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Climate Change and Economic Vulnerability in Thailand: An Analysis of Future Risk of Tourism Industry

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Abstract

The purpose of this paper is to examine the impact of climate change on the Thailand economy, especially the tourism sector. The study revealed that Thailand is rich in biodiversity, ecosystems, and natural resources. Thailand is considered vulnerable to climate change and variability. Thailand's natural resources are important assets for local communities and support the economies of many countries. Climate is an important element of tourism and can attract tourists. Climate factors include temperature, precipitation, cloud, air, wind, and humidity. Safety and easy access for tourists are important for the development of this business. Thailand is considered a country vulnerable to climate change due to its economic, physical, geographical and political diversity. The losses and impacts caused by climate change are unprecedented. Weather-related disasters, floods, earthquakes, inundations and severe weather conditions cause loss of life, property and livelihood in the country, and lead to all kinds of security and economic disasters. Climate change will directly affect visitors and reduce business income. There is relationship between tourist arrivals and gross domestic product of Thailand. Thailand is considered to be at high risk from the effects of climate change. Extreme temperatures and rising seas threaten parts of Thailand, including Bangkok. Erosion is considered a major problem in the country due to climate change. Climate change could cause climate of weather crosswise the country. Therefore, the government needs to implement the necessary policies to mitigate the impact and save the economy before a real disaster occurs.

Keywords: Climate change, Global warming, Natural calamities, Sustainable Development and Tourism industry.

Introduction

The issue of climate change has many impacts on people's lives. Climate change and global warming are now recognised as a global crisis affecting people's livelihoods and ecosystems, as evidenced by rising sea levels due to ice and snow melting, and global warming due to emission of greenhouse gases. Agriculture and industry are not the only ones affected by climate change (Ushakov, 2021); Thailand's tourism industry is one of the country's major sources of income. Climate change have affected human livelihoods and ecosystems worldwide. Changes in temperature, rainfall patterns, sea levels and the frequency of natural disasters are expected to have a major impact on the tourism industry in the future (Sungkaew, 2020). These changes will alter behaviour and health of peoples (Kaosa-ard, 1994). The effects of high temperatures can cause severe coral bleaching. Environmental assets are vital to Thai economy and the health of local communities. Unfortunately, environmental degradation and depletion of natural resources threaten local livelihoods and tourism. Southeast Asian countries are often considered to be some of the world's most vulnerable to damage from climate change, environmental degradation and natural disasters. Without rapid change and mitigation, societies and businesses will face greater climate risks (Wongtada, 2017).

Thailand is the second largest emitter of carbon dioxide in Asia and ranks 13th in the world in terms of risk from the effects of climate change. Despite its economic importance, marine resources are vulnerable to the effects of climate change. The climate is now warming, as observed in the increases in global average air and sea temperatures, and raising of sea level (Iamtrakul et. al., 2024). Coastal communities are vulnerable to the effects of climate change due to their remoteness, geographic area, high population, and the economic activities of coastal infrastructure and natural resources (Chon et. al., 1993). Climate change poses a threat to the livelihoods of communities that rely heavily on marine tourism as their main source of income (Glanzberg, 1993). The weather, the wealth and health of the place are important factors in deciding where to travel. In terms of domestic tourism, the northern provinces have long attracted Thais because of the cool climate of the rich landscape, while the coastal provinces attract international tourists and tourists who love the white sands and rich underwater world. Tourism is a climate-sensitive sector. To counter these effects, the Thai government has worked hard to ensure a

competitive economy in the world market, both in terms of the health of the region and the health of its people (Shafiai & Rashid, 2021).

Objectives

The objectives of the study are:

- To analyze the impacts of climate change on the economy of Thailand, with a special focus on the tourism sector.
- To examine the vulnerabilities of Thailand's tourism industry to changing climate patterns and natural disasters.
- To evaluate the government's policies and strategic measures aimed at mitigating the effects of climate change on the economy and tourism industry in Thailand.

