the kitchen of the world" due to the combination of the consumption of abundant natural resources, a year-round growing season, and a relatively low-cost but highly skilled labor force. By supporting continuous investments in R&D and technology, particularly in the area of food safety, and showing a commitment to meeting international quality standards, the result has been that the food industry has continuously shown impressive annual growth, and presently contributes approximately 23% of the country's GDP. Thailand is one of the largest net-food exporting countries in the world with a food trade balance to consumption that reached a record value of US$19.26 billion in 2017. Thailand remains the only net food exporter in Asia and is the first of the world's top ten producers of many important agricultural products including rice, cassava, sugarcane, palm oil, coconut, pineapple, and natural rubber. Roughly 50% of the total land area in the country is used for agricultural production. However, this research points out many agricultural problems within the supply chain such as an increase in the severity level of disasters from climate change, lack of Irrigation systems of agricultural food households in some areas, damages caused by pests, different types of soil quality in each agricultural area, labor shortage from The uncertainty of natural disasters such as drought or floods, due to reliable research reports from the cycle of sunspots that radiate heat to agricultural soils in a cycle of every 10.45-11.11 years, affecting the uncertainty of agricultural food production. The research is detailed in Figure Caption 2.



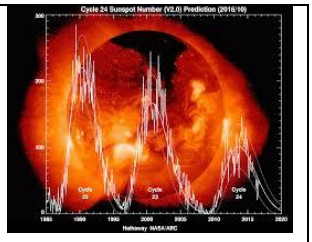
a) The sun and Sunspot



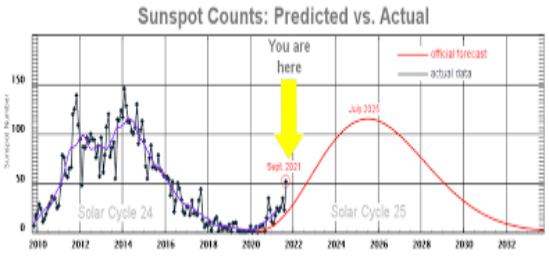
b) Sunspot and Solar Flares



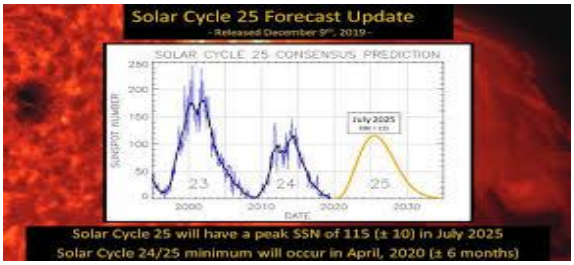
c) Accounting for the number of increasing and decreasing Sunspot Circle for each 11.1 years, continually



d) Solar Cycles are surrounding 11, 22, 44, 88, … years of support circle



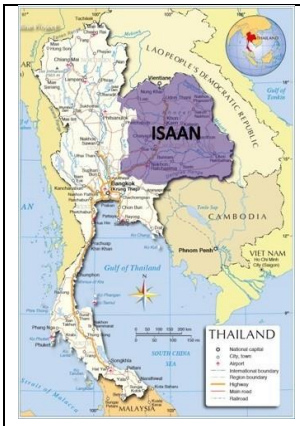
e) Solar Cycle Update



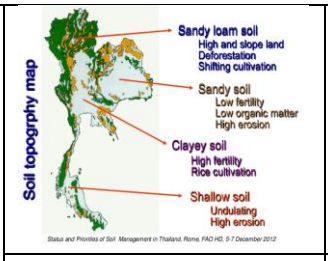
f) What is the 11-year solar cycle?

Figure 2: Associations between the accounting decay and formation of the Sunspot Circle of the Solar Cycle and Dendrochronology of Year Rings' Trees that effects of Global Climate Change, significantly
Sources: David H. Hardaway (NASA) (2014 update 2017)

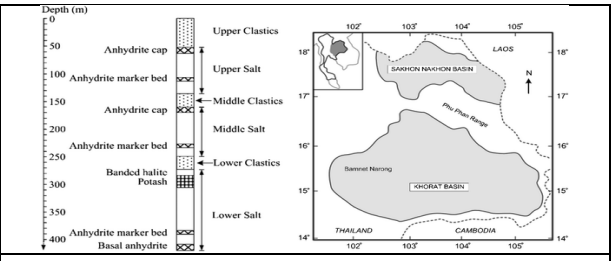
Step II: Narrative analysis: focuses on interpreting and understanding the status of the Thai farmers, gardeners, and pleasantries personnel who are the first sources to have produced food to feed the food industry and are a valuable export product for Thailand's economy. On the other hand, Thailand's agriculture sector faces problems such as fluctuating prices of agricultural products, inappropriate use of farm inputs, lack of water, depleted natural resources, and ageing farmers. The rice production in the country is among the top ten countries worldwide, following Vietnam in 2022. Apart from rice cultivation, crop plantation in the country has also extended to rubber, sugarcane, cassava, and other major crops including shallots, potatoes, garlic, and onions. Although Thailand is currently the 13th largest food exporter in the world and the 2nd largest food exporter in ASEAN after Vietnam 2022 was considered the golden year for Thai food exports, with exports worth 1.51 trillion baht, an increase of 22% at an increasing rate, despite previously being the world's number 1 rice producer and exporter. What are the problems with Thailand's large-scale farming model? Lack of plot managers with well-rounded skills, land fragmentation, poor water management, farm debts, weak collaboration among group members, enticing benefits in the short run, and inequality are some of the key problems facing the government while implementing the large-scale farming model: The land of *Thung Kula Rong Hai* used to be the land that produced the world's best quality jasmine rice, which was in demand on the world market. But this land is located in the northeastern region (ISAAN), where a large amount of rock salt has accumulated beneath the ground. Yields and qualities have declined due to salt seeping into the soil, causing soil salinity. The amount of land that used to be fertile for cultivation has decreased. There is research to support this problem, and the government should have a vision for what is happening to farmers in the northeastern region (Santiboon & Prokrongsri, 2020). The research showed the effect of rock salt on salinity land in Figure Caption 3.



