The Potential of the China-Thailand Agricultural Trade, A Case of the China-Thailand Rice Trade

BOONSUB PANICHAKARN[1,2,5], SUPAKYADA KULTHUNYAHIRUN[2], LIURONG PAN[3], SETHASILP INTHANON[4], SUPAVANEE THIMTHONG[1,2], PONNAPA MUSIKAPUN[1,2,*]

[1]Faculty of Logistics and Digital Supply Chain,
Naresuan University,
Muang, Phitsanulok, 65000,
THAILAND

[2]ASEAN Logistics Academic Network,
Naresuan University,
Muang, Phitsanulok, 65000,
THAILAND

[3]College of Economics and Management,
Beibu Gulf University,
Qinzhou, Guangxi, 535000,
CHINA

[4]Faculty of Business Administration and Information Sciences,
Merseburg University of Applied Sciences,
D-06217 Merseburg,
GERMANY

[5]Faculty of Business Administration and Technology,
Baise University,
Baise, Guangxi, 533000
CHINA

**Corresponding Author*

Abstract: - This study investigates the potential of China-Thailand agricultural trade by analyzing the competitive strength, influencing factors, and forecasting models for Thai rice exports to China from 1986 to 2021. Using econometric modeling and multiple regression analysis, factors influencing Thai rice exports to China were identified, including price, GDP, exchange rates, and the impact of the COVID-19 pandemic. Analytic Hierarchy Process (AHP) were used to analyze consumer preferences and selection factors for Thai rice. Results showed that Thai rice exports are strongly influenced by China's GDP, exchange rates, and rice prices, with the COVID-19 pandemic acting as a significant shock. The AHP analysis recognized quality, cost, and accessibility factors as primary determinants of Chinese rice import preferences. Thailand's comparative advantages arises from its exquisite rice varieties (Jasmine, Glutinous rice) and China's sustained GDP increase. Nonetheless, rice exchange policies, lower production yields, and higher logistics costs pose tremendous constraints on export overall performance.

Key-Words: - China-Thailand Agricultural Trade, Analytic Hierarchy Process (AHP), Thai Rice Exports, Econometric Modeling, Export Forecasting, Consumer Preferences, Competitive Advantage.

Received: May 25, 2025. Revised: August 27, 2025. Accepted: September 25, 2025. Published: April 29, 2026.

1 Introduction

Between 1998 and 2018, Thailand's exports to China improved appreciably from USD 1.77 billion to USD 30.32 billion, more often than not driven with the aid of business items (60–70%), with agricultural merchandise contributing 14–30% [1], [2]. However, World Trade Organization data

indicate that international change slowed markedly in past due 2022 amid sizable financial disruptions [3]. Although global merchandise trade volumes rose by 3.5% in 2022, forecasts for 2023 were downgraded to just 1.0%, far below initial projections, [4]. The International Monetary Fund emphasizes trade openness as essential for economic growth, particularly in East Asia, where import tariffs have declined significantly over two decades, [5], [6]. Integration of agricultural markets enhances food availability in climate-affected regions but redistributes benefits unequally between high- and low-income economies, [7], [8].

Thailand's agricultural exports—including rice, rubber, sugarcane, tapioca, and fruits—contribute substantially to its GDP and export value, [9]. Thailand's main agricultural exports to China encompass rubber, cassava, fruits, and rice. Notably, the proportion of rice exports declined sharply from 37.9% in 1998 to 10.2% in 2018, even as fruit exports extended from zero.6% to 18.6%, [10]

[11] although domestic rice supply stays ok, Thailand faces intensifying opposition from major exporters which includes Vietnam and USA. Concurrently, China's pursuit of rice self-sufficiency has similarly constrained import call for [12], [13]. These dynamics spotlight the want to re-examine Thailand's exchange competitiveness and develop centered techniques to sustain its rice export overall performance, [14], [15], [16].

2 Literature Review

Thailand exports rice to China due to its comparative advantages—favorable agro-climatic conditions and lower labor costs—enhancing production efficiency, [16]. Although China is a significant rice producer, it imports Thai rice to satisfy domestic demand and secure reserves [16]. This trade pattern displays Ricardo's idea of comparative advantage, in which countries export items they produce enormously extra successfully and import those less successfully produced, [17]. Thailand profits from export-pushed income, whilst China complements food protection, each results inspired with exchange rate fluctuations, labor cost differentials, and evolving trade policies.

2.1 Thailand (ASEAN) and China Trade

Thailand's trade relations with China and ASEAN are historically rooted, tracing back to the Han and Tang dynasties, and were formally reestablished in 1975 following a hiatus in 1949, [18]. Milestones such as ASEAN+3 (1997), China's WTO accession (2001), and the establishment of the China–ASEAN Free Trade Area (2002) have substantially regional economic integration, [19]. Contemporary projects, together the Belt and Road and the China–ASEAN Expo, in addition improve collaboration in agriculture and logistics, [20].