Methods and Materials

- Study area:** The Kingdom of Thailand covers an area of 513,115 square kilometers in Southeast Asia. It has border with Myanmar, Laos, Cambodia, and Malaysia. It is divided into central, northern, northeaster, eastern and southern regions. Approximately 47 percent of the country's land is agricultural land. Thailand has made remarkable progress in socio-economic development over the past four years, transforming from a low-income country to a high-income country in less than a generation. The country's economy is driven by agriculture, trade and services, and tourism, supporting a population of approximately 69.8 million (2020). As the economy has developed, the proportion of urban population in the total population has steadily increased. Coastal erosion is a major coastal problem in the Gulf of Thailand, rather than the Andaman Sea. It affects local fishing communities as well as major coastal ports and commercial centres. This will lead to extreme weather conditions such as rising seas, flooding, and climate change risks such as temperature and rainfall, which will significantly affect the country's economy, especially agriculture and business.



- **Hypothesis:**
H₀₁: There are no relationship between tourist arrivals and GDP of Thailand, and
H_{1a}: There are relationship between tourist arrivals and GDP of Thailand.
- **Design and approach:** The design of this study was defined and used as qualitative. Secondary data was used in this research. Secondary data is collected by various governments. reports, Thailand Tourism Department, international publications, research articles, published articles, online papers etc.
- **Method of analysis:** A range of qualitative analysis methods, including descriptive, analytical content and textual analysis, were used to uncover the full spectrum of approaches to climate change and its impact on tourism industry in specific.

Results and Discussion

Thailand has made great strides in business over the past few years. The country is vulnerable to natural disasters: floods, tsunamis, storms, inundations, landslides, forest fires, and epidemics. Hydrological events and droughts frequently affect Thailand, which experienced one of the deadliest events in human history: the 2004 Indian Ocean tsunamis. Droughts and floods pose the greatest threat to the country. Storms are also less of a risk to the northern part of the country. Thailand's long coastline, complex agricultural system, and sensitivity to extreme weather conditions make it vulnerable to climate change. Thailand's rapid economic growth has led to increased energy demand. In addition to its geographical and economic disadvantages, Thailand is also expected to be greatly affected by climate change. The German Watch Global Climate Risk Index 2021 ranks Thailand 9th in the world in long-term climate risk. Thailand is Asia's second-largest economy after Indonesia. Since the 1960s, the growth of agriculture has supported Thailand's transition to an industrial economy. Rice is the country's most vital crop. It is a major exporter of shrimp. Other products include coconuts, maize, rubber, soybeans, sugar, and cassava. Thailand is the world's third largest seafood exporter.

Electrical and electronic goods are Thailand's biggest export, and the country is vulnerable to climate change, and agriculture is no exception. As temperatures rise, rainfall becomes more unpredictable, and extreme weather conditions become more frequent, Thai farmers are struggling to keep up. The country's agriculture is particularly vulnerable to climate change. Rice is Thailand's most important crop and is particularly sensitive to temperature changes. As temperatures rise, the growing season shortens, reducing the amount of water available for irrigation. This results in lower yields and lower productivity. This makes this tropical Southeast Asian country a tourist destination, but it is also vulnerable to the effects of climate change. Climate change affects all major activities of the Thai economy: agriculture, trade and commerce. Since the mid-20th century, various studies have shown temperature across Thailand has changed. Thailand is heavily affected by climate change due to major disasters such as heavy rainfall, floods and droughts, as well as the effects of sea level rise on the country's coasts. Floods are Thailand's biggest natural disaster in terms of economic and humanitarian impact, with the country listed as one of the top 10 flood-prone countries in the world. Farmers are affected by floods and inundations every year, resulting in crop losses, low productivity, high debt and low household income.

Changes in regional climate patterns can have a major impact on the sustainability of agriculture, with disruptions to operations at critical stages from planting to harvest. Changes in temperature and humidity can also increase pest populations, including the white grub that damages potatoes and the brown grub that typically feeds on crops during the rainy season. Given that Thailand is a major exporter of rice and cassava, and agriculture still benefits a large portion of the population, the impacts of climate change on business should have a major financial impact at all levels. Besides agriculture, many other important sectors in Thailand, such as water management, food security, health, tourism, property management, and human peace and security, are also vulnerable to the effects of climate change. Therefore, climate change is one of the key issue in Thailand that affects the lives and livelihoods of society, economic growth and sustainable development.

