# DETERMINANTS OF TOURISM EFFICIENCY IN OECD COUNTRIES: A TWO-STAGE DEA MODEL

TUNYACHANOK GUSAROJ

MASTER OF ECONOMICS IN APPLIED ECONOMICS
MAEJO UNIVERSITY
2022

# DETERMINANTS OF TOURISM EFFICIENCY IN OECD COUNTRIES: A TWO-STAGE DEA MODEL

TUNYACHANOK GUSAROJ

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ECONOMICS
IN APPLIED ECONOMICS
ACADEMIC ADMINISTRATION AND DEVELOPMENT MAEJO UNIVERSITY
2022

**DETERMINANTS OF TOURISM EFFICIENCY IN OECD COUNTRIES:**
**A TWO-STAGE DEA MODEL**

TUNYACHANOK GUSAROJ

THIS THESIS HAS BEEN APPROVED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ECONOMICS
IN APPLIED ECONOMICS

**APPROVED BY** **Advisory Committee**

Chair .....
(Assistant Professor Dr. Jorge Fidel Barahona Caceres)
...../...../.....

Committee .....
(Assistant Professor Dr. Wanvilai Chulaphan)
...../...../.....

Committee .....
(Dr. Kantaporn Chuangchid)
...../...../.....

Program Chair, Master of Economics .....
in Applied Economics (Assistant Professor Dr. Ke Nunthasen)
...../...../.....

**CERTIFIED BY THE OFFICE OF** .....
**ACADEMIC ADMINISTRATION** (Associate Professor Dr. Yanin Opatpatanakit)
**AND DEVELOPMENT** Vice President
...../...../.....

**ชื่อเรื่อง** ปัจจัยที่มีผลต่อประสิทธิภาพการท่องเที่ยวในประเทศในกลุ่มประเทศ OECD: แบบจำลอง DEA สองขั้นตอน
**ชื่อผู้เขียน** นางสาวธัญญชนก กุศะโรจน์
**ชื่อปริญญา** เศรษฐศาสตรมหาบัณฑิต สาขาวิชาเศรษฐศาสตร์ประยุกต์
**อาจารย์ที่ปรึกษาหลัก** Assistant Professor Dr.Jorge Fidel Barahona Caceres

## บทคัดย่อ

การศึกษานี้ตรวจสอบประสิทธิภาพการท่องเที่ยวและปัจจัยที่มีผลต่อการท่องเที่ยวใน 28 ประเทศในช่วงปี 2010-2016 โดยใช้การวิเคราะห์ประสิทธิภาพทางด้านผลผลิต data envelopment analysis (DEA) ผลการวิจัยพบว่าค่าประสิทธิภาพการท่องเที่ยวของกลุ่มประเทศ OECD มีการขยายตัวอย่างต่อเนื่อง ค่าประสิทธิภาพเฉลี่ยทวีปยุโรป หรือกลุ่มที่มีรายได้สูงซึ่งมีมูลค่าภาคการท่องเที่ยวที่มีประสิทธิภาพสูง ในขั้นตอนที่ 2 จากการวิเคราะห์ถดถอยโทบิทเพื่อหาปัจจัยที่ส่งผลต่อประสิทธิภาพการท่อเที่ยว การศึกษาพบว่าการเปิดกล้างทางการค้า การพัฒนาเศรษฐกิจ การพัฒนาเมือง และกฎระเบียบด้านสิ่งแวดล้อมมีผลที่ดีต่อประสิทธิภาพในอุตสาหกรรมการท่องเที่ยว และมีผลกระทบเชิงบวกอย่างมีนัยสำคัญต่อประสิทธิภาพการท่องเที่ยว ผลลัพธ์เหล่านี้สามารถช่วยรัฐบาลในการวางแผนโดยการจัดสรรเงินทุนเพื่อส่งเสริมความร่วมมือด้านการท่องเที่ยวในภูมิภาคและเพิ่มประสิทธิภาพของอุตสาหกรรมการท่องเที่ยว เพื่อเพิ่มความสามารถในการแข่งขันในอุตสาหกรรมการท่องเที่ยว

คำสำคัญ : อุตสาหกรรมท่องเที่ยว, วิธีการวิเคราะห์ล้อมกรอบข้อมูล, แบบจำลองโทบิท, ประสิทธิภาพเชิงเทคนิคทางด้านผลผลิต

| | |
|---|---|
| **Title** | DETERMINANTS OF TOURISM EFFICIENCY IN OECD COUNTRIES: A TWO-STAGE DEA MODEL |
| **Author** | Miss Tunyachanok Gusaroj |
| **Degree** | Master of Economics in Applied Economics |
| **Advisory Committee Chairperson** | Assistant Professor Dr. Jorge Fidel Barahona Caceres |


## ABSTRACT


This study investigates the tourism efficiency and its determinants for 28 countries over the period 2010 to 2016 by using output-oriented data envelopment analysis (DEA). The results show that the efficiency value of OECD countries is constantly expanding. The average of tourism efficiency in high-income countries have high efficiency tourism value. In second stage, Tobit regression to determine the explanatory variables. Finding suggest that trade openness, economic development, urbanization, and environmental regulation have a positive effect on the efficiency of tourism industry. These have significant positive impact on tourism efficiency. These results can help governments in planning through allocation of funds to promote regional tourism cooperation and increasing the efficiency of tourism industry to increase the competitiveness in tourism industry.



Keywords : Tourism industry, Data envelopment analysis, Tobit regression, Output-oriented technical efficiency

# ACKNOWLEDGEMENTS

I would like to express my deep and sincere gratitude to my thesis advisors, Asst. Prof. Dr. Jorge Barahona Caceres for giving suggestions, continued support and encouragement until this research is complete. I am extremely grateful for what he has offered me. My Special thanks goes to Co-advisor Asst. Prof. Dr. Wanvilai Chulaphan and Dr. Kantaporn Chuangchid for their invaluable help and review deficiencies of this research with great care until the research is completed.

Finally, my thanks go to all the people who have supported me to complete the research work directly or indirectly. I would like to thankfully with my parents and my friends for all their supports throughout the period of this research.

Tunyachanok Gusaroj

# TABLE OF CONTENTS

Page

# LIST OF TABLES

**Page**

# LIST OF FIGURES

**Page**

# CHAPTER 1
# INTRODUCTION

The tourism industry is one of the largest services traded internationally (Du et al., 2016). The tourism industry can also improve the balance of payments, generating income, taxes, currency, and jobs to eliminate major economic problems such as inflation and unemployment (Chaabouni, 2018).

This tourism industry is global force for economic growth and development. Which, create good jobs and new innovation for entrepreneurship (World Tourism Organization, 2019). However, the tourism activity has an impact to environmental damage. As a result, many countries promote the conservation of natural resources and environmental heritage protected for the sustainable tourism development (Rodríguez-Díaz and Pulido-Fernández, 2020).

The Organisation for Economic Co-operation and Development (OECD) is the international organization that work for good policy with the aim of better life. The OECD collaborate with partners in local, region and international levels of 38 countries for support in the range of partners. They are Australia, Austria, Belgium, Canada, Chile, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal,

Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States (Organisation for Economic Co-operation and Development, 2022).

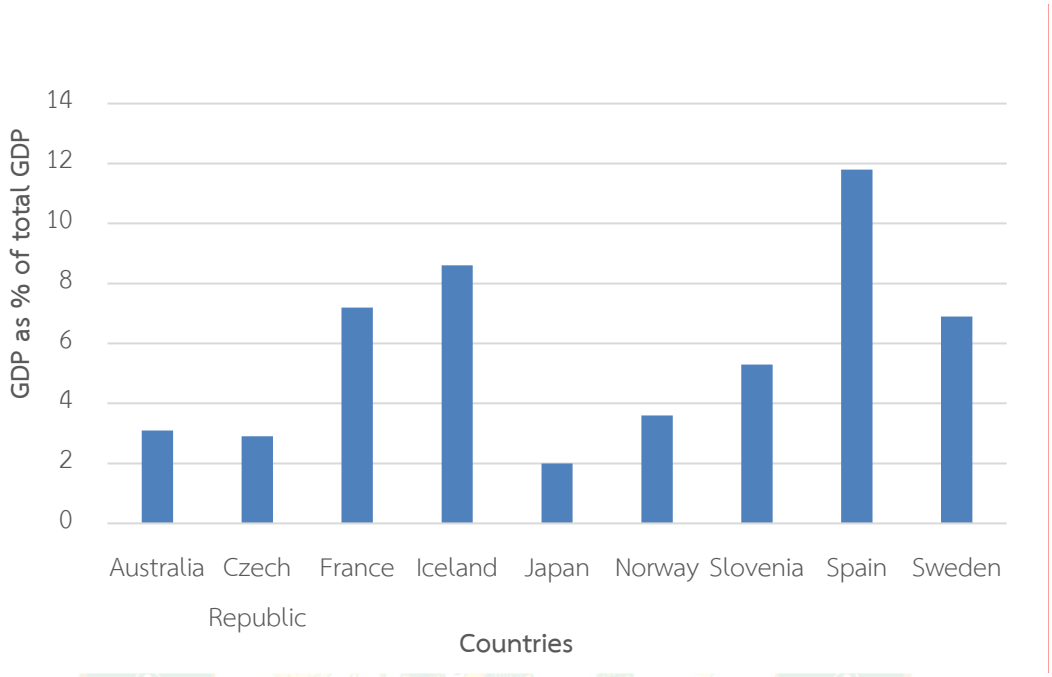


***Figure 1*** *Tourism GDP (direct) as percent of total GDP*

Source: OECD Statistics (2020)

The growth and development of tourism is an important for social and economic activity in the Organisation for Economic Co-operation and development (OECD) member countries. In 2018, Table 1 shows ability generating USD 893,901 million from the total of international arrivals to OECD member countries 56.9% of total global tourism arrivals or around 940 million people (OECD, 2020). Tourism's total contributes 5.48 % of gross domestic product as Figure 1. Moreover, the travel and tourism ensure employments more than 7.0 % of total employment as follow

Table 2. Tourism also generates domestic value added of export. 81% of total exports which create revenue for economy (OECD, 2020).

***Table 1*** *International travel receipts in OECD member countries, 2018*

| **Countries** | **Travel receipts (million dollar)** |
|---|---|
| Australia | 45,036 |
| Austria | 23,087 |
| Belgium | 8,911 |
| Canada | 26,346 |
| Chile | 2,956 |
| Czech Republic | 7,451 |
| Denmark | 9,101 |
| Estonia | 1,789 |
| Finland | 3,662 |
| France | 65,452 |
| Germany | 42,955 |
| Greece | 18,987 |
| Hungary | 6,924 |
| Iceland | 6,924 |

Source: OECD (2020)

***Table 1 (Continue)*** *International travel receipts in OECD member countries, 2018*

| Countries | Travel receipts (million dollar) |
|---|---|
| Ireland | 6,182 |
| Israel | 7,245 |
| Italy | 49,236 |
| Japan | 42,096 |
| Korea | 15,319 |
| Latavia | 1,058 |
| Lithuania | 1,504 |
| Luxembourg | 4,993 |
| Mexico | 22,526 |
| Netherlands | 18,869 |
| New Zealand | 11,004 |
| Norway | 5,843 |
| Poland | 14,067 |
| Portugal | 19,878 |

Source: OECD (2020)

***Table 1 (Continue)*** *International travel receipts in OECD member countries, 2018*

| **Countries** | **Travel receipts (million dollar)** |
|---|---|
| Slovak Republic | 3,199 |
| Slovenia | 3,192 |
| Spain | 81,473 |
| Sweden | 14,949 |
| Switzerland | 16,971 |
| Turkey | 25,220 |
| United Kingdom | 48,602 |
| United States | 214,680 |
| **Total** | **893,901** |

Source: OECD (2020)

***Table 2*** *Total tourism employment (direct) as % of total employment, 2018*

| **Country** | **Total tourism employment (direct) as % of total employment** |
|---|---|
| Australia | 5.2 |
| Canada | 3.9 |
| Chile | 6.4 |
| Colombia | 3.2 |
| Costa Rica | 6.6 |
| Czech Republic | 4.4 |
| Denmark | 9.0 |
| Estonia | 4.3 |
| Finland | 5.4 |
| France | 7.5 |
| Greece | 10.0 |
| Iceland | 15.8 |
| Ireland | 10.3 |

Source: OECD.Stat (2022)

***Table 2 (Continue)*** *Total tourism employment (direct) as % of total employment, 2018*

| Country | Total tourism employment (direct) as % of total employment |
|---|---|
| Israel | 3.6 |
| Japan | 9.8 |
| Latvia | 8.5 |
| Lithuania | 4.8 |
| Luxembourg | 8.2 |
| Mexico | 6.0 |
| Netherlands | 6.3 |
| New Zealand | 8.0 |
| Norway | 7.0 |
| Slovenia | 7.7 |
| Spain | 13.5 |
| Sweden | 2.4 |
| Switzerland | 4.4 |

Source: OECD.Stat (2022)

***Table 2 (Continue)*** *Total tourism employment (direct) as % of total employment, 2018*

| Country | Total tourism employment (direct) as % of total employment |
|---|---|
| Turkey | 7.7 |
| United States | 3.9 |
| **Average** | **7.0** |

Source: OECD.Stat (2022)

The tourism creates awareness of economic, cultural and environmental value. Helping to raise funds for protection and management of protected areas (UNWTO, 2021). Organisation for Economic Co-operation and development (OECD) established a whole-of-government policy approach that help countries member to reframe tourism growth to better spread the benefits, reduce inequalities, and economic development (OECD, 2018). The government plays a key role in supporting the development of tourism that creates economic benefits. The Organisation for Economic Co-operation and development (OECD) member organize policy as the centerpiece of tourism administration to succussed. Policies that want to maximize economic, environmental, and social benefit. Such as support investment, improve quality of the tourism offer, skill of labor in tourism industry, sustainable in tourism policies for eco-friendly, and spread economic benefit by better plan for the suitable

tourism growth for each destination (OECD, 2020). To achieve the development, the tourist destination will be efficient in services. Expanding the potential of the tourism industry as a major attraction and added value. The Organisation for Economic Co-operation and development (OECD) countries can compete with global marketplace (Dupeyras and MacCallum, 2013).