2.2 International Rice Trade

Urban Chinese consumers, mainly in cities like Chengdu, demonstrate a robust preference for Thai Hom Mali rice, attributing their picks to its premium flavor and texture, frequently related to higher income and educational attainment stages, [21], [22]. Consumer willingness to pay is in addition inspired by attributes such as grain colour, aroma, and brand reputation, [23]. Policy professionals advise transitioning from generalized price controls to focused subsidies and streamlined supply chains to bolster food security, enhance trade sustainability, and reinforce food safety, decorate trade sustainability, and growth resilience in opposition to nearby and environmental vulnerabilities, [23], [24], [25], [26], [27], [28], [29].

2.3 Rice situation in Thailand

From 2000 to 2018, Thailand's paddy cultivation area fluctuated between 9.3 and 12.0 million hectares, attaining its lowest factor in 2002 (9.65 million ha) and peaking in 2011–2012 (11.95 million ha), [30]. Annual production ranged from 25.84 million tons in 2000 to a high of 38.1 million tons during 2011–2012 [30]. Yield performance stepped forward steadily, rising from 2.61 tons/ha in 2000 to a peak of 3.19 tons/ha in 2011 and 2012, with averages between 2.8–3.1 tons/ha throughout the period, [31].

2.4 Rice Situation in China

China's harvested paddy area during 2000–2018 fluctuated between 26.5 million hectares (2003) and 30.78 million hectares (2015), with production efficiency enhanced by effective on-the-job training and delivery methods, [32]. Annual output ranged from 160.65 million tons (2003) to 212.67 million tons (2017), influenced by market demand and supply conditions, [31], [32]. Yields consistently exceeded 6 tons/ha, reaching a peak of 7.03 tons/ha in 2018, [33]. Compared to Thailand, China's paddy productivity was consistently higher during this period, [33].

Despite increased output post-2010, China failed to meet safety stock levels, particularly between 2000–2006, necessitating growing imports from 2012 onward, [34], [35]. In 2017, China's rice imports reached a peak of almost 6 million tons,

with annual imports constantly exceeding 4 million tons among 2015 and 2018. In 2016, Vietnam and Thailand emerged as important suppliers, with Thailand contributing 20.4% of overall rice imports.

In case of rice trade policy reforms in China, following WTO accession, China exempted rice exports from VAT in 2002 and abolished export subsidies by 2004, [36], [37]. These reforms contributed to export declines, despite price increases in 2008 to stabilize the global market, [38].

2.5 The Requirement for Thai Rice Imported from Thailand to China

Importing rice into China from Thailand requires a range of documentation, including a trade contract, commercial invoice, packing list, certificate of origin, planting inspection certificate, and quota certificate. The tariff rate is 1% for quota rice and 65% for non-quota rice, [39].

2.5.1 Inspection and Quarantine Requirements for Rice Imported from Thailand

Thailand exports brown, white, and broken rice to China under rigorous food safety and phytosanitary regulations. Exporters are required to register processing facilities and adhere to China's quarantine protocols, [40]. Shipments must be pest- and contaminant-free, devoid of soil, and accompanied by valid phytosanitary and fumigation certificates. Packaging must utilize clean, unused materials and include accurate labelling in compliance with import standards. Transport vehicles must avoid contamination, and exporters must follow documentation and procedural standards set by China's quality inspection agency, [41], [42].

2.5.2 Requirements on Labels, Packaging, Inspection, and Quarantine of Imported Thai Rice

Importers must obtain a rice business license and a health certificate. A 1% import tariff applies to quota rice, while non-quota imports are subject to a 65% tariff and a 13% VAT, [43]. The Ministry of Commerce issues the Tariff Quota Certificate, and label approval is required before customs clearance, [44].

2.6 Thailand - China Rice Trade

Rice continues to be a essential component of Thailand's agricultural exports, producing a trade value of THB 180,270 million in 2018, [45]. Bilateral rice trade with China grew drastically from 250,000–300,000 tons throughout 2000–2002 to 10–11 million tons in 2016–2018, representing about 9–10% of overall trade volume, [11]. Although export volume declined by 16.75% in 2018, China remains a strategic market, sourcing 78% of its rice imports from Vietnam and Thailand, [46]. Jasmine and white rice accounted for over 60% of total export value and 50% of volume. Jasmine rice prices rose 180% from 2002 to 2018, while white rice prices grew 109%. Thai rice exports declined between 2007–2011 due to contamination concerns and the Thai rice pledging policy.

2.7 Research on Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is both a problem-solving framework and a theory of measurement that enables structured decision-making through hierarchical modeling and pairwise comparisons, [47], [48]. It captures expert judgments to prioritize elements, evaluate consistency, and handle complex problems using both logic and subjective input, [49], [50]. AHP has been applied to assess critical success factors in China–Thailand e-commerce logistics [51], and to rank hydropower development alternatives in Nepal using multidimensional criteria across social, economic, environmental, political, and technical domains, [52]. Pairwise weighting is calculated using Saaty's standardized comparison scale.