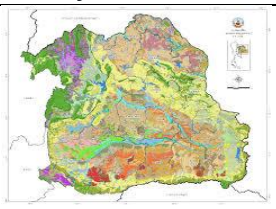
a) Map of Thailand, focused on Northeastern Region (ISAAN Located)



b) Quality of soil type for agricultural food security



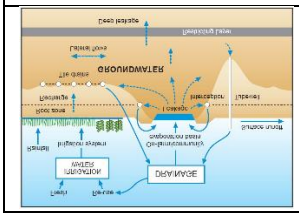
c) The two great salt rock basins: Korat and Sakon Nakhon basins, which cover 80% of Northeastern Land



d) Focused on the two great rock basins in ISAAN Land

e) Rice plant growth in the salty land in ISAAN Areas

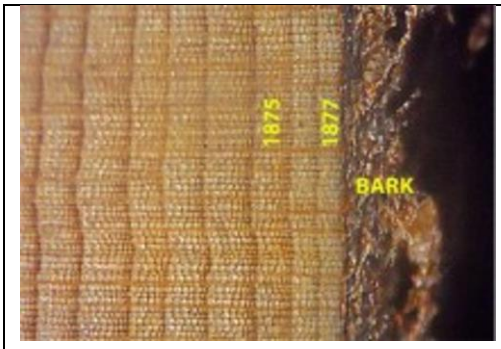
f) Large sinkholes formed by salt seepage into the soil



g) A model of salt seepage from salt rock basins to the ground	h) Cross-section on land to underground indicates that the land has been composited of salt at Ban Dung, Sakon Nakhon Rock Salt Basin	i) Salt Farm at Pimai District in the Korat Rock Basin	j) Salt industry: The White Gold has changed the farmers to local real industrial, sustainable, really?

Caption Figure 3: Effects of two Large Salt Rock Basins have been changed on salinity soils throughout the first of three areas of Thai's agricultural food products
Sources: a)-f): Santiboon and Pragongsri (2022); g)-j): Passaga et al., (2020)

Step III: Discourse analysis: The science of dendrochronology can be used to estimate when a tree fell or naturally died if the calendar year dates of tree growth rings can be determined. A tree's annual growth changes throughout the year continually in response to seasonal climate changes. Tree rings are important data banks, while one considers that trees often live for hundreds of years. Therefore, containing a long record of environmental conditions. Matching tree ring width patterns in living and well-preserved dead trees can be correlated among different tree ring series and tree ring chronologies extending far beyond the range of living trees that can be constructed. This process, called cross-dating, is the fundamental principle of dendrochronology (Eakin & Horton, 2019).



a) A principle of cross-dating Dendrochronology by John King (2019)

b) What can tree rings tell us about climate change? Recording past weather environmental conditions, tree rings allow us to see how trees might respond to future climate change

Figure Caption 4: Using the principle of cross-dating and pattern-matching morphological and statistical techniques, A Dendrochronologist, John King (2019) of Lone Pine Research determined this axe-cut stump was cut late in the growing season of 1877 reported by Dan Eakin & Elizabeth Horton (2019), and Niall Farrelly, Hui Xing, Teagasc and Brian Tobin (2023)

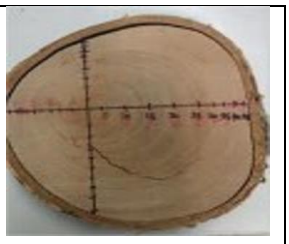
Sources: Photos by John King (2019) (a); and by Mabel Amber (2023)

Step IV: Grounded theory: Because heat, drought, and flooding exacerbate the plight of Thai farmers. Although Thailand has millions of people working in agriculture, the agricultural sector still generates relatively low incomes. Recording of climate conditions affecting agricultural food production from tree rings by studying the research results of Santiboon (2010, 2011, 2012) who analyzed the relationship between the cycle of sunspots that increased or decreased every 11 years and the characteristics of tree rings that were samples of dark and light brown color, the number of rings in the cycle every 11 years as well. This factor indicates the natural phenomenon that is affected by natural disasters, a truly reliable of local weather to climate change, scientifically. The research methodology process reported in Figure Caption 5 was analyzed.

g) *Dipterocarpus alatus* (Rubber trees)

h) The tiny hole left in the tree's trunk quickly heals as the tree continues to grow

i) Dendrochronology in its simplest form is a matter of counting rings (Dark brown and light colours indicate that of years of good rainy and drying weather)

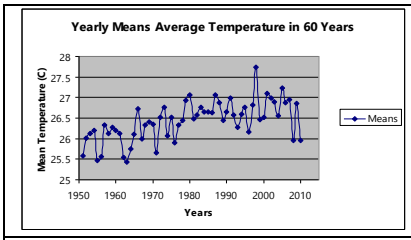
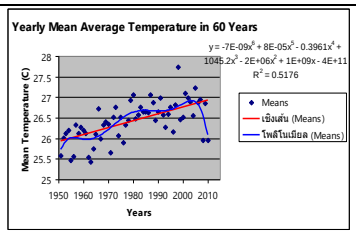
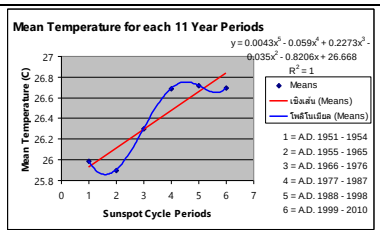
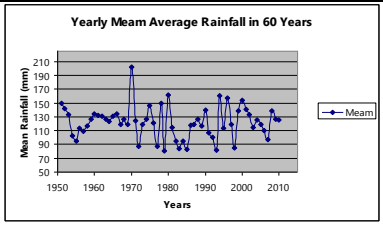
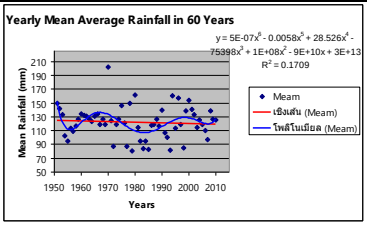
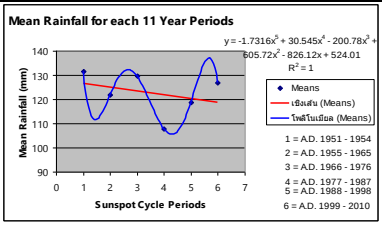