Thailand is a beautiful destination of local and foreign holidaymakers. However, in this era of increasing climate change, it still faces threats, security and major risks such as sea level rise, floods, temperature increase, droughts, coral bleaching, etc. If these dangers and risks are not addressed, local and national economies will suffer. Tourism accounts for 21 percent of Thailand's GDP and million international tourists visited every year. Climate change will affect all regions and people differently, with some groups bearing the brunt of the burden more than others. Particularly vulnerable workers are those working in sectors that are vulnerable to climate change and do not have adequate response mechanisms, such as low-income people, communities in disaster areas, and businesses that

depend on climate and natural resources for their livelihoods. In Thailand, we see rising temperatures and years of rainfall leading to increasingly heavy flooding and more severe flooding. These impacts affect the entire country, affecting all industries from tourism to public health to national governance. Businesses can lose nature and culture due to climate change. Health officials are facing the risk of a resurgence of the disease. Agriculture should be the focus of attention as it is directly affected by climate change. More than 12 million people currently work in agriculture in Thailand, making it one of the most important jobs in the country. When weather conditions such as temperature and rainfall change, farmers face more problems due to various risks. Rice can be damaged by floods during the rainy season, while rice in the highlands can face drought during harvest. In aquaculture, high temperatures can kill fish, crabs and other seafood. Animal health, growth and development can be affected.

Thailand's climate risk map assesses the vulnerability of agriculture and food security to the impacts of three climate change hazards (heat, drought and floods), as well as climate security reflecting regional inequalities. The provinces most at risk of heatstroke, including Nakhon Ratchasima, Ubon Ratchathani, Buriram, Khon Kaen, Sisaket, Surin and Roi Et, are located in the northeast; Nakhon Ratchasima faces extreme temperatures, climate and floods. The hazards of climate change affect Thailand at every level, affecting health, public facilities and housing. Water scarcity not only affects livelihoods, but can also lead to biodiversity loss, increased water pollution and crop failure. In addition to biodiversity loss, Thailand has experienced coastal erosion. Chiang Mai and Ubon Ratchathani are most affected provinces. Thailand has long coastlines, agriculturally based rural communities and densely populated cities in flood plains. Thailand experiences drought due to inadequate rainfall, poor land management and reduced water flow. Thailand's northeast is particularly vulnerable to climate change and has high poverty rates. Thailand's agriculture is sensitive to climate change and is heavily affected by weather conditions. Agriculture is Thailand's second largest source of greenhouse gas emissions. Other important sectors in Thailand vulnerable to climate change include water management, food security, health, tourism, infrastructure management, and human resources peace and security.

Climate change in Thailand is a global issue with serious consequences. The country is already experiencing the effects of climate change, including rising temperatures, increased air pollution and changing rainfall patterns. These changes are expected to continue in the future, with major impacts on the country's economy, environment and people. Tourism plays a major role in the Thai economy, accounting for 20-22% of gross domestic product. Climate change is causing the loss of cultural and tourist sites. Bangkok, Chiang Mai and Phuket, which generate the most income from tourism, are considered high-risk areas. Climate change is disrupting water supplies, housing and public services, affecting millions of people living in cities. Bangkok, Nakhon Ratchasima, Samut Prakan and Khon Kaen are the most at-risk provinces. Climate change could cause respiratory diseases, malnutrition and infections that were previously under control or eliminated to re-emerge. Climate change has a huge impact on everyone, but tackling it requires regional, national and international cooperation.

Thailand emits less than one percent of the world's greenhouse gas emissions, but is one of the ten countries most affected by climate change. National parks and forests that have been cut down or mixed together will be more at risk from the heat. Meanwhile, Bangkok and its suburbs are among the 10 provinces most at risk of flooding due to increased rainfall and dam construction in the Chao Phraya River basin. The effects of climate change are uncertain and vary from region to region. Lower-income groups may face greater challenges because moving from high-risk areas is more difficult than for higher-income people. Sea level rise caused by climate change poses a major threat to Thailand due to climate change. The Thai government's Department of Marine and Coastal Resources estimates tropical ecosystems are considered particularly vulnerable because many species of tropical organisms have adapted to extreme temperatures. They cannot survive when temperatures rise. Climate change has had a major impact on tourism in Phuket, Thailand. Due to rapid economic growth, large population and large number of tourists, Phuket is experiencing water shortages, causing demand for water to exceed supply. Small islands like Phuket are particularly vulnerable to the effects of climate change, including sea level rise, which can affect coastal areas and the tourism industry. The effects of climate change on the global environment are related to increasing temperatures, rising sea levels, changing rainfall patterns and weather patterns, all of which have direct impacts on tourist areas such as Phuket.