3 Research Methodology

This study applies quantitative methods using secondary data from econometric modeling and the Analytic Hierarchy Process (AHP), [53]. It draws on datasets from official sources, including the Bank of Thailand, FAO, and China's National Bureau of Statistics, covering 1986–2021. Econometric analysis examines Thai rice export volumes to China through multiple regression using GDP, exchange rates, production, and interest rates as variables, evaluated via F-statistics, p-values, and R^2. AHP ranks export criteria—quality, accessibility, and finance—based on stakeholder input, enabling a strategic assessment of Thai rice export competitiveness, [53].

4 Results and Analysis

The data employed in this study are derived from authoritative statistical agencies in both Thailand and China, encompassing a range of key economic and trade variables. These include the value of Thai

rice exports, average export price, gross domestic product (GDP), GDP per capita, population, exchange rate, interest rate, production volume, and agricultural yield, spanning the period from 1986 to 2021, [54]. Eonometric modelling (multiple regression) has been employed to analyze the interdependencies among key variables.

This study investigates the determinants of Thai rice export volume (vol, tons) application a ambit of macroeconomic and trade-related variables.. Key independent variables include export value (val), average export price (pc), GDP and population of China and Thailand (gd_ch, gd_th, pp_ch, pp_th), and GDP per capita (gc_ch, gc_th). The model additionally incorporates exchange rates (Yuan/USD, Baht/Yuan, Baht/USD), interest rates, rice production volumes, and yields for both countries. To account for external shocks, a binary variable (cv) captures the presence of the COVID-19 pandemic, coded as 1 during affected years and 0 otherwise.

The results (Table 1, Appendix) is shown that the model accounts for 83.6% of the variation in Thai rice exports to China, with an adjusted R-squared of 0.6814. Among the statistically significant predictors, Thailand's GDP exhibits a negative effect (coefficient: –0.3358), while GDP per capita shows a positive relationship (coefficient: 0.0241) with export volume. Exchange rates (Yuan/USD and Baht/Yuan) are positively correlated with rice exports, while Chinese rice yield exerts a significant negative effect (-6.9868).

Independent variable is Thai rice exported volume (tons). Three dependent variables are Average Thai rice exported price (USD), China Gross Domestic Product (billion USD), and Exchange rate (Baht/Yuan). Moreover, dummy variable is COVID pandemic (1 when happened, 0 when not).

Additional analysis (Table 2) identifies four critical predictors: average Thai rice export price (-1356.083), China's GDP (1.141464), the Baht/Yuan exchange rate (-108181.9), and COVID-19 (-657547.4). Forecasting scenarios using GDP projections from Statista (2023) and exchange rates from WalletInvestor (2023) indicate expected GDP growth rates between 2.99% and 5.24%, and an exchange rate increase to 5.977% by 2028.

According to the forecasted macroeconomic data presented in Table 3 and Table 4, China's projected GDP growth and the Baht/Yuan exchange rate for the years 2024 and 2028 serve as critical inputs for modeling Thai rice export volumes. The forecasting model analyzes these variables to project future Thai rice export volumes under different scenarios, including scenario USD 20 reduction in average export price in 2024, assuming non-pandemic-related disruptions.

Table 2. Multiple Regression Output

Multiple Regression Output

Source	SS	df	MS	Number of obs	=	36
				F (6, 29)	=	8.58
Model	2.2025e+12	4	5.5063e+11	Prob > F	=	0.0001
Residual	1.9888e+12	31	6.4154e+10	R-squared	=	0.5255
				Adj R-squared	=	0.4643
Total	4.1913e+12	35	1.1975e+11	Root MSE	=	2.5e+05

vol	Coefficient	Std. err.	t	P > | t |	[95% conf.	interval]
pc	-1356.083	275.2044	-4.93	0	-1917.366	-794.8002
gd_ch	1.141464	0.2088474	5.47	0	0.715517	1.567411
ex_by	-108181.9	46411	-2.33	0.026	-202837.8	-13526.08
cv	-657547.4	237806.7	-2.77	0.009	-1142557	-172537.5
cons	1284451	281851	4.56	0	709611.7	1859290

Source: created by the authors

The forecasting equation (1) integrates these variables to estimate Thai rice export volumes for years such as 2024, under scenarios like a USD 20 price reduction in the absence of a pandemic.

$$vol = -1356.083\Delta pc + 1.141464\Delta gd_{ch} - 108181.9\Delta ex_{by} - 657547.4\Delta cv + 1284454 \quad (1)$$

Table 3. The forecasted GDP of China for the Year 2022 to 2028.