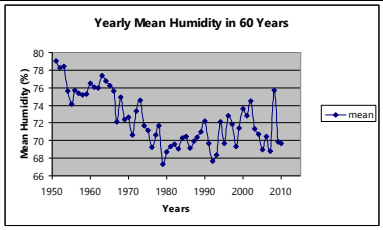
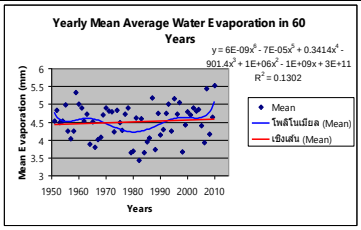
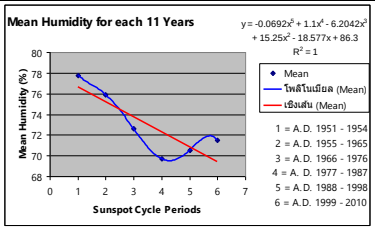
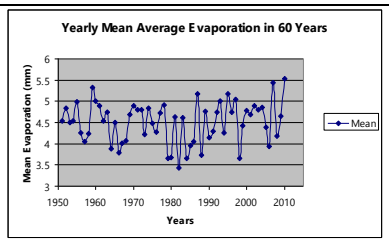
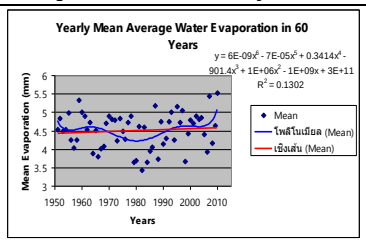
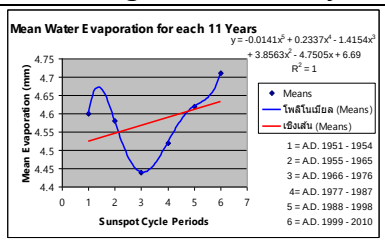
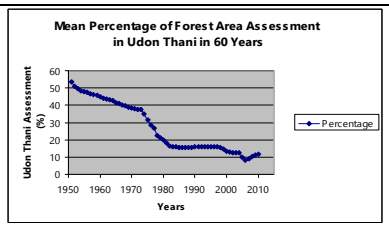
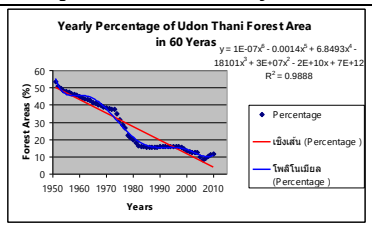
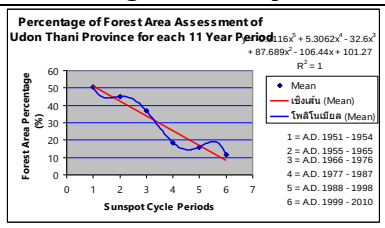
j) Measuring for accounting year rings with Vernier caliper, there are 6 alternating dark and light brown rings and 5 rings, corresponding to the decay and formation of the sunspots cycle.

Figure Caption 5: Design research method to investigate of Dendrochronology Technique and Sunspot Cycle
Sources: Toansakul Santiboon (2010, 2011, 2012)

Step V: Thematic analysis: involves identifying, analyzing, and reporting patterns or themes within data. The rings of a tree are like a time capsule recording past environmental conditions and provide an opportunity for scientists to understand how trees might respond to future climate change. Researchers are currently conducting a dendrochronological study (a tree-ring dating technique), as part of the Fit Forests project, to understand how trees respond to climate change (Farrelly, Hui-Xing, &Tobin, 2023).

Table 1: Yearly means the average of temperatures, rainfall, water-humidity, water evaporation, and percentage area of forest in 60 years (1951-2010)

		
a) Yearly mean average temperature	b) Multivariate Analysis is nonsignificant and this temperature rise is an unequivocal certainty	c) Multivariate analysis is significant and the 11 years running means of increasing temperature
		
d) Yearly mean average rainfall	e) Multivariate analysis is nonsignificant and this	f) Multivariate analysis is significant and the 11 years

	rainfall decreases unequivocal certainty	running means of decreasing accounting rainfall
		
g) Yearly mean average water-humidity	h) Multivariate analysis is nonsignificant and this water-humidity decreases unequivocal certainty	i) Multivariate analysis is significant and the 11 years running means of decreasing accounting water-humidity
		
j) Yearly mean average water-evaporation	k) Multivariate analysis is nonsignificant and this water-evaporation increases unequivocal certainty	L) Multivariate analysis is significant and the 11 years running means of decreasing accounting water-evaporation
		
m) Yearly mean average percentage area of forest assessment	n) Multivariate analysis is nonsignificant and percentage area of forest decreases unequivocal certainty	o) Multivariate analysis is significant and the 11 years running means of decreasing accounting percentage area of forest

Sources: *The original raw data from Udon Thani Meteorological Station, Northern Meteorological Center (Weather forecast service in Chiang Mai), Thai Meteorological Department, and Udon Thani Provincial Department of Royal Forest Office*

However, there were analyzed practical applications in research studies, that show off the associations between tree rings dendrochronology is the technique that can be applied to relate the sunspot cycle is a temporary phenomenon on the surface of the sun that appears visibly as dark spots compared to surrounding regions in Thailand to investigate the relationships between Dendrochronology Technique and Sunspot Cycle to analyze of the sample size of the 60 tree rings and 80 average years from 20 districts at rice fields, limb of water basins, and down hills thought out of Udon Thani province (Santiboon, 2010), and update in 2011 and 2012 with the sample sizes throughout of Thailand. The results are reported in Table 1.

As reported in Table 1, the climate characteristically change was investigated, determined, and analyzed, and they're transferred to effects of climatologically substance data for determining global

warming; the mean of temperature, rainfall, and relative humidity. Statistically, significance was not found for investigating and analyzing data with multivariate analysis. However, changing and adapted data that it's followed as the Sun Spot cycle for accounting increasing and decreasing every 4.8 years (1955 – 1962, …, 1999 – 2003 A.D.) and 6.2 years (1951 – 1954, …, 2004 – 2010 A.D.), the total is 11 years (1951 – 1954, …, 1999 – 2010 A.D.) surrounding years. the current prediction for the next sunspot cycle maximum gives a smoothed sunspot number maximum in 2013.