Krabi Province is located in the south of Thailand, bordering the Andaman Sea, and has many of the beautiful beaches and islands that make Thailand famous. Ayutthaya was once the capital of the Kingdom of Siam, and its ruins are breath-taking and hauntingly beautiful. It's only an hour from Bangkok, making it an easy day trip or overnight trip. Sukhothai is another beautiful old city. It has hiking trails, hidden waterfalls and elephant herds. Thailand's largest and most accessible island attracts millions of tourists each year with its many hotels, white

beaches, Patong parties, colourful snorkelling and eclectic cuisine. Koh Samui is surrounded by white sandy beaches dotted with temples, hiking trails, beautiful resorts, beach towns and villages. Koh Tao island is one of Thailand's best diving and snorkelling spots. Trang is a province located just south of Krabi, having beautiful Andaman coastline but fewer people. Khao Lak is less than two hours from Phuket International Airport and has easy access to miles of beaches and beautiful national parks., Prachuap Khiri Khan is famous for the charming and lively town of Hua Hin. The state is a skinny country bordered by the Gulf of Thailand on one side and Myanmar on the other. Thailand's first marine park. Koh Lantai has beautiful beaches, good restaurants and Mu Ko Lanta National Park, a great place to dive and see undeveloped beaches.

Table 1: Arrivals of Tourists in Thailand

Year	Number of Tourists	Year	Number of Tourists
2015	29.90	2020	06.70
2016	32.50	2021	00.43
2017	35.59	2022	11.07
2018	38.18	2023	28.15
2019	39.80	2024	36.10

Source: <https://www.statista.com/>, Note: Tourist number in millions.

Table 1 discussed the trend of tourist arrivals in Thailand. Number of tourist arrivals in Thailand was increased continuously, but was declined in 2020-21 due to the corona pandemic. Thailand has sand beaches and palm tree-lined islands in the south, to the mist-covered hillsides and temple-studded mountains in the north, to the never-ending chime and hum of Bangkok's neon lights and endless ruins. Bangkok is a beautiful place and one of my favourite cities in the world, with so much to offer, but it's one of my favourites in the best way possible. Many travellers prefer Chiang Mai to Bangkok for its slower pace of life. This beautiful city is filled with temples, restaurants, and bars. Thailand's coastline is dotted with over 1,400 islands, but few are as famous e.g. Koh Phi Phi in the Andaman Sea. Koh Phi Phi consists of two islands, Phi Phi Don and Phi Phi Leh, known for their beauty, excellent diving, and fun party scene. Thailand's tourists are unevenly distributed, with most opting for tourist destinations in islands and southern coast. Bangkok attracts many tourists beyond its beaches. Similarly, cities known for their cultural heritage, such as Ayutthaya, Sukhothai and Chiang Mai, also attract large numbers of tourists, indicating that the number of tourists in tourist areas puts pressure on the resources of the selected areas.

Table 2: Number of Domestic Tourist Arrivals in Thailand, 2023

Month	Number	Month	Number
January	21.92	July	19.79
February	20.34	August	20.14
March	20.36	September	19.51
April	21.41	October	20.75
May	19.73	November	21.62
June	19.18	December	24.32

Source: <https://www.statista.com/statistics/1140514/thailand-number-of-domestic-tourists/>
Note: Tourist number in millions.

