

What is the Impact of Tourism Infrastructure Development on  
the International Tourism Inflow in Thailand during 2008 to  
2019?

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By                                      Miss Wucaihong Huang  
Field of Study                      Business and Managerial Economics  
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Tourism has become a main income factor of national revenue in Thailand. Tourism infrastructure is the important foundation for Thailand to improve its attractiveness around the world. This study firstly employed a SWOT analysis to show the current insight of tourism infrastructure in Thailand. The key findings of this study showed that transport infrastructure, ICT infrastructure and medical infrastructure have positive impacts on international tourism inflows in Thailand during 2008 to 2019 by employing an extending gravity model. Thus, the tourism planners should generate ICT promote, transport development and medical tourism into policies planning. Tourism policy makers in Thailand should focus on long-term planning and take infrastructure development loans from international institutions. At the same time, Thai government should encourage private sector to join the national projects to fasten the construction.



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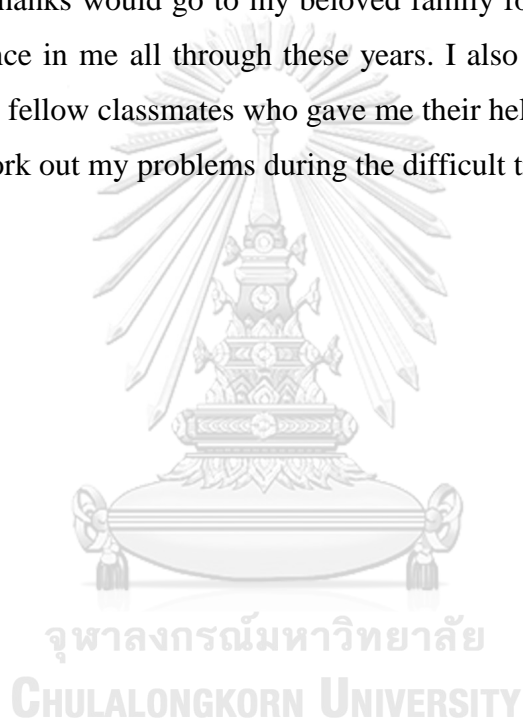
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Wucaihong Huang



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## 1 Introduction

The openness of international trade made the whole world united and provided so many chances for everyone to get a better know of each other. With physical infrastructure development, people around the world can choose to travel outboard. Tourism, as one of the social economic activities, has become a main factor for generating the job opportunities and income for the whole society of the world. International tourism is currently the world's largest economic determine for most countries, especially towards the case of developing countries. Tourism has become a main income factor of national revenue in Thailand as well. The National Economic and Social Development Board had reported that Tourism covered 11.46% of GDP in Thailand in 2019<sup>1</sup>. In recent years, Southeast Asian tourism has become more and more popular due to its reasonable price and high quality of goods and service. Thailand, relying on its distinguishable tropical landscape, rich scenic spots and religious culture, has become a leader of tourism in Southeast Asia and even Asia, and is also the most favorite outbound destination for so many international tourists. Since Thailand has become one of dreamlands for the international tourists, central government of Thailand also did so many infrastructure projects to fill the gaps of international tourists' demand. During these years, some scholars found that the develop of physical infrastructure has contributed the international inbound and outbound tourism, which were mostly transport infrastructure relevant. While there is still an extensive need to focus on some other infrastructure, such as medical facilities and information and communication technology (ICT) infrastructure, those demands for other tourism infrastructure are closely correlated with the willingness of international tourists. In this study, the author defined the important tourism infrastructure in Thailand combining with the travel purposes of the international tourists and globalization trend. After that, this study concentrated on finding the impacts of tourism infrastructure development on the international tourism inflows to Thailand.

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<sup>1</sup> In 2019, tourism revenue in Thailand had achieve 62,288.54 million USD, and the GDP of 2019 in Thailand was 543,701.18 million USD. The tourism revenue of 2019 accounts 11.46% for the GDP of 2019 in Thailand.

This study selected the data of international arrivals from 13 foreign countries and regions, which cover 85% of international tourists of Thailand in 2019. The database for this study has been drawn from the time period of 2008 to 2018 since the data availability and this period is true to the life now. The objectives of this study are threefold. First, this study highlighted the main determining factors represented the tourism infrastructure in Thailand. Second, the author did a SWOT analysis to show the insight of tourism infrastructure in Thailand under the current situation. Last but not least, this study analyzed the impact of these main factors of tourism infrastructure on international tourism inflows in Thailand during 2008 to 2019 by employing gravity model. The result of this study can provide a referential thought for the policy makers and tourism practitioners. It helps form the marketing strategies and policy development for the tourism industry in Thailand. It can show main directions for the national tourism planners to enhance the tourism facilities to further the flourish of tourism industry in Thailand.

## **2 Literature Review**

### **2.1 Tourists Motivation**

Tourists' motivation forms the travel destination chosen. In recently academic field, many scholars explained travel motivation as a push factor that makes the travel destination had been chosen (Kassean, 2013; Kim, 2003; Prayag, 2011). The choose of travel destination is motivated by the budget which tourists prepare to pay during the visit (Masiero, 2012). Consumer behavior theory suggests that the income of consumers and the price of products determine the basic consumption behavior. The income level of travelers forms their initial willingness of travelling abroad. Song H (2010) found that the tourist arrivals of Hong Kong are significantly affected by the GDP per capita of origin countries by extending the demand function. Price is another determined factor in consumer behavior. The travel expenditure could be formed by the prices. Meanwhile, relative price can tell the differences of the price level between two countries, it can be used as an indicator that tells us whether the international tourists will be attracted by the differences between the price of destination countries and their domestic price. In the academic literature, many researchers used the CPI of

the traveling country relative to the CPI of the travelers' country. There are many researches' results show that the relative price has a significant impact on the tourist demands in some countries (Dogru T, 2017; Dritsakis, 2004; Kosnan SS, 2013; Garin-Munoz, 2000). Dritsakis (2004) and Muñoz (2000) found that price is a good indicator for travelling costs when travelers decided to go to the foreign country from the origin countries. The way to calculate most tourism relative price is the ratio based on the consumer price index (CPI) of the travel destination and the CPI of the origin countries. Due to the basic demand function, tourism price is expected to have a negative impact on tourism. Through the tourism demand function, when the cost of travelling in a destination country is lower than the origin country, international tourists are willing to travel in the lower price destination. As well as other economic factors are also important determinants for the selection of tourists' outboard travel, such as national income of the tourist origin country and relative tourism prices (AG, 2001).