Their developments require appropriate strategies. So, it necessary to evaluate the performance of tourism industry. To provide tourism policymakers with explicit indicators for future strategic decisions (Barros et al., 2011). One such indicator is a measure of tourism efficiency (Tomic and Marcikic, 2018). Tourism efficiency is the indicator productivity of industry and can be used as a measurement of the potential of the tourism destination. Consequentially, tourism efficiency has been investigated in recent years as increasing the efficiency in tourism is an important to achieve the maximize the economic benefits from tourism industry outcomes (Higuerey et al., 2020).

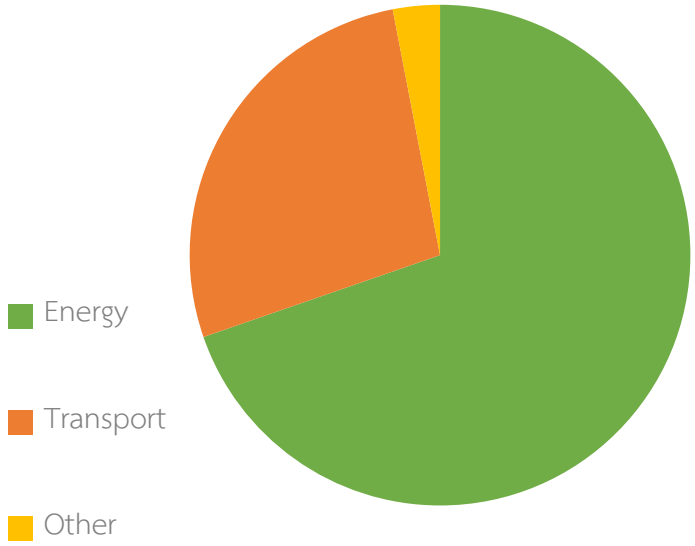


***Figure 2*** *Share of energy tax, transport tax, resources tax, pollution tax per environmental tax, 2018*

Source: OECD (2022a)

In the economies of Organisation for Economic Co-operation and development (OECD) member, tourism has important role to economies. The government has implemented policies that want to increase the economic benefits of tourism development (OECD, 2000). The concept of sustainability in tourism policy has been adopted for tourism development (OECD, 2020). Environmental taxes are extremely used in OECD economic. The environmental taxes is the effective tools for environmental policy (OECD, 2006). The environmental tax is the collection of taxes including energy tax, vehicle traffic tax, carbon tax resource tax pollution tax and etc. (He et al., 2019). The environmental tax can adjust the economic behaviors to protect the environment (European Parliamentary Research Service, 2020). Taxation is

favorable to inputs in research and development for new consumer products, innovations and technologies with less environmental impact. The environment-related innovation help reduce the greenhouse (OECD, 2010). The environmental tax account for 1.56 percent of GDP and 5.56 % of total tax divide to Energy tax (69%), Transport tax (27%), and Oher tax (3%) in 2013 as follow Figure 2 (OECD, 2022a).

***Table 3*** *Environment tax in OECD member countries, 2013*

| Country | Revenue from environmental tax | |
|---|---|---|
| | Percent of total tax | Percent of GDP |
| Australia | 7.47 | 2.08 |
| Austria | 5.26 | 2.24 |
| Belgium | 4.56 | 2.04 |
| Canada | 3.68 | 1.13 |
| Chile | 6.81 | 1.38 |
| Czech Republic | 8.15 | 2.78 |
| Denmark | 8.10 | 3.94 |
| Estonia | 7.81 | 2.49 |
| Finland | 6.65 | 2.91 |
| France | 4.31 | 1.94 |
| Germany | 5.59 | 2.05 |

Source: OECD (2015b)

***Table 3 (Continue)*** *Environment tax in OECD member countries, 2013*

| Country | Revenue from environmental tax | |
|---|---|---|
| | Percent of total tax | Percent of GDP |
| Germany | 5.59 | 2.05 |
| Greece | 8.09 | 2.71 |
| Hungary | 7.09 | 2.76 |
| Iceland | 5.69 | 2.02 |
| Ireland | 8.37 | 2.36 |
| Israel | 9.26 | 2.83 |
| Italy | 6.49 | 2.78 |
| Japan | 5.37 | 1.54 |
| Korea | 9.25 | 2.25 |
| Luxembourg | 5.65 | 2.22 |
| Mexico | -5.81 | -0.47 |
| Netherlands | 9.22 | 3.44 |
| New Zealand | 4.16 | 1.35 |
| Norway | 5.37 | 2.15 |
| Poland | 6.21 | 1.92 |
| Portugal | 6.38 | 2.13 |

Source: OECD (2015b)

***Table 3 (Continue)*** *Environment tax in OECD member countries, 2013*

| Country | Revenue from environmental tax | |
|---|---|---|
| | Percent of total tax | Percent of GDP |
| Portugal | 6.38 | 2.13 |
| Slovak Republic | 5.89 | 1.74 |
| Slovenia | 11.64 | 4.28 |
| Spain | 5.70 | 1.86 |
| Sweden | 5.51 | 2.36 |
| Switzerland | 6.57 | 1.78 |
| Turkey | 13.87 | 4.06 |
| United Kingdom | 7.63 | 2.51 |
| United States | 3.01 | 0.77 |
| **Average** | **5.16** | **1.56** |

Source: OECD (2015b)

To ensure the environmental policy can promote sustainable tourism development. Therefore, determinant the factors environmental taxes that impact to tourism efficiency by using environmental taxes. However, we don't know the impacts of the policies such as the environmental tax on tourism efficiency in each OECD country. To address the aforementioned gap, this study aims to investigate how are the efficiency value of tourism industry in each OECD member countries?

and what are the main factors that influence their tourism efficiency? To obtain empirical information for policy makers to evaluate how them evaluate the tourism competitiveness for suit in their policy.

## 1.1 IMPORTANCE OF THIS STUDY

Measure the tourism efficiency of OECD member countries, which provide explicit indicators and empirical for implemented policies to tourism development. Also, determinants the tourism efficiency in OECD member countries for use the results to determine the guidelines for improving tourism efficiency.

## 1.2 ADVANTAGE OF THIS STUDY

The result will help to understand the performance of tourism industry in countries how efficient the tourism industry in OECD member countries. Moreover, the effect of environmental tax, economic development, urbanization and trade openness on tourism efficiency in OECD member countries.

## 1.3 OBJECTIVES OF THIS STUDY

The objectives of this study are (1) measure tourism efficiency in each OECD member countries using the DEA model (2) investigate the determinants of tourism efficiency using a Tobit regression model.

## 1.4 DELIMITATION

The objective of this study is measure tourism efficiency and investigate the determinants of tourism efficiency in OECD member countries. This study aims to investigate how are the efficiency value of tourism industry in each OECD member countries? and what are the main factors that influence their tourism efficiency? The study investigates the tourism efficiency by use output variables including tourist recipe and tourist arrivals. The input variables are the employment in tourism industry, number of rooms and protected areas. The factors used are GDP per capita, urban population, total trade and environmental tax. The delimitation of population size is OECD member countries. In this study, researcher attempt to collect data which could be collected from 28 OECD member countries, including Australia, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Japan, Latvia, Lithuania, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United States on the period 2010-2016.

# CHAPTER 2
# LITERATURE REVIEW

In this study on the title of determinants of tourism efficiency in OECD countries: A Two-Stage DEA model. The study about the measure tourism efficiency in each OECD member countries and the determinants of tourism efficiency. This study including the theory, concept, related research and conceptual framework to as study approach as follow: 2.1 Concept and Theory 2.2 Related research 2.3 Conceptual framework

## 2.1 CONCEPT AND THEORY

2.1.1 Production Theory

The production operation uses inputs to maximize productivity. The production possibility of firm can show in the production function (Coelli et al., 2005).

**Production function**

Production function means the relationship between quantity of inputs used to generate the quantity of outputs of the good and service productions.

$$Y=f(L,K,H,N) \quad (1)$$

Where $Y$ is quantity of output, $K$ is the quantity of physical capital, $L$ is the quantity of labour, $H$ is the quantity of human capital, $N$ is the quantity of natural

resource and $f(\ )$ is the function of how the inputs are used to produce the outputs (Mankiw, 2011).

2.1.2 Efficiency

Efficiency is the performance of DMUs increase the outputs under the limit of resource. The measurement of efficiency according from Farrell (1957) measure by production possibilities frontier that represent by the production function. The efficiency can measure by ratio of output per input (Cracolici et al., 2008) as follow:

$$\boldsymbol{Efficiency} = \frac{\boldsymbol{output}}{\boldsymbol{input}} \quad (2)$$

The efficiency measure of performance relative efficiency of DMUs with benchmark (Chang Jung Christain University, 2019). The relative of efficiency of DMU can measure as follow:

$$\boldsymbol{Efficiency} = \frac{\boldsymbol{weighted\ sum\ of\ outputs}}{\boldsymbol{weighted\ sum\ of\ inputs}} \quad (3)$$

Farrell (1957) divide the economic efficiency in 2 characteristics are:

1. Allocate efficiency means the ability of DMUs that can use the appropriate proportion under the inputs price assumption.
2. Technical efficiency means the ability of DMUs that can produce as much as possible under the resource.

The measurement of efficiency by Data envelopment analysis applied the linear programming for measurements. The measurement of efficiency determine the

product of Y, which 2 inputs are the labor and capital under the constant returns to scale (Charnes et al., 1978).

There are two methods for measuring efficiency which are Input-Oriented and Output-Oriented.

1. Output-Oriented measure

Output-Oriented measure under assumption of constant returns to scale (Charnes et al., 1978) can be considered from Figure 3.

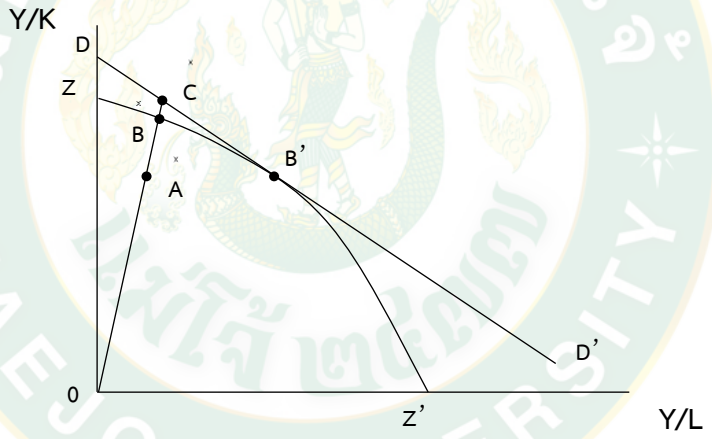


*Figure 3 The Output-Oriented technical efficiency measure*

Where $Y$ is quantity of output, $K$ is the quantity of physical capital, $L$ is the quantity of labour.

The Output-Oriented measure under assumption of constant returns to scale. ZZ' is the production possibility frontier. If DMUs produce at point A inefficient can measure by distance of AB. So, the output-oriented technical efficiency score measure as follow:

$$\mathrm{TE_o} = 1 - \frac{AB}{0B} = \frac{0A}{0B} \quad (4)$$

If you know the price information show as BB' line. The output-oriented allocative efficiency score measure as follow:

$$\mathrm{AE_I} = \frac{0B}{0C} \quad (5)$$

The output-oriented economic efficiency measure as follow:

$$\mathrm{EE_O} = \mathrm{TE_O} \times \mathrm{AE_O} = \frac{0A}{0B} \times \frac{0B}{0C} = \frac{0A}{0C} \quad (6)$$

2. Input-Oriented measure

The Input- Oriented technical efficiency measure determines the DMUs of good (y) by use 2 inputs (K, L). The DMUs produces products under the assumption of constant returns to scale. In the assumption, isoquant of units fully efficient show as DD' (Figure 4) (Charnes et al., 1978).