Table 2 represented the domestic tourist arrivals in Thailand in 2023. It has found that tourist arrivals throughout the year. November to January is the peak months for tourist. Visitors may be affected by the quality of the tourism industry, such as transportation or services. The large number of tourists is causing a major crisis in the ecosystem. Thailand's long coastline, fragile agricultural system, and vulnerability to extreme weather conditions make the country vulnerable to climate change. Since the 20th century, climate change has caused the climate in Thailand to warm. Thailand is considered to be at high risk from the effects of climate change. Extreme temperatures and rising seas threaten parts of Thailand, including Bangkok. Erosion is considered a major problem in the country due to climate change.

Table 3: Revenue from Multiple Segments of Tourism Industry in Thailand

Year	Camping	Cruises	Hotels	Package Holidays	Vacation Rentals	Total
2017	30.76	19.62	1265.00	895.40	391.80	2602.58
2018	34.17	20.17	1285.00	943.10	421.80	2704.24
2019	37.50	20.74	1313.00	999.70	956.40	2827.34
2020	2.17	4.77	624.00	482.40	234.10	1347.33
2021	5.08	1.51	860.60	654.80	249.40	1771.39
2022	30.56	11.84	1142.00	922.00	454.10	2560.50
2023	31.60	17.96	1342.00	1146.00	607.10	3144.66
2024	32.93	19.04	1438.00	1298.00	679.20	3467.17

Source: <https://www.statista.com/outlook/mmo/travel-tourism/thailand#revenue>, Note: revenue in million USD.

Table 3 discussed the revenue from multiple segments of tourism Industry in Thailand. Revenue from segments in tourism industry was increasing continuously, but was declined in 2020-21 due to the corona pandemic. Tourism is crucial to many economies, but rising global temperatures are putting parts of the industry at risk. The climate crisis is changing the face of many tourist destinations and is already making some holidaymakers rethink their plans. Coral bleaching and increasing droughts are already impacting the Thailand's tourism potential. Thailand's Maya Bay, Malaysia's Sipadan Island and the Philippines' Boraca Island are all being impacted, and some places in the region are now closing tourist spots to give the most damaged areas time to recover. Rising temperatures are likely to result in tourists travelling in spring and autumn rather than the summer, as well as opting for cooler destinations.

Table 4: Total value of the tourism's contribution to the GDP in Thailand

Year	Revenue	Year	Revenue
2017	2825.19	2020	883.03
2018	2964.69	2021	356.11
2019	3028.78	2022	1258.12

Source: <https://www.statista.com/statistics/1143427/thailand-value-of-tourism-gdp/>, Note: Value of tourism's GDP in billion Thai baht.

Table 4 discussed the total value of the tourism's contribution to the GDP in Thailand. It has found that contribution of the industry was increasing continuously, but was declined in 2020-21 due to the corona pandemic. Effectiveness and good practices, coordination and integration of different activities, development and support of environmental technology and infrastructure are important for stability and impact. Decentralization of participation in climate governance to local governments is critical for future climate change. The solution to global warming cannot be based on national policies alone; consumer behaviour must change for the economy to become green. When market mechanisms work, they force producers to react.

Table 5: Calculating Linear Regression between Gross Domestic Product of Thailand's Tourist Inflow*.

Year	Tourist Arrivals	Gross Domestic Products
2015	29.90	40129.62

2016	32.50	41336.42
2017	35.59	45635.68
2018	38.18	50675.42
2019	39.80	54395.67

Source: <https://www.statista.com/>, Note: Tourist arrivals in millions, and gross domestic product is in crores USD.
* Pre-corona pandemic analysis.

Table 5 (a): Summary Output

Regression Statistics	
Multiple R	0.976639639
R Square	0.953824985
Adjusted R Square	0.938433314
Standard Error	1507.996323
Observations	5

Source: Calculated by author.

Table 5 (b): ANOVA Analysis

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	140923516.4	140923516.4	61.9702	0.00427096
Residual	3	6822158.731	2274052.91		
Total	4	147745675.1			

Source: Calculated by author.

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-5159.543873	6588.638848	-0.783097085	0.490701845
Tourist Arrivals	1465.991529	186.2258683	7.87211542	0.00427096

Source: Calculated by author.