## **2.2 Attractiveness of a Travel Destination**

McGee et al. (1996) found that a destination's attractiveness could be the pull motivations for travelers, such as nature resource, tourism infrastructure, cultural influences, entertainment, which may stimulate and enhance inherent desires. The contribution of infrastructure is a potential determine of the attractiveness of a destination. The accessibility of a travel destination can catch travelers' eyes, which could be measured by transport infrastructure. With the development of transport infrastructure, it could help save more time for the travelers to enjoy their leisure entertainment. The development of transport infrastructure has a significant positive impact on the tourism industry. It had been proven by so many previous empirical studies. Khadaroo(2007) proved that the transport infrastructure of Mauritius has been contributing positively to the tourism number. The air transportation, railways passenger carrying capacity, and quality of tourism services were significantly associated with the inbound tourism index (Khan, 2018).

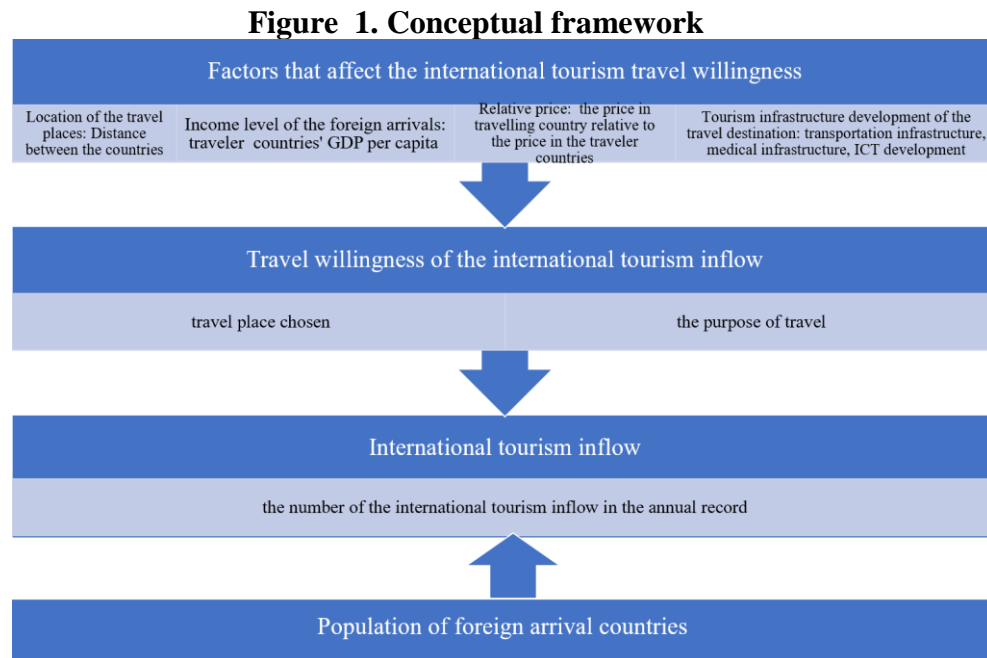
Meanwhile, with the development of internet communication technology recently, the world change to be more united and the lifestyle of us change to be more efficient and convenient. Internet communication technology (ICT) infrastructure

development in a destination makes the destination more attractive. The international tourists can access some applications by using the Internet to overcome so many difficulties during the travel, such as ticket and accommodation booking and language barriers. The development of internet communication technology (ICT) also boosts the tourism industry in Thailand. With the rapidly trend of internet innovation, much more information travelers can get easily and convince. Such as the social media (the best-known of these is Facebook) could provide a real-time access to the page set directly by tourism products' and services' suppliers. What's more, travelers can check the reviews of those products and services that help them know more about what they want without any language boundary. ICT development innovated some many new platforms and medias for the suppliers of tourism products and services and tourists online and offline in Thailand, and became an important part that drives the development of tourism industry in Thailand (Firoiu, 2013).

More on top, the travel purposes of the international tourists are not only leisure entertainment. More and more international visitors go to Asian countries are seeking for the health care. The price and technology superiorities in Asian countries has attracted many tourists with medical care purposes. The medical services have become the rising attractiveness of Asian countries these years. Medical care trip becomes a hit trend for the international tourists to Thailand. The health care institutes in Thailand generating the international technique and the affordable price, have become more and more popular all around the world. Medical tourism brings economic benefits to Thailand (Noree, 2106). Medical tourism generates a value added approximately equal to 0.4% of the GDP in Thailand (NaRanong, 2011). The international medical center is one of the important facilities in the tourism infrastructure due to the increasing number of medical care purpose tourists.

### 3 Research Methodology

#### 3.1 Conceptual framework



The conceptual framework above shows the relationship between the travel willingness and the international tourism inflow. According to the international tourism demand theory, the determining factors were the income level of the traveler's country, relative price (Lim, 1997; Peng et al; Witt and Witt, 1995). The physical distance is also a point that determines the main tourism arrivals from the geography perspective. There are also so many researches pointed out that the transport infrastructure and ICT factor development boot the tourism industry in some countries (Brown, Barry, & Matthew Chalmers, 2003; Khadaroo, Jameel and Seetanah, Boopen, 2007; Khan SA, Qianli D, SongBo W, Zaman K, Zhang Y, 2017). In addition, from the annual investigation, there are a large amount of medical care tourists come to the developing country in Asia to enjoy the medical projects, so the medical infrastructure also can be the special factor that attract the inbound tourism in developing countries. What's more, the different population of the travelers' countries or regions determines the international tourism demand in the specific country level.