Year	The forecasted China GDP (billion USD)
2022	17,820.46 x 1.0299 = **18,353.29**
2023	18,353.29 x 1.0524 = **19,315.00**
2024	19,315.00 x 1.0448 = **20,180.31**
2025	20,180.31 x 1.0408 = **21,003.67**
2026	21,003.67 x 1.0396 = **21,835.42**
2027	21,835.42 x 1.0362 = **22,625.86**
2028	22,625.86 x 1.0344 = **23,404.19**

Source: created by the authors

Table 4. The forecasted values of China's GDP and the Baht/Yuan exchange rate for 2024 and 2028

Year	China GDP	Exchange rate (Baht/Yuan)
2024	20,180.31	5.301
2028	23,404.19	5.977

Source: created by the authors

Table 5. The projected Thai rice exported volume of 2024 and 2028 with and without the COVID pandemic

Changing average Thai rice exported price (USD)	Year 2024	Year 2028
Without the COVID pandemic		
-50	1,390,648.86	2,125,115.35
Changing average Thai rice exported price (USD)	**Year 2024**	**Year 2028**
-20	1,349,966.37	2,084,432.86
0	1,322,844.71	2,057,311.20
+20	1,295,723.05	2,030,189.54
+50	1,255,040.56	1,989,507.05
With the COVID pandemic		
-50	733,101.46	1,467,567.95
-20	692,418.97	1,426,885.46
0	665,297.31	1,399,763.80
+20	638,175.65	1,372,642.14
+50	597,493.16	1,331,959.65

Source: created by the authors

The forecasted value is an export volume of approximately 1,349,966.37 tons. In Table 5, scenario-based projections combined the effects of price fluctuations and disruptions, particularly the COVID-19 pandemic. Overall, rising Chinese GDP and a decreasing Baht value are supported Thai rice exports, although the impact of pandemic continues to pose significant constraints on growth potential.

4.1 Analytic Hierarchy Process (AHP), Results

The Analytic Hierarchy Process (AHP) results, detailed in Figure 1, reveal that quality is the primary determinant in Thai rice product trading decisions, receiving a dominant weight of 53.90%, followed by financial factors at 31.50% and accessibility at 14.60%.

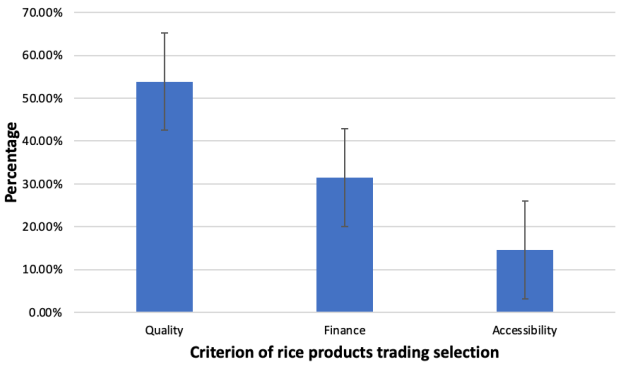

Fig. 1: The results of AHP for rice products trading selection
Source: created by the authors

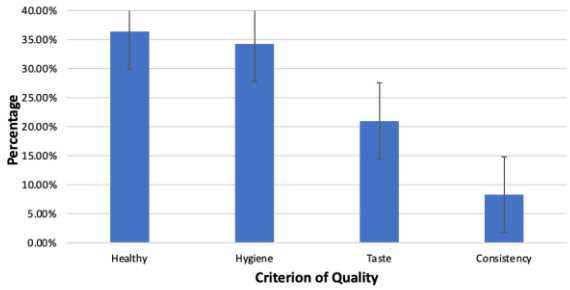

Fig. 2: The results of AHP for quality criteria
Source: created by the authors

In the quality critiria (Figure 2), consumers placed the highest importance on health attributes, with 36.40%, followed by hygiene (34.30%), taste (21.00%), and stability (8.30%). In criteria of finance (Figure 3), product cost was the primary concern (47.80%), ahead of logistics costs (34.10%), tariff cost (10.40%), and exchange rate (7.70%). In criteria of accessibility (Figure 4), product availability ranked first (49.00%), with market access (24.40%), e-commerce (16.90%), and nationalism (9.70%) respectively. These findings highlight the importance of healthy products, product cost, and product availability to enhance competitiveness in the international rice trade market.

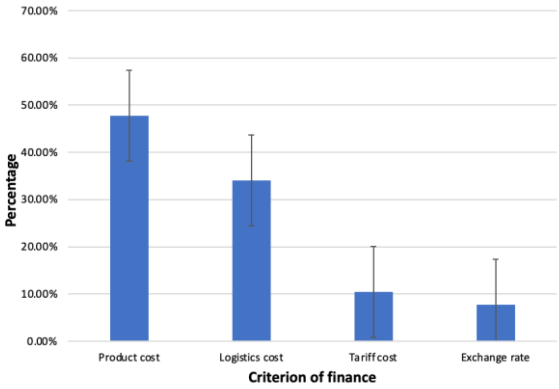

Fig. 3: The results of AHP for finance criteria
Source: created by the authors

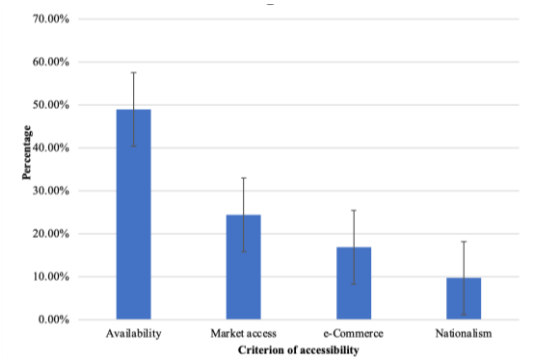

Fig. 4: The results of AHP for accessibility criteria
Source: created by the authors

Table 6 shows the consistency results of Rice products trading selection, quality criteria, finance criteria, and accessibility criteria. Every factor have value less than 0.1 that means all factors pass the criteria.