Results

The United Nations in Thailand (2020) reported the situation in the *Thai Agricultural Sector: From Problems to Solutions*, Thailand is known as a land rich in agricultural resources: "A bowl of rice and a water bowl." Thailand has been affected by various problems like many countries, the COVID-19 disease has created severe wounds in many dimensions. Income from the tourism industry is zero. Airlines, tour operators, and various sectors related to the tourism industry go bankrupt, causing a chain effect. Shops closed, hotels and accommodations were unable to bear the heavy costs. However, the agriculture sector in Thailand employs around 30 percent of the total labor force covering 6.4 million households. However, it also generates the lowest value added per worker with the slowest growth relative to other economic sectors, as its contribution to national income has declined over the past three decades accounting for only 10 percent of GDP in 2019. The many problems that afflict the sector include:

Poverty: Some 40% of farming households earned an annual income below Thailand's poverty line of 32,000 baht.

Debt: 30% of farming households have debt levels above the average annual farming income per person and 10% have three times higher debt.

Aging: Agricultural labor aged 40-60 increased significantly from 39 percent of the workforce in 2003 to 49 percent in 2013, while younger farmers aged 15-40 declined from 48 percent to 32 percent over the same period. Aging problems differ across regions.

Land ownership and access to water resources: According to farmer registration 2017, some 40% of farm households do not have land ownership and only 42% of water sources have access to water resources creating a large inequality in the access to land and water resources.

The small size of farm: Farming households, an overall average of 14.3 rai owned for agricultural families. Small plantation areas partly affect the productivity of 50% of total farming households productivity levels below the mean.

Limited farming portfolio: Two-thirds of households still grow one kind of crop production a year, especially for key economic crops in-season rice and off-season rice accounts for 88% of the households that are engaged in a rotation of monoculture.

This reporter summarized that Climate change will further increase the production risks faced by the agricultural sector. The changing climate has also added to resource problems such as water scarcity, pollution, and soil degradation. According to the Ministry of Agriculture and Cooperatives, floods and droughts in Thailand continue to rise with higher intensity. Most affected areas are from the Northeastern and Southern regions. Before the war, around 90% of Ukraine's agricultural exports were transported by sea. After the start of the war, the Russian military blocked Ukraine's Black Sea ports and brought exports to a virtual standstill. Therefore, Russia's invasion of Ukraine has caused the greatest military-related increase in global food insecurity in at least a century. Because Russia invaded Ukraine, global food prices hit an all-time high in March 2022. As above, Ukrainian exports, especially wheat, are of crucial importance to some Asian and African countries including Thailand. From 2016 to 2021, they received 92% of Ukrainian wheat. Prices had fallen below their pre-invasion

levels by December 2022, and by January 2024, the FAO announced that global food prices had fallen to their lowest level in three years (Welsh, 2024).

However, Thailand has long been called "the kitchen of the world" due to the combination of having an abundance, of natural resources, a year-round growing season, and a relatively low-cost but highly skilled labor force. By supporting continuous investments in R&D and technology, particularly in the land of food safety, and showing a commitment to meeting international quality standards, the food industry has continuously shown impressive annual growth, and at present contributes, approximately 23% of the country's GDP (Poapongsakorn, 2023). Thailand is one of the largest net foods to export food production to many countries with a food trade balance that reached a record value of US$19.26 billion in 2017-2020. Thailand remains the only net food exporter in Asia. It has been one of the world's top-ten producers of many important agricultural products including rice, cassava, sugarcane, palm oil, coconut, pineapple, and natural rubber. Roughly 50% of the total land area in the country is used for agriculture (Varanyanond, 2023).

This means the main strategies of "Thai Kitchen to the World" include: expanding agriculture and food business, adding value to agricultural produce with high-technology production processes, supporting cooperation at regional and international levels, and supporting Thai investments abroad, especially in building. The global fears of a recent food crisis, have prompted many countries to stockpile more food, including chicken products. Food processing with roughly 9,000 food processing companies in Thailand, the government is the main producer and exporter of many processed foods including canned tuna, frozen seafood, shrimp, and chicken. Processing food exports contributed about 52% of total food exports and nearly 15% of Thai manufacturing output. Processing foods fall into the first three general categories: minimal processing, moderate food, and high food processes (The Broad of Investment of Thailand, 2022).

Finally, global crop and food prices have been increasing since mid-2020. Russia's unprovoked and unjustified aggression against Ukraine has further driven up prices. Due to the war Ukraine, a leading grain exporter, has seen a dramatic drop in its exports. This has resulted in major food security concerns for millions of people around the world. The actions of the EU and the United Nations have helped curb the price rise, but the outlook remains difficult. Following Russia's withdrawal from the initiative, exports from Ukraine declined again, and prices increased to grow up. The positive global harvest outlook is currently stabilizing the prices. However, the global food supply remains insecure as the war and Russia's blockage of the Black Sea ports reduces Ukraine's ability to export grain and foodstuff to the Global market.

The food-rich environment of Thailand

The culinary landscape of Thailand is a dynamic canvas, forever evolving and adapting, influenced by a myriad of factors. Chief among these is the geographical diversity that shapes the country's cuisine. Thailand is bordered by the PDR Laos and Myanmar in the north, so much of its food reflects these particular country's cuisines, China. Much of the cuisine also largely differs because of the northern region's unique climate, which is both comfortable and cool, making it an ideal place to grow several different vegetables and herbs. Saltiness is largely utilized in many Thai dishes, but this is not the case in the northern region of Thailand (Iverson, 2023). This means the geography of Thailand has affected its food-producing investment. Thailand enjoys a tropical climate which is influenced by seasonal monsoon winds. The southwest monsoon (May) brings a stream of warm moist air from the Indian Ocean toward Thailand, causing abundant rain throughout the country, especially the mountainous regions.

This phenomenon is intensified through the Inter-Tropical Convergence Zone (ITCZ) from May to October and tropical cyclones which produce a large amount of rainfall. The northeastern monsoon storm starts in October and brings cold and dry air from the anticyclone in China over major parts of

Thailand, the monsoon causes mild weather and abundant rain along the eastern coast. Mean annual rainfall is 1,200-4,500 mm, with lower totals on the leeward side and higher totals on the windward side. The mean temperature is 26.3°C in the north and 27.5°C in the southern and coastal areas, this suitable land indicates a food-rich environment in Thailand (Climate Change Knowledge Portal, 2023).