#### 3.2 Gravity model in tourism

Classical models of international trade are like Heckscher, Ohlin and

Samuelson (H-O-S) or Ricardo ignore the presence of some factors that are presented in New Trade Theory (N-T-T) models such as economies of scale or transportation cost (Baltagi, 2003). Helpman (1987) was the first using the gravity model to explain the bilateral trade. The gravity model which has been established from Newton's universal law of gravitation explains that economic size (GDP) of two countries and distance in between can predict the amount of trade (Feenstra RC, 2014). It can be presented as

$$X_{ij} = K \frac{(Y_i)^\alpha (Y_j)^\beta}{(1+eD_{ij})^f} \quad (1)$$

In this model,  $X_{ij}$  represents the trade volumes between country  $i$  and country  $j$ ;  $Y_i$  and  $Y_j$  are GDP of country  $i$  and country  $j$ ;  $D_{ij}$  refers to the distance between country  $i$  and country  $j$ ;  $K$  and  $e$  are universal gravitational constants;  $\alpha$  and  $\beta$  are parameters. Gravity model required panel data analysis. Panel data analysis could generate rich information, and it can also make up for the lack of time series and cross-sectional data. Gravity model also has been applied in tourism industry. Tourism, which contains goods and services trading, is a representative of cross-border trade. Similar to traditional gravity models for international trade, the central theme of gravity models for tourism is that the differences of travel purpose from an origin country to another destination is strongly linked with the population of these two places, which refers to the market size of tourism, and negatively proportional to the distance between them. At the very beginning, for most of gravity models, Mayo EJ (1988) stated that the key determinant of the model was physical distance between two countries since the distance between them was viewed as a significant proxy for all the expenses related with travel. Uysal M (1984) and Getz (1986) argued that the gravity model has been extensively applied in tourism due to the simplicity of the equation and its effectiveness in forecasting. Generally, tourists will pay attention to not only specific self-owned resources in destinations, but also tourism goods and services associated with the travel environment (i.e., infrastructure, facilities, and so on). For these reasons, traditional gravity models, which only contained population of two countries and distance in between could not explain these influential elements in tourism industry. Therefore, researchers in tourism tried to extend original gravity

models to more complex models with more variables, which can explained the special factors in tourism industry. Mohd Hafiz Mohd Hanafiah and Mohd Fauzi Mohd Harun (2010) found that the higher income level, higher population rate and shorter destinations had significant positive impacts on the international tourism visitors in Malaysia by using gravity model and adjusted some variables related to tourism. Jameel Khadaroo, Boopen Seetanah(2008) also found that transport infrastructure is a main determine when the travel destination are African and Asian countries by using Gravity model approach bilateral tourism flows among 28 countries over the decade 1990–2000.

Rewriting the basic gravity model in logarithmic form and in terms of international trade between country  $i$  and  $j$  gives:

$$\ln X_{ij,t} = \text{constant} + \alpha \ln Y_{it} + \beta \ln Y_{jt} - f \ln D_{ij} + \varepsilon_{it} \quad (2)$$

In equation (2), it implies that the international trade flow of time  $t$  between country  $i$  and country  $j$  depends on the purchasing power of these two countries which could be evaluated as their GDP at that time. The distance between two countries is expected a negative impact on their trade flows, because the physical distance gains the cost of the trades no matter freight forwarding or time spending.

Rewriting equation (2) in logarithmic form and in terms of international tourist flows of country  $i$  in Thailand gives:

$$\ln TR_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln D_{iT} + \beta_3 \ln X'_{it} + \varepsilon_{it} \quad (3)$$

In equation (3), TR stands for international demand for tourist goods and services of Thailand;  $Y$  stands for GDP of origin country;  $X'$  is a vector of variables explaining the international tourism demand to Thailand;  $D_{iT}$  refers to distance between origin country and Thailand;  $\beta_0$  is a constant variable and  $\varepsilon$  is the idiosyncratic error term. The terms  $i$  and  $t$  indicate visitors' origin countries and year of observation respectively.

There are so many academic researches using the gravity model to explore the function for the international tourism demand. Then the author specifies the classical international demand factors combined with the gravity determinants, arguing it with



the tourism infrastructure. The function shows below:

$$TR_{it} = f(Dis_{it}, Pop_{it}, GDPpercapita_{it}, RP_{it}, INFR_{Tt})$$

This study is focusing on the impact of development of tourism infrastructure which lies at transport infrastructure, ICT infrastructure and medical infrastructure. The dataset this study chooses is based on the related proxies from the 2018 top 13 arrivals countries over the period of 2008 to 2018 and arrange into a panel display. The extending regression from equation (3) can be written as down below:

$$\ln TR_{it} = \beta_0 + \beta_1 \ln Dis_{it} + \beta_2 \ln Pop_{it} + \beta_3 \ln GDPpercapita_{it} + \beta_4 \ln RP_{it} + \beta_5 \ln Tran.INFR_{Tt} + \beta_6 \ln ICT.INFR_{Tt} + \beta_7 \ln Med.INFR_{Tt} + \varepsilon_{it} \quad (4)$$

$TR_{it}$ : The number of tourists from country/region i to Thailand in year t.

$Dis_{it}$ : Distance between country/region i and Thailand.

$Pop_{it}$ : Population of country/region i in year t.

$GDPpercapita_{it}$ : GDP per capita of country/region i in year t.

$RP_{it}$ : Relative prices between country/region i and Thailand in year t.

$Tran.INFR_{Tt}$ : The transport infrastructure development of Thailand in year t.

$ICT.INFR_{Tt}$ : The ICT infrastructure development of Thailand in year t.

$Med.INFR_{Tt}$ : The medical infrastructure development of Thailand in year t.

### 3.3 Hypotheses

Getting the inspiration from so many scholars previously, the tourism infrastructure should have a significant positive impact on the tourism arrivals in Thailand. Relying on the positive impact, this study will set hypothesis as below:

**H<sub>1</sub>**:  $\beta_5 > 1$ , the transport infrastructure development in Thailand has a significant positive effect on the international tourism inflow during 2008 to 2019.

**H<sub>2</sub>**:  $\beta_6 > 1$ , the ICT infrastructure development in Thailand has a significant positive effect on the international tourism inflow during 2008 to 2019.

**H<sub>3</sub>**:  $\beta_7 > 1$ , the medical infrastructure development in Thailand has a significant positive effect on the international tourism inflow during 2008 to 2019.

## **4 Results and Discussion**

### **4.1 SWOT analysis of tourism infrastructure in Thailand**

Firstly, this study employs SWOT analysis to give an overview for the tourism infrastructure in Thailand. Through SWOT analysis, it helps this study easily show a deeper insight to the audiences to know about the develop of tourism infrastructure in Thailand roughly.