Table 6. Consistency results

Factor	Consistency Value	Criteria
Rice products trading selection	0.01	Pass
Quality criteria	0.02	Pass
Finance criteria	0.03	Pass
Accessibility criteria	0.01	Pass

Source: created by the authors

5 Discussion, Conclusion and Implication

This study identifies key economic and market factors influencing Thailand's rice exports to China. Key factors include international rice prices, China's GDP growth, and the Baht/Yuan exchange rate. A weaker Baht effects price competitiveness, while China's economic expansion and stronger currency increase import demand. In addition, The COVID-19 outbreak has impacted trade, making the risk of agricultural exports vulnerable to the impact of the international economic crisis..

Thailand's domestic economic growth also affects export. As incomes rise, domestic consumption shifts toward higher-quality and processed rice, impacting supply availability. Data from provinces such as Guangdong, Yunnan, Fujian, and Zhejiang indicate that Chinese consumers prioritize health, hygiene, taste, availability, and accessibility, especially through e-commerce. Maintaining product quality and improving supply chain efficiency are therefore crucial to long-term competitiveness.

Theoretically, the study contributes to international trade education and research by integrating econometric modeling with the Analytic Hierarchy Process (AHP) to examine agricultural and trade between emerging markets. The study corroborates traditional trade theories while demonstrating the increasing importance of non-economic influences such as consumer behavior and pandemics.

Strategically, Thailand needs to manage exchange rate volatility, invest in logistics infrastructure and digital trade, and align its export offering with Chinese consumer demand. Increasing rice variety diversity and enhancing supply chain resilience are crucial to sustaining Thailand's market in China.

6 Limitations and Future Research Directions

This study provides meaningful insights but is limited by its reliance on historical macroeconomic data, which may not fully capture evolving factors such as policy reforms, climate change, technological disruption, and geopolitical shifts. Key aspects—including government support, trade agreements, and digital trade—remain underexplored. Future research should integrate real-time market data, stakeholder perspectives, and climate modeling, with particular emphasis on digital platforms and shifting consumer behavior among younger Chinese demographics.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

The authors wrote, reviewed and edited the content as needed and verifies that none utilized artificial intelligence (AI) tools were used. The authors take full responsibility for the content of the publication.

References:

[1] Bhuthong, P., Rattanasimanon, P., & Udomkiattikul, N. (2022). Agricultural Exports from Thailand to China: A Value Chain Analysis of Cassava and Durian. In J. Menon & V. Roth (Eds.), *Agricultural Trade between China and the Greater Mekong Subregion Countries: A Value Chain Analysis* (pp. 59-107). ISEAS–Yusof Ishak Institute.

[2] Intarakumnerd, P., Chairatana, P.-a., Tangchitpiboon, T. (2002). National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, *31*(8), 1445-1457. https://doi.org/10.1016/S0048-7333(02)00074-4.

[3] Salvatore, D. (2020). Growth and trade in the United States and the world economy: Overview. *Journal of Policy Modeling*, *42*(4), 750-759. https://doi.org/10.1016/j.jpolmod.2020.03.001.

[4] Kontsas, S., Kalogiannidis, S. (2022). A Conceptual Forecasting Analysis of International Trade Aspects Based on Globalization Impact Issues. *International Journal of Scientific Research and Management*.

https://doi.org/https://doi.org/10.18535/ijsrm/v10i1.em6.

[5] Reinhardt, N. (2000). Back to Basics in Malaysia and Thailand: The Role of Resource-Based Exports in Their Export-Led Growth. *World Development*, *28*(1), 57-77. https://doi.org/10.1016/S0305-750X(99)00111-4.

[6] Irwin, D. A. (2025). Does trade reform promote economic growth? A review of recent evidence. *The World Bank Research Observer*, *40*(1), 147-184. https://doi.org/10.1093/wbro/lkae003.

[7] Brown, M. E., Carr, E. R., Grace, K. L., Wiebe, K., Funk, C. C., Attavanich, W., Buja, L. (2017). Do markets and trade help or hurt the global food system adapt to climate change? *Food Policy*, *68*, 154-159. https://doi.org/10.1016/j.foodpol.2017.02.004.

[8] Donaldson, D. (2015). The gains from market integration. *Annual Review of Economics*, *7*(1), 619-647.