The table (5-a) shows that R square is found to be 0.953824985, showing, that the degree of relation between the independent variable X, i.e. arrivals of tourists, and the dependent variable Y, i.e. gross domestic product. Table (5-b) shows that p value (0.004) is less than critical value at 5% level of significance ($p < 0.05$), therefore we will reject the null hypothesis-1. So, it is concluded that there is relation between tourist arrivals and gross domestic product in Thailand.

Government Initiatives

Thailand is one of the Southeast Asian country affected most by the climate change. The country is increasingly facing severe floods, inundations and storms that are causing more deaths. In response to climate change, Thailand aims to achieve carbon neutrality by 2050 and net zero greenhouse gas emissions by 2065. An important step in making the country's climate change needs a reality is identifying short and long-term projects, key investments and initiatives to reduce emissions and climate change. The Department of Tourism and the Office of Natural Resources and Environmental Policy and Planning have worked with local and international experts to save tourism from the impacts of climate change. Thailand does not have a good record of commitment to climate change and sustainable development goals. The path to carbon neutrality and net zero will be difficult and will require strong will. Tourism security is one way to help protect countries and businesses at risk from climate change.

Thailand is implementing a national carbon reduction plan called as "Thailand's Sustainable Poverty Reduction Strategy." Thailand's rapid economic growth has led to increased energy demand. Thailand has implemented demand management plans and energy conservation plans to adapt to climate change and meet its large energy demand. The main goal is to promote Thailand's sustainable development, low-carbon growth and climate change by 2050. In recent years, the Thai government and policymakers have invested money, research, legislation, and political activities to reduce pollution, protect the environment, and combat climate change. Thailand established the country's National Climate Change Committee in 2007. Such committee is chaired by the Prime Minister and consists of members from the public, private sectors, and institutions. It works to develop the country's climate policy.

Conclusion

The effects of climate change and global warming have affected the tourism industry worldwide, and Thailand is no exception. Many of Thailand's most popular destinations in the northern provinces rely on cold winter weather

to attract more visitors. This makes the local economy vulnerable to global crises such as hot, short summers. Thailand's rapid economic growth has led to many environmental problems. The country is facing climate problems, wildlife decline, deforestation, soil erosion, water scarcity, and waste issues. In terms of climate change, the increase in rainfall in almost all parts of Thailand every year causes many natural disasters such as floods and frequent floods, and there is a risk of greater disasters such as tsunamis. Drought and floods pose the greatest threat to the country. We see that temperatures are increasing in Thailand, and the rainfall over the years has led to increasingly severe floods and more severe floods.

Climate change is causing the loss of cultural and tourist sites. Bangkok, Chiang Mai and Phuket, which generate the most revenue from tourism, are considered high-risk areas. Rising temperatures are affecting the country's economy, trade and energy, while the path to safety remains uncertain. Thailand's tourism industry has suffered during the COVID-19 pandemic, with international visitors falling from more than 40 million in 2019, before the pandemic, to 6.7 million in 2020 and then again to 428,000 in 2021. This is partly due to the rise in the cost of international travel, which has led to fewer long-term travellers who tend to stay longer and spend more, and has attracted tourists from countries such as Malaysia and Singapore.

Country's tourism industry is facing new challenges. Political conflicts, the spread of AIDS among the Thai population, and the large number of hotels threaten the country's economy. In response, the Prime Minister's Office, the National Tourism Organization, and the private sector have made concerted efforts to rebuild Thailand's image and promote the country as a tourist destination. The future of Thailand's business sector looks bright, depending on political stability, government commitment, and public-private partnerships to make Thai business a reality as expected (Chon et. al., 1993). Despite its problems, Thailand is still a great place. The government is also aware of the country's problems (especially pollution and poor infrastructure) and is working to address them. Thailand has benefited from a stable of long-term hotel projects, including the Dusit Thani and Oriental Hotel in Bangkok and the Royal Cliff Resort in Pattaya (Glanzberg, 1993).

Therefore, it is vital to develop climate change strategies to ensure the sustainability and strength of the tourism industry. The Thai government attaches great importance to the implementation of social norms. The government needs to consider environmental protection management to ensure that the negative impact on the business and industrial environment is kept to a minimum. Thailand also needs to address emissions from agriculture through carbon reduction (such as recycling) and offset strategies such as carbon capture and storage.

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