#### **4.1.1 Strengths**

Tourism in Thailand has been developing rapidly these two decays. Thailand had constantly adjusted its transport infrastructure plans to provide more convenience for the international tourists, such as building one more modern Suvarnabhumi Airport, which could accommodate more domestic and international passenger flow after its completion. For alleviating the pressure of passenger flow at Suvarnabhumi Airport, Don Mueang Airport is also continuously put into use. Bangkok is an important aviation hub in Southeast Asia. For international direct flight, there are more than 30 air routes which can direct access the major cities in Asia, Europe, America and Oceania. Besides, most of the capital cities of tourism provinces are equipped airports in downtowns. Air transportation in Thailand are relatively developed compared to so many Asian countries. There are 38 airports in Thailand, which contains 7 international airports among them. The flight time from major province or region in Thailand to Bangkok takes only about one hour. Visitors can enjoy direct flights while travelling cross districts. In terms of land transportation, both cars and trains can access all over the country. Road transportation in Thailand is relatively developed, and the network of roads covers most main parts of Thailand. The total mileage of highways in Thailand is about 51,537 kilometers. Among them, the first-class highway is 7,100 kilometers; the second-class highway is 10780 kilometers; the government-level highway is 33,200 kilometers; and the intercity highway is 280 kilometers.

Information and communications technology (ICT) have been adapted to daily life nowadays. ICT development brings opportunities and convenience for the society, and also gives a path for tourism industry in Thailand. Thailand entered the ranks of

accelerating ICT development at an early stage, with outstanding performance in broadband indicators, and its investment in fiber-to-the-home. What's more, 4G technology continued to be improved for many years in Thailand. The penetration rate of smart phones and the number of mobile broadband users have reached full marks, and the user experience of e-government and Internet participation have also been improved. Nowadays, various forms of telecommunication networks have covered most parts of Thailand, including telephones, mobile phones, ADSL broadband Internet, satellite modems and dial-up network access services.

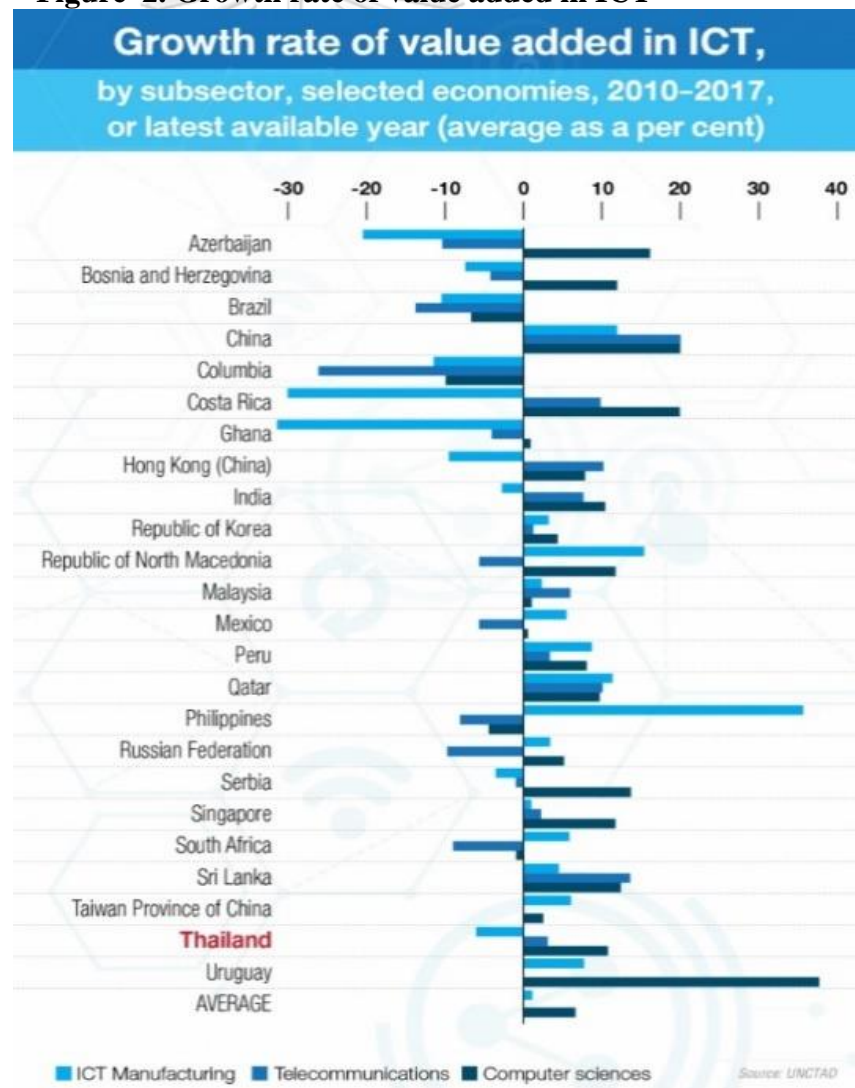
Besides travelling purpose tourists, more and more international tourists are flowing to Thailand for the advanced and special international medical services and traditional medical therapies. Chantal H (2013) found that medical tourists in Thailand are mostly came from Japan, United States, United Kingdom , Middle East and Australia. Besides, 35% of the medical tourism revenue in Thailand was contributed by patients from South East Asian nations. For the medical services system, Thailand also provides integrated wellness centers and facilities, including traditional therapies, such as Thai massage, spa, sanipratics activities. The international hospitality in Thailand has achieved the top 5 rank in Asia during these years. While medical tourists appreciate Thailand's excellent service experience, Thai hospitals hire multilingual speaking staffs (e.g. English, Arabic, Japanese, etc) to solve the linguistic barriers in order to feeds the variety needs from customers (Wong, 2014). The doctors in omost of the Thai hospitals are trained under western medicine pattern and achieve the international certification, and most of the attending doctors in Thailand got the clinical experience in the developed countries, such as US and UK. Similar to other medical tourism countries, non-Thai health care specialists with international qualification certificates are allowed to practice in Thailand as well. The private medical system in Thailand is equipped a high standard and friendly price in the whole Southeast Asia respectively.

#### **4.1.2 Weaknesses**

Throughout Thailand's transport infrastructure, railway system is falling relatively behind in the transportation system of whole country. The railway system in Thailand are narrow gauge, covering 47 provinces, which has been separated into four

main lines starting from Bangkok to the north, east, south and northeast of Thailand. The rail tracks, locomotives, and carriages have served the railway system for more than 10 years, and some of the locomotives or spare parts have been used more than 15 years. Currently, only 156 locomotives are available in Thailand, and the daily maintenance cost is quite expensive. Besides, there are too many railway intersections with roads inside cities since the fast speed of urban growth in Thailand. Since the problems of physical equipment over-aged and routes design, Thai railways is lack of safety and punctuality, and it is normal to be late whether it is passenger or freight trains. What's more, with the huge inflow of tourist these years, urban traffic congestion becomes more and more aggravated in Thailand.

**Figure 2. Growth rate of value added in ICT**



Data Source: UNCTAD

For ICT infrastructure development in Thailand, although its broadband infrastructure covers most of the country, it lags behind the development of advanced technologies, especially the use of data. Figure 2 shows the value-added growth of ICT industry from the sub-sectors of developing countries and transition economies, it shows that although the telecommunications and computer sciences of Thailand was in an increasing trend, the ICT manufacturing of Thailand experienced negative growth. This negative growth implied that the ICT creativity in Thailand still couldn't follow the other rivals. Most of the tourists related ICT products in Thailand rely on the import techniques, and Thai creativity still needs to improve to feed the market demand.

#### **4.1.3 Opportunities**

Fasten the construction of high-speed railway system, it will help tourism industry improve the tourist mobility. Thus, the tourism competitive of Thailand would reach to a higher level. For the urban areas of most capital cities, there are still many blanks in rail transit projects and urban road planning. Since road trips in Thailand become more and more popular, the qualities of roads in Thailand still leave some spaces to be improved.

Due to the demand of rural nature explore, the telecommunications in rural areas of Thailand still need to be constructed. There is still a huge space for IT investment in Thailand, such as IT products and services, especially ICT infrastructure, which can be adapted 4G and increased to 5G.

The expensive medical costs drive the people from the developed countries to seek medical care overseas, especially for those high-cost treatments which are not covered by their insurance in their countries. With a huge amount of needs in medical and healthcare services home and abroad, the rising health care industry shows its power in the whole market. Most of the medical purpose tourists would choose to stay in the private medical and healthcare institutions due to privacy and advanced treatments. Some of treatments which require long waiting periods or treatments which are not available in origin countries could be easily finished in Thailand with friendly prices. Special treatments provided by Thai hospitals is another attractiveness

for medical purpose tourists come to Thailand. Meanwhile, second home retirement policy in Thailand refills the demand of medical tourism. Under these conditions, there are so many opportunities for the Thailand to promote its medical tourism.

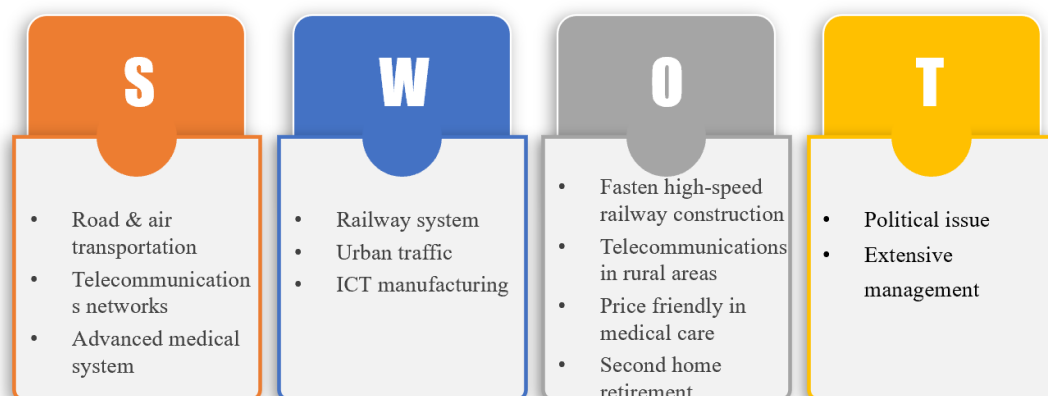
#### 4.1.4 Threats

Even the tourism industry brings so many revenues for Thailand, the development of tourism infrastructure still needs to get permissions from the government. The politics stability in Thailand has a huge impact on the procedures of infrastructure development projects. Political issue is one of the prominent issues in Thailand.

During the period of tourism infrastructure development, most of the constructions adapt extensive management. This would bring drawbacks for society and environment, such as air pollution and water pollution. Balance between saving costs and putting efforts on sustainable development is hard to make decisions for most developing countries. While doing the construction, sustainable development strategy is the hardest part, which is mostly like to be ignored in many projects. The sustainable tourism infrastructure requires advanced technologies and scientific designs. Design sustainable strategies for Thailand to develop its tourism infrastructure, tourism industry planners might need to put more efforts on the raw material seeking and talents recruitment.

Generally, through SWOT analysis, it's clear that there're still so many spaces left to improve tourism infrastructure in Thailand. The SWOT analysis results can be generated as the graph below.

**Figure 3. SWOT analysis of tourism infrastructure in Thailand**



## 4.2 Data collection

This study will use the relevant data during 2008 to 2019. And the selected countries and regions are: China, India, Russia, Japan, Vietnam, Korea, Taiwan, Germany, Indonesia, U.K., France, U.S.A., Hong Kong. These 13 countries' and regions' tourists are the major tourism in Thailand in 2019 which covers 85% of the international tourism inflows.

Firstly, the dependent variable in this study, the numbers of international tourism arrivals to Thailand from selected countries and regions, is acquired from CEICData. Secondly, for those explanatory variables, physical distance between Thailand and origin countries and regions, this study chooses the distance between Bangkok and capital cities of selected countries and regions. About the population variable of the origin countries and regions, which can refer to the demand scales of the selected countries and regions, this study would draw the total number of population base from them. Both of distance and population database were acquired from World Bank's World Development Indicators (WDI). Meanwhile, the level of tourists' personal income is a motivated factor for them making decisions to travel abroad. It is approximated in this study by GDP per capita of the origin countries and regions. The GDP data of the 13 countries and regions are taken from the World Bank's World Development Indicators and cover from 2008–2018.

The price level in the destination country is another factor that may has an impact on the international tourism demand. For this reason, this study uses a proxy of relative prices between Thailand and the origin countries and regions. In the academic filed, most of researchers calculate the tourism relative prices as the ratio of the CPI in destination country respect to the CPI in origin countries (Martin and Witt, 1987; Morley, 1994; Proenca and Soukiazis, 2005). So the relative price in this study would calculate as  $\frac{CPI_{Tt}}{CPI_{it}}$ , where  $CPI_T$  stands for consumer price index in Thailand;  $CPI_i$  stands for consumer price index in selected countries and regions; the term  $t$  indicates the year of observation.

The main tool of domestic transportation in Thailand is still vehicle. When the

international tourists come to visit, their daily transportations are mostly on the road. The quality of the road in Thailand is a good indicator for transport infrastructure development in Thailand. This index represents an assessment of the quality of roads in a given country based on data from the WEF Executive Opinion Survey, which generates the long-term and extensive survey results of more than 14,000 business leaders in 144 countries. The index of a country of operation on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards).

Due to various obstacles such as coverage costs, capacity of existing infrastructure and the demand for new infrastructure, the progress of Internet access is not easy in developing country. Nowadays, we can access internet by different devices, such as computer, laptops and mobile phones. The better ICT infrastructure a country obtains, the more people can access internet. Thus, the total number of internet users can be a good indicator to evaluate the development of ICT infrastructure in Thailand.

Thailand has been transforming into the world's top medical tourism destination. Investment in the Thai healthcare & medical business provides not only promising returns but also opportunities for investors to take part in upgrading healthcare service and improving well-being for Thais and people around the world. Medical infrastructure of the whole country is not only represented by physical infrastructure, such as hospitals and beds. It is also represented by the biomedical sector, which includes biotechnology and medical device. There are rising numbers of companies listing in SET (Stock Exchange of Thailand) and healthcare industry become a new star in the stock market in Thailand. The international visitors are more likely to do the healthcare in private medical institutions, so the medical infrastructure development for them should be an attractive point that makes them come to Thailand. Gross Capital Stock (GCS) of Human Health & Social Work can be a good indicator for the development of healthcare industry and is more partial to the private institutes in medical care market. It can also be an indicator for the medical infrastructure development because the market supply is following the market demand as well. With the dramatic increase in the return of healthcare industry, more and more capital has been injected into this industry and the infrastructure of medical care



has been improved. The more medical care purpose visitors want, the more tangible and intangible infrastructure in this market would be set up. This study collects Gross Capital Stock (GCS) of Human Health & Social Work in Thailand as the medical infrastructure indicator.

The data source of this study is summarized as following:

**Table 1. Data summary**

Type	Variable	Measurement	Unit	Source
Dependent variable	$TR_{it}$	The number of tourists from each selected country/region to Thailand in year t	Number	CEICData
Independent variable	$DiS_{it}$	Distance between each capital city of selected country/region and Thailand	Kilometer	CEPII
Independent variable	$Pop_{it}$	Population of each selected country/region in year t	Number	WDI
Independent variable	$GDP_{percapita_{it}}$	GDP per capita of each selected country/region in year t	Dollars	WDI
Independent variable	$RP_{it}$	Relative price between each selected country/region and Thailand in year t	Ratio	WDI
Independent variable	$Tran.INF_{Tt}$	Quality of Roads in Thailand in year t	Index	WDI
Independent variable	$Med.INF_{Tt}$	Gross Capital Stock (GCS) of Human Health & Social Work of Thailand in year t	THB mn	CEICData
Independent variable	$ICT.INF_{Tt}$	The total number of internet users of Thailand in year t	Number	CEICData

### 4.3 Data results

Firstly, the author runs Pooled OLS estimator, fixed effect estimator, and random estimator to test the regression. The results show as follow:

Table 2. Results of static panel data estimations

Variables	Pooled OLS	Fixed effects estimator	Random effects estimator
	lnTR	lnTR	lnTR
const	-17.8965	-23.0494	-22.1995
	[-2.193]*	[-2.836]**	[-2.773]***
lnGDPpc	0.746039	0.531325	0.579272
	[2.248]**	[2.078]*	[2.039]**
lnPop	0.512524	0.336282	0.40918
	[2.742]**	[1.743]	[2.308]**
lnDis	-0.550596	-0.212776	-0.329105
	[-1.899]*	[-0.8242]	[-1.318]
lnRP	0.0399732	0.0259054	0.0362992
	[0.7676]	0.3395	[0.5607]
lnICTINF	0.423824	0.405331	0.403612
	[1.581]	[2.003]*	[1.947]*
lnTRANINF	1.03089	1.45511	1.37638
	[3.292]***	[3.91]***	[3.714]***
lnMEDINF	0.709053	1.21896	1.11127
	[0.9785]	[1.873]*	[1.743]*
Obs.	135	135	135
Joint test on named regressors - Test statistic: $F(7, 10) = 14.0657$ with p-value = $P(F(7, 10) > 14.0657) = 0.000192065$			
Hausman test - Null hypothesis: GLS estimates are consistent Asymptotic test statistic: Chi-square(7) = 63.2898 with p-value = 3.31535e-011			

Notes:

- Value of t-statistics in brackets.
- \*Significant at 10%. \*\*Significant at 5%. \*\*\*Significant at 1%.
- The dataset is based on selected countries and regions from 2008 to 2018.
- The selected countries and regions are: China, India, Russia, Japan, Vietnam, Korea, Taiwan, Germany, Indonesia, U.K., France, U.S.A., Hong Kong.

First of all, for the result of joint significance test,  $F(7, 10) = 14.0657$  with p-value =  $P(F(7,10) > 14.0657) = 0.000192065$ , it implies that there's individual heterogeneity in the model so pooled OLS result was inappropriate. Through the results of Hausman test,  $H = 9.60988$  with p-value =  $\text{prob}(\text{chi-square}(7) > 9.60988) = 0.21178$ , it implied that there's individual heterogeneity and it's correlated with the independent variables of the model, the fixed effects model is preferred in this case.

The test result of fixed effects model suggests that the developments of ICT infrastructure, transport infrastructure and medical infrastructure are significantly affecting the international tourism arrivals in Thailand from 2008 to 2018 in a positive way. The coefficient of ICT infrastructure implies that 10% increase in internet users in Thailand, the international tourist inflow will be increased by 4% in Thailand by holding the influences from other variables to be constant. The coefficient of ICT infrastructure implies that 10% increase in Quality of Roads index in Thailand, the international tourist inflow will be increased by 14.6% in Thailand by holding the influences from other variables to be constant. The coefficient of medical infrastructure implies that 10% increase in Gross Capital Stock (GCS) of Human Health & Social Work in Thailand, the international tourist inflow will be increased by 12.1% in Thailand by holding the influences from other variables to be constant. The fixed effects model result shows the GDP per capita is a positive significance economic variable for the international tourism inflow in Thailand. This variable is a good proxy to reflect the purchasing power of international tourists in a country level.

Although the result of fixed effects model followed the track of previous expectation, there're still endogeneity and dynamism in tourism cannot be catered for in this static panel model. In the context of tourism, Naudé WA(2005) pointed out that there are reputation effects that apply over time in tourist decision making on their vacation destinations, because of good experiences after travelling to a certain destination or reviews from other travelers. In fact, once people have been enjoying their vacations to a particular country and have a good improvement on it, they may generally visit the destination again. There is much less uncertainty associated with going again to an impressive country than travelling to a new destination. At the same time, with the hard efforts of tourism planners, Thailand drawn the world's attention. And the good services and affordable price helped Thailand earned a lot of word-of-mouth advertising. Adding a time variable in the model, normally time dummy variable, can adjust the special reputation effects during the time goes by. Meanwhile, time dummy variables can measure the differences of national policies and industrial situation annually. If a certain policy has influence on dependent variable, it could be explained by dummy variables before and after the policy. Adding the time dummy variable can improve the result accuracy of the model. For these reasons, this study

applies a dynamic framework analysis to highlight the important insights into the debate.

The equation (4) can be extended as:

$$\ln TR_{it} = \beta_0 + \beta_1 \ln TR_{i,t-1} + \beta_2 \ln Dis_{it} + \beta_3 \ln Pop_{it} + \beta_4 \ln GDPpercapita_{it} + \beta_5 \ln RP_{it} + \beta_6 \ln Tran.INFR_{Tt} + \beta_7 \ln ICT.INFR_{Tt} + \beta_8 \ln Med.INFR_{Tt} + \beta_9 T_i + \varepsilon_{it} \quad (5)$$

The result of dynamic panel data estimations showed in table 3.

**Table 3. Results of dynamic panel data estimations**

Model 4: 1-step dynamic panel, using 124 observations Included 11 cross-sectional units Time-series length: minimum 6, maximum 11 Including equations in levels Dependent variable: lnTR				
variables	Coefficient	Std. Error	z	p-value
lnTR(-1)	0.346517	0.059705	5.804	<0.0001***
const	-24.9835	3.4929	-7.153	<0.0001***
lnGDPpc	0.683542	0.071906	9.506	<0.0001***
lnPop	0.416821	0.038654	10.78	<0.0001***
lnDis	-0.495175	0.062844	-7.879	<0.0001***
lnRP	0.0310326	0.022679	1.368	0.1712
lnICTINF	0.519121	0.178405	2.91	0.0036***
lnTRANINF	2.3817	0.686062	3.472	0.0005***
lnMEDINF	0.747464	0.262355	2.849	0.0044***
T2008	-0.0387047	0.075479	-0.5128	0.6081
T2009	-0.0263663	0.085262	-0.3092	0.7571
T2010	-0.0882359	0.078835	-1.119	0.263
T2011	0.0094127	0.078977	0.1192	0.9051
T2012	0.0296043	0.078724	0.3761	0.7069
T2013	0.16029	0.07918	2.024	0.0429**
T2014	0.111144	0.081531	1.363	0.1728
T2015	0.103965	0.081873	1.27	0.2041
T2016	0.07016	0.081046	0.8657	0.3867
T2017	-0.154197	0.081407	-1.894	0.0582*
T2018	0.0737087	0.081521	0.9042	0.3659
Sum squared resid	12.05212			
S.E. of regression	0.34042			
Number of instruments = 95 Test for AR(1) errors: z = -3.22974 [0.0012] Test for AR(2) errors: z = -0.779352 [0.4358] Sargan over-identification test: Chi-square(75) = 86.0694 [0.1797]				

Notes:

- a. \*Significant at 10%. \*\*Significant at 5%. \*\*\*Significant at 1%.
- b. The dataset is based on selected countries and regions from 2008 to 2018.
- c. The selected countries and regions are: China, India, Russia, Japan, Vietnam, Korea, Taiwan, Germany, Indonesia, U.K., France, U.S.A., Hong Kong.

The Sargan over-identification test result shows that the regression is suitable for the dynamic panel model. Moreover, using the Arellano–Bond test of first-order and second-order autocorrelation, the author rejects the presence of second-order autocorrelation in the residuals.

The lagged tourist arrivals variable is positive and significant. This result suggests the presence of repeated tourism in Thailand during 2008 to 2018. Word-of-mouth spreading does really exist in tourism industry.

The GDP per capita of the origin countries has a positive significant effect to the tourism arrivals in Thailand. The coefficient of GDP per capita variable suggests that 10% increase of GDP per capita in origin countries and regions, there's 6.8% increase in the international tourists in Thailand by holding the influences from other variables to be constant. This result shows that the purchasing power of the tourists, which can be interpreted as their personal income, still weighted in the tourism industry in Thailand.

The population is the indicator of demand scale. The larger population countries provide more opportunities for the whole tourism market. The estimation coefficient of the population shows that if there's 10% population increase in origin countries and regions, the international tourists will increase by 4.2% by holding the influences from other variables to be constant. Due to the lasted research, Chinese tourists created the largest tourism revenue of Thailand in 2019. China is the most populous nation in the world. With the help of international tourism policy in Thailand, Chinese visitors have become the most tourists of Thailand. Recently, due to the higher income level in different regions, the effect of population is shifting weaker with the significant 5%.

The estimation result of distance factor shows that the international tourist inflow in Thailand is sensitivity affected by the distance. The coefficient of distance

factor shows that if 10% increase in distance between origin country and Thailand, the international tourists from that origin country will decrease by 5% by holding the influences from other variables to be constant. Physical distance had the expected negative sign, meaning that international tourist arrivals decrease as transportation costs and the time spending increase. But the distance factor has less impact on the international tourism because of the development of transportation. With the development of physical transport infrastructure and transport services, more and more people in favor of travel inbound and outboard.

The coefficient of relative prices is found to have a tiny effect on tourism. Meanwhile the coefficient doesn't have the expected negative sign; it can be understood as the price of Thailand was much cheaper than that in the selected countries and regions even the inflation still appeared during 2008 to 2018. The relative price is no long a significant variable in tourism industry of Thailand, indicating that relative prices don't appear to have any substantial impact on tourist arrivals in Thailand. This can be explained by the fact that the main tourists of Thailand come from the countries with relatively high standards of living. Therefore, the decision to visit Thailand is determined by personal income levels rather than by the cheaper price in Thailand. This is consistent with Eilat and Einav (2004) in that tourists are less sensitive to prices when they travel to less developed countries because of the low existing price level.

This study adopted the annual total number of Internet users in Thailand as an indicator of ICT infrastructure. In terms of international trade, equipping a better information communication technology is more likely to have increasing exports (Clarke & Wallsten, 2006). The result of ICT factor shows that if 10% increase in total number of internet users in Thailand, there's a 5.2% increase in the international tourism inflow by holding the influences from other variables to be constant. The significance of ICT factor is implying that the development of ICT infrastructure in Thailand, especially the physical ICT infrastructure, was taking a responsibility for attract the tourists' attention strongly. The coefficient was not in our expectation because Thailand's ICT infrastructure was continuously fitting the international level during 2008 to 2018. Thailand as the central of southeastern Asia, many physical ICT infrastructure was built earlier due to the internal trade demand.

As for transport infrastructure (quality of roads), a 10% increase in the total quality roads is likely to generate a 23.8% increase in international tourism inflow in Thailand by holding the influences from other variables to be constant. In most of developing countries, road infrastructure increases the accessibility of tourists inside destination country, which eventually reduces the costs of transportation and time spending. This result also implies that the integrative development of transportation and tourism happened in Thailand. For tourism industry, transportation is not only one of the essential elements, but also transformed into scenic spots in case of road trips are popular in the trend. For transportation, it is necessary to improve the utilization of roads by developing tourism, and the transport infrastructure needs to expand more efficient infrastructure, such as high-speed train, through gaining profits from tourism in Thailand. In terms of tourism and transport infrastructure, they need each other at this time.

The coefficient of medical infrastructure implies that 10% increase in medical infrastructure; the international tourist inflow will be increased by 7.5% in Thailand by holding the influences from other variables to be constant. Thailand has become the primary destination of medical tourism in the world, and the scale of medical tourism ranks first place in the world. The traditional therapies and the advanced technique of healthcare services make Thailand become an attractive destination for the medical care. This result is under the expectation, implying that the medical tourism in Thailand is still on the raising trend, there's still uncertainty for the international tourists to choose Thailand as a medical care places even the prices are really outstanding all around the world. The more effort for Thailand should put in building a reputation of the medical care in the international market.

For time dummy variable, the result shows in the year of 2013, there's something created a positive effect with 95% of probability in total amount of international tourists. Getting through the international tourists' nationalities in 2013, Chinese tourists became the major tourists of the total international arrivals in Thailand. The continued growth of Chinese tourists to Thailand is mainly due to favorable factors such as culture influence, political stability, the absence of natural disasters, the increase in direct flights of budget airlines from China to Thailand. At the same time, the Tourism Bureau of Thailand had successful organized a lot of

promotion activities in China with Chinese tourism organizations, which helped Thailand obtain a good reputation in Chinese market. But down to 2017, there's a tourism security issue created a negative effect with 90% of probability in total amount of international tourists. It was reported that Thailand ranked 118th in security-performance rankings, which among 136 tourism destinations participating in the ranking by World Economic Forum (WEF). Due to the increasingly amount of international tourism inflow, tourism security was still a weakness of Thailand's tourism in 2017. As the potential problems under the tourism industry in 2017, it strongly affected the national image of Thailand at that time, so the negative impact on international tourism inflow appeared in 2017.

## 5 Conclusion

This empirical investigation presents an approach to analysis international tourism inflows of 13 countries and regions in Thailand during 2008 to 2018. This study has explored the international tourism demand for visiting Thailand by extending gravity model into a quantitative regression. After testing the regression in some quantitative models, it showed that the special characteristic, which is reputation effects, in the international tourism demand should be solved by dynamic panel model. This study is focusing on the impact of development of tourism infrastructure on international tourism inflow in Thailand during 2008 to 2018, enhancing ICT factor, transport infrastructure and medical infrastructure as the tourism infrastructure. Further data analysis result suggests that ICT infrastructure, transport infrastructure and medical infrastructure are sensitive factors when international tourists visit to Thailand. It could be seen from the results that international tourists would pay attention to the internet availability, spots accessibility and medical resource and standard when they come to Thailand. Among the whole analysis, the development of medical infrastructure should be highlighted due to the current trend of medical tourism in Thailand. Medical tourism is an emerging market; Thailand seems to do a good performance in this market. The other economic determinants, which are income level and population size, are also pronounced for the tourism demand of travelling to Thailand.

Turn to the national planning perspective, Thai government should generate



ICT promote, transport development and medical tourism into tourism planning, especially in some undeveloped areas. The spending on these projects is also taking a huge part of public finance and government spending. Thus, policy makers should pay more attention to long-term planning. An integrated, efficient and eco-friendly tourism system should be developed, which should be sustainable for social and industry. It should be noted that Thai government would gain the initiative of getting the infrastructural development loans from some international authorities and institutions rather than carrying capital expenditure cuts from the government budget itself. What's more, the private sector should be encouraged to take national infrastructure projects during the infrastructure construction process, because this also pulls the whole construction industry grow up. Once this condition has been released, Thai government should pay attention to improve the legality and regulatory environment and remove unnecessary complicated formalities and practices. By doing so, it can help ensure that the private sector has rational intensive constraints to invest in relative infrastructure projects and their operations are under an efficient governmental framework. As one of the pillar industries to promote the economic development in Thailand, tourism industry has attracted worldwide attention. Behind the scenes, tourism is a highly interrelated comprehensive industry and social undertaking. It's not only an industry brings profits for the government, but also an industry creates opportunities for all the people who work in the industry chain. The shortage of any department in tourism industry will directly restrict the healthy operation of the industry chain.

There are still some inadequacies in this study due to data unavailable and broad points of view. For the future study, it would be more accurate and efficient to analyze the impact of tourism infrastructure development on international tourism inflow in terms of tourists with different income levels and different travelling purposes for Thailand.

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