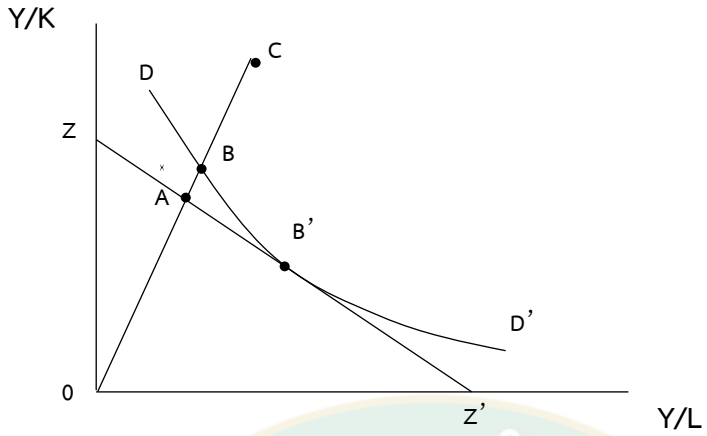


*Figure 4 The Input-Oriented technical efficiency measure*

Where $Y$ is quantity of output, $K$ is the quantity of physical capital, $L$ is the quantity of labour. DD' show full efficient of DMU.

If DMUs use the ratio of input at point C to produce 1unit. The inefficiency of DMUs can measure by distance of BC which

$$TE_I = \frac{BC}{0C} = 1 - \frac{BC}{0C} \quad (7)$$

The input-oriented allocative efficiency score can show the calculate as follow:

$$AE_I = \frac{0A}{0B} \quad (8)$$

The input-oriented economic efficiency can show the calculate as follow:

$$EE_I = TE_I \times AE_I = \frac{BC}{0C} \times \frac{0A}{0B} = \frac{0A}{0C} \quad (9)$$

2.1.3 Data envelopment analysis

Data envelopment analysis (DEA) is a non-parametric method using Linear Programming for measure the efficiency by relative efficiency of decision-making unit

(DMUs) in case of multiple inputs and outputs. Charnes et al. (1978) proposed the assumption of constant returns to scale (CRS) and input-oriented. Then, Banker et al. (1984) proposed the assumption of Variable returns to scale (VRS).

The efficiency measurement by DEA model with the input-orientated and output-orientated on the constant returns to scale (CRS) and variable returns to scale (VRS) assumptions (Coelli et al., 2005). The model can be shown as follows:

**The Input-Orientated DEA model with constant returns to scale**

$$\begin{aligned} &Min_{\theta\lambda}\,\theta \\ &S.t.\ -y_i + y\lambda \geq 0 \\ &\theta x_i - x\lambda \geq 0 \\ &\lambda \geq 0 \end{aligned} \tag{10}$$

Where $i = 1, \ldots, n$ , $n$ is the number of decision-making units, $\lambda$ is the DMU's weight and the efficiency score is and $\emptyset$ is the relative efficiency of DMUs. $y$ and $x$ are observed output and input values.

**The Output-Orientated DEA model with constant returns to scale**

$$\begin{aligned} &Max_{\theta\lambda}\,\theta \\ &S.t.\ -\theta y_i + y\lambda \geq 0 \\ &x_i - x\lambda \geq 0 \\ &\lambda \geq 0 \end{aligned} \tag{11}$$

Where $i = 1, \ldots, n$ , $n$ is the number of decision-making units, $\lambda$ is the DMUs weight and the efficiency score is and $\emptyset$ is relative efficiency of DMUs. $y$ and $x$ are observed output and input values.

**The Input-Orientated DEA model with variable returns to scale**

$$\begin{gathered} Min_{\theta\lambda}\,\Theta \\ S.t.\ -y_i + y\lambda \geq 0 \\ \Theta x_i - x\lambda \geq 0 \\ I1\,\lambda \leq 1 \\ \lambda \geq 0 \end{gathered} \tag{12}$$

Where $i = 1, \ldots, n$, $n$ is the number of decision-making units, $\lambda$ is the DMU's weight and the efficiency score is and $\emptyset$ is relative efficiency of DMUs. $y$ and $x$ are observed output and input values. $I1\ \lambda \leq 1$ define an inefficient decision-making of unit. It's only benchmark with other decision-making of units that similar size.

**The Output-Orientated DEA model with variable returns to scale**

$$\begin{gathered} Max_{\theta\lambda}\,\Theta \\ S.t.\ -\Theta y_i + y\lambda \geq 0 \\ x_i - x\lambda \geq 0 \\ I1\,\lambda \leq 1 \\ \lambda \geq 0 \end{gathered} \tag{13}$$

Where $i = 1, \ldots, n$ , $n$ is the number of decision-making units, $\lambda$ is the DMU's weight and the efficiency score is and $\emptyset$ is relative efficiency of DMUs. $y$ and $x$ are

observed output and input values. $\mathrm{I}1\ \boldsymbol{\lambda} \leq 1$ define an inefficient decision-making of unit. It's only benchmark with other decision-making of units that similar size.

2.1.4 Tobit Regression model

Tobit Regression model is the method for estimating the probability by assume the probability equal to normal cumulative distribution function. The Tobit model is applied with the limited dependent variables (Tobin, 1958). The estimate uses the parameters by Maximum Likelihood Estimation. The Tobit regression model show as follows:

$$y^*_i = \boldsymbol{x}_i\beta + \varepsilon_i$$

$$y^*_i \geq 1 \qquad (14)$$

$$y^*_i \leq 0$$

Where $i$ ($i$ = 1, 2, ..., n), $y^*_i$ is the dependent variable, $\boldsymbol{x}_i$ is the independent variable, $\beta$ is coefficients of the explanatory variable, $\varepsilon$ is error term

## 2.2 RELATED RESEARCH

### 2.2.1 Measurement of tourism efficiency

Several examples of studies estimating the tourism efficiency can be found Assafand Tsionas (2019); Barisicand Cvetkoska (2020); Barros et al. (2011); Marcikicand Radovanov (2020); Tomicand Marcikic (2018). For instance, Hadad et al. (2012), investigate the efficiency of 105 countries using DEA. The input variables selected were number of employees, number of rooms in the tourism industry, natural resources, and cultural resources. The output variables are number of tourists and expenditure per tourists. The result show that the developed countries attract tourists more than developing countries. The globalization, accessibility and labor productivity are important to tourism efficiency. Yiand Liang (**2015)** employed by DEA and the Malmquist index of 21 cities in Guangdong province, China from 2004 to 2010, the input index as the number of travel agencies, star-rated hotel and tourism workers. The output index as the tourism revenue and number of overnight visitors. Based on DEA model and Malmquist show that overall, the tourism efficiency is quite high. But the differences between the cities are quite large, show that the improving the performance tourism is difference in each city.

Barisicand Cvetkoska (2020), estimated the output-oriented technical efficiency of 28 countries of the European Union by using the DEA model. The output selected are international travel and tourism consumption and capita

investment. The input selected are travel and tourism's total contribution to GDP and employment. The result from output-oriented BCC DEA model shows that European union average efficiency is quite high around 0.9441. Wang et al. (2006) employed DEA model to examining the relative cost efficiency of 49 hotels in Taiwan. The input index used are number of employees, number of rooms, and area of food and beverages department. The input price index are average room rates, average price of food and beverage operations and average wage rates of employee. The result show that the overall of hotel industry is not efficient because of inadequate operations can also affect hotel operations. Another study, by Cracolici et al. (2008) applied DEA method to asses inbound tourist service quality efficiency. The findings indicated that need to improve the performance of input and output index of South Korea and Japan inbound tourists.

Benito et al. (2013) adopted the traditional DEA ratio output-oriented model with CRS, VRS and NIRS to examine the efficiency tourism in Spain during 2002 to 2010. The inputs selected were accommodation capacity and tourist arrivals. The output selected was number of bed-night. The result show that the average efficiency score from VRS is 0.737. The VRS can analysed scale up and down for each region. Radovanov et al. (2020) applied the output-oriented variable return to scale DEA model to evaluate the efficiency of tourism led to significant for rectification of efficiency score from uncontrollable variations. The finding showed that the average

efficiency score is relatively high measure of approximately 80%. In Table 4 can show the summarized of the related studies in case of tourism efficiency analysis.

***Table 4*** *Literature reviews of tourism efficiency analysis*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Barišić, P., & Cvetkoska, V. (2019) | Analyzing the Efficiency of Travel and Tourism in the European Union | 28 member states of the European Union | International travel and tourism consumption, capital investment, Travel and tourism's total contribution to GDP and Travel and tourism's total contribution to employment. | Output-oriented BCC DEA model |
| Tomic, S., & Marcikic, A. (2018) | EVALUATION OF EFFICIENCY IN TOURISM INDUSTRY | Bosnia and Herzegovina, Montenegro, Croatia, Republic of Macedonia, Slovenia and Serbia | Government prioritization of travel and tourism industry, T&T government expenditure, international tourist arrivals, international tourism inbound receipts and T&T industry GDP. | Output-oriented CRS DEA model |

***Table 4 (Continue)*** *Literature reviews of tourism efficiency analysis*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Corne (2015) | Benchmarking and tourism efficiency in France | 16 French conurbations | Output: Occupancy rate and Revenue per available room<br>Input: output space and hospitality categories | Output-oriented with variable return to scale DEA model |
| Barros et al. (2011) | Performance of French destinations: Tourism attraction perspectives | 22 French tourism destinations | Nights slept, accommodation capacity and tourism arrivals. | Output-oriented technically efficiency DEA model with CRS efficiency model. |

***Table 4 (Continue)*** *Literature reviews of tourism efficiency analysis*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Pavković et al. (2021) | Determining efficiency of tourism sector in Certain European countries and regions by applying DEA analysis | 29 European countries | Output: tourist receipts, number of inbound tourists and number of bed-nights<br>Input: tourism cost, number of staff and number of bed places | DEA model with CRS |

2.2.2 Determinants of tourism efficiency

The related research can show summarized as follow Table 5. When analyzing the determinants of tourism efficiency, examine the variables that affect to efficiency and research objectives. In previous study, the level of urbanization, openness of trade was related with the tourism (Chaabouni, 2018; Song and Li, 2019). For instance, Chaabouni (2018)selected the tourism GDP, capital stock, labor, and number of arrivals as determinants tourism efficiency and employed the Tobit model to determinants of tourism efficiency, as the trade openness, urban population, had significant impact on the tourism efficiency. Song and Li (2019) selected the fixed asset investment, employment, number of scenic spots, environmental government investment, total tourists received, and revenue of tourism enterprises as determinants efficiency of a sustainable tourism. and employed to determinants efficiency by Tobit regression. The economic development, level of urbanization and degree of opening up, as factor that affect to technical efficiency in tourism industry. In addition, the differences in research, conflicting the relationships between economic development and tourism efficiency. Li et al. (2020) found that economic development had detrimental to tourism efficiency, while the study of Song and Li (2019) has a positive effects.

The relationship between environmental regulation and tourism efficiency has been explored, Yeand Wang (2019) investigate the environmental regulations on

economic efficiency. Qiu et al. (2017) measured tourism eco-efficiency and determinants the factors. They found that the high-growth group has eco-efficiency tourism high value, the low-growth group has eco-efficiency tourism low value. The scale effect, structural effect, technical effect and environmental regulation are the main influence with tourism eco-efficiency in China. However, according (2021) selected per-capita tourism revenue, number of tourists, ratio of accommodation revenue to total tourism revenue, energy consumption pollutant discharges, fixed asset investment grade of tourist attractions, and environmental government invest to tourism as a proxy environmental regulation. They found that environmental regulation has a positive affect to environmental governance efficiency and overall efficiency of tourist attractions.