Thai culture environment for growing food production

Thai culture values serenity and avoids conflict and sudden displays of anger. Visitors should not take care to create conflict and handle disagreements with a smile, without assigning blame. The concept of enjoinment emphasizes that life should be fun, and Thais often display positive emotions in social interactions. Public displays of affection are not common in traditional Thai society, especially among lovers, but are becoming more accepted among younger generations (Thailand Family Law Center, 2014). The most common ingredients use in Thai cooking are fresh herbs and spices, such as lemongrass, ginger, garlic, chili peppers, fish sauce, coconut milk, and palm sugar. Thai cuisine varies across regions, with dishes influenced by local traditions and ingredient availability. In central Thailand, sticky rice is not commonly used as a staple food and is often made with coconut milk/cream (Watanasin, 2020). The Thai government's Kitchen of the World campaign has further boosted the growing Thai food business (Yambunjong & Premruetai, 2023).

Currently, Workers' ages are more than 12 million people in Thailand who work in the agricultural sector, making it one of the country's main employment sectors. In 2020, people showed that almost half of Thailand's land area is used for agriculture (46.54%), half of which is used for rice cultivation (46.04%). During the season changes rising temperatures, and fluctuating rainfalls, farmers face increasing difficulties due to various risks. Data from the Ministry of Commerce indicates that the agricultural sector contributes only 9% to the country's GDP. The Department of Agricultural Economics, Ministry of Agriculture and Cooperatives, reveals that the average annual income per agricultural household was THB 80,271, approximately THB 6,689 per month in 2022 (United Nations Development Program of Thailand, 2024). By the thirteenth century, the Thai people had established Thai cuisine as we know it today, with various types of meat and seafood combined with local vegetables, herbs, and spices such as garlic and pepper, and served with rice (Tira, 2024).

Food security in Thailand

The availability of food is a critical factor for human survival. Food scarcity must be supported by a profound impact on health and productivity, leading to potential conflicts, and having sufficient food is considered a vital aspect of stability. Recognizing its significance, the United Nations has designated food security as the second goal of the Sustainable Development Goals (SDGs), aimed at eradicating hunger, achieving food security, improving nutrition, and promoting sustainable agriculture (The Nation, 2023). The FAO has reported a growing severity of global food shortages since 2014. In Thailand, approximately one in 10 people lack access to sufficient food. Yet, some agricultural lands are being used to cultivate tobacco. Thailand is the second-largest tobacco leaf producer in the ASEAN country group and the 16th largest globally (United Nations in Thailand, 2023).

According to the National Economic and Social Development Council, Thailand faces a "food security crisis", despite being the world's 13th-largest food exporter. UN agencies last year reported that 10.5% of the Thai population faces severe food insecurity (i.e., no food for a day or more). Sustainable Development Goal 2 (Zero Hunger) is one of the two Goals. The World Health Organization (WHO). Regarding this year's theme, FCTC Articles 17 and 18 that highlight parties to the convention shall support farmers by offering technical advice on sustainable alternative crops, linking them to necessary supplies and marketing, and providing financial support to increase the production of the best healthy food (Vandelaer, 2023).

Thailand ranks 64th in global food security according to the 2022 Global Food Security Index (GFSI), which assesses and reports on the food security situation in 113 countries worldwide. Thailand's score is 60.1%, which represents for food security a slight improvement in food security from the previous year's score. In the Asia-Pacific region, Thailand ranked 9th among countries in the Pacific-Asia group and 15th among countries with medium-high income levels, indicating a relatively favourable food security situation. under the FAO's definition of food security, which comprises four components: availability, accessibility, utilization, and stability, there are still significant issues that Thailand needs to address. The following are the major issues that Thailand must focus on in its battle for food security: *Food Availability* (This entails increasing food production in Thailand to ensure an adequate and consistent quantity of food); *Food Access* (This refers to the ability to obtain quality and nutritious food resources, reflecting the issue of hunger); *Food Utilization:* (This involves understanding and benefiting from food suitably, including hygienic food preparation that adheres to nutritional principles); and *Food Stability* (This refers to the ability to access sufficient food even during times of crisis, without the risk of food shortages).

Food production in Thailand

Agriculture in Thailand is highly competitive, diversified, and specialized and its exports are very successful internationally. Rice is the country's most important crop, with some indicating 60% of Thailand's 13 million farmers grow it on almost half of Thailand's cultivated land (SCB Economic Intelligence Center, 2017). Thailand is a major exporter in the world in the rice market. Rice exports amounted to 1.3% of GDP in 2014 (Lee, 2015). Agricultural production accounts for an estimated 9%-10.5% of Thai GDP (The World Bank, 2016). 40% of the population works in agriculture-related jobs (Luedy, 2016). The farmland they work for was valued at US$ 2,945/rai ($18,410/ha; $7,450/acre) in 2013 (Attavanich, 2013). Most Thai farmers own fewer than eight ha (50 rai) of land.[7] (Note: 1 acre = 2.529 rai or 43,560 sq. ft.), other agricultural commodities produced in significant amounts include fish and fishery products, tapioca, rubber, grain, and sugar. Exports of industrially processed foods such as canned tuna, pineapples, and frozen shrimp are on the rising product.

As agriculture declined in relative financial importance in terms of income, with the rising industrialization, and westernization of Thailand from the 1960s, it continued to provide the benefits of employment and self-sufficiency, rural social support, and cultural custody. Technical and economic globalization have continued to change agriculture to a food industry which exposed smallholders to such an extent that environmental and human values have declined markedly in all but the poorer areas. However, Thailand's military government in 2016 introduced "Thailand 4.0", an economic model designed to break Thailand out of the middle-income trap (World Bank Group, 2016). For agriculture, Thailand 4.0 aims at a seven-fold increase in the average annual income of farmers from 56,450 baht to 390,000 baht by 2037. It is unclear how this goal is reached, given that Thai farms are small – 43% of the productions are smaller than 10 rai, and another 25% are between 10–20 rai. These small plots are already mechanized, 90% use machinery. Concomitantly, agricultural research budgets have dropped from 0.9% of agricultural GDP in 1994 to only 0.2% in 2017 (Poapongsakorn & Chokesomritpol, 2017). Meanwhile, the population ages, the World Bank estimates that by 2040, 42% of Thai people age who will be over 65 years old (World Bank Group, 2016).