[9] Kunanuntakij, K., Varabuntoonvit, V., Vorayos, N., Panjapornpon, C., Mungcharoen, T. (2017). Thailand Green GDP assessment based on environmentally extended input-output model. *Journal of Cleaner Production*, *167*, 970-977. https://doi.org/10.1016/j.jclepro.2017.02.106.

[10] Li, H., Aide, T. M., Ma, Y., Liu, W., Cao, M. (2007). Demand for rubber is causing the loss of high diversity rain forest in SW China. In D. L. Hawksworth & A. T. Bull (Eds.), *Plant Conservation and Biodiversity* (pp. 157-171). Springer Netherlands. https://doi.org/10.1007/978-1-4020-6444-9_11.

[11] Zixin, Z. J. A. (2023). Research on Agricultural Cooperative Development between China and Thailand Based on Empirical Analysis. *Agricultural & Forestry Economics and Management*, *6*(4), 19-31. https://dx.doi.org/10.23977/agrfem.2023.060403.

[12] Chen, C. C., McCarl, B. A., & Chang, C. (2006). Estimating the impacts of government interventions in the international rice market. *Canadian Journal of Agricultural Economics*, *54*(1), 81-100. https://doi.org/10.1111/j.1744-7976.2006.00039.x.

[13] Wang, X., Qiang, W., Niu, S., Growe, A., Yan, S., & Tian, N. (2022). Multi-Scenario simulation analysis of grain production and demand in China during the peak population period. *Foods*, *11*(11), 1566. https://doi.org/10.3390/foods11111566.

[14] Nguyen, H.-T.-M., Do, H., Kay, A., & Kompas, T. (2020). Rice policy in a transitional economy: balancing the social and political objectives. *Food Security*, *12*(3), 549-566. https://doi.org/10.1007/s12571-019-01005-x.

[15] Ryan, J. (2002). Assessing the impact of food policy research: rice trade policies in Viet Nam. *Food Policy*, *27*(1), 1-29. https://doi.org/10.1016/S0306-9192(01)00024-0.

[16] Suwannarat, P. (2017). Ascertaining the competitiveness of Thai exports to PRC. *Competitiveness Review: An International Business Journal*, *27*(3), 275-299. https://doi.org/10.1108/CR-04-2016-0026.

[17] Siddiqui, K. (2018). David Ricardo's Comparative Advantage and Developing Countries: Myth and Reality. *International Critical Thought*, *8*(3), 426-452. https://doi.org/10.1080/21598282.2018.1506264.

[18] Chirathivat, S. (2002). ASEAN–China Free Trade Area: background, implications and future development. *Journal of Asian Economics*, *13*(5), 671-686. https://doi.org/10.1016/S1049-0078(02)00177-X.

[19] Chiang, M.-H. (2019). China–ASEAN economic relations after establishment of free trade area*. *The Pacific Review*, *32*(3), 267-290. https://doi.org/10.1080/09512748.2018.1470555.

[20] Bi, S. (2021). Cooperation between China and ASEAN under the building of ASEAN Economic Community. *Journal of Contemporary East Asia Studies*, *10*(1), 83-107. https://doi.org/10.1080/24761028.2021.1888410.

[21] Panichakarn, B., Pochan, J., Shafiq, M., Saleem, I., Wang, Y., Nazeer, S. (2024). The interplay of digital transformation, agility, environmental volatility, and innovation to spur enterprise performance: Evidence from Chinese electric vehicle firms. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(4), 100408. https://doi.org/https://doi.org/10.1016/j.joitmc.2024.100408.

[22] Xu, P., Su, H., & Lone, T. (2018). Chinese consumers' willingness to pay for rice. *Journal of Agribusiness in Developing and Emerging Economies*, *8*(2), 256-269. https://doi.org/10.1108/JADEE-11-2016-0077.

[23] Bairagi, S., Gustafson, C. R., Custodio, M. C., Ynion, J., & Demont, M. (2021). What drives consumer demand for packaged rice? Evidence from South and Southeast Asia. *Food Control*, *129*, 108261. https://doi.org/10.1016/j.foodcont.2021.108261

[24] Fathelrahman, E., Osman, R., Hoag, D. L., Sixt, G. N., & Strzepek, K. (2024). Bilateral Trade Welfare Impacts of India's Export Ban of Non-Basmati Rice Using the Global Partial Equilibrium Simulation Model (GSIM). *Foods*, *13*(19).

[25] Qiang, W., Liu, A., Cheng, S., Kastner, T., & Xie, G. (2013). Agricultural trade and virtual land use: The case of China's crop trade. *Land Use Policy*, *33*, 141-150. https://doi.org/10.1016/j.landusepol.2012.12.017.

[26] Shafiq, M., & Soratana, K. (2020). Lean readiness assessment model – a tool for Humanitarian Organizations' social and economic sustainability. *Journal of Humanitarian Logistics and Supply Chain Management*, *10*(2), 77-99. https://doi.org/10.1108/JHLSCM-01-2019-0002.