***Table 5*** *Literature review of determinants of tourism efficiency*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Marcikicand Radovanov (2020) | EFFICIENCY OF TOURISM DEVELOPMENT: APPLICATION OF DEA AND TOBIT MODEL. | 33 European countries | Output: Average receipts per arrival, international arrivals, Share of GDP, Share of employment Input: Government expenditure. | Output-oriented DEA model |
| | | | Average receipt per arrival, tourism industry share of GDP, Tourism industry share of employment, Government prioritization of travel and tourism industry, visa requirement, number of rooms, rate of use and natural site. | Tobit model |

***Table 5*** *(Continue) Literature review of determinants of tourism efficiency*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Gómez Vega et al. (2021) | Clustering and country destination performance at a global scale: Determining factors of tourism competitiveness | a global scale 140 countries | Output: Revenue from tourist<br>Input: International tourist arrivals, number of employments in tourism sector and number of hotel room. | Output oriented CRS DEA model |
| | | | GDP per capita, Natural attractions, UNSCO culture heritage Aircraft departure, government tourism prioritization, visa requirements, Internet users and insecurity index. | Truncated regression models |

***Table 5 (Continue)*** *Literature review of determinants of tourism efficiency*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Liu et al. (2021) | Spatial–Temporal Heterogeneity and the Related Influencing Factors of Tourism Efficiency in China | 30 provinces in China | Output: tourism income and reception number<br>Input: fixed total asset investment in the tourism industry, tourism resource endowment, total numbers of star-grade hotels, travel agencies, number of employees in the tourism industry, total energy resource consumption in the tourism industry and ratio of the tourism revenue to GDP. | SBM model and Malmquist index model |
| | | | Gross domestic product, tourism resource endowment, density of roads, location entropy, openness degree and environmental cost. | Geographically Weighted Regression (GWR) Model |

***Table 5 (Continue)*** *Literature review of determinants of tourism efficiency*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| Assafand Josiassen (2012) | Identifying and Ranking the Determinants of Tourism Performance A Global Investigation | All countries in world | Output: number of international tourists, total number of domestic tourists, the average length of stay of international tourists, and the average length of stay of domestic tourists.<br>Input: number of employments in tourism industry, capital investments and total number of accommodations. | Output-Oriented technical efficiency DEA model with VRS. |
| | | | Crime rate, fuel price level, hotel price index, time required to start a business, airport density, number of international fairs and exhibition, environmental performance, quality of airport service, protected area, hospital beds, number of hotel rooms, openness of bilateral air service agreements, Number of World Heritage cultural sites, Number of World Heritage natural attractions, Education index, Level of staff training, Number of five- and four-star hotels, Creative industries exports, | Bootstrapped truncated regression. |

***Table 5 (Continue)*** *Literature review of determinants of tourism efficiency*

| Author (Year) | Title | Scope | Data | Methodology |
|---|---|---|---|---|
| | | | Number of operating airlines, Quality of airline services, GDP per capita, Service-mindedness of population toward foreign visitors, Stringency of environmental regulation in the tourism industry and Government expenditures on the tourism industry | |
| Corneand Peypoch (2020) | On the determinants of tourism performance. | 13 French administrative regions | Output: tourist tax and tourist arrivals. Input: number of employments in tourism industry and number of rooms. | Output-oriented DEA model with CRS and fsQCA. |
| | | | Number of monuments, number of museums, presence of beaches and ski resorts. | Bootstrapped truncated regression. |

***Table 5 (Continue)*** *Literature review of determinants of tourism efficiency*

| **Author (Year)** | **Title** | **Scope** | **Data** | **Methodology** |
|---|---|---|---|---|
| Choi et al. (2021) | Evaluating the efficiency of Korean festival tourism and its determinants on efficiency change: Parametric and non-parametric approaches | 13 French administrative regions | Output: number of festival visitors and Economic Impacts of Festival.<br>Input: Festival Budget, Festival Duration | DEA model with CRS and VRS and Stochastic frontier analysis. |
| | | | Diversity of festival programs, foods to eat, thing to buy, on-site guidance and explanation, infrastructure & safety, number of hosted festival and ratio of tourists from other regions. | Tobit regression, conventional truncated regression, Simar & Wilson Approach with double bootstrapping. |

***Table 5 (Continue)*** *Literature review of determinants of tourism efficiency*

| **Author (Year)** | **Title** | **Scope** | **Data** | **Methodology** |
|---|---|---|---|---|
| Benito et al. (2013) | Determinants of Spanish Regions' Tourism Performance: A Two-Stage, Double-Bootstrap Data Envelopment Analysis | Spanish regions | Output: Tourist arrivals.<br>Input: number of<br>Beds and number of bed-nights | DEA model |
| | | | Number of cultural properties and possessions, coastal, museum collections, number of natural parks, number of clubs federated, ski resort, number of restaurants and number of retailers. | Truncated normal regression model |

## 2.3 CONCEPTUAL FRAMEWORK

In this study, use two major methodologies for efficiency and factors analysis. First, evaluate the efficiency with base on the production theory. Efficiency estimation based on the literature review as mention above. The selected inputs are the number of rooms, employment in tourism industry and protected area. These inputs are show the capability of accommodating tourists. The selected outputs are the number of tourists and tourist receipts. The variable of tourist arrivals and tourist receipts indicate the performance in capacity the tourist. Which based on empirical of Benito et al. (2013); George Assaf (2012); Hadad et al. (2012); Solana-Ibañez et al. (2017). This study focuses on output-oriented technical efficiency with variable returns to scale by Data envelopment analysis model that utilizes linear programming to determine the technical efficiency. In second major, determine the efficiency of tourism efficiency. The tourism efficiency is represented by output-oriented technical efficiency in tourism industry. Which determinant the factors according to previous studies of Song and Li (2019); Zha et al. (2021), the selected independent variables are the environmental tax, GDP per capita, total trade and urban population by using Tobit regression model. The conceptual framework of the study can be summarized in Figure 5 as follow:

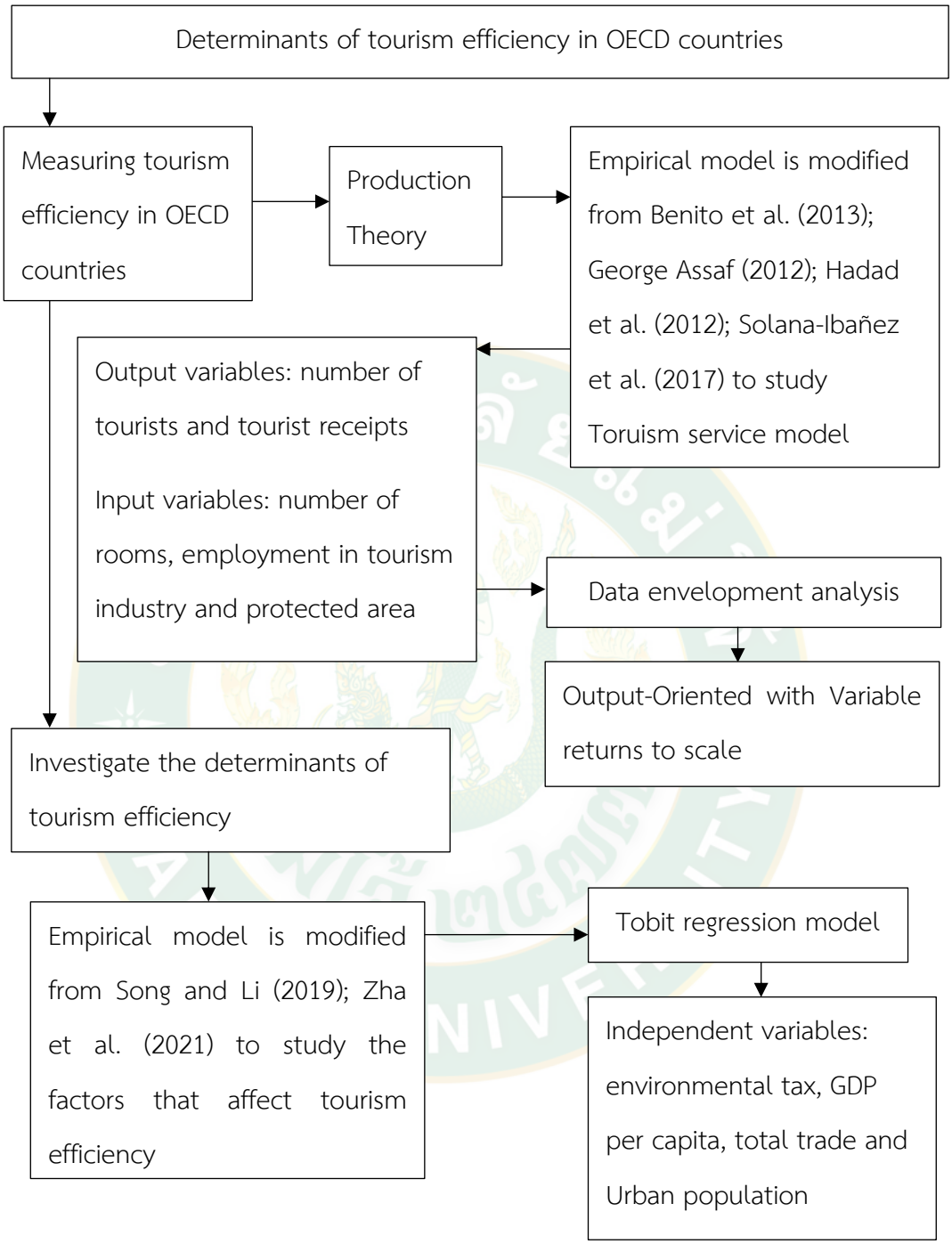


***Figure 5*** *Conceptual framework*

# CHAPTER 3
# METHODOLOGY

In this study, the objective is to measure the tourism efficiency by use DEA model in each OECD member countries and determinants the factors that affect to tourism efficiency in OECD member countries.

## 3.1 DATA

This study uses panel data that includes 28 OECD member countries, including Australia, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Japan, Latvia, Lithuania, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United States for the period 2010 to 2016. The environmental tax (% of GDP) and protected areas (square kilometres) are obtained from the OECD statistics database. Protected areas is calculated from the sum of terrestrial protected area and marine protected area (Square kilometres). The employment in tourism industry (amount of people) and Accommodation capacity (number of rooms) are from World Tourism Organization (UNWTO). The total receipts (current US$) and arrivals (amount of people) of tourists, GDP per capita (current US$), Urban population and total of trade (% of GDP) are from World Bank national accounts data and OECD National Accounts data files and United Nations Conference on Trade. The urban population (amount of people) is from World Bank staff

estimates based on the United Nations Population Division's World Urbanization Prospects: 2018 Revision on the period 2010 to 2016.

## 3.2 THEORETICAL MODEL

3.2.1 Productivity and efficiency analysis in the tourism industry

The estimation tourism efficiency based on production theory. It uses to determinant the relationship between outputs and inputs by show the maximum output from input. We can identify model quantity of output as a function of capital and labor (Cracolici et al., 2008; Sickles and Zelenyuk, 2019). The production function is described as follow:

$$Q = f(K, L) \tag{15}$$

Where $Q$ is quantity of output, $K$ and $L$ are capital and labor respectively. In the tourism industry production of tourist services is defined by the number of tourists and income received from tourists (George Assaf, 2012; Solana-Ibañez et al., 2017). In turn, inputs used in the production of tourism services include the labor in the model using the number of employees in the tourism industry, the capital proxy by accommodation capacity and natural resources (Benito et al., 2013; Hadad et al., 2012). Based on their analysis, tourism services model the following way:

$$Q=f(AC, E, NR) \tag{16}$$

Where $Q$ are number of tourist and revenue from tourists, $AC$ is accommodation capacity, $E$ is employment of tourism industry, and $NR$ is natural resource.

The number of tourists visiting and tourism revenue reflect the indicators that important to measure the achievement in tourism industry (Yi and Liang, 2015). The accommodation capacity is important indicators to measure the ability to accommodate incoming tourists (Wang et al., 2006). The labor is a main input of productivity. Labor force used in the manufacture of products and services (Joppe and Li, 2016). According to Hadad et al. (2012) natural resources is the major components of competitive advantage of destination areas.

We based the efficiency analysis on Cracolici et al. (2008), they use the determinant frontier production function, the performance of industry with output to input ratio are considered as the efficiency. The ratio to measure of efficiency as follow:

$$\boldsymbol{Efficiency} = \frac{\boldsymbol{output}}{\boldsymbol{input}} \tag{17}$$

To measure efficiency tourism industry, in each country has different patterns of activity levels. A formula for relative efficiency that multiple sources of inputs and outputs. The relative efficiency for compare the weighted average of efficient unit with benchmark. The relative efficiency can help compare the efficiency value in each country (Chang Jung Christain University, 2019). The relative efficiency as follow:

$$\boldsymbol{Efficiency} = \frac{weighted\ sum\ of\ outputs}{weighted\ sum\ of\ inputs} \tag{18}$$

In the commonly measure of efficiency on estimation of the extent of the feasibility of the defined production (Production frontier). The distance function can

explain the technology to measure efficiency by measured the distance of produced output and input vectors (Coelli et al., 2005). In this study, we focus on the outputs that focus on the optimal output combinations that can be produced by a set of inputs (Chen et al., 2018; O'Donnell et al., 2011). Which is usually referred to as output-oriented technical efficiency (OTE). OTE is measured the following way:

$$OTE_{it} = \frac{Qit/Xit}{Qit/Xit} = \frac{Qit}{Qit} = D_0(x_{it}, q_{it}, t) \leq 1 \quad (19)$$

Where $i$ is countries ($i$ = 1, 2, ..., 28), $t$ is years ($t$ = 2010 to 2016), $OTE$ is output oriented technical efficiency, $Q_{it}$ is an aggregate output, $X_{it}$ is an aggregate input. $D_0(x_{it}, q_{it}, t)$ is the output distance function representing the production meta-technology available in period $t$. If the output-oriented technical efficiency of $j$ countries or weight leading to that efficiency equal 1 means the tourism industry is efficient relative to other. In another hand, if the output-oriented technical efficiency of $j$ countries or weight leading to that efficiency less than 1. The other countries are more efficiency than $j$ countries or that $j$ countries less efficient in tourism industry.

The technical efficiency is evaluation of region performance for competitiveness analysis. This indicates that when the highly level of efficient, means that the country is highly tourism and highly competitive (Peypoch and Solonandrasana, 2006). The performance evaluation for each region can find the unfavourable factor hindering the tourism development (Bi et al., 2011)

3.2.2 Determinants of tourism efficiency analysis

Following Song and Li (2019), tourism efficiency is affected by the economic development, level of urbanization, level of degree of opening, and environmental regulation (Zha et al., 2021). In particular our model is specified as follows:

$$OTE_{it} = f(ED_{it}, UR_{it}, ER_{it}, O_{it}) \quad (20)$$

Where $i$ represent countries ($i$ = 1, 2, ..., 28), $t$ represent year ($t$ = 2010 - 2016), output-oriented technical efficiency of tourism ($OTE_{it}$), economic development ($ED_{it}$), urbanization ($UR_{it}$), environmental regulation ($ER_{it}$), and trade openness ($O_{it}$).