Moreover, Thailand's food exports average one trillion baht annually. Locally consumed foods earn two trillion baht annually in the domestic market. Thailand is a leading food exporter: rice is the chief export, accounting for about 17.5 percent of all food exports, followed by chicken, sugar, processed tuna, tapioca flour, and shrimp. Thailand's largest export markets are Japan, China, Vietnam, Indonesia, Myanmar, Cambodia, Malaysia, and the Philippines. Thailand's food exports accounted for 2.5 percent of the world food trade in 2019. Food imports in 2019 amounted to 401 billion baht,

down slightly (Macan-Markar, 2016). Thailand produced 2018: 104.3 million tons of sugarcane (4th largest producer in the world, only behind Brazil, India, and China); 32.1 million tons of rice (6th largest producer in the world); 31.6 million tons of cassava (2nd largest producer in the world, just behind Nigeria); 15.4 million tons of palm oil (3rd largest producer in the world, behind Indonesia and Malaysia); 5 million tons of maize; 4.7 million tons of natural rubber (largest producer in the world); 3.8 million tons of mango (including mangosteen and guava) (3rd largest producer in the world, only behind India and China); 2.1 million tons of pineapple (4th largest producer in the world, only behind Costa Rica, Philippines and Brazil); 1 million tons of banana; 1 million tons of vegetable; 885 thousand tons of coconut (9th largest producer in the world); 516 thousand tons of orange. In addition, to smaller productions of other agricultural products (Food and Agriculture Organization Data Statistic, 2017).

Thailand is the largest producer and exporter of dairy products in ASEAN (Thongnoi, 2018). The National School Milk Programme supported the Thai dairy industry, by providing an outlet for locally-produced milk (Suwanabol, 2015). Thai palm oil crops yield 4–17 percent oil compared to around 20 percent in competing countries. In addition, Indonesian and Malaysian oil palm plantations are 10 times the size of Thai plantations (Arunmas & Wipatayotin, 2018). Rice production in Thailand represents a significant portion of the Thai economy and labor force (SCB Economic Intelligence Center, 2017). In 2017, the value of all Thai rice traded was 174.5 billion baht, about 12.9% of all farm production (Poapongsakorn & Chokesomritpol, 2017). 40% of Thai people work in agriculture, and 16 million of them are rice farmers one estimated occupation (Lee, 2015). In 2018, Thailand exported over 11 million tons of sugar, earning 115 billion baht in revenue (Wangkeit, 2020). In the early 21st century, the Thai government has suffered from increasing levels of air pollution. Field burning has been identified as a key contributor. In addition to releasing CO_2, sugarcane burning emits, acidic is a price of fine particles, which hurt air quality and human health (Ma, Karkee, & Zhang, 2013).

In terms of fruits and vegetables: Thailand is a leading producer and exporter of tropical fruits such as durian, mangosteen, rambutan, longan, salak, and langsat, producing around 700,000 tons of durian per year, 400,000 tons of which are exported to China and Hong Kong (Svasti & Jariyasombat, 2018). According to the Thai Food and Drug Administration (FDA) the plant can be used as a key ingredient in many food and cosmetic products (Theparat, 2020). Thailand rubber price recently, 65 baht per kilogram to be manufactured by the Marketing Organization for Farmers (MOF) under the supervision of the Rubber Authority of Thailand (Rubber Authority of Thailand, 2024). The agriculture ministry estimates that 21,000 tons of the chemicals are stockpiled in Thailand. Glyphosate remains in use, evidently due to US pressure. Thailand's leading organic crops are coffee beans, mulberry leaf tea, fresh vegetables, and fruit, growing by less than 0.2 percent of Thailand's farmers. Fifty-eight percent of the organic food sold at retail in Thailand is imported (SCB Economic Intelligence Center, 2017).

The Thirteenth National Economic and Social Development Plan (2023-2027) reach the stage when "Thailand becomes a developed country with security, prosperity, and sustainability by the Sufficiency Economy Philosophy" in the spirit of the National Strategy on Sufficiency Economy including *Philosophy* by perpetuating, maintaining, and furthering national development; *Resiliency* by focusing on three levels of development; *Sustainable Development Goals* (SDGs) by basing the development direction on the concept of "leaving no one behind" and focuses on enhancing good quality of life for all groups of people in terms of access to adequate necessities of life; a healthy environment; supportive factors for both physical and mental health; opportunities to capitalize on one's potentials to improve one's livelihood; and commitment to pass on natural resources and a healthy environment to future generations; *Bio-Circular-Green Economy Model* (BCG Model) by focusing on scientific, technological and innovative knowledge to create added economic value and

strive for a balance between the conservation and use of the natural resources base and biodiversity. These policies indicate that the food-rich environments support the food security and sustainability of Thai people's lives.

The situation of Thai farmers regarding current agricultural products

The agricultural economy is an important sector of Thailand's regional economy and is a source of income for people residing in the region areas. The National Economic and Social Development Council reported that this situation of the people's income indicates that the Thai agricultural economy in 2022 would be worth approximately 1.53 trillion baht, or 8.8% of the gross domestic product or GDP (GDP) in 2023. In the past 10 years, the Thai agricultural economy expanded by only 7.7% while other countries expanded at high rates. Signs of low growth in the past 10 years in the Thai agricultural sector. It shows the limitations in adding value to agriculture products that can increase income, and create higher profits. The farmers provide sustenance and support their families including profits that are considered an important part of farmers that would be used to invest in further development and increase business efficiency in various dimensions, such as purchasing land to increase agricultural production. They can buy machinery to make their incomes increase production efficiency, invest in building water storage during periods of high water and reserve it during periods of low water, or invest in agricultural cultivation technology that increases efficiency and reduces cultivation costs in the long term (Thai PBS Policy Watch, 2023).

Thailand's outdated and unproductive agriculture needs a shake-up. Despite the natural abundance; farmers remain poor amid rising investment costs and low prices. Droughts and floods from climate change have also increased their production risks, making farmers' lives much more difficult. The heart of startups is technological innovation to solve the farmers' problems from the previous agricultural time by modernizing agriculture processes using technology to build new business opportunities that old players cannot deliver. Startups benefit small players and consumers and their popularity often disrupts old businesses, prompting their readjustments that contribute to economic vitality and growth. Agriculture technology (AgTech), the use of technology in agriculture, has played an important role in improving farm productivity, profits, and sustainability (Jantarasiri, 2022).

DISCUSSIONS

Thailand has long been called "the kitchen of the world" with its abundant natural resources, highly skilled workforce, and strength in research. The food industry contributed roughly 23% of the country's GDP. The value of Thailand's food industry, including local consumption and exports, is expected to reach USD 102 billion in 2017.1 Thailand is also one of the largest net food exporting countries in the world, and the second in Asia with a food trade balance of a record value of USD 16.7 billion in 2016-2021. With abundant natural resources, a year-round growing season, relatively low labor costs, and a skilled workforce, Thailand enjoys numerous competitive advantages in the food and agricultural industries. Roughly 50% of the total land area in the country is used for agricultural purposes, allowing over 80% of raw materials to be used in the food industry which can be sourced locally at competitive prices. The country is a top-ten global producer of important agricultural products including rice, cassava, sugarcane, palm oil, coconut, pineapple, and natural rubber.

In leveraging its geography with local agricultural resources, the Thai government designated the food industry as one of ten key growth engines in line with the "Thailand 4.0" economic model. The government also created the food-optimized industrial park, known as Food Crudity. Hosting roughly 9,000 food processing companies in Thailand, the country is the main producer and exporter of several processed foods including canned tuna, frozen seafood, shrimp, and chicken. Processing food exports contribute about 52% of total food exports, and account for nearly 15% of Thai manufacturing output. To further extend shelf life, and add a high value to local agricultural and fisheries products. Thailand adopted canning, high-technology freeze drying, and other preservation

processes. The country is recognized as the top exporter of many canned foods such as canned pineapple and tuna. The country exported over USD 2 billion in canned tuna and USD 611 million in canned pineapple in 2016-2020 and stood as the top global exporter of both products

Most of the land areas throughout Thailand's Regions are often continuously experiencing natural disasters, Although Thailand is one of the country's important agricultural regions. Yet, it is frequently grappled by droughts affecting crop production as most of the cultivation depends on rain-fed irrigation. A smoothed sunspot number maximum of about 69 in the late Summer of 2013 and the maximum peak in 2015-2016, and in 2026-2027. This was over five years into Cycle 24 (2010-2020), and the Cycle 25 (2021-2031) will be predicted. This period times will be affected by the floodplain. On the other hand, a smoothed sunspot number minimum in 2007-2012 into Cycle 24, and 2018-2023 into Cycle 25, was approximately six years, this effect may destroy the food land to have a drought throughout the world. Understanding and predicting the solar cycle remains one of the grand challenges in astrophysics with major ramifications for space science and the magnetohydrodynamic phenomena elsewhere in the universe. The current scientific consensus on climate change is that solar variations only play a marginal role in driving global climate change since the measured magnitude of recent solar variation is much smaller than the forcing due to greenhouse gases (Santiboon, 2015).

Certainly! Rock salt basins play a crucial role in both industrial salt production, and managing brine salinity for agriculture. The plateau consists of two plains: the southern Khorat plain is drained by the Mun and Chi rivers, while the northern Sakon Nakhon plain is drained by the Loei and Songkhram rivers. Salt kingdom in the land of the Northeastern Region (Isaan), is evidence that the sea was deposited about 100 million years ago, and the water flowing in this land has been blocked by mountains. Elevation of the Phu Phan Mountains in the central region has led to the division of the Isaan land into 2 parts, it looks like a basin like the bottom of the pan, consisting of parts in the north called "Sakon Nakhon Salt Rock Basin" and the southern part called "Korat Salt Rock Basin." The Phu Phan Mountains divide the two rock salt basin plains. The soil is mostly sandy, with substantial salt deposits, and contains a large volume of rock salt deposits, estimated to be more than 18 trillion tonnes. The Northeast is sitting on massive deposits of potash and rock salt. All salt is salty: salt and potash mines, because of problems related to salination. The granting of permission for such mines is not only an issue for the government but for all people as they are directly affected by the agriculture of their food production (Santiboon & Prakongsri, 2022). Therefore, saline soil problems are a major obstacle to the development of the northeastern region with a soil salinity area of approximately 17.81 million rai and soil that has the opportunity to become soil salinity for approximately 19.40 million rai (Passago et al., 2012).

As one of the world’s leading producers of agricultural commodities, Thailand’s food supply is large enough to serve the global market. Raw materials are processed to increase the products’ shelf life and quality. Thailand produced over 2.4 million tons of chicken and over 200,000 tons of shrimp in 2016, placing the country in the top five globally as both a chicken and shrimp exporter. Approximately 70% of poultry production is locally consumed. This number is expected to increase by 4-5% in 2017, from around 1.7 million tons in 2016. Thailand also supplies various frozen seafood products such as frozen cuttlefish and fish meat to serve throughout the world consumers. Many companies are using computerized systems to control their production processes. Combined with the changing lifestyles consumers, and the purchases of processed foods, are rapidly growing: ready meals, convenient meat, and meat products have shown strong domestic and export demand.

However, the market for Thai-made ready-to-eat food is fairly evenly balanced between domestic and export sales absorbing 53.9% and 46.1% of industry output, respectively. The market should bounce back to growth over 2024 to 2026, the forecast is thus for sales to the domestic market to expand by 3.0-4.0% annually on general economic growth and the positive impacts of this on

consumer purchasing power; and an expansion in sales made through modern trade outlets; the development of new product lines, with healthier options likely to be especially important; and an uptick in economic activity that will boost sales of goods that are easy to consume. The volume and value of ready-to-eat foods distributed to the domestic market increased by 0.8% and 7.5% in 2022, respectively. Thus, overall domestic consumption of ready-to-eat products is expected to have shrunk by -1.0% to -2.0% through 2023 (Kornboontritos, 2024).

Thailand's strengths in food processing have also brought the country to global prominence in the seasonings and ingredients industries. The value of Thailand's food ingredients exports in 2016 reached USD 616 million. With over 550 manufacturers, Thailand is the sixth-ranking, largest food seasoning in the world exporters, accounting for a roughly 5.4% market share. Surrounded by countries with large Muslim populations, Thailand is considered an ideal investment destination. The country's major export markets are Singapore, Malaysia, Indonesia, Brunei, the UAE, Saudi Arabia, and Egypt. In 2016, the value of Thailand's halal food exports reached USD 5.8 billion with an annual growth rate of 8%. For 2023, the return to dining-in restaurants and rising interest in freshly prepared food will drag on sales, these are expected to have fallen between -2.0% and -3.0% in the year (Department of International Trade Promotion, 2023). In 2024, food exports will increase by around 2%, worth $40.6 billion or more than 1.4 trillion Baht. This growth is supported by the recovery of developing and emerging economies and the tourism and service sectors, as well as the depreciation of the baht, which is the most beneficial to the export sector (Arunmas, 2024). Offering a variety of raw materials, leading global companies, manufacture food ingredient products in Thailand for export back to their home countries for the globalized market. The National Halal Industry Committee set guidelines for developing and driving the country's halal industry over the next four years (2024-2027). The goal is to expand the country's industrial GDP by 1.2%, totaling 55,000 million Baht (Kaosod English News, 2024).

The export value of agricultural commodities decreased by 13.2 percent, compared with a 16.2% increase in the previous quarter. By implementing advanced technologies and food standards, Thailand is working to ensure the best quality of foods for the global market. In addition, the government is promoting a campaign focused on healthy living to ensure an optimum level of physical and mental health along with globalized trends. Healthy foods have become mainstream among many Thais. The local consumption value for healthy foods in Thailand reached USD 5.3 billion in 2016 at a 6.7% growth rate. The government has continued to support this rapidly growing sector by providing a mix of tax incentives and research support to ensure that the country's food manufacturers produce the highest-quality products that benefit both the health of consumers and the environment. However, the total value of agricultural products exported from Thailand reached around 1.78 trillion Thai baht. Over the past years, the total value of exporting agricultural products did not change drastically, with the highest value in 2022 (Ciba, 2024). The Thailand Industry Outlook over the next 3 years (2023-2025) covers a range of factors that will impact food industries. Those factors include challenges and opportunities to represent the attractiveness of each food industry that relies on the macroeconomic environment and sector-specific factors (Industry Team, 2023).

CONCLUSION

Thailand has long been called "the kitchen of the world" with its abundant natural resources, Thailand is also one of the largest net food exporting countries in the world. Thailand is a leading exporter of food products in Southeast Asia, specializing in farmed agricultural products and seafood. Thai food products have long been one of the country's driving forces in economic development. The agriculture and food sectors account for 10-15% of gross national income. It employs around 46% of the country's working population, and agricultural and food trade generates up to 10-15% of national exports. Agricultural production focuses on the following food crops: rice, cassava, maize, and

banana. Thailand is a leading food exporter: rice is the chief export, accounting for about 17.5 percent of all food exports, followed by chicken, sugar, processed tuna, tapioca flour, and shrimp. Thailand's largest export markets are Japan, China, Vietnam, Indonesia, Myanmar, Cambodia, Malaysia, and the Philippines. In 2021-2025: Food security major food exports: rice, canned tuna, sugar, meat, cassava products, and canned pineapples. Rice is not only the main staple crop of the country, it's the primary agricultural export. Thailand has for the last decades been one of the world's largest rice exporters. The value of Thailand's food exports was US$38.8 billion in 2022, while the value of Thailand's imports of food ingredients was US$3.3 billion. Thailand ranks 64th in global food security according to the 2022 Global Food Security Index (GFSI), which assesses and reports on the food security situation in 113 countries worldwide. Thailand's average score is 60.1 out of 100 representing a slight improvement from the previous year's score.

Agriculture accounts for only six percent of Thailand's GDP, but the sector employs around one-third of the country's labor force. In 2023, the Thai government launched the Global Thai Program, a diplomatic initiative to increase the number of Thai restaurants worldwide. The state provided training programs, grants, and information to Thai investors who wanted to open restaurants abroad. Thailand has proactively adopted advanced technologies and policies to encourage food production to ensure safety and quality with over 2,000 food packaging manufacturers. Thailand is home to many leading Japanese, American, and European food packaging companies to retain its position as a world leader in the food processing industry and adapt to the changing lifestyles of consumers with convenient, safe, impurity-free, functional, and eco-friendly designed food packaging will continue to be major priorities in Thailand. The food security is unsustainable, Thai farmers have been steadily on the rise with an average of over 50 years old, while the young generations are uninterested in farming and go for work in service and manufacturing or the industrial sector. The problem of Thai farms also consists of the decrease in the average size of small-scale land. Therefore, agriculture is one of the most important economic in food resources as it employs approximately 30% of the country's labor force. However, the Thai agricultural sector is a factor in structural challenges, especially labor shortage and lack of production planning and management. Although, the government will compensate field crop farmers with 1,148 baht per rai, while horticulture farmers will be given 1,690 baht per rai.

On the other hand, agriculture in Thailand is highly competitive, diversified, and specialized and its exports are very successful internationally. Rice is the country's most important crop, with some 60 percent of Thailand's 13 million farmers growing it on almost half of Thailand's cultivated land. Thailand's agriculture sector faces problems such as fluctuating prices of agricultural products, inappropriate use of farm inputs, lack of water, depleted natural resources, and ageing farmers. Additionally, the effects of climate-resilient change varieties with improved water management techniques offer hope for a more sustainable and adaptive future. Thailand is considered highly vulnerable to the effects of climate change. Extreme heat and rising sea levels threaten parts of Thailand. Water and soil erosions are considered a major problem due to climate change within the country. According to farmer registration 2022, some 40% of farm households do not have land ownership, and 42% of Thai farmers have access to water resources, creating a large inequality in access to their land and water resources. A farmer indicates that is poorly accounted for exactly 26.27%.

Statistically significant is recorded the farmer registration, the Bank of Agriculture and Agricultural Cooperatives (BAAC) and the National Credit Bureau (NCB) to reflect households' financial problems from the lens of monthly income and expenditure flows, their financial attitudes and use of financial services from all sources to smooth consumption and debt dynamics and repayment behaviours. To reach an export value of USD 58.6 billion in 2036, Thailand's public and private sectors are joining hands to launch the first phase of the "World Food Valley" project covering 2,000 rai in Ang Thong

province. This important project will provide infrastructure and complete industry development services such as raw materials and quality control, testing, approval, and mentoring services, which create a system for the food industry to gather all levels of the value chain together. Numerous investors have shown an interest in investing in this mega-project. Food crops exhibit a spectrum of responses under salt stress. Salinity not only decreases the agricultural food production of most crops, but also, affects soil physicochemical properties, and the ecological balance of the area in Thailand.

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