[27] Shafiq, M., & Soratana, K. J. L. (2019). Humanitarian logistics and supply chain management a qualitative study. *LogForum*, *15*(1). https://doi.org/10.17270/J.LOG.2019.325.

[28] Tansuchat, R., Suriyankietkaew, S., Petison, P., Punjaisri, K., & Nimsai, S. (2022). Impacts of COVID-19 on Sustainable Agriculture Value Chain Development in Thailand and ASEAN. *Sustainability*, *14*(20).

[29] Timmer, C. P. J. A., & Studies, t. P. P. (2014). Food security in A sia and the P acific: the rapidly changing role of rice. *Asia & the Pacific Policy Studies*, *1*(1), 73-90. https://doi.org/10.1002/app5.6.

[30] Thanawong, K., Perret, S. R., & Basset-Mens, C. (2014). Eco-efficiency of paddy rice production in Northeastern Thailand: a comparison of rain-fed and irrigated cropping systems. *Journal of Cleaner Production*, *73*, 204-217. https://doi.org/10.1016/j.jclepro.2013.12.067.

[31] Chauhan, N. S., Mohapatra, P. K. J., & Pandey, K. P. (2006). Improving energy productivity in paddy production through benchmarking—An application of data envelopment analysis. *Energy Conversion and Management*, *47*(9), 1063-1085. https://doi.org/10.1016/j.enconman.2005.07.004.

[32] Kashif, A. R., Shafiq, M., Tahir, A. H., Wahid, S., Ahmed, S. J. F. U. J. o. B., & Economics. (2020). Impact of on job training, training design and training delivery style on organizations performance. *Foundation University Journal of Business & Economics*, *5*(2), 40-51. https://doi.org/10.33897/fujbe.v5i2.444.

[33] Han, J., Zhang, Z., Luo, Y., Cao, J., Zhang, L., Zhuang, H., Tao, F. (2022). Annual paddy rice planting area and cropping intensity datasets and their dynamics in the Asian monsoon region from 2000 to 2020. *Agricultural Systems*, *200*, 103437. https://doi.org/10.1016/j.agsy.2022.103437.

[34] Nazeer, S., Saleem, H. M. N., Shafiq, M. (2024). Examining the Influence of Adoptability, Alignment, and Agility Approaches on the Sustainable Performance of Aviation Industry: An Empirical Investigation of Supply Chain Perspective. *International Journal of Aviation, Aeronautics, and Aerospace*, *11*(1), 8. https://doi.org/10.58940/2374-6793.1898.

[35] Xin, F., Xiao, X., Dong, J., Zhang, G., Zhang, Y., Wu, X., Li, B. (2020). Large increases of paddy rice area, gross primary production, and grain production in Northeast China during 2000–2017. *Science of The Total Environment*, *711*, 135183. https://doi.org/10.1016/j.scitotenv.2019.135183.

[36] Awan, A. G., & Shafiq, M. (2015). Supply chain management in humanitarian relief logistics. *Industrial Engineering Letters*, *5*(10)

[37] National Bureau of Statistics of China. (2022, October 25). *China Statistical Yearbook,* [Online]. https://www.stats.gov.cn/english/Statisticaldata/yearbook/ (Accessed Date: January 10, 2025).

[38] Seck, P. A., Tollens, E., Wopereis, M. C. S., Diagne, A., Bamba, I. (2010). Rising trends and variability of rice prices: Threats and opportunities for sub-Saharan Africa. *Food Policy*, *35*(5), 403-411. https://doi.org/10.1016/j.foodpol.2010.05.003.

[39] Pasadilla, G. O., Liao, C. M. (2006). Non-tariff measures faced by Philippine agricultural exports in East Asia. *Asian Journal of Agriculture and Development*, *3*, 115-138.

[40] Baird, I. G. (2024). "Organic" rice: different implications from process and product environmental verification approaches in Laos

and Thailand. *Agriculture and Human Values*, *41*(4), 1417-1430. https://doi.org/10.1007/s10460-024-10556-5.

[41] Baur, X., Budnik, L. T., Zhao, Z., Bratveit, M., Djurhuus, R., Verschoor, L., Jepsen, J. R. (2015). Health risks in international container and bulk cargo transport due to volatile toxic compounds. *Journal of Occupational Medicine and Toxicology*, *10*(1), 19. https://doi.org/10.1186/s12995-015-0059-4.

[42] Nawaz, M. J., Qayyum, A. (2022). The impact of inclusive leadership on project success: mediating role of employee engagement and moderating role of leader self-Sacrifice. *Journal of Positive School Psychology*, *6*(11), 2577-2602.

[43] Acharya, S. (2010). Import Liberalisation and Revenue Replacement: Impacts in a Small Asian Developing Economy. *The European Journal of Development Research*, *22*(3), 417-442. https://doi.org/10.1057/ejdr.2010.4.