Previous study of Parte-Estebanand Alberca-Oliver (2013) show that increasing the economic development will lead to an increase in tourism efficiency. When the economic resources and policy support to tourism industry, plan for tourism growth for each destination, spread the economic, and benefit to areas that attraction more visitors. In addition, investment in tourism infrastructure and overall infrastructure for accommodate and increase the convenience of visitors (Nissan et al., 2011). It's stimulating the physical international tourism by emerging destinations. But also increases the competitiveness, which reflected in the higher expenditure on destination visitors (Mihalic, 2014). In turn urbanization is said positively affect tourism efficiency (Li et al., 2020). Urbanization is fundamental in transform development cities to be middle or high income. When urban areas refer to economic activities concentrated in the area. Hence, urbanization plays a role in building a tourism

center due to its attractions and amenities. Urban expansion is a strategically important role in the development of the country, which includes the hotel industry and other service industries (Zhang et al., 2013).

Zha et al. (2021), said that environmental regulation has an impact for tourism efficiency. The environmental regulations are tools used for solving environmental problems. It is improving the quality of environmental from economic activities resulting in sustainability (Ye and Wang, 2019). Moreover, in the creation of tourism products and services, it is necessary to use natural resources. It may damage the natural resources in the tourist area. Therefore, the environmental governance will ensure the resources are restored to support the consumption of tourists. The tourist attractions gain benefit from a better environmental, it will improve the location and result to more tourism demand. And increase competitiveness of tourist attractions (Zha et al., 2021).

In addition, Cao et al. (2015) evaluate the effect of opening degree on tourism efficiency. International connections to facilitate trade, movement of goods and services that open up more countries. Structural investment in transportation will enable the country to open up more international trade. These developments will help to attract arrival of tourists increasing tourism demand increase (Çalışkan et al., 2019). In addition, international trade will help as a spread the news because the products will be shipped to a manufacturing facility. This will help increase

information for tourists. Recognition of a country's existence will spur the demand for tourism in that country (Kulendran and Wilson, 2000). We can assume equation as follows:

$$OTE_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 UR_{it} + \beta_3 ER_{it} + \beta_4 O_{it} \quad (21)$$

Where $i$ represents countries observed ($i$ = 1, 2, ..., 28), $t$ is year ($t$ = 2010 - 2016), $\beta_0$ is a constant amount, and $\beta_1$- $\beta_4$ are coefficients of the explanatory variables. $OTE_{it}$ is the output-oriented technical efficiency of tourism, $ER_{it}$ is the environmental regulation, $ED_{it}$ is the economic development, $UR_{it}$ is the urbanization, and $O_{it}$ is the trade openness.

We predict that the environmental regulation has the relationship with technical efficiency tourism in positive way. The environmental regulation can support the management of resource, improve resource and reduce environmental pollution. Environmental restoration is therefore essential for the tourist destination to make travel decisions (Chou et al., 2019; Qiu et al., 2017). The level of urbanization is expected to be positive affect to tourism efficiency. When high level of urbanization means that the flow of population technology and capital to develop region. These influences are a solid foundation to develop infrastructure, service systems and innovation of tourism. Hence, it will pave the way of infrastructure and promote the talent of the tourism industry (Li et al., 2020). The trade openness contributes the connection in business level. It can reduce cost of

internal transition as well as promote international travel and exchange. This has resulted in the increasing demand for tourism as it reduces travel expenses (Camelia et al., 2011; Chaisumpunsakul and Pholphirul, 2017). Then, we expect that the trade openness has a positive impact to tourism development. The economic development is expected to be positive relationship with the tourism efficiency. The economic development through development policies leads to investment, management, and development in tourism. In particular, investment, marketing and operational decisions of tourism establishments to provide a conducive environment for the tourist destination area (Dieke, 2003). So, the economic development influence to tourism development (Chaabouni, 2018).

## 3.3 EMPIRICAL MODEL

### 3.3.1 Productivity and efficiency analysis in the tourism industry

The measurement of efficiency in the tourism industry by the data envelopment analysis. DEA is a non-parametric method for evaluating the efficiency base on input and output of different decision-making units (DMUs). Due to the uncontrollable variations in the macroeconomic of each country. The DEA model with variable returns to scale would be more appropriate (Poldrugovac et al., 2016). The DEA model have orientation that demand on whether decision makers have more influence on developing input or output levels. The output-oriented DEA model give the information about the extent to improve outputs that can make

input levels decrease (Marcikic and Radovanov, 2020; Radovanov et al., 2020). In this study we focus on output oriented technical efficiency with variable returns to scale.

$$
\begin{aligned}
&Max\emptyset \\
&s.t.\ \ \textstyle\sum_{j=1}^{n} X_{ij}\lambda_j \le x_{io}\ i = 1, 2, \ldots, m; \\
&\textstyle\sum_{l=1}^{n} y_{\mathrm{rj}} \ge \emptyset y_{ro}\ r = 1, 2, \ldots, s; \\
&\textstyle\sum_{j=1}^{n} \lambda_{\mathrm{j}} = 1 \\
&\lambda_{\mathrm{j}} \ge 0
\end{aligned}
\qquad (22)
$$

Where $i = 1, \ldots, n; r = 1, \ldots, s$ (inputs) $; j = 1, \ldots, m$ (outputs), $n$ is the number of decision-making units and $DMU_o$, $\lambda$ is the DMU's weight and the efficiency score is $\emptyset$, $y_r$ *and* $x_i$ are observed output and input values, $y_{ro}$ is the amount of output $r$ used by $DMU_o$, and $\emptyset$ is relative efficiency of DMUs.

Note that $1 \le \phi < \infty$, and $\phi - 1$ is the proportional increase in outputs that could be achieved by the $i$-th firm, with constant input quantities. $1/\emptyset$ is defined as technical efficiency value that varies between zero and one. That is the output-oriented technical efficiency value (Coelli et al., 2005).

We use DEA model to measure the efficiency of tourism industry. In the analysis, two output are number of tourist arrivals and tourism expenditures and three input are accommodation capacity proxy by number of rooms (Coghlan, 2012), employment in tourism industry and protected areas (measured as the terrestrial area plus marine area).

3.3.2 Determinants of tourism efficiency analysis

The econometric model to estimating tourism efficiency as following below:

$$OTE_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 UR_{it} + \beta_3 ER_{it} + \beta_4 O_{it} + \varepsilon_{it} \quad (23)$$

We proxy the variable of economic development using GDP per capita measured by US dollar for economic development, the variable of urbanization by urban population, the variable of environmental regulation by environmental tax measured by US dollar, and the variable of total trade measured by percent of GDP. The econometric model is shown below:

$$OTE_{it} = \beta_0 + \beta_1 GDPP_{it} + \beta_2 UR_{it} + \beta_3 ET_{it} + \beta_4 TT_{it} + \varepsilon_{it} \quad (24)$$

The variable of GDP per capita and urban population has been transformed in to the natural logarithmic to stabilize the variance of a series. As an equation follow below:

$$OTE_{it} = \beta_0 + \beta_1 LnGDPP_{it} + \beta_2 LnUR_{it} + \beta_3 ET_{it} + \beta_4 TT_{it} + \varepsilon_{it} \quad (25)$$

Where $i$ represents countries ($i$ = 1, 2, ..., 28), $t$ represents year ($t$ = 2010-2016), $\beta_0$ is a constant amount, $\beta_1$- $\beta_4$ are coefficients of the explanatory variables, $OTE_{it}$ is the output-oriented technical efficiency of tourism, $LnGDPP_{it}$ is the natural logarithmic of GDP per capita, $UR_{it}$ is the natural logarithmic of urban population, $TT_{it}$ is the total of trade, $ET_{it}$ is the environmental tax, and $\varepsilon_{it}$ is a random disturbance term.

Due to technical efficiency of the tourism industry is a censored dependent variable. These may lead to a bias in the estimation results. In this study use Tobit regression to determinants the tourism efficiency by panel data from 2010 to 2016 in OECD countries.

The economic development represented by higher GDP per capita brings the projects and opportunity for economic activity such as building tourism supply, transportations and utilities infrastructure service industry. And also, coordination of legal planning to promote tourism. It will stimulate tourism to be able to protect the interests of the economy (Vujko and Gajić, 2014). Which help increase the ability to use benefits and resulting in higher results from the tourism industry (Sun et al., 2014). We expect that GDP per capita representing economic development will affect a positive sign for tourism efficiency. The level of urbanization expects a positive sign for tourism efficiency. The expansion of city to the natural areas, change the socio-economic structure in these areas to respond of tourists for consuming nature and leisure destination (Qian et al., 2012). In the urban is the key gateway for tourists in the transportation. Tourism occupies a large amount of space within city attractions. The modernity of the urban can provide better environment for tourism (Edwards et al., 2008; Gotham, 2007).

Natural features such as natural landscapes, hydrological structures, clean water, and fresh air is an attraction of tourists. Nature-based tourism is a rapidly

growing for tourists. Due to the environment is interesting for tourists. Hence, maintaining a high level of overall environmental quality is essential for the competitiveness of tourist destination (Knowles et al., 1999). Should be aware of the importance of protecting the environment. A good environment makes the tourism industry of the destination more competitive (Huybers and Bennett, 2003). So, we expected that environmental tax will affect in a positive way to tourism efficiency. Then, we expect that total of trade will affect a positive to tourism efficiency. The total of trade represents the flow of goods from one country to another. The free trade allows countries to increase their welfare through a comparative advantage, while global market forces and competition enable efficient production of goods and services at minimum costs. Due to the low cost of the service, the transaction cost of travel is low. That makes it easier for tourists to decide to travel (Song et al., 2017). And also, the trade will stimulate business trips to the destination. There will also cause more international travel (Kumar et al., 2018).

# CHAPTER 4
# RESULT AND DISCUSSION

This study aims to (1) measure tourism efficiency in each OECD member countries using the DEA model (2) investigate the determinants of tourism efficiency using a Tobit regression model. This study including the efficiency analysis and determinants analysis to as study approach as follow: 4.1 Efficiency analysis in the tourism industry 4.2 Determinants of tourism efficiency analysis

## 4.1 EFFICIENCY ANALYSIS IN THE TOURISM INDUSTRY

Table 6 show the efficiency value for 28 countries over the period 2010 to 2016. The average of tourism efficiency value in the period was 0.783 to 0.840. It seems that the tourism industry in the OECD member countries has continued to expand and develop during 2010 to 2016. The output-oriented technical efficiency reached a maximum value of 0.840 in 2016.

The highest tourism efficiency obtained by DEA model are Australia, United States, Denmark, Estonia, France, Iceland, Lithuania, Netherlands, Poland, Switzerland and Israel. These are the high-income countries. From TTCI (2019) data, high-income countries have high Travel and Tourism competitiveness due to the that countries had readiness in business environment, ICT readiness, human resources, and international openness. Associated with economic development at a high level. This

will increase the competitiveness in the tourism industry as well. In observed period, Japan has lowest efficiency value. Which accord with Hadad et al. (2012), it is also emphasize the low level of tourism efficiency in Japan. Due to the tourist per worker and beds ratio low which, means worker cannot fully accommodate or serve tourists and accommodate capacity able to provide services to tourists less.

***Table 6*** *Output-oriented technical efficiency during 2010 to 2016*

| Region | Country | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Europe** | Czech Republic | 0.585 | 0.619 | 0.662 | 0.662 | 0.670 | 0.701 | 0.750 | 0.664 |
| | Denmark | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Estonia | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Finland | 0.549 | 0.582 | 0.602 | 0.607 | 0.532 | 0.435 | 0.447 | 0.536 |
| | France | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Germany | 0.954 | 0.891 | 1.000 | 1.000 | 1.000 | 0.994 | 1.000 | 0.977 |
| | Greece | 0.787 | 0.810 | 0.814 | 0.945 | 1.000 | 1.000 | 1.000 | 0.908 |
| | Hungary | 0.908 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.987 |
| | Iceland | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Ireland | 0.888 | 0.978 | 0.954 | 1.000 | 1.000 | 1.000 | 1.000 | 0.974 |
| | Latvia | 0.734 | 0.744 | 0.676 | 0.983 | 1.000 | 1.000 | 1.000 | 0.877 |
| | Lithuania | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Netherlands | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Norway | 0.595 | 0.596 | 0.600 | 0.595 | 0.579 | 0.562 | 0.582 | 0.587 |

***Table 6 (Continue)*** *Output-oriented technical efficiency during 2010 to 2016*

| Region | Country | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Europe** | Poland | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Portugal | 0.825 | 0.796 | 0.747 | 0.786 | 0.827 | 0.822 | 0.877 | 0.811 |
| | Slovak Republic | 0.327 | 0.390 | 0.361 | 0.391 | 0.337 | 0.318 | 0.365 | 0.355 |
| | Slovenia | 0.967 | 0.909 | 0.904 | 0.897 | 1.000 | 1.000 | 1.000 | 0.954 |
| | Spain | 0.763 | 0.783 | 0.976 | 1.000 | 0.815 | 0.811 | 0.933 | 0.869 |
| | Sweden | 0.752 | 0.647 | 0.644 | 0.639 | 0.664 | 0.716 | 0.794 | 0.694 |
| | Switzerland | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **Asia** | Israel | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | Japan | 0.230 | 0.162 | 0.217 | 0.211 | 0.252 | 0.330 | 0.421 | 0.261 |
| **America** | Chile | 0.255 | 0.264 | 0.284 | 0.265 | 0.237 | 0.269 | 0.308 | 0.269 |
| | Mexico | 0.304 | 0.291 | 0.286 | 0.289 | 0.351 | 0.380 | 0.424 | 0.332 |
| | United States | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

***Table 6 (Continue)*** *Output-oriented technical efficiency during 2010 to 2016*

| Region | Country | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Australia and Oceania** | Australia | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| | New Zealand | 0.496 | 0.505 | 0.509 | 0.512 | 0.542 | 0.607 | 0.621 | 0.542 |
| **Average** | | **0.783** | **0.784** | **0.794** | **0.8137** | **0.8145** | **0.819** | **0.840** | **0.807** |

Table 6 show, in Europe region, Denmark, Estonia, France, Iceland, Lithuania, Netherlands, Poland and Switzerland registered the highest average tourism efficiency value (1.000). According to Radovanov et al. (2020), these countries have high efficiency show that the Europe remains the leading region in Travel and Tourism competitiveness. Which comes with performing well on infrastructures, natural resource, safety and security, and other tourism-specific facilities. These countries are strong performance in all of facilities for tourism (TTCI, 2013). While Slovak Republic registered the lowest value (0.355). The potential tourism in Slovakia according to Zatko (2018), due to insufficiently high level of service and infrastructures, tourism cannot reach its full potential. In Asia region, the tourism efficiency value ranged from 0.162 to 1.000. Israel had the highest average tourism efficiency value. According to TTCI (2009), show the Israel's infrastructures is well

developed to suitable for tourism infrastructure. It also has many worlds heritage cultural sites. And also Israel is high income country, it tends to be highly competitive due to its readiness in achieved infrastructures and other aspects (TTCI, 2019). Japan had the lowest average tourism efficiency value. The output-oriented technical efficiency values increased significantly in Japan during 2013 to 2016. There is a measure of support for the tourism industry from the government. These make Japan a destination for tourists (MLIT, 2013; OECD, 2015a).

In America region in Table 6, the tourism efficiency value ranged from 0.237 to 1.000. United States had the highest average tourism efficiency value. According to TTCI (2017), the United States is the country that facilitate for business due to exceptional tourist service infrastructure and strong global connection. So, these enable tourist to increase access travel. Which, Chile has the lowest tourism efficiency value. Following the Bianchiand Aqueveque (2017), Chile has performed well but the infrastructures and transportation are low level, which makes the tourism industry inefficient.

In Australia and Oceania region as show in Table 6, the tourism efficiency value ranged from 0.496 to 1.000. Australia had the highest average tourism efficiency value. Following TTCI (2015), the strengths in case of Travel and tourism competitiveness, whether it is rich nature, World Heritage natural sites and good transport infrastructure of tourism. Also, policies to support openness in bilateral Air

Service Agreements. New Zealand had a low level of average tourism efficiency value. Although New Zealand is small economy but it is an open and advanced economy in terms of trade and tourism (Tsui et al., 2017). According TTCI (2013) report that New Zealand's ground transportation network is still relatively underdeveloped. While the air transport infrastructure is efficient. It makes the competitiveness of this country's tourism not fully high.

Table 6 also indicates that Europe region have the technical efficiency tourism higher than overall. Due to OECD's members, there are mostly European countries. Also, most European countries are in the free movement zone (Schengen Area). Schengen visa- free zone is benefit for population of Europe zone. It is facilitated to travelers who want to visit EU countries that are Schengen regions. Encourage travels arrivals to the region (SchengenVisaInfo, 2020).

As results that mention above show Japan have the less efficient (0.261) in the tourism efficiency. But, TTCI (2019) show Japan is ranked 4$^{th}$ of T&T competitiveness index. When analyzing the index calculation of the report, the set of factors are the natural and cultural resources, infrastructure, T&T policy and enabling conditions and enabling environment. which the previous study doesn't consider the employment in tourism industry. In this study, consider the comparison of tourist per worker according to Table 7. It can be shown that the tourist per worker around 2.35. Accommodate the tourist of Japan compare with other countries is relatively low.

According to World Bank (2022a, 2022b, 2022c) report the share of service employment up to 71.79 percent of total employments as follow figure 6. And also, Chile has low efficient (0.269) because the tourist per worker around 7.14. So, these countries cannot use fully the potential of employment.

Australia and United States are high the efficient counties (1.000). According to Table 7 show that the tourist per worker around 11.92 and 12.99 is respectively. These counties cannot use less the potential of employment when compared to other countries. On the other hand, the tourism receipt per worker of Australia is 62362.4 and United States is 39702.0. It's mean that the 1 worker can make money 62362.4 US dollar and 39702.0 US dollar. Which these counties can use available resources to generate high income when compare with other countries.

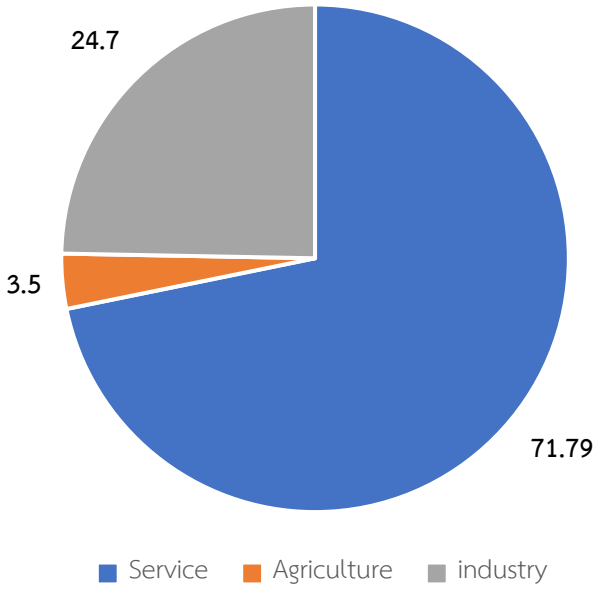


***Figure*** *6 Labour Division by sector in Japan, 2016*

Source: World Bank (2022a, 2022b, 2022c)

***Table 7*** *The comparison of tourist per worker and tourism receipt per worker*

| Country | Technical efficiency | Ratio | |
|---|---|---|---|
| | | Tourists per worker | Tourism receipt (US$) per worker |
| Australia | 1.000 | 11.92 | 62362.4 |
| Denmark | 1.000 | 40.78 | 28568.1 |
| Estonia | 1.000 | 129.29 | 72179.6 |
| France | 1.000 | 63.71 | 49998.2 |
| Iceland | 1.000 | 49.24 | 64191.9 |
| United States | 1.000 | 12.99 | 39702.0 |
| Israel | 1.000 | 23.91 | 82773.8 |
| Lithuania | 1.000 | 45.03 | 28977.6 |
| Netherlands | 1.000 | 30.34 | 39786.4 |
| Poland | 1.000 | 87.58 | 67649.0 |
| Switzerland | 1.000 | 52.46 | 116328.0 |
| Hungary | 0.987 | 32.24 | 19253.8 |

Source: OECD.Stat (2020a); World Bank (2020b, 2020c)

***Table 7 (Continue)*** *The comparison of tourist per worker and tourism receipt per worker*

| Country | Technical efficiency | Ratio | |
|---|---|---|---|
| | | Tourists per worker | Tourism receipt per worker |
| Germany | 0.977 | 19.62 | 33212.2 |
| Ireland | 0.974 | 43.87 | 52318.9 |
| Slovenia | 0.954 | 44.58 | 49003.9 |
| Greece | 0.908 | 60.42 | 52419.4 |
| Latvia | 0.877 | 23.05 | 11566.8 |
| Spain | 0.869 | 28.12 | 756.804 |
| Portugal | 0.811 | 19.62 | 47190.3 |
| Sweden | 0.694 | 37.70 | 73899.3 |
| Czech Republic | 0.664 | 33.93 | 33720.4 |
| Norway | 0.587 | 32.56 | 42528.1 |
| New Zealand | 0.542 | 14.82 | 43331.4 |

Source: OECD.Stat (2020a); World Bank (2020b, 2020c)

***Table 7 (Continue)*** *The comparison of tourist per worker and tourism receipt per worker*

| Country | Technical efficiency | Ratio | |
|---|---|---|---|
| | | Tourists per worker | Tourism receipt per worker |
| Finland | 0.536 | 22.47 | 41916.4 |
| Slovak Republic | 0.355 | 11.81 | 18905.6 |
| Mexico | 0.332 | 12.54 | 7140.28 |
| Chile | 0.269 | 7.14 | 5815.13 |
| Japan | 0.261 | 2.35 | 3772.04 |

Source: OECD.Stat (2020a); World Bank (2020b, 2020c)

## 4.2 DETERMINANTS OF TOURISM EFFICIENCY ANALYSIS

The results of the Tobit regression model are shown in Table 8. According to the results, the coefficient for urban population remains positive and significant with tourism efficiency. Level of urbanization is a strategic key role the development of tourism enterprises. In the urban, public and private investment in various facilities. The activities in that areas describe a high concentration of economic activity or tourist attraction (Luo et al., 2015). The urbanization shows the spatial concentration of labor, consumer, markets and many activities. The urbanization is the tourist destinations as gateways of tourists (Luo et al., 2016). The level of urbanization shows a significant influence on the tourist destination. This result is consistent with Chaabouni (2018), the expansion of urban provides enormous opportunities to sustain high growth through the more efficiency use of available resources.

***Table 8*** *Tobit regression analysis results of this study*

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| *C* | -2.401758 | 0.866973 | -2.770280 | 0.0056*** |
| *LnGDPP* | 0.175984 | 0.055412 | 3.175887 | 0.0015*** |
| *LnUP* | 0.056624 | 0.030424 | 1.861176 | 0.0627** |
| *ET* | 0.145014 | 0.041946 | 3.457156 | 0.0005*** |
| *T* | 0.003252 | 0.000948 | 3.430070 | 0.0006*** |

Notes: ***, ** indicate significance at the levels of 1% and 5%, C refers to constant term, LnUP refers to urban population, ET refers to environmental tax, T refers to total trade, and LnGDPP refers to gross domestic product per capita.

The environmental tax has a significant and positive role on the tourism efficiency. The environmental tax is an indicate that approach contributing to environmental problems. It is a tool for promoting a transition to sustainable economies (Labeaga and Labandeira, 2020). Revenue that generated by environmental tax will environmental protection programs such as promote development and implementation technologies that help reduce pollution (Eurostat, 2013). However, environmental tax affect to polluters considers the cost of

environmental pollution when they make production and consumption decisions, provide incentives for further technological innovations and emissions reductions (OECD, 2022b). Reducing pollution and eco-friendly is best alternative to the natural resources available in various places to be restored. That will enable the attractions to be beautiful to attract tourists (Ahmad and Rauf, 2018; Miceikiene et al., 2018). When environmental developed, reflecting tourist destination has been restored. To increase the competitiveness of the tourist attraction. According to Zha et al. (2021), environmental regulation can improve the technical efficiency in tourist attractions.

The coefficient of GDP per capita that represent economic development indicates the positive and statistically significant relationship with tourism efficiency. As more economic development means that the infrastructure has been developed. The expenditure government increase access to facilities of transportation sector such as improvement highway networks (Magazzino and Mele, 2020). Transport is a fundamental driver of the tourism industry. It's a precondition for traveler transport. Visitors will be comfortable in traveling from one place to another (Page and Ge, 2009). However, tourism also contributes economic development. The occurrence of tourist spending activities affects the flow of money into the economy causing economic development (Eugenio-Martin et al., 2008). So, high level of economic development led to be perfect macro environmental which will help to increase usability of tourism industry (Sun et al., 2014). According Li et al. (2020) find similar

results, they study tourism economic contact on the efficiency of the tourism industry.

The coefficient of trade openness represent by total of trade has positive and statically significant, indicating the trade openness and tourism are interrelated. Openness has fostered the circulation of people, finance and cross-border products across regions. Both would help to have more opportunities to accommodate the flow of funds, products and services. It can reduce the cost of international transactions (Tang, 2021). Expansion of international transportation company respond the international company and tourists for travel in case of business travel or other travel (Chaisumpunsakul and Pholphirul, 2017). It can also increase the competition, so that visitors from abroad can enjoy more varied prices for products and services (Wong and Tang, 2010). This result corresponds with Song and Li (2019) the degree of opening have positive effects to tourism efficiency.

# CHAPTER 5
# CONCLUSION AND RECOMMENDATIONS

The study of Determinants of tourism efficiency in OECD countries: A Two-stage DEA model. The objective of this study are (1) measure tourism efficiency in each OECD member countries using the DEA model (2) investigate the determinants of tourism efficiency using a Tobit regression model. This study is quantitative research using secondary data. This study including the conclusion, policy recommendation and limitation to as study approach as follow: 5.1 Conclusion 5.2 Policy Recommendations 5.3 Limitation of the study

## 5.1 CONCLUSION

The aim of this study was to analyzed the efficiency of tourism industry and determinant the factors that affect to tourism efficiency in OECD members from 2010 to 2016. The number of employments in tourism industry, number of rooms, and protected areas used to build input indexes. The revenue and number of tourists arrival used as output indexes. These output and input indexes analyzed by the output-oriented DEA model; the result show overall tourism efficiency is quite low (0.807). Which the difference in the level of efficiency in each country. This shows that the addition indicators to guide governments for drive the work to tourism development. The most efficient region is Europe region. We found that Europe region, Denmark, Estonia, France, Iceland, Lithuania, Netherlands, Poland and

Switzerland have the most efficient tourism industry. In Australia region, the Australia has the most efficient tourism industry, while Asia region, we found that Israel is the most tourism efficiency. The reason for this is high-income countries of these countries. This reflet countries with high income levels have the perfect infrastructure such as business environment, human resources, ICT readiness, and international openness. With the good infrastructures, these countries are highly Travel and Tourism competitiveness. In this study, it can be clearly seen that Japan and Chile should allocate the labor to maximum the outcome. This reflet countries with low performance in tourism industry should manage the inputs to create maximum benefits.

In the second stage, the panel Tobit regression model. The model estimated the trade openness, economic development, level of urbanization and environmental tax on tourism efficiency. The result show that environmental tax, economic development, urbanization and trade openness has significance of these influences increased to tourism efficiency. This is consistent with the conclusions drawn from previous studies. Based on the conclusions, the tourism industry is potential and importance to economic. So, government should plan the policy that well planned and allocated money for tourism development, thus affecting the economy that will benefit.

## 5.2 POLICY RECOMMENDATIONS

The policymakers and governments should be developing the tourism industry by develop tourist attractions to accommodate tourists. Due to environmental regulation has positive affect to tourism efficiency by focus on implementing environmentally-friendly tourism policies in accordance with the policies of the UN SDGs. The environmental policy and management can make natural areas for tourism destination. Moreover, the urbanization has affect positive to tourism efficiency, government support investment in urban. The urban development with good transportation system and business environment that will facilitate tourists. And, the trade openness affects in positive way to tourism efficiency. So, international openness development focus on promoting trade and investment that affect to the cost of transportation. And the economic development affect in positive way to tourism efficiency by develop infrastructure to enhance Travel and Tourism competitiveness. By allocating funds to improve the efficiency of the tourism industry. Moreover, resource allocation policies should manage the resource to benefit the economy. Another important point is human development for labor force to divide the workforce into other sectors that shortage labor such as engineering, sale, marketing and IT job by creating opportunities through training.

## 5.3 LIMITATION OF THE STUDY

In this study, the data collected in OECD member countries. We use the Quantitative Research by secondary data. Due to the limit of access data in some countries. So, the sample of the data can collect only 28 countries of OECD member countries including Australia, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Japan, Latvia, Lithuania, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United States. Because of data source updated during study and limit of times. This study therefore collects the data using the period 2010-2016.

Due to the variable of protected areas is calculated by total of the terrestrial protected area and marine protected area. In some countries don't have maritime zone. Therefore, protected area data in some countries does not include marine protected areas. However, the information used was reasonable. The countries that have the terrestrial protected area and marine protected area can accommodate to be tourist destinations. The countries can accommodate more tourists. Show that the country has high potential in tourism industry.

# REFERENCES


Ahmad, F. & Rauf, A. 2018. Tourism and Environmental Pollution: Evidence from the One Belt One Road Provinces of Western China. **Sustainability**, 10(

Assaf, A. & Josiassen, A. 2012. Identifying and Ranking the Determinants of Tourism Performance A Global Investigation. **Journal of Travel Research**, 51(388-399.

Assaf, A. G. & Tsionas, M. G. 2019. A review of research into performance modeling in tourism research - Launching the Annals of Tourism Research curated collection on performance modeling in tourism research. **Annals of Tourism Research**, 76(266-277.

Banker, R. D., Charnes, A. & Cooper, W. W. J. M. S. 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. 30(1078-1092.

Barisic, P. & Cvetkoska, V. (2020). Analyzing the Efficiency of Travel and Tourism in the European Union. In (pp. 167-186).

Barros, C., Botti, L., Peypoch, N., Robinot, E., Solonandrasana, B. & A, G. 2011. Performance of French destinations: Tourism attraction perspectives. **Tourism Management**, 32(141-146.

Benito, B., Solana-Ibañez, J. & López, P. 2013. Determinants of Spanish Regions´ Tourism Performance: a Two-Stage Double Bootstrap DEA Analysis. **Tourism Economics**, 20(987-1012.

Bi, G., Luo, Y. & Liang, L. 2011. Efficiency Evaluation of Tourism Industry With Data Envelopment Analysis (DEA): A Case Study in China. **Journal of China Tourism Research**, 7(104-116.

Bianchi, C. & Aqueveque, C. 2017. Tourism Destination Competitiveness of Chile: A Stakeholder Perspective. **Tourism Planning and Development**, 14(

Çalışkan, U., Arıkan Saltık, I., Ceylan, R. & Bahar, O. 2019. Panel cointegration analysis of relationship between international trade and tourism: Case of Turkey and silk road countries. **Tourism Management Perspectives**, 31(361-369.

Camelia, S., Carlos, L. & Surugiu, M.-R. 2011. A Panel Data Modelling of International Tourism Demand: Evidences for Romania. **Economic Research**, 24(134-145.

Cao, F., Huang, Z., Jin, C. & Xu, M. 2015. Influence of Chinese economic fluctuations on tourism efficiency in national scenic areas. **Tourism Economics**, 22(5), 884-907.

Chaabouni, S. 2018. China's regional tourism efficiency: A two-stage double bootstrap data envelopment analysis. **Journal of Destination Marketing & Management**, 11(

Chaisumpunsakul, W. & Pholphirul, P. 2017. Does international trade promote international tourism demand? Evidence from Thailand's trading partners. **Kasetsart Journal of Social Sciences**, 39(

Chang Jung Christain University. 2019. **DEA Tutorial**.

Charnes, A., Cooper, W. W. & Rhodes, E. 1978. Measuring the efficiency of decision making units. **European Journal of Operational Research**, 2(6), 429-444.

Chen, H., Tsai, B.-K., Liou, G.-B. & Hsieh, C.-M. 2018. Efficiency Assessment of Inbound Tourist Service Using Data Envelopment Analysis. **Sustainability**, 10(1866.

Choi, K., Kang, H. J. & Kim, C. 2021. Evaluating the efficiency of Korean festival tourism and its determinants on efficiency change: Parametric and non-parametric approaches. **Tourism Management**, 86(104348.

Chou, D., Jiménez, Y., Pérez-Rodríguez, J. & Hernández, J. 2019. Air pollution and tourism demand: A case study of Beijing, China. **International Journal of Tourism Research**, 21(

Coelli, T., Rao, D. S., O'Donnell, C. & Battese, G. 2005. **An Introduction to Efficiency and Productivity Analysis**.

Coghlan, A. 2012. Linking natural resource management to tourist satisfaction: A study of Australia's Great Barrier Reef. **Journal of Sustainable Tourism**, 20(41-58.

Corne, A. 2015. Benchmarking and tourism efficiency in France. **Tourism Management**, 51(91-95.

Corne, A. & Peypoch, N. 2020. On the determinants of tourism performance. **Annals of Tourism Research**, 85(103057.

Cracolici, M. F., Nijkamp, P. & Rietveld, P. 2008. Assessment of Tourism Competitiveness by Analysing Destination Efficiency. **Tourism Economics**, 14(325-342.

Dieke, P. 2003. Tourism in Africa's Economic Development: Policy Implications. **Management Decision - MANAGE DECISION**, 41(287-295.

Du, D., Lew, A. & Ng, P. 2016. Tourism and Economic Growth. **Journal of Travel Research**, 55(454-464.

Dupeyras, A. & MacCallum, N. 2013. **Indicators for Measuring Competitiveness in Tourism: A Guidance Document**.

Edwards, D., Griffin, T. & Hayllar, B. 2008. Urban Tourism Research: Developing an Agenda. **Annals of Tourism Research**, 35(4), 1032-1052.

Eugenio-Martin, J. L., Martín-Morales, N. & Sinclair, M. T. 2008. The Role of Economic Development in Tourism Demand. 14(4), 673-690.

European Parliamentary Research Service. 2020. **Understanding environmental taxation**. [Online]. Available https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646124/EPRS_BRI(2020)646124_EN.pdf.

Eurostat. (2013). **Environmental taxes-A statistical guide**. Document Number)

Farrell, M. J. 1957. The Measurement of Productive Efficiency. 120(3), 253-281.

George Assaf, A. 2012. Benchmarking the Asia Pacific tourism industry: A Bayesian combination of DEA and stochastic frontier. **Tourism Management**, 33(5), 1122-1127.

Gómez Vega, M., Herrero, L. & Valdivia, M. 2021. Clustering and country destination performance at a global scale: Determining factors of tourism competitiveness. **Tourism Economics**.

Gotham, K. 2007. Destination New OrleansCommodification, rationalization, and the rise of urban tourism. **Journal of Consumer Culture - J CONSUM CULT**, 7(305-334.

Hadad, S., Hadad, Y., Malul, M. & Rosenboim, M. 2012. The Economic Efficiency of the Tourism Industry: A Global Comparison. **Tourism Economics**, 18(931-940.

He, P., Sun, Y., Shen, H., Jian, J. & Yu, Z. 2019. Does Environmental Tax Affect Energy Efficiency? An Empirical Study of Energy Efficiency in OECD Countries Based on DEA and Logit Model. 11(14), 3792.

Higuerey, A., Viñán-Merecí, C., Malo-Montoya, Z. & Fernández, V.-A. 2020. Data

Envelopment Analysis (DEA) for Measuring the Efficiency of the Hotel Industry in Ecuador. **Sustainability**, 12(1590.

Huybers, T. & Bennett, J. 2003. Environmental Management and the Competitiveness of Nature-Based Tourism Destinations. **Environmental and Resource Economics**, 24(3), 213-233.

Joppe, M. & Li, X. P. 2016. Productivity Measurement in Tourism:The Need for Better Tools. 55(2), 139-149.

Knowles, T., Macmillan, S., Palmer, J., Grabowski, P. & Hashimoto, A. 1999. The development of environmental initiatives in tourism: responses from the London hotel sector. 1(4), 255-265.

Kulendran, N. & Wilson, K. 2000. Is there a relationship between international trade and international travel? **Applied Economics**, 32(8), 1001-1009.

Kumar, M., Prashar, S. & Jana, R. K. 2018. Does international tourism spur international trade and output? Evidence from wavelet analysis. **Tourism Economics**, 25(135481661878839.

Labeaga, J. & Labandeira, X. 2020. Economics of Environmental Taxes and Green Tax Reforms. **Sustainability**, 12(350.

Li, Y., Li, R., Ruan, W. & Liu, C.-H. 2020. Research of the Effect of Tourism Economic Contact on the Efficiency of the Tourism Industry. **Sustainability**, 12(14).

Liu, Z., Lu, C., Mao, J., Sun, D., Li, H. & Lu, C. 2021. Spatial–Temporal Heterogeneity and the Related Influencing Factors of Tourism Efficiency in China. **Sustainability**, 13(5825.

Luo, J. M., Qiu, H., Goh, C. & Wang, D. 2016. An Analysis of Tourism Development in China From Urbanization Perspective. **Journal of Quality Assurance in Hospitality & Tourism**, 17(1), 24-44.

Luo, J. M., Qiu, H. & Lam, C. 2015. Urbanization impacts on regional tourism development: a case study in China. **Current Issues in Tourism**, 19(1-14.

Magazzino, C. & Mele, M. 2020. On the relationship between transportation infrastructure and economic development in China. **Research in Transportation Economics**, 100947.

Mankiw, N. G. 2011. **Essentials of Economics**. Cengage Learning.

Marcikic, A. & Radovanov, B. (2020). EFFICIENCY OF TOURISM DEVELOPMENT: APPLICATION OF DEA AND TOBIT MODEL. In (pp. 15-28).

Miceikiene, A., Ciuleviciene, V., Rauluskeviciene, J. & Streimikiene, D. 2018. Assessment of the effect of environmental taxes on environmental protection. **Ekonomicky casopis**, 66(286-308.

Mihalic, T. (2014). Tourism and Economic Development Issues. In (pp. 77-117).

MLIT. 2013. **White Paper on Tourism in Japan, 2013**. [Online]. Available https://www.mlit.go.jp/common/001018364.pdf.

Nissan, E., Galindo, M.-A. & Méndez, M. T. 2011. Relationship between tourism and economic growth. **The Service Industries Journal**, 31(10), 1567-1572.

O'Donnell, C., Fallah-Fini, S. & K, T. (2011). **Comparing Firm Performance Using Transitive Productivity Index Numbers in a Meta-frontier Framework**: University of Queensland, School of Economics. Document Number)

OECD. 2000. **Measuring the Role of Tourism in OECD Economies**. [Online]. Available https://www.oecd-ilibrary.org/content/publication/9789264182318-en.

---. 2006. **The Political Economy of Environmentally Related Taxes**.

---. 2010. **OECD Multilingual Summaries Taxation, innovation and the environment**. [Online]. Available https://www.oecd-ilibrary.org/docserver/9789264087637-sum-en.pdf?expires=1646840559&id=id&accname=guest&checksum=B0240F5B227824D8141B362B1E74558B.

---. 2015a. **OECD Economic Surveys: Japan 2015**. [Online]. Available https://www.oecd-ilibrary.org/content/publication/eco_surveys-jpn-2015-en.

---. 2015b. **Sectoral and economic trands of environmental significance**. [Online]. Available https://www.oecd-ilibrary.org/docserver/9789264235199-20-en.pdf?expires=1646896704&id=id&accname=guest&checksum=55ACD083F9A40CCCC4B778EE1CB3BA13.

---. 2018. **OECD Tourism Trends and Policies 2018**. [Online]. Available https://www.oecd-ilibrary.org/content/publication/tour-2018-en.

---. 2020. **OECD Tourism Trends and Policies 2020**. [Online]. Available https://www.oecd-ilibrary.org/content/publication/6b47b985-en.

---. 2022a. Environmental tax (indicator). (Publication no. doi: 10.1787/5a287eac-en ).

---. 2022b. **Taxation and Environmental Policies**. [Online]. Available https://www.oecd.org/tax/tax-policy/taxationandenvironmentalpolicies.htm.

OECD Statistics. 2020. Key tourism indicators. (Publication. Available https://stats.oecd.org/Index.aspx?DataSetCode=TOURISM_KEY_IND_PC

OECD.Stat. 2020a. Employment in tourism (Publication. Available https://stats-2.oecd.org/

---. 2020b. Environmentally related tax revenue. (Publication. Available https://stats.oecd.org/WBOS/index.aspx

---. 2020c. Marine protected area. (Publication. Available https://stats.oecd.org/WBOS/index.aspx

---. 2020d. Terrestrial protected areas. (Publication. Available https://stats.oecd.org/WBOS/index.aspx

---. 2022. Total tourism employment (direct) as % of total employment. (Publication. Available https://stats.oecd.org/WBOS/index.aspx

Organisation for Economic Co-operation and Development. 2022. **Organisation for Economic Co-operation and Development**. [Online]. Available https://www.oecd.org/about/.

Page, S. & Ge, Y. (2009). Transportation and tourism: A symbiotic relationship? In (pp. 371-395).

Parte-Esteban, L. & Alberca-Oliver, P. 2013. Determinants of technical efficiency in the Spanish hotel industry: regional and corporate performance factors. **Current Issues in Tourism**, 18(1-21.

Pavković, V., Jević, G., Jevic, J., Nguyen, P. & Sava, C. 2021. DETERMINING EFFICIENCY OF TOURISM SECTOR IN CERTAIN EUROPEAN COUNTRIES AND REGIONS BY APPLYING DEA ANALYSIS. **Journal of process management and new technologies**, 9(49-61.

Peypoch, N. & Solonandrasana, B. 2006. Research Note: Technical Efficiency in the Tourism Industry. **Tourism Economics**, 12(653-657.

Poldrugovac, K., Tekavcic, M. & Jankovic, S. 2016. Efficiency in the hotel industry: An empirical examination of the most influential factors. **Economic Research-**

**Ekonomska Istraživanja**, 29(583-597.

Qian, J., Feng, D. & Zhu, H. 2012. Tourism-driven urbanization in China's small town development: A case study of Zhapo Town, 1986–2003. **Habitat International**, 36(1), 152-160.

Qiu, X., Yiping, F., Yang, X. & Zhu, F. 2017. Tourism Eco-Efficiency Measurement, Characteristics, and Its Influence Factors in China. **Sustainability**, 9(1634.

Radovanov, B., Dudic, B. a. Z., Gregus, M., Marcikic, A. & Karovič, V. 2020. Using a Two-Stage DEA Model to Measure Tourism Potentials of EU Countries and Western Balkan Countries: An Approach to Sustainable Development. **Sustainability**, 12(4903.

Rodríguez-Díaz, B. & Pulido-Fernández, J. I. 2020. Sustainability as a Key Factor in Tourism Competitiveness: A Global Analysis. 12(1), 51.

SchengenVisaInfo. 2020. **Schengen Visa Information**. [Online]. Available https://www.schengenvisainfo.com/.

Sickles, R. & Zelenyuk, V. 2019. **Measurement of Productivity and Efficiency: Theory and Practice**.

Solana-Ibañez, J., Para-González, L. & Nieto, C. 2017. Efficiency and exogenous factors: evidence from Spanish tourism regions. **Academia Revista Latinoamericana de Administración**, 30(108-123.

Song, H., Li, G. & Cao, Z. 2017. Tourism and Economic Globalization: An Emerging Research Agenda. **Journal of Travel Research**, 57(004728751773494.

Song , M. & Li, H. 2019. Estimating the efficiency of a sustainable Chinese tourism industry using bootstrap technology rectification. **Technological Forecasting and Social Change**, 143(45-54.

Sun, J., Zhang, J., Zhang, J., Ma, J. & Zhang, Y. 2014. Total Factor Productivity Assessment of Tourism Industry: Evidence from China. **Asia Pacific Journal of Tourism Research**, 20(3), 280-294.

Tang, R. 2021. Does trade facilitation promote the efficiency of inbound tourism?—The empirical test based on Japan. 23(1), 39-55.

Tobin, J. 1958. Estimation of Relationships for Limited Dependent Variables. **Econometrica**, 26(1), 24-36.

Tomic, S. & Marcikic, A. (2018). EVALUATION OF EFFICIENCY IN TOURISM INDUSTRY. In (pp. 289-298).

Tsui, K., Balli, F., Tan, D., Lau, O. & Hasan, M. 2017. New Zealand business tourism: Exploring the impact of economic policy uncertainties. **Tourism Economics**, 24(135481661773138.

TTCI. 2009. **The Global Competitiveness Report 2009-2010**. [Online]. Available http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2009-10.pdf.

---. 2013. **The Travel & Tourism Competitiveness Report 2013**. [Online]. Available http://www3.weforum.org/docs/WEF_TT_Competitiveness_Report_2013.pdf.

---. 2015. **The Travel & Tourism Competitiveness Report 2015**. [Online]. Available https://ep00.epimg.net/descargables/2015/05/06/f2c1e517ce56a6453171d3a9d1b1da05.pdf.

---. 2017. **The Travel & Tourism Competttitiveness Report 2017**. [Online]. Available https://www.weforum.org/reports/the-travel-tourism-competitiveness-report-2017.

---. 2019. **The Travel & Tourism Competitiveness Report 2019**. [Online]. Available http://reports.weforum.org/travel-and-tourism-competitiveness-report-2019/files/2019/09/TTCR19-PART-1.pdf.

UNWTO. 2021. **Sustainable Development**. [Online]. Available https://www.unwto.org/sustainable-development.

Vujko, A. & Gajić, T. 2014. The government policy impact on economic development of tourism. **Ekonomika poljoprivrede**, 61(789-804.

Wang, F.-C., Hung, W.-T. & Shang, J.-K. 2006. Measuring the Cost Efficiency of International Tourist Hotels in Taiwan. **Tourism Economics**, 12(65-85.

Wong, K. & Tang, T. C. 2010. Tourism and Openness to Trade in Singapore: Evidence Using Aggregate and Country-Level Data. **Tourism Economics**, 16(965-980.

World Bank. 2020a. GDP per capita (current US$). (Publication. Available https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

---. 2020b. International tourism, number of arrivals. (Publication. Available https://data.worldbank.org/indicator/ST.INT.ARVL

---. 2020c. International tourism, receipts (current US$). (Publication. Available https://data.worldbank.org/indicator/ST.INT.RCPT.CD

---. 2020d. Trade (% of GDP). (Publication. Available https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS

---. 2020e. Urban population. (Publication. Available https://data.worldbank.org/indicator/SP.URB.TOTL

---. 2022a. Employment in agriculture (% of total employment). (Publication. Available https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=JP

---. 2022b. Employment in industry (% of total employment). (Publication. Available https://data.worldbank.org/indicator/SL.IND.EMPL.ZS?locations=JP

---. 2022c. Employment in services (% of total employment). (Publication. Available https://data.worldbank.org/indicator/SL.SRV.EMPL.ZS?locations=JP

World Tourism Organization. 2019. **International Tourism Highlights, 2019 Edition**. [Online]. Available https://www.e-unwto.org/doi/pdf/10.18111/9789284421152.

Ye, F.-F. & Wang, Y.-M. 2019. The effects of two types of environmental regulations on economic efficiency: An analysis of Chinese industries. 30(5), 898-929.

Yi, T. & Liang, M. 2015. Evolutional Model of Tourism Efficiency Based on the DEA Method: A Case Study of Cities in Guangdong Province, China. **Asia Pacific Journal of Tourism Research**, 20(7), 789-806.

Zatko, J. 2018. Tourist Potential of Slovakia: Realized Opportunities, Prospects of Increasing the Efficiency of Use. **Bulletin of Kyiv National University of Culture and Arts. Series in Tourism**, 82-90.

Zha, J., Dai, J., Xu, H., Zhao, C., Tan, T. & Li, Z. 2021. Assessing efficiency and determinants of tourist attractions based on a two-subprocess perspective: A case of Chengdu, southwestern China. **Journal of Destination Marketing & Management**, 19(100542.

Zhang, H., Luo, J. M., Xiao, Q. & Denizci Guillet, B. 2013. The impact of urbanization on hotel development: Evidence from Guangdong Province in China. **International Journal of Hospitality Management**, 34(92-98.

มหาวิทยาลัยแม่โจ้
MAEJO UNIVERSITY

APPENDIX

Descriptive Statistics (Tourism efficiency analysis)

| | Number of tourism arrivals | number of rooms | Employm-ent in tourism (person) | Protected areas (Square kilometres) | Tourism receipts (Current US$) |
|---|---|---|---|---|---|
| Mean | 15386555.46 | 413657.2194 | 805825.1582 | 294147.2461 | 20403413265 |
| Standa-rd Error | 1510989.547 | 67105.95348 | 100604.8159 | 45558.56388 | 2914192044 |
| Median | 7590000 | 103975 | 218339.5 | 51103.305 | 8995000000 |
| Mode | 6482000 | 653878 | #N/A | 60063.75 | 1065000000 |
| Std. Dev. | 21153853.65 | 939483.3488 | 1408467.422 | 637819.8944 | 40798688609 |
| Sample Variance | 4.47486E+14 | 8.82629E+11 | 1.98378E+12 | 4.06814E+11 | 1.66453E+21 |
| Kurtosis | 3.523985276 | 17.14598913 | 6.266439135 | 7.730180676 | 18.70029063 |
| Skewne-ss | 2.138916028 | 4.098137003 | 2.616005089 | 2.912668143 | 4.227189738 |
| Range | 83963000 | 5104570 | 6427395 | 2800968.94 | 2.48621E+11 |
| Maxim-um | 84452000 | 5114007 | 6440900 | 2805101.29 | 2.49183E+11 |
| Minim-um | 489000 | 9437 | 13505 | 4132.35 | 562000000 |
| Sum | 3015764870 | 81076815 | 157941731 | 57652860.23 | 3.99907E+12 |
| Observ-ations | 196 | 196 | 196 | 196 | 196 |

Descriptive Statistics (Determinants of tourism efficiency)

| | Output oriented technical efficiency | Urban population | GDP per capita (current US$) | Environmental tax (% of GDP) | Trade (% of GDP) |
|---|---|---|---|---|---|
| Mean | 0.806997449 | 27563730.34 | 36996.20929 | 2.375964 | 97.7059 |
| Standard Error | 0.018401173 | 3753968.004 | 1549.291915 | 0.068194301 | 3.285221661 |
| Median | 1 | 6973357 | 36473.82688 | 2.3275 | 84.4342 |
| Mode | 1 | N/A | N/A | 2.331 | N/A |
| Std. Dev. | 0.0184 | 52555552.06 | 21690.08681 | 0.95472 | 45.9931 |
| Sample Variance | 0.066366221 | 2.76209E+15 | 470459865.9 | 0.911490681 | 2115.365547 |
| Kurtosis | -0.36553 | 10.86835784 | 0.167020285 | 1.201831 | -0.67009 |
| Skewness | -1.02981 | 3.224508567 | 0.783657206 | -0.312262 | 0.55426 |
| Range | 0.8382 | 264068612 | 94173.6948 | 5.825 | 199.5273767 |
| Maxim-um | 0.1618 | 264366216 | 102913.4508 | 4.707 | 226.041 |
| Minimum | 1 | 297604 | 8739.756043 | -1.118 | 26.514 |
| Sum | 158.172 | 5402491146 | 7251257.02 | 465.689 | 19150.4 |
| Observa-tions | 196 | 196 | 196 | 196 | 196 |

# CURRICULUM VITAE

| | |
|---|---|
| **NAME** | Tunyachanok Gusaroj |
| **DATE OF BIRTH** | 22 February 1999 |
| **EDUCATION** | Master degree in applied economics |