[44] Imbruno, M. (2016). China and WTO liberalization: Imports, tariffs and non-tariff barriers. *China Economic Review*, *38*, 222-237. https://doi.org/10.1016/j.chieco.2016.02.001.

[45] Intarakumnerd, P., Chairatana, P.-a., Tangchitpiboon, T. (2002). National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, *31*(8), 1445-1457. https://doi.org/10.1016/S0048-7333(02)00074-4.

[46] Radmehr, R., Ali, E. B., Shayanmehr, S., Saghaian, S., Darbandi, E., Agbozo, E., Sarkodie, S. A. (2022). Assessing the global drivers of sustained economic development: the role of trade openness, financial development, and FDI. *Sustainability*, *14*(21), 14023. https://doi.org/10.3390/su142114023.

[47] Bernasconi, M., Choirat, C., & Seri, R. (2010). The analytic hierarchy process and the theory of measurement. *Management Science*, *56*(4), 699-711.

[48] Saaty, T. L. (1990). An exposition of the AHP in reply to the paper "remarks on the analytic hierarchy process". *Management Science*, *36*(3), 259-268.

[49] Salgado, E. G., Salomon, V. A. P., Mello, C. H. P. (2012). Analytic hierarchy prioritisation of new product development activities for electronics manufacturing. *International Journal of Production Research*, *50*(17), 4860-4866.

[50] Garuti, C., Salomon, V. A. (2012). Compatibility indices between priority vectors. *International Journal of the Analytic Hierarchy Process*, *4*(2).

[51] Duval, Y., Hardy, S. (2021). Climate change and trade facilitation: estimating greenhouse gas emission savings from implementation of cross-border paperless trade in Asia and the Pacific. *Journal of Asian Economic Integration*, *3*(2), 190-210. https://doi.org/10.1177/26316846211035567.

[52] Singh, R. P., & Nachtnebel, H. P. (2016). Analytical hierarchy process (AHP) application for reinforcement of hydropower strategy in Nepal. *Renewable and Sustainable Energy Reviews*, *55*, 43-58. https://doi.org/10.1016/j.rser.2015.10.138.

[53] Vaidya, O. S., & Kumar, S. (2006). Analytic hierarchy process: An overview of applications. *European Journal of Operational Research*, *169*(1), 1-29. https://doi.org/10.1016/j.ejor.2004.04.028.

[54] Kothari, S. P., Li, X., Short, J. E. (2009). The effect of disclosures by management, analysts, and business press on cost of capital, return volatility, and analyst forecasts: A study using content analysis. *The Accounting Review*, *84*(5), 1639-1670.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Boonsub Panichakarn carried out conceptualization, and writing - original draft.
- Supakyada Kulthunyahirun carried out organized conceptualization, writing - original draft, and project administration.
- Liurong Pan was responsible for formal analysis and prepare resources.
- Sethasilp Inthanon was carried out formal analysis and writing - review & editing.
- Supavanee Thimthong was carried out methodology and writing - review & editing.
- Ponnapa Musikapun carried out the investigation and writing - review & editing.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

No conflict of interest

APPENDIX

Table 1. Regression Analysis

Source	SS	df	MS	Number of obs	=	36
				F(17, 18)	=	5.40
Model	29.26442	17	1.72143647	Prob > F	=	0.0004
Residual	5.73558048	18	.31864336	R-squared	=	0.8361
				Adj R-squared	=	0.6814
Total	35.0000004	35	1.00000001	Root MSE	=	.56449

zvol	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
pc	-.0012137	.001329	-0.91	0.373	-.0040058	.0015784
gd_ch	.0058053	.0037985	1.53	0.144	-.002175	.0137856
gd_th	-.3358131	.1105055	-3.04	0.007	-.5679765	-.1036497
pp_ch	.0394008	.0277272	1.42	0.172	-.0188518	.0976535
pp_th	-.3748719	.3845589	-0.97	0.343	-1.1828	.4330564
gc_ch	-.0073482	.0053412	-1.38	0.186	-.0185696	.0038732
gc_th	.0240973	.0083082	2.90	0.010	.0066424	.0415522
ex_yd	2.004019	.629524	3.18	0.005	.6814383	3.3266
ex_by	3.065214	1.012407	3.03	0.007	.9382257	5.192201
ex_bd	-.0859297	.2234706	-0.38	0.705	-.555424	.3835645
in_ch	.0459552	.2008221	0.23	0.822	-.3759563	.4678667
in_th	-.1106199	.1386838	-0.80	0.435	-.4019838	.180744
pd_ch	.1042088	.0407092	2.56	0.020	.0186819	.1897356
pd_th	-.0808632	.1158413	-0.70	0.494	-.3242366	.1625103
yi_ch	-6.98675	2.560652	-2.73	0.014	-12.36648	-1.60702
yi_th	.8105039	2.41244	0.34	0.741	-4.257845	5.878853
cv	-1.753941	1.158154	-1.51	0.147	-4.187134	.6792507
_cons	-35.79421	22.71049	-1.58	0.132	-83.50717	